

The authors of abstracts marked \*\*\* have indicated a financial interest.

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### *Houston Research Posters*

#### HP01 PRE-OPERATIVE CLEFT LIP MEASUREMENTS AND MAXILLARY GROWTH IN PATIENTS WITH A UNILATERAL CLEFT LIP AND PALATE

Gregory Antonarakis<sup>1</sup>, Bryan Tompson<sup>2</sup>, David Fisher<sup>2</sup>, <sup>1</sup>Department of Orthodontics, University of Geneva, Switzerland and <sup>2</sup>Hospital for Sick Children, Toronto, Canada

**AIMS:** Maxillary growth in patients with a cleft lip and palate is highly variable. The aim of this research was to investigate associations between pre-operative cleft lip measurements and maxillary growth in patients with a complete unilateral cleft lip and palate (cUCLP).

**SUBJECTS AND METHOD:** A cross-sectional study on children with cUCLP, following an identical treatment protocol in a single centre with all primary surgery performed by one operator, was carried out to explore associations between pre-operative cleft lip measurements and maxillary growth determined cephalometrically. Pre-operative cleft lip measurements, made by a single operator at the time of primary cheiloplasty, were available for each patient. Maxillary growth was evaluated on lateral cephalometric radiographs taken prior to any orthodontic treatment and alveolar bone grafting ( $8.5 \pm 0.7$  years). The presence of associations between pre-operative cleft lip measurements and cephalometric measurements of maxillary growth was determined using regression analyses.

**RESULTS:** In the 58 patients, the cleft lateral lip element was deficient in height in 90 per cent and in transverse width in 81 per cent. There was an inverse correlation between cleft lateral lip height and transverse width with a  $\beta$  coefficient of  $-0.382$  ( $P = 0.003$ ). Patients with a more deficient cleft lateral lip height displayed a shorter maxillary length (ANS-PNS;  $\beta$  coefficient =  $0.336$ ;  $P = 0.010$ ), a less protruded maxilla (S-N-ANS;  $\beta$  coefficient =  $0.334$ ;  $P = 0.008$ ), and a shorter anterior maxillary height (N-ANS;  $\beta$  coefficient =  $0.306$ ;  $P = 0.020$ ) than those with a less deficient cleft lateral lip height. No statistically significant associations were found with posterior maxillary height or maxillary inclination.

**CONCLUSION:** Patients with a cUCLP present with varying degrees of cleft lateral lip hypoplasia. Pre-operative measurements of cleft lateral lip deficiency are related to later observed deficiencies of maxillary length, protrusion, and anterior height, but not posterior height or inclination.

#### HP02 THE EFFECT OF RHEUMATOID ARTHRITIS AND FUNCTIONAL LOADING ON PHYSICAL AND MECHANICAL PROPERTIES OF THE MANDIBULAR CONDYLE IN A TRANSGENIC MOUSE MODEL

Despoina Koletsis<sup>1</sup>, Spiros Zinelis<sup>2</sup>, Margarita Makou<sup>1</sup>, George Eliades<sup>2</sup>, Theodore Eliades<sup>3</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Dental Biomaterials, University of Athens, Greece and <sup>3</sup>Clinic of Orthodontics and Paediatric Dentistry, University of Zurich, Switzerland

**AIMS:** To investigate the effect of rheumatoid arthritis and functional loading through diet modification on physical and mechanical properties and structural characteristics in a transgenic mouse model compared with healthy littermates.

**MATERIALS AND METHOD:** Twenty three, 4-week old hybrid male mice; 11 were of transgenic line hTNF 197 (Tg 197- presenting rheumatoid arthritis) and 12 were healthy littermates, both from mixed background CBA  $\times$  C57BL/6. Four groups of mice were formed. Group 1 [n = 5, Tg-hard] included transgenic mice who received an ordinary (hard) diet; group 2 [n = 6, Tg-soft] included transgenic line mice who received a soft diet; group 3 [n = 6, control-hard] healthy littermates receiving an ordinary (hard) diet and group 4 [n = 6, Control-soft] healthy littermates with a soft diet. The experimental period was 28 days. Following sacrifice, the mandibular condyles were subjected to X-ray microcomputed tomography to identify morphological and structural characteristics and micro-attenuated reflection Fourier transform infrared spectroscopy to reveal collagen/proteoglycan conformation, whereas resin-embedded and metallographically polished specimens were

evaluated employing scanning electron microscopy energy dispersive X-ray spectroscopy and tested for mechanical properties, through Vickers hardness (HV100) measurements.

**RESULTS:** Flattening of the condylar heads, derangement of the trabecular matrix and lower mineralization was observed for the transgenic groups. A-helix to amide I percentage area ratio was significantly lower for the transgenic animals and after adjusting for diet ( $\beta = -4.29$ , 95% CIs:  $-8.52, -0.06$ ;  $P = 0.04$ ), while no significant differences were observed between groups for proteoglycan to amide I ratio. Multivariable analysis revealed significantly lower HV100 values for the rheumatoid arthritis groups after adjusting for diet ( $\beta = -10$ , 95% CIs:  $-16, -4$ ;  $P = 0.001$ ).

**CONCLUSION:** Internal derangement of the anatomical structure with denaturation in the collagen structural components of the mandibular condyles, followed by lower HV100 values for the diseased animals were observed, while no association with functional loading through diet modification was recorded.

### HP03 ASSESSMENT OF THE BIOMECHANICAL BEHAVIOUR OF ALIGNERS BY MEANS OF FINITE ELEMENT MODEL ANALYSIS

Roberto Rongo<sup>1</sup>, Vincenzo D'Antò<sup>1</sup>, Armando V. Razionale<sup>2</sup>, Sandro Barone<sup>2</sup>, Roberto Martina<sup>1</sup>, <sup>1</sup>School of Orthodontics, University of Naples 'Federico II' and <sup>2</sup>Department of Civil and Industrial Engineering, University of Pisa, Italy

**AIMS:** To develop a finite element model (FEM) to simulate orthodontic treatment by means of thermoplastic aligners, which can be helpful to better understand the behaviour of this appliance.

**MATERIALS AND METHOD:** Cone-beam computed tomography (CBCT) scanning and surface structured light scanning were used to create multibody orthodontic models of teeth, oral soft tissues and alveolar bone structures. The digital simulation focused on analysis of the behaviour of three upper anterior teeth. Moreover, the analyses were carried out using different aligner thicknesses with the support of composite structures polymerized on tooth surfaces while simulating a 2 degree rotation of an upper central incisor.

**RESULTS:** All tooth rotations around the three principal axes were evaluated in order to assess possible undesired rotations around the axes different from the vertical tooth axis ( $x$ -axis). With no attachments, the aligner yielded a 0.95 degree rotation around the  $x$ -axis without additional rotations. The presence of a bevelled attachment on the tooth surface increased the amount of rotation up to 1.29 degrees without any significant rotation around the other two axes. The amount of rotation around the  $x$ -axis resulted in a further increase (up to 1.31°) when using a rectangular-shaped attachment. However, in this configuration, a deviation of the rotation axis from the principal tooth axis was present. In addition, all simulations also demonstrated a movement on the neighbouring teeth. The maximum rotation (0.99°) was obtained with a 1 mm thick aligner; however, with the 0.3 mm thick aligner the resulting rotation was 0.90 degrees.

**CONCLUSION:** The presented method can be used in future applications to simulate different orthodontic movements with thermoplastic aligners.

### *Scientific Posters*

### SP01 THREE-DIMENSIONAL ASSESSMENT OF THE EFFECT OF BONDED RAPID MAXILLARY EXPANSION ON THE NASAL CAVITY, MAXILLARY SINUS AND UPPER NASOPHARYNX. A PROSPECTIVE CONE BEAM COMPUTED TOMOGRAPHIC STUDY

Mohammed Almuzian<sup>1</sup>, Jim McDonald<sup>2</sup>, Ashraf Ayoub<sup>2</sup>, <sup>1</sup>Department of Orthodontics, <sup>2</sup>Glasgow Dental Hospital and School, U.K.

**AIMS:** To assess and correlate the rapid maxillary expansion (RME) effect on oro-nasopharyngeal airways spaces and to assess the validity of the 'ITK Snap' software package.

**SUBJECTS AND METHOD:** Sample size calculation indicated a sample size of 14 patients. These patients required maxillary expansion for the management of a narrow upper dental arch. Pre- (T1) and immediate post- (T2) RME cone beam computed tomographic images were taken. Using the 'OnDemand3D' software package, head posture, in three planes of space (pitch, rolling and yaw angle), and neck posture (lordosis) were measured in the first

week (W1). Subjects that showed a difference, of more than 5 degrees in head posture or lordosis were excluded. T1 scans were orientated according to a standardised method and the T2 scans were superimposed onto the anterior cranial base of the new T1 image and both saved. The volume of the lower part of the nasal cavity (LNC), right and left maxillary sinus space (RMS and LMS), upper nasopharynx (UNP), upper and lower retropalatal space (URP and LRP) were measured using ITK Snap software package at W1 and repeated at W2.

**RESULTS:** A Student's *t*-test showed that there was no significant difference between the W1 and W2 sets of measurements ( $P > 0.05$ ). RME produced statistically significant dentoalveolar expansion. URP reduced significantly, which might be due to infero-anterior displacement of the palatal shelves secondary to RME. Additionally, UNP expanded significantly. PCC showed that there was a strong correlation between the volumetric changes of the right and left maxillary sinuses due to analogous anatomical articulations.

**CONCLUSION:** The immediate expansion of LNC and UNP secondary to RME might be associated with a reduction in nasal resistance, improvement in nasal breathing and theoretically it can be an option for treatment of paediatric obstructive sleep apnoea/hypopnoea. Future studies could include colour mapping for detailed localisation of the changes as morphological changes of airway space are as important as volumetric changes. ITK-Snap software is a free and reliable package for measuring airway volumes. The immediate effect of RME on the volume of the nasopharyngeal airway spaces has a mushroom-like pattern

#### SP02 A RANDOMISED CONTROLLED CLINICAL TRIAL TO QUANTIFY THE EFFECT OF CHEWING GUM ON ORTHODONTIC OUTCOME IN ADOLESCENT PATIENTS

Julie Williams, Martyn Sherriff, Jonathan Sandy, Anthony Ireland, School of Oral and Dental Sciences, University of Bristol, U.K.

**AIMS:** To quantify the effect of chewing gum on orthodontic outcome in adolescent patients.

**SUBJECTS AND METHOD:** Six hundred and three adolescent patients (222 males, 381 females) aged 12 to 16 years within nine hospital orthodontic departments across the South West of England, who had completed treatment and for whom Peer Assessment Rating (PAR) scores were available. This was a multi-centred randomised controlled trial with two parallel groups allocated to chew gum as a primary analgesic following fixed appliance placement and adjustment, or asked not to chew gum and to use ibuprofen as required (control). Ethical approval was obtained. Data from the written records for every visit from initial bond-up to debond was collated and analysed using parametric tests and generalised linear modelling. The primary measures of orthodontic outcome investigated were: duration of treatment, number of visits and reduction in PAR score, in addition to a secondary outcome namely the number, location and timing of attachment failure.

**RESULTS:** The use of chewing gum for pain relief had no significant effect on any of the measures of outcome ( $\alpha = 0.05$ ). Average treatment time was 18.3 months (range 6.4 ~ 46.3 months). The mode total number of visits was nine (range 4~36 visits). The mean PAR score reduction was 83.5 per cent. There was no significant effect of chewing gum on breakages in either the upper ( $\chi^2 = 14.17$ ,  $P = 0.29$ ) or lower ( $\chi^2 = 11.27$ ,  $P = 0.66$ ) arch.

**CONCLUSION:** Advising adolescent patients to chew gum had no clinically significant effect on the outcome of fixed appliance therapy.

#### SP03 JUDGING ORTHODONTIC TREATMENT COMPLEXITY

Maité Clijmans<sup>1</sup>, Annelies Kellens<sup>1</sup>, Steffen Fieuws<sup>2</sup>, Guy Willems<sup>1</sup>, <sup>1</sup>Department of Oral Health Sciences - Orthodontics, KULeuven and <sup>2</sup>Interuniversity Institute for Biostatistics and Statistical Bioinformatics, KULeuven and Universiteit Hasselt, Leuven, Belgium

**AIMS:** To investigate possible relationships between anticipated overall treatment complexity (AOTC) of an orthodontic case and malocclusion characteristics.

**SUBJECTS AND METHOD:** Two groups of orthodontists (group A and group B) were asked to define perceived treatment complexity of orthodontic cases based on 16 characteristics of malocclusion (PTC) by means of a questionnaire. Each question was answered on a six point ordinal scale, with 1 'not applicable; option (score 0). Group A was also asked to give

the AOTC of the specific case on a five point ordinal scale. The Index of Orthodontic Treatment Need (IOTN) score of the specific cases, as well as the malocclusion characteristics were assessed by one author.

RESULTS: A significant relationship existed between IOTN and AOTC ( $P < 0.0001$ ). Twenty two per cent of the variability was explained by differences in IOTN. The addition of objective characteristics of malocclusion to explain AOTC did not significantly increase the explained variability ( $P = 0.086$ ). In judging inter-observer agreement, a weighted kappa of 0.60 for group A and 0.56 for the group B was found. The weighted kappa for the agreement in the AOTC equalled 0.06.

CONCLUSION: The relationship between IOTN and AOTC was found to be significant. Moderate agreement on perception of orthodontic treatment complexity among the observers was found in the present study and a low level of agreement regarding anticipated overall treatment complexity.

#### SP04 DO ORTHODONTIC FORCES INCREASE NICOTINE-INDUCED PERIODONTAL BONE LOSS? AN *IN VIVO* AND *IN VITRO* STUDY

Christian Kirschneck, Peter Proff, Michael Maurer, Claudia Reicheneder, Piero Römer, Department of Orthodontics, University of Regensburg, Germany

AIMS: Nicotine, a major component of tobacco products, is known to cause chronic periodontal inflammation and loss of periodontal attachment. Currently 26 per cent of adults and 12 per cent of juveniles in orthodontic practise are considered to be smokers. Both were therefore evaluated *in vivo* and *in vitro* to determine whether application of orthodontic forces has detrimental effects on nicotine-induced periodontal inflammation and bone loss.

MATERIALS AND METHOD: Seven male Fisher344-rats were injected with a nicotine dosage of 1.89 mg/kg body weight per day sub cutaneously (s.c.), equivalent to the mean nicotine intake of a European smoker (14.2 cigarettes/day). Seven more animals received physiological saline solution s.c. as controls. In both groups the first two upper left molars were mesialised *en bloc* by means of a Sentalloy® nickel titanium closed coil spring with a force of 0.25 N for four weeks, whereas the contralateral side served as the control. Periodontal bone loss was quantified by measuring the mean distance of the enamel-cementum-border to the bone level on three-dimensional images obtained by cone-beam computed tomography (CBCT). *In vitro* a force of 2 g/cm<sup>2</sup> was applied and/or 3/5/7.5 µM nicotine solution to human periodontal fibroblasts. Within the cell culture, supernatant gene expression levels of RANKL, OPG, IL-6 and COX-2 were determined by means of quantitative real-time polymerase chain reaction as well as protein concentrations of PGE<sub>2</sub> and IL-6 by means of commercially available ELISA kits. Statistical analysis was performed with SPSS Statistics® 21 by means of one-way (Welch) ANOVAs as well as independent *t*-tests at a significance level of 0.05. Effect sizes were calculated as Pearson's correlation coefficient *r*.

RESULTS: Orthodontic force application significantly increased nicotine-induced periodontal bone loss *in vivo*. *In vitro* a significant, dose-dependent augmentation of expression levels of pro-inflammatory (COX-2, PGE<sub>2</sub>, IL-6) and pro-osteoclastic markers (RANKL-OPG ratio) were found when applying forces and nicotine simultaneously compared to the sole administration of nicotine.

CONCLUSION: When treating chronic smokers orthodontically, one has to expect increased periodontal bone loss and inflammation. Thus orthodontic treatment, if desired by the patient, should only be performed after cessation of smoking. Orthodontists should explain the increased risks to smoking patients and press for smoking abstinence during treatment.

#### SP05 PHARMACOLOGICALLY INDUCED TOOTH ANCHORAGE AND REDUCED ROOT RESORPTION BY MEANS OF STRONTIUM RANELATE

Christian Kirschneck<sup>1</sup>, Michael Wolf<sup>2</sup>, Claudia Reicheneder<sup>1</sup>, Peter Proff<sup>1</sup>, Piero Römer<sup>1</sup>, Departments of Orthodontics, <sup>1</sup>University of Regensburg and <sup>2</sup>University of Bonn, Germany

AIMS: Currently available anchorage mechanisms in orthodontics have certain disadvantages, such as limited patient compliance (headgear) and the necessity for surgical

interventions (miniscrews). The potential of the novel osteoporosis drug strontium ranelate for pharmacological induction of tooth anchorage during orthodontic treatment was evaluated.

**MATERIALS AND METHOD:** A constant reciprocal force of 0.25 N was applied for two to four weeks both to the first upper left molar and the blocked incisors of 48 male Wistar rats by means of a Sentalloy® closed coil nickel titanium spring. Strontium ranelate was given to half of the animals at a human therapeutic equivalent dose of 900 mg/kg body weight per day by means of oral gavage. The remaining animals received a physiological saline solution as controls. Blood from the retrobulbar venous plexus was taken at regular intervals and analyses of strontium serum levels and alkaline phosphatase performed. Quantification of tooth movement was achieved by optometric (microscope) and cephalometric (cone beam computed tomographic) measurements. Quantitative real-time polymerase chain reaction was used to determine relative alveolar gene expression of osteoclastic markers and OPG-RANKL, and osteoclastic activity was evaluated in sagittal tartrate resistant acid phosphatase stained histological sections of the alveolar process. Statistical analysis was performed with SPSS Statistics® 21 by means of two-way mixed ANOVAs and MANOVA at a significance level of 0.05. Effect sizes were calculated as Pearson's correlation coefficient  $r$ .

**RESULTS:** Strontium ranelate treatment significantly reduced orthodontic tooth movement by up to 40 per cent compared to the controls after four weeks of orthodontic treatment. Significantly less osteoclastic activity and reduced root resorption area were shown by gene expression and histological analyses. Blood analyses confirmed sufficient bioavailability and pharmacodynamic efficacy of strontium ranelate.

**CONCLUSION:** Strontium ranelate could be a potential, viable agent for pharmacological induction of orthodontic tooth anchorage and reduce undesired root resorption in orthodontic treatment. Further studies are needed to assess a targeted applicability and efficacy at teeth used for orthodontic anchorage. Prolonged orthodontic treatment time is to be expected in patients under strontium ranelate medication.

#### SP06 MANAGEMENT OF AESTHETICALLY RELEVANT WHITE SPOT LESIONS BY RESIN INFILTRATION\*\*\*

Michael Knösel<sup>1</sup>, Amely Eckstein<sup>1</sup>, Hans-Joachim Helms<sup>2</sup>, Departments of <sup>1</sup>Orthodontics, and <sup>2</sup>Statistics, University of Göttingen, Germany

**AIMS:** To assess the long-term durability of the aesthetic improvement of white spot lesions (WSL) achieved by resin infiltration (ICON, DMG) in comparison to baseline and to untreated WSL.

**SUBJECTS AND METHOD:** Twenty subjects with WSL, after multibracket treatment, were recruited for lesion infiltration using a randomized split-mouth design. Spectrophotometric follow-up assessments of colour and lightness (CIE-L\*a\*b\*) data of WSL in comparison to surrounding sound enamel were carried out prior to infiltration (baseline), after 1 day, 1 week, 4 weeks, 3 months, 6 months, 1 year, and 2 years. Effects of infiltration and time elapse on colour differences were analysed by multi-factorial ANOVA and pairwise comparisons.

**RESULTS:** There was an assimilation of infiltrated WSL to the colour of adjacent enamel that was found to be colour stable over 2 years.

**CONCLUSION:** Resin infiltration is a technique that is suitable for long-term improvement of the aesthetic appearance of WSL.

#### SP07 A COMPARATIVE STUDY OF FAIRBAIRN ROBIN TRIAD AND ISOLATED CLEFT PALATE

Miriam Alexandrova, Gabriela Alexandrova, Simona Dianiskova, Department of Orthodontics, Slovak Medical University / Private Orthodontic Practice, Bratislava, Slovakia

**AIMS:** To evaluate variables associated with isolated cleft palate (ICP) and cleft palate related to Pierre Robin sequence (Fairbairn Robin triad), namely the extent of the cleft and the gender predominance.

**SUBJECTS/MATERIALS AND METHOD:** Eighty two newborn children (47 girls, 35 boys with ICP treated at the cleft centre LFUK and UNB Ruzinov Hospital between 2006-2013. The patients were divided into two groups. The characteristics of Pierre Robin sequence (microgenia, microglossia, glossophthosis) were present in the first group of patients whilst the second group contained patients without these signs. In both groups the extent of the cleft was measured and patients were divided into two groups (affected hard palate, soft palate and uvula, or only soft palate and uvula affected). The data were statistically evaluated by Chi-square test (SPSS 19).

**RESULTS:** Of 82 newborn children (whole group) 47 (57.3%) were evaluated as Fairbairn Robin triad. In 43 children (52.4%) the cleft extended to the uvula and soft palate and in 39 (47,6%) to the uvula, soft and hard palate. The results indicated a larger extent of cleft in the group of patients with Pierre Robin sequence, in 21 (48.8 %) newborn children the cleft extended to uvula and soft palate and in 26 (66.7 %) newborn children to the uvula, soft and hard palate. In the second group (without signs of Pierre Robin sequence) the cleft was more often located only in the soft tissues, cleft of the uvula and soft palate was observed in 22 children (51.2%), and in 13 children (33.3%) a cleft of the uvula, soft and hard palate was present. The study demonstrated also that girls were more affected than boys in both instances.

**CONCLUSION:** There may be a link between the extent of an ICP and Pierre Robin sequence. The differences were not significant ( $P > 0.1$ ), but pointed to larger clefts in the group of patients with Fairbairn Robin triad.

#### SP08 WHICH INDICES ARE MORE COMPATIBLE WITH ORTHODONTIC TREATMENT COST IN TURKEY?

Serhat Mertoğlu<sup>1</sup>, Ali Altug Bıçakcı<sup>2</sup>, <sup>1</sup>Department of Orthodontic, Pamukkale University, Denizli and <sup>2</sup>Gaziosmanpasa University, Tokat, Turkey

**AIMS:** To identify which index is compatible with orthodontic treatment costs by conducting a survey.

**SUBJECTS AND METHOD:** After cephalometric and model analyses of 10 patients with different orthodontic problems, the Peer Assessment Rating (PAR) Index, Index of Orthodontic Treatment Need (IOTN) and Index of Complexity, Outcome, and Need (ICON) were performed on their study model. An e-survey that included frontal and lateral photographs and the results of the cephalometric and model analyses was prepared. All orthodontists registered with the Turkish Orthodontic Association were contacted by e-mail, and those who wished to participate in the survey took part by clicking a link in the e-mail to reach the page containing the form. The orthodontists were asked to evaluate the 10 cases one by one, and determine the orthodontic treatment cost for each case. The data was statistically analyzed using the SPSS 14.0 program.

**RESULTS:** In total 251 orthodontics completed the survey; a participation rate of 44.5 per cent. When the correlation was examined between the approximate orthodontic treatment costs of the cases used in the study with PAR, IOTN, ICON indices and Angle classification, the highest correlation was found with the PAR Index. The correlation between Angle classification and cost was found to be statistically irrelevant.

**CONCLUSION:** The PAR index is more compatible with orthodontic treatment cost in Turkey.

#### SP09 CEPHALOMETRIC APPRAISAL OF POST-TREATMENT TOOTH ERUPTION: A 20 YEAR FOLLOW-UP STUDY

Simon Poelmans<sup>1,2</sup>, Maïté Clijmans<sup>2</sup>, Steffen Fieuws<sup>3</sup>, Guy Willems<sup>2</sup>, <sup>1</sup>Department of Oral Health Sciences, Katholieke Universiteit and <sup>2</sup>Department of Orthodontics, University Hospitals Leuven and <sup>3</sup>Interuniversity Institute vor Biostatistics and statistical Bioinformatics, Leuven, Belgium

**AIMS:** To assess the amount of tooth eruption that occurs during 20 years after completion of orthodontic treatment, and to analyze possible correlations with age and mandibular growth pattern present.

**MATERIALS AND METHOD:** A retrospective longitudinal cephalometric investigation of dentoalveolar changes was performed in 72 patients (50 females, 22 males). Two lateral cephalograms, taken at the end of orthodontic treatment and on average 20 years later, were available for each subject. The mean age at the beginning of the observation period was 21.5 years and the mean observation period was 19.7 years. Changes in cephalometric measurements were statistically evaluated.

**RESULTS:** For all parameters, there was evidence of an increase in tooth eruption parameters during the 20 year interval. Furthermore a significant difference in change was found between different growth patterns for all parameters. For the majority of the parameters, the increase was higher for subjects who were younger at the end of orthodontic treatment. There was no evidence for a difference in change between males and females.

**CONCLUSION:** Continued tooth eruption readily occurs after termination of orthodontic treatment in all patients. There is a correlation between the mandibular growth pattern present and the amount of tooth eruption in the posterior and anterior regions in both the mandible and maxilla after completion of orthodontic treatment. These changes are more pronounced in patients treated orthodontically during adolescence.

#### SP10 POST-ORTHODONTIC RETENTION. A PROSPECTIVE CLINICAL TRIAL

Ahmed AIAIwan, Jan Huggare, Department of Dental Medicine, Section of Orthodontics, Karolinska Institutet, Stockholm, Sweden

**AIMS:** To compare the efficiency of two types of lower dental arch retainers, by evaluating patients prospectively during the first six months post-treatment.

**SUBJECTS AND METHOD:** A total of 53 patients were randomized into two groups. Group 1 consisted of 27 patients who were given an Essix vacuum formed retainer (VFR) in the upper arch and a twist flex lingual bonded retainer in the lower arch. Group 2 consisted of 26 patients who were given an Essix VFR in the upper and lower arch. Little's irregularity index (LII) was measured pre- (T0), immediately after (T1) and six months post- (T2) treatment. In order to evaluate the perception of the respective type of retainer, every participating patient completed a questionnaire at T2. Non-parametric statistical analysis was used to compare median changes in LII between the two study groups.

**RESULTS:** Between T1 and T2 a significant change in the LII in patients was observed in group 2 with a median change of 0.4 mm ( $P < 0.05$ ), compared to a median change of 0 mm in group 1. Although the change was statistically significant in group 2, probably it was not clinically meaningful, at least not when contact displacements were distributed among several teeth. Questionnaire data revealed that patients coped well with having an Essix VFR in both dental arches.

**CONCLUSION:** 1. When compliance factors are ruled out, lingually bonded twist flex retainers are more effective than Essix VFRs in preventing post-orthodontic changes of the lower anterior teeth, given that a 0.5 mm change in LII is considered clinically significant. 2. The majority of patients tolerate the use of Essix VFRs.

#### SP11 ELECTROMYOGRAPHIC AND CLINICAL ASSESSMENT OF STOMATOGNATHIC FUNCTION OF OBSTRUCTIVE SLEEP APNOEA PATIENTS TREATED WITH A MANDIBULAR ADVANCEMENT APPLIANCE

Georgia E. Pappa<sup>1</sup>, Athanasios E. Athanasiou<sup>2,3</sup>, Manolis J. Papagrigrakis<sup>4</sup>, Moschos A. Papadopoulos<sup>2</sup>, <sup>1</sup>Orthodontic Specialist, Chalkida, Greece, <sup>2</sup>Department of Orthodontics, Aristotle University of Thessaloniki, Greece and <sup>3</sup>Dubai College of Dental Medicine, U.A.E., <sup>4</sup>Department of Orthodontics, National and Kapodestrian University of Athens, Greece

**AIMS:** To evaluate signs and symptoms of temporomandibular disorders (TMD) and masticatory muscle function of obstructive sleep apnoea (OSA) patients after one year's nocturnal treatment with a mandibular advancement appliance.

**SUBJECTS AND METHOD:** Thirty-six consecutive OSA patients diagnosed by two hospital sleep laboratories and referred for oral appliance therapy. Twenty-two healthy adults formed the control group. The patients were treated for one year using a mandibular repositioning appliance, which advanced the mandible 70 per cent of maximal protrusion and opened it 5-

8 mm vertically. Pre-treatment and six-months and one-year post-treatment TMD assessment utilized Helkimo's anamnestic and clinical indices. The electric dynamic energy of masseter and temporalis muscles, by means of surface electromyography (sEMG), was recorded before placement of the appliance and one day, six months and one year after the beginning of treatment. Statistical analysis utilized the SPSS 19.0 software and the level of significance was set at  $P < 0.005$ .

**RESULTS:** No statistically significant differences were found in the anamnestic and clinical indices six months and one year after treatment. Right and left anterior temporalis muscles showed significantly greater sEMG activity during maximal voluntary clenching after six months and one year compared to the beginning of treatment, and revealed also significant differences when compared with the control group. The sEMG activity of the masseter muscle one year after treatment was statistically increased but no differences were observed in relation to the control group.

**CONCLUSION:** The mandibular advancement appliance used in patients with OSA had no adverse effects on stomatognathic function.

#### SP12 PRECISION OF LE FORT I OSTEOTOMY DURING ORTHOGNATHIC SURGERY: A MULTICENTRE RETROSPECTIVE STUDY

Stefan Abela<sup>1</sup>, David Tewson<sup>2</sup>, Sharon Prince<sup>2</sup>, Dirk Bister<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Guy's and St Thomas' NHS Foundation Trust, London and <sup>2</sup>Department of Oral Health, Norfolk and Norwich University Hospital, Norwich, U.K.

**AIMS:** To evaluate the precision of the Le Fort I osteotomy by comparing the planned facial surgical movements to the achieved outcomes.

**SUBJECTS AND METHOD:** Ten consecutive patients, who had undergone a Le Fort I osteotomy procedure alone or in combination with a mandibular osteotomy from eight different hospitals in the East of England between 2009 and 2010, were identified. Seven units agreed to participate in the study and 65 patients were identified. Sixty cases met the inclusion criteria and were included in this study. Pre- and post-operative records (lateral cephalograms) were obtained retrospectively, and traced digitally. Three radiographic points were used as cephalometric landmarks; i) point A (A-pt), ii) upper incisor tip (UI) and iii) upper first molar occlusal point (U6). The final position of the maxilla was compared to the initial planned position by digitising and tracing the pre-surgical, the planned and the immediate post-surgical lateral cephalograms, utilising Dolphin imaging software, version 10.0.

**RESULTS:** Overall, 73 per cent of subjects were within 2 mm of prediction and 18 per cent of the results were within 1 mm of prediction. Accuracy had a negative correlation with increased surgical complexity. The difference was not statistically significant for any specific movements of the maxilla.

**CONCLUSION:** Pre-operative surgical planning of Le Fort I osteotomies is accurate. Every effort should be made to reduce any potential sources of error even further. Precision with digital model planning and computerised fabrication of orthognathic surgery wafers has to be evaluated and compared to conventional surgical wafers.

#### SP13 A SCIENTIFICALLY BASED NEW CLINICAL APPROACH TO NASOALVEOLAR MOULDING AS A KEY ELEMENT OF INTEGRATED ORTHODONTIC CARE IN CLEFT LIP AND PALATE

Maria Chernobrovkina<sup>1</sup>, Alexey Silin<sup>2</sup>, Marina Trushko<sup>3</sup>, <sup>1</sup>Orthodontic Department, The Turner Scientific and Research Institute for Children's Orthopedics, <sup>2</sup>Department of General Dentistry, North-Western State Medical University n.a. I.I. Mechnikov and <sup>3</sup>Pediatric Rehabilitation Center of Congenital Craniofacial Abnormalities, Saint-Petersburg, Russia

**AIMS:** To enhance clinical efficiency of early rehabilitation and to determine the treatment response to function, aesthetics and growth in orofacial clefts.

**SUBJECTS AND METHOD:** One hundred and twenty eight patients with bilateral and unilateral cleft lip and palate (CLP) aged from 6 months to 8 years. Each subject had pre-surgical nasoalveolar moulding and lip repair. After surgery for each child, individualized simple, light and breathable endonasal stents for both nostrils were constructed using a

proven clinical algorithm. The symmetry and aesthetics of the nasolabial area (nose shape, deviation and profile, nostrils perimeter, internostril angles) and dental arch sizes were assessed by photometry, direct measurements and three-dimensional (3D) facial scanning using surface registration 3D data points collection algorithm and software analysis. Nasal airway size before and after endonasal stent therapy was evaluated by rhinomanometry. Rhinoscopy was carried out at baseline and every 6 months to examine nasal septal deformities and other anomalies. Statistical analysis included ANOVA tests and regression models.

**RESULTS:** Early integrated orthodontic care of CLP proved its efficiency acting on three key elements: function, aesthetics and growth. As infant orthopaedics corrected the form and perimeter of the arches and teeth, application of individualized endonasal stents from the first months until the end of the pubertal spurt, improved normal breathing and aesthetics by uprighting the nasal septum, stimulating the restricted mid-facial growth and reshaping the nasal area without widening the nostrils too much.

**CONCLUSION:** Nasoalveolar septum moulding proved its clinical application in the early rehabilitation of a CLP in patients and can be used as a tool to stimulate growth, improve function, aesthetics and patient well-being in the long term.

#### SP14 IMPLANTS VERSUS EXTRAORAL APPLIANCES: TREATMENT OF CLASS III MALOCCLUSION WITH MAXILLARY RETRUSION BY ALTERNATE RAPID MAXILLARY EXPANSION-CONSTRICTION AND MINI-IMPLANTS

Hatice Gökalp, Funda Aydın Mustafa, Department of Orthodontics, Faculty of Dentistry, Ankara University, Turkey

**AIMS:** A combination of facemask and maxillary expansion has been used for maxillary protraction in growing persons for a number of years. Nevertheless, using extraoral appliances reduces cooperation. The alternate rapid maxillary expansion-constriction (Alt-RAMEC) protocol is an effective procedure for mobilizing maxillary sutures. The aim of this prospective study was to determine the effectiveness of intraoral protraction of the maxilla by Alt-RAMEC and mini-implants.

**SUBJECTS AND METHOD:** Fifteen individuals (9 boys, 6 girls), mean age  $12.83 \pm 1.58$  years. Self-drilling mini-implants (1.5-6 mm) were inserted in the mandibular canine-premolar region under local anaesthesia. Alt-RAMEC protocol, which was 2 turns daily (0.5 mm) during 10 days, was performed using a McNamara type expansion appliance followed by Alt-RAMEC. In the 5th week, a force of approximately 400 g via Class III intermaxillary elastics on each side, was applied from hooks placed in the region between the second premolar and first molar of the McNamara type expansion appliance and mini-implants. After the 7th week, expansion and constriction ceased with the elastics used until a positive overjet and a Class I canine relationship was achieved. Six boys and three girls (mean age  $11.37 \pm 1.29$  years) were treated with a facemask-rapid palatal expander combination while untreated Class III subjects (4 boys, 3 girls, mean age  $10.16 \pm 1.13$  years) were used as controls. Mann-Whitney *U* and Wilcoxon signed rank tests were used for statistical analyses.

**RESULTS:** The maxilla and point A were positioned anteriorly according to measurements of SNA, A-T vert., Pr-T vert., UL-T vert., overjet and Wits appraisal ( $P < 0.05$ ).

**CONCLUSION:** Orthopaedic success can be achieved without extraoral appliances or mini-plates. Mini-implants inserted in the mandible can be an alternative treatment modality when compared with extraoral appliances or mini-plates.

#### SP15 ASSESSMENT OF A PROTRACTION SPRING AND ALTERNATE RAPID MAXILLARY EXPANSION-CONSTRICTION IN CLASS III MALOCCLUSIONS ASSOCIATED WITH MAXILLARY RETRUSION

Hatice Gökalp, Gözde Çobanoğlu, Department of Orthodontics, Ankara University Faculty of Dentistry, Turkey

**AIMS:** To assess the effects of the alternate rapid maxillary expansion and constriction (Alt-RAMEC) protocol in combination with a protraction spring in Class III growing patients.

**SUBJECTS AND METHOD:** All subjects included in the study had a Class III malocclusion. One group, consisting of 15 patients (9 males, 6 females) with a mean age of  $11.8 \pm 0.73$

years were treated with Alt-RAMEC/protraction spring. The other study group comprised nine patients (6 males, 3 females) treated with rapid maxillary expansion (RME)/facemask. The untreated control group consisted of seven subjects (4 males, 3 females). The data obtained was statistically analyzed by Mann-Whitney *U* and Wilcoxon signed rank tests.

**RESULTS:** Both the Alt-RAMEC/protraction spring and the RME/facemask groups showed significantly favourable effects leading to correction of the Class III malocclusion. The Alt-RAMEC/protraction spring protocol produced a more effective advancement of the maxilla (SNA +2.2°) and greater intermaxillary changes (ANB +4.5°) versus the RME/facemask protocol. Significant differences were recorded for mandibular skeletal changes (SNB -2.3°) and vertical skeletal relationships (Go-Me/FH +2.9°) only with the Alt-RAMEC/protraction spring protocol.

**CONCLUSION:** The Alt-RAMEC/protraction spring protocol induced more favourable skeletal short-term effects compared with RME/facemask therapy in Class III growing patients.

#### SP16 ABSENCE OR PRESENCE OF A MID-PALATAL SUTURE IN PATIENTS WITH COMPLETE UNILATERAL CLEFT LIP AND PALATE

Sherif Zahra<sup>1</sup>, Philip K T Chen<sup>2</sup>, Eric J W Liou<sup>2</sup>, <sup>1</sup>Division of Orthodontics and Children Dentistry, International Medical University, Kuala Lumpur, Malaysia and <sup>2</sup>Department of Craniofacial Orthodontics, Chang-Gung Memorial Hospital, Taipei, Taiwan

**AIMS:** The absence/presence of the mid-palatal suture in patients with a cleft lip and palate has not been well investigated, although this is essential for rapid palatal expansion and maxillary growth modification. The aim of this study was to test the hypothesis that the mid-palatal suture is present in patients with a unilateral complete cleft lip and palate (UCLP).

**SUBJECTS AND METHOD:** Twenty-three consecutive growing patients with a UCLP who received cone beam computed tomography (CBCT) and maxillary growth modification at the bone age of cervical vertebral maturation stage 2 (CVS2) from 2007-2013 in ChangGung Memorial Hospital, Taipei. For each patient, the CBCT axial sections before treatment were examined for prevalence of the presence, extent of suture in the maxilla, and maturation of the mid-palatal suture at the basal and alveolar bone levels. The data were analysed statistically.

**RESULTS:** The prevalence of the presence of a mid-palatal suture was 100 per cent at the basal-bone levels but decreased significantly ( $P < 0.001$ ) to 60.87 per cent at the alveolar levels. The incidence of late stage suture maturation was 86.96 per cent at the basal-bone levels and decreased significantly ( $P < 0.001$ ) to 14.29 per cent at the alveolar levels when the mid-palatal suture was present. The extent of the suture in the maxilla was  $72.00 \pm 20.52$  per cent at the basal-bone levels and decreased significantly ( $P < 0.001$ ) to  $28.54 \pm 27.00$  per cent at the alveolar levels.

**CONCLUSION:** Although the mid-palatal suture in patients with a UCLP is present, it fades away sharply and matures gradually from the basal bone down to the alveolar bone level of the maxilla at the bone age of CVS2.

#### SP17 A NEW PREFABRICATED FULL ADAPTABLE OCCLUSAL SPLINT FOR TREATMENT OF TEMPOROMANDIBULAR JOINT DISORDERS – RESULTS OF A PATIENT QUESTIONNAIRE

Ute Botzenhart<sup>1</sup>, Aladin Sabbagh<sup>2</sup>, Reem Sabbagh<sup>2</sup>, Tomasz Gredes<sup>1</sup>, Tomasz Gedrange<sup>1</sup>, <sup>1</sup>Department of Orthodontics, TU Dresden and <sup>2</sup>Orthodontic Practice, Erlangen, Germany

**AIMS:** To investigate patients' perceptions after treatment with a new prefabricated chair-side customized, water based, full adaptable occlusal splint (AquaSplint) in connection with temporomandibular joint disorders (TMD).

**SUBJECTS AND METHOD:** After conclusion of AquaSplint treatment, patients ( $n = 100$ ) were surveyed by means of a standardized questionnaire, concerning wear period and comfort, improvement of TMD, pain, joint clicking and other disorders in this context as well as potential recommendations. Answers were examined separately and the results were calculated in percentages.

**RESULTS:** In 82 per cent treatment time averaged 4, 5 or more weeks with a wear period of 8 hours at night (48%) and 0 to 1-2 hours (30% respectively) in the daytime. Seventy three per cent reported an improvement of symptoms, 24 per cent up to 60 per cent, and 18 per cent up to 30 or 90 per cent, respectively. In most cases TMD and pain relief were noted in the first (32.87%), second (23.29%) or in the third week or later (17.8%). Forty seven per cent of the patients would recommend AquaSplint treatment very much.

**CONCLUSION:** With TMD caused pain, AquaSplint is an excellent therapy for quick pain relief and also during orthodontic rehabilitation.

#### SP18 EFFECTS OF ASYMMETRIC CANINE SUBSTITUTION ON THE PERCEPTION OF SMILE ATTRACTIVENESS

Takashi Murakami<sup>1</sup>, Takeshi Yanagita<sup>1</sup>, Tomoki Kataoka<sup>2</sup>, Hiroshi Kamioka<sup>2</sup>, Departments of Orthodontics, <sup>1</sup>Okayama University Hospital and <sup>2</sup>Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, Okayama city, Japan

**AIMS:** To elucidate whether variations in the morphology, size and/or shade of the maxillary canines influence the perception of smile attractiveness in patients with a unilateral canine substituted for a missing maxillary lateral incisor (asymmetric canine substitution).

**MATERIALS AND METHOD:** A smiling photograph of a hypodontia patient with a maxillary canine unilaterally substituted for a missing lateral incisor. Seventeen images were created digitally modifying the width, tip height, gingival height and shade of the canine. The subjects included 104 laypersons and 23 orthodontists from Okayama University Hospital. All participants were shown the images and given a questionnaire on which they were asked to describe their perception of the smile using a 100-point visual analogue scale.

**RESULTS:** The canine tip height and colour shade had a marked effect on perceived smile attractiveness in the patient with asymmetric canine substitution. In contrast, the canine width and gingival height did not affect the perception of the patient's asymmetric condition. The orthodontists perceived the patient to be less attractive than the laypersons for all four parameters of smile attractiveness, and there were significant differences in perceived smile attractiveness between the laypersons and orthodontists with respect to the alterations in canine width and colour variation.

**CONCLUSION:** The morphology, size and shade of the maxillary canines in patients with asymmetric canine substitution have a marked effect on perceived smile attractiveness.

#### SP19 PAIN PERCEPTION BY PATIENTS AND ORTHODONTISTS DURING ORTHODONTIC THERAPY

Bhavna Shroff<sup>1</sup>, Sara Schutte<sup>1</sup>, Andrew Hansen<sup>1</sup>, Steven Lindauer<sup>1</sup>, Alvin Best<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Periodontics/Biostatistics, VCU, Richmond, USA

**AIMS:** Pain is an undesirable side effect often associated with orthodontic therapy. The objective of this study was to measure patients' perceived pain levels during orthodontic treatment, including how they manage pain, and to compare their responses to those of practicing orthodontists. In addition, patients' and orthodontists' beliefs about the use and effectiveness of alternative pain therapies were measured.

**SUBJECTS AND METHOD:** Orthodontists and patients were asked to complete corresponding surveys assessing anticipated pain during orthodontic treatment, and methods used to treat it, including alternative, non-pharmacological treatments. The resulting data were analyzed using chi-square and *t*-tests to determine if patients and orthodontists had different perceptions of pain and treatment strategies for pain.

**RESULTS:** There were discrepancies between patients' experiences and orthodontists' expectations: Fifty nine per cent of orthodontists expected their patients to experience pain 24 hours after an appointment, but 22 per cent of patients reported never experiencing pain ( $P < 0.0001$ ). Eighty four per cent of orthodontists reported that they recommend post-procedure over-the-counter medications, but only 33 per cent of patients utilized this strategy. Specifically, 48 per cent of orthodontists said they recommended their patients take ibuprofen to treat orthodontic pain. However, 54 per cent of patients reported that their orthodontist did not make any specific recommendations at all. The majority of patients reported that they would be willing to try bite wafers (73%) and topical analgesic gel (80%)

as alternative therapies for pain management. Orthodontists, however, were less likely to recommend these alternative therapies.

**CONCLUSION:** There is a difference of opinion regarding the amount, timing, and treatment of pain between patients and orthodontists. Improved communication between patients and orthodontists would be beneficial. Further investigation into alternative therapies for pain should be completed.

#### SP20 SKELETAL ANCHORAGE CHANGES TREATMENT STRATEGIES IN PATIENTS WITH MULTIPLE APLASIA

Susanne Wriedt<sup>1</sup>, Maximilian Moergel<sup>2</sup>, Joachim Wegener<sup>3</sup>, Heinrich Wehrbein<sup>1</sup>, Departments of <sup>1</sup>Orthodontics, <sup>2</sup>Maxillofacial Surgery, and <sup>3</sup>Prosthodontics, J.-Gutenberg University Medical Center, Mainz, Germany

**AIMS:** To evaluate whether and how treatment strategies in patients with multiple aplasia change when using skeletal anchorage, especially palatal implants.

**MATERIALS AND METHOD:** Using the records (panoramic radiograph, lateral cephalogram, model casts, photographs and interdisciplinary medical file) the course of treatment of 39 patients with multiple aplasia (i.e. at least two aplastic teeth per quadrant) were evaluated extracting parameters such as number and place of aplasia and persisting primary teeth, appliances used, direction of tooth movement, place and type of prosthetic restoration. Descriptive analyse, Chi square, and Mann-Whitney-*U*-test were performed using SPSS20.

**RESULTS:** At the start of treatment the age of the patients was  $14.6 \pm 4.5$  years; there was aplasia of  $12 \pm 6$  permanent and persistence of  $7 \pm 4$  primary teeth. Except for two patients with ectodermal dysplasia, there were no syndromes. The appliances used were plates (26%), functional (39%), fixed (88%) and skeletal anchorage (44%). Teeth were moved in transversal (36%), sagittal (80%), and vertical (85%) directions. Eleven patients needed orthognathic surgery. Using skeletal anchorage, more spaces in the anterior ( $P = 0.024$ ) and posterior ( $P = 0.030$ ) region were closed orthodontically. Closing one tooth space per quadrant by mesialization of the teeth, persisting primary teeth were left ( $P = 0.008$ ) or only single tooth implants were needed ( $P = 0.018$ ). Wider (implant based) prosthetic constructions were avoided.

**CONCLUSION:** Using skeletal anchorage in subjects with multiple aplasia, more spaces are closed orthodontically or are provided by single tooth implants. Thus extensive prosthetic restoration is avoided.

#### SP21 EFFECT OF BUCCAL CORRIDOR RATIO ON ATTRACTIVE SMILES JUDGED BY LAY PEOPLE AND DENTAL PROFESSIONALS

Behnam Khosravani Fard<sup>1</sup>, Souka Shalileh<sup>2</sup>, Syed Hadi Sajadi<sup>1</sup>, <sup>1</sup>Azad University, Tehran, and <sup>2</sup>General practitioner, Tehran, Iran

**AIMS:** To evaluate buccal corridor ratio in attractive smiles, selected by lay people, orthodontists, prosthodontists and restorative/cosmetic dentists in a male population, and to compare lay people's perception of buccal corridor ratio with that of professionals.

**SUBJECTS AND METHOD:** Using a 10 centimetre visual analogue scale, 12 lay people, six orthodontists, three prosthodontists and three restorative/cosmetic dentists rated the attractiveness of 100 black and white smiling photographs of 18 to 25 year old ( $20 \pm 0.7$ ) male dental student who had not undergone aesthetic or orthodontic treatment and had no dental abnormalities. The photographs were cropped from the nasal base to the chin. Buccal corridor ratios during smiling with an average score of 6 or more (attractive smiles) in each rater group were calculated using Adobe Photoshop 7, based on visible maxillary dentition width divided by inner intercommissural width. The mean buccal corridor ratio in attractive and unattractive smiles was compared. The mean attractiveness scores and buccal corridor ratio in attractive smiles among rater groups was compared using Mann-Whitney *U* and Kruskal-Wallis tests.

**RESULTS:** Buccal corridor ratio in attractive smiles ( $0.82 \pm 0.02$ ) in comparison with unattractive smiles ( $0.8 \pm 0.04$ ) statistically influenced smile attractiveness, although this was not clinically significant. Lay people preferred smiles with a mean buccal corridor ratio of

0.81 ± 0.5 and maximum mean attractiveness score of 7.08 ± 0.7, while orthodontists preferred smiles with a maximum mean buccal corridor ratio of 0.83 ± 0.01 and minimum attractiveness score of 6.39 ± 0.5, which was not clinically significant.

CONCLUSION: Buccal corridor ratio does not play an important role in the attractiveness of smiles. Orthodontists and restorative/cosmetic dentists are more sensitive to it and prefer the largest buccal corridor ratio in comparison with lay people.

#### SP22 A LOOK AT COMBINED APPLICATION OF PIEZOSURGICAL CORTICOTOMY AND MINISCREWS

Olga Arsenina, Natalia Popova, Anna Popova, Department of Orthodontics, Central Research Institute of Dentistry and Maxillofacial Surgery, Moscow, Russia

AIMS: Clinical evaluation and construction of treatment plans for patients with different types of malocclusion using miniscrews, braces and piezosurgical corticotomy combinations. The aim of this research was to decrease the duration and increase the efficiency of treatment.

SUBJECTS AND METHOD: Sixty patients (aged 18-45 years) with different malocclusions for whom a clinical examination and anthropometric and radiographic analyses were carried out. Therapy was undertaken in 36 patients using the Damon system appliance (Ormco, USA), in 24 patients with lingual brackets (Incognito, Germany) or Vector Tas orthodontic miniscrews (186 miniscrews). Orthodontic treatment using miniscrews and piezosurgical corticotomy was performed in 20 subjects.

RESULTS: Orthodontic miniscrews allowed control of movement of the teeth without patient cooperation provided by absolute support, safety and predictability. They have minimal anatomical limitations due to their small size. They can be loaded immediately after installation. In addition orthodontic miniscrews resulted in a significant reduction in treatment time.

CONCLUSION: A combination of miniscrews and piezosurgical corticotomy allows increased efficiency and a reduction in treatment time of approximately 3-6 months.

#### SP23 MORPHOLOGICAL AND FUNCTIONAL CHANGES OF THE DENTAL SYSTEM IN PATIENTS WITH EAR, NOSE AND THROAT PATHOLOGY

Ksenia Piksaikina, Olga Arsenina, Natalia Popova, Anna Popova, Department of Orthodontic, Central Research Institute of Dentistry and Maxillofacial Surgery, Moscow, Russia

AIMS: To evaluate morphological changes of the dental system in patients with pathology of pharyngeal tonsils before and during orthodontic treatment.

SUBJECTS AND METHOD: Forty children (20 boys, 20 girls) aged 5-14 years with pharyngeal tonsil diseases and different malocclusions. The data included clinical examination, anthropometric and radiographic analyses, rhinopneumometry and electromyography (EMG) of the muscles in the maxillofacial region. During treatment a set of measures was provided to restore nasal breathing and correct the myofunctional balance in the maxillofacial region using an elastopositioner.

RESULTS: The prevalence of dentofacial anomalies among patients with hyperplasia of the pharyngeal tonsils (adenoids) was 90 per cent. Comparative analysis of the anthropometric study of dental models after treatment showed that use of elastopositioners improved the morphological parameters of the dental system. EMG analysis showed incoordination of the masticatory muscles. Functional analysis (rhinopneumometry) showed that the functional appliance and gnathotraining (gymnastics of muscles) improved the position of the lower jaw and tongue. This resulted in an increase of airway space (larynx). Lateral radiographic analysis showed an improvement of the anatomical skeleton and soft tissues.

CONCLUSION: The complex symptoms of disorders of the dentition in patients with ear, nose and throat pathology was identified, and complex treatment techniques were proposed, developed in conjunction with an otorhinolaryngologist, that included an elastopositioner appliance and myogymnastic, breathing exercises.

## SP24 DOES ORTHOGNATHIC SURGERY IMPROVE THE FACIAL SOFT TISSUE PROFILE?

Katharina Klaus, Sabine Ruf, Department of Orthodontics, Justus-Liebig-University, Giessen, Germany

**AIMS:** To define which Class II patients benefit most from combined orthodontic/orthognathic surgery treatment.

**SUBJECTS AND METHOD:** Twenty surgical Class II division 1 patients (9 males, 11 females) were retrospectively included. The pre- and post-treatment profile photographs were converted into black silhouette profiles and randomized. Forty male judges (20 orthodontists, 20 laypeople) evaluated the profile silhouettes on 100 mm visual analogue scales (VAS), anchored with 'not pleasing' and 'very pleasing'. Soft tissue and cephalometric measurements and subjective VAS assessments were correlated.

**RESULTS:** On average, soft tissue profile aesthetics improved by only 12.6 per cent, with large interindividual variations (VAS-changes between +40% and -11%). The VAS-changes showed no correlation with the surgical procedure (mono-/bimaxillary). Younger orthodontists assessed the largest degrees of improvements, while older laypeople, younger laypeople and older orthodontists evaluated the profiles more critically. However, all four groups of judges agreed in terms of the patients showing the least and the largest improvements. A consistent improvement of soft tissue profile aesthetics was only achieved in patients with pre-treatment profile convexity angles  $\leq 155$  degrees, pre-treatment ANB-angles  $\geq 8$  degrees and pre-treatment VAS scores  $\leq 20$  mm.

**CONCLUSION:** Only patients with very severe Class II malocclusions (profile angle  $\leq 155^\circ$ , ANB  $\geq 8^\circ$ , VAS score  $\leq 20$  mm) show a consistent improvement in soft tissue profile aesthetics after orthognathic surgery. In borderline cases, soft tissue facial improvements should be predicted in a defensive manner.

## SP25 DIAGNOSTICS OF THE SKULL SECTIONS OF CLASS II DIVISION 2 PATIENTS

Maria Dushenkova, Leo Persin, Natalia Pankratova, Maria Markova, Irina Roubleva, Department of Orthodontics & Pediatric Tooth Replacement, Moscow State Dentistry University, Russia

**AIMS:** To study the intensity of age-related change in the cerebral and facial parts of the skull of Class II division 2 children to detect skull morphological structures differing from normal growth intensity in the primary dentition.

**MATERIALS AND METHOD:** Sixty two lateral teleroentgenograms of the head were obtained. Thirteen longitudinal and 14 vertical parameters of the facial and cerebral parts of the skull of 30 children (7-12 years of age) in the primary dentition and of 32 children (12-15 years of age) after this period were studied.

**RESULTS:** The intensity of age-related changes of many longitudinal and vertical parameters of the skull significantly differed from normal. This intensifies abnormality of the facial skull section resulting in occlusion and facial configuration abnormality.

**CONCLUSION:** Children with a Class II division 2 malocclusion should be treated as early as possible, using orthodontic appliances of an optimal design.

## SP26 IMPROVEMENTS IN THE TREATMENT OF PATIENTS WITH DISTAL OCCLUSION AND RETRUSION OF THE UPPER ANTERIOR TEETH

Maria Dushenkova, Leo Persin, Maria Markova, Irina Roubleva, Department of Orthodontics & Pediatric Tooth Replacement, Moscow State Dentistry University, Russia

**AIMS:** To study the intensity of age-related changes in linear and angular parameters of the skull in children with distal occlusion and retrusion of upper anterior teeth and to compare them with subjects without such anomalies. Detection of some distinctive features can perfect diagnosis and help to determine the most favourable age when orthodontic treatment should be started to obtain stable results.

**MATERIALS AND METHOD:** Sixty two teleroentgenograms of the head in lateral projection of children with a distal occlusion and deep incisor distocclusion (Angle Class II division 2). Thirty of them were obtained during the primary dentition (at the age of 7-12 years) and 32

after maturation of the permanent teeth (at the age of 12-15 years). Values of 19 linear and 16 angular parameters of the cerebral and facial skull sections were obtained.

**RESULTS:** The data obtained indicated that orthodontic treatment for children with distal occlusion and retrusion of the upper anterior teeth is necessary at an early age. During diagnosis attention should be paid to the linear and angular parameters of the intensity of age-related changes that considerably differ from normal.

**CONCLUSION:** As a result of the findings of this study orthodontic appliances of an optimal design can be chosen to improve treatment at an early age.

#### SP27 EVALUATION OF ROOT RESORPTION AFTER NON-EXTRACTION ORTHODONTIC TREATMENT USING CONE BEAM COMPUTED TOMOGRAPHY

Kyung ha You, Yoon-Ah Kook, Yoonji Kim, Department of Orthodontics, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea, South

**AIMS:** To evaluate the incidence and severity of root resorption of the maxillary incisors during non-extraction orthodontic treatment with fixed appliances in adults by means of cone beam computed tomography (CBCT).

**SUBJECTS AND METHOD:** Subjects were recruited from patients who had orthodontic treatment with full fixed orthodontic appliance without extractions (except third molars). Inclusion criteria were: (1) malocclusion with mild to moderate crowding, (2) overbite and overjet less than 5 mm, (3) adult patients with fully developed permanent dentitions and (4) no history of trauma or crown fracture of the anterior teeth. Forty patients (13 females, 27 male) were found to meet these criteria. The mean age of the patients was 27.88 years. CBCT examinations were performed before and at the end of orthodontic treatment. Root length and surface resorption were measured.

**RESULTS:** The mean amount of root shortening was 0.46 mm (SD 0.45 mm) and 0.64 mm (SD 0.44 mm) for the maxillary right central and lateral incisors. The lateral incisors showed statistically more root resorption ( $P < 0.05$ ). At the maxillary central incisors, 67.5 per cent showed root shortening between 0.5-1 mm. At the lateral incisors, a lesser amount of root resorption (less than 1 mm) was found in 77.5 per cent of subjects. Some teeth had root shortening greater than 2 mm with no definite reason. Surface resorption was found in 10 per cent of the maxillary central incisors, and in 2.5 per cent of the lateral incisors and all had simultaneous involvement of root shortening. Pearson correlation analysis showed original root length had a high correlation with the amount of root resorption.

**CONCLUSION:** 1. The mean amount of root shortening was less than 1 mm in over 70 per cent of subjects. However, in some patients, more than 2 mm of root shortening combined with simultaneous surface resorption was observed. 2. A strong correlation was observed between the amount of root resorption and original root length. Age and treatment duration were not a contributing factor to root resorption in this study. 3. Clinicians should pay more attention to possible surface root resorption which may not be observed on two-dimensional radiographs and should inform the patients about this.

#### SP28 UNITED REFERENCE METHOD: A NEW METHOD OF THREE-DIMENSIONAL EVALUATION AND ITS RELIABILITY AND APPLICATION IN A CLEFT PALATE CASE

Shereef Shahan<sup>1</sup>, Letizia Perillo<sup>1</sup>, Gennaro Carrino<sup>1</sup>, Fady Fahim<sup>2</sup>, Departments of Orthodontics, <sup>1</sup>Second University of Naples, Italy and <sup>2</sup>Cairo University, Egypt

**AIMS:** To apply the united reference method (URM) for three-dimensional (3D) evaluation in a cleft lip and palate (CLP) subject to verify its reliability.

**MATERIALS AND METHOD:** URM is a combination of a 3D superimposition, based on the anterior cranial base anatomical surface, and cephalometric measurements based on a reference plane. 3D superimposition enables measurement of differences whereas the combination of the two systems allows determination of the direction of changes in order to produce descriptive measurements to evaluate treatment outcome. For the 3D superimposition, only one reference plane is used for the pre- and post-cone beam computed tomographs, named the corrected Frankfort horizontal (C-FH). In addition, more auxiliary reference planes having a stable relation with the C-FH, either parallel or perpendicular to it, and related to the area affected by treatment, may be used. Linear and

angular measurements are produced by the projection of the same pre- and post-landmarks on the C-FH to produce descriptive measurements. Reference related points were digitized once while points affected by treatment were digitized twice. Due to the asymmetry of FH components, C-FH midline was corrected by sella point identified through a new semi-automated method. URM was applied to measure volumetric linear and angular changes in a cleft palate case. For statistical evaluation of the method error, landmarks were identified and measurements were produced multiple times once a week for the same case by the same operator. Both the standard deviation and Pearson correlation were made to assess method reproducibility.

**RESULTS:** Intra-operator correlations were above 0.995 for all digitized X, Y and Z coordinates of dental and skeletal points as well as sella point showing high correlation and reliability. Intra-operator correlations were above 0.871 for linear distances measured between two similar dental points and for angular changes pre- and post-treatment.

**CONCLUSION:** URM for 3D evaluation is a reliable method to measure changes which can be applied in CLP cases.

#### SP29 PSYCHOSOCIAL PREDICTORS IN ADULT PATIENTS UNDERGOING ORTHODONTIC TREATMENT

María José González Olmo<sup>1</sup>, Cecilia Peñacoba Puente<sup>2</sup>, Martín Romero Maroto<sup>1</sup>, Noelia Santos Puerta<sup>3</sup>, Carolina Ruiz Duque<sup>4</sup>, Departments of <sup>1</sup>Orthodontics, <sup>2</sup>Psychology and <sup>4</sup>Pediatric Dentistry, Rey Juan Carlos University and <sup>3</sup>Rey Juan Carlos University, Alcorcón, Madrid, Spain

**AIMS:** To study the role of psychosocial variables in adult patients undergoing orthodontic treatment.

**SUBJECTS AND METHOD:** Seventy-four patients (average age  $33.24 \pm 10.56$  years) undergoing metal multibracket-fixed orthodontic treatment. The patients were assessed twice. The first stage, at the beginning of treatment, included assessment of some psychological variables, and the second stage, 6 months later.

**RESULTS:** Dental social impact differentiates between patients with a high and low negative effect, while self-efficacy differentiates between patients with high and low positive effect. Trait anxiety and self-esteem differentiate between both types of effect (positive and negative). Trait anxiety and self-esteem (when trait anxiety weight is controlled) are significant predictive variables of effective balance.

**CONCLUSION:** These results have important practical implications, because it seems essential to adopt a bio-psychosocial model incorporating assessment methods focusing on day-to-day changes in mood and well-being.

#### SP30 EFFECTS OF LOWER THIRD MOLAR ANGULATION AND POSITION ON LOWER ARCH CROWDING

Mimoza Selmani<sup>1</sup>, Juljana Gjorgova<sup>2</sup>, Manushaqe Selmani<sup>1</sup>, <sup>1</sup>Dental University, Prishtina, Kosovo and <sup>2</sup>Dental University, Skopje, Former Yugoslav Republic of Macedonia

**AIMS:** To determine the relationship between lower arch crowding and the presence of angulation and position of the lower third molar.

**SUBJECTS AND METHOD:** Measurements of the dental arch were made in 120 subjects aged 16 to 21 years (average age 18 years). The subjects were divided into two groups: Class I normal occlusion comprised 35 males and 25 females with a mean age of 18.87 years, whereas Class I crowding comprised 27 males and 33 females with a mean age of 18.5 years. Dental pantomograms (DPT) were used to calculate the ratio of retromolar space (Ganss ratio), angulation of the third molar to the second molar, and third molar to the base of the mandible. Differences between these measurements of the lower arch 'crowded' and 'normal' (right and left sides) groups were made by Mann-Whitney *U* test.

**RESULTS:** Measurements of Ganss ratio, third molar angulation to the base of the mandible, and third molar to second molar inclination, was statistically significant between the crowded and normal groups.

**CONCLUSION:** There is a strong relationship between angulation and the position of the third molars and lower arch crowding.

### SP31 FACTORS INFLUENCING LIP LINE CANTING

Woo-Sung Son, Mi-Jeong Kim, Jung-In Bae, You-Min Kim, Won-Jae Yi, Department of Orthodontics, Pusan National University, Yangsan, Korea, South

AIMS: To evaluate factors which influence lip line canting in facial asymmetry.

SUBJECTS AND METHOD: Thirty two patients with menton deviation of 4 degrees to the MSR plane (mean age  $20.41 \pm 3.82$  years). Three-dimensional cone-beam computed tomographs were analyzed. Sixteen measurements (4 linear, 12 angular) were measured in order to evaluate factors which influence lip line canting. Mx. canting, Mx. and Mn. occlusal plane canting, vertical difference of antegonions and lip line canting were measured to the FH plane. Menton deviations were measured to the MSR plane. All measurement used the defined multiplanar reconstruction images.

RESULTS: Mx. canting, occlusal plane canting of the upper canine, lower canine and upper first premolar were negatively correlated with lip line canting. Occlusal plane canting of the upper second premolar, first molar, lower first and second premolar, first molar and antegonion height difference and menton deviation were positively correlated with lip line canting.

CONCLUSION: Lip line canting is more severe in facial asymmetry patients and positively correlated with occlusal plane canting of the upper second premolar, first molar, lower first, second premolar, first molar and antegonion height difference and menton deviation.

### SP32 RELATIONSHIP BETWEEN GUM CHEWING RATE AND AUTONOMIC NERVOUS SYSTEM ACTIVITY

Hiroko Ohmori<sup>1,2</sup>, Hiroaki Kirimoto<sup>1,2</sup>, Yorichika Shioya<sup>2</sup>, Takashi Ono<sup>1,2</sup>, <sup>1</sup>Department of Orthodontic Science, <sup>2</sup>Tokyo Medical and Dental University, Japan

AIMS: Recent studies have revealed a relationship between malocclusion and general health. However, patients with malocclusion reportedly exhibit impaired occlusal function. Stress, which involves the autonomic nervous system (ANS), is reduced by mastication. The objective of the present study was to clarify the effect of masticatory function on general health. The relationship between the gum chewing rate and ANS activity were investigated.

SUBJECTS AND METHOD: Ten healthy adult patients without malocclusion. Measurements were performed in a silent room at a temperature of 26°C from 10:00 to 12:00. The patients were instructed to chew at their natural rate, a slow rate (36 cycles/minute), and a normal rate (72 cycles/minute) for 3 minutes. ANS activity was calculated using differences in the heart rate (HR), which were measured using a pulse frequency metre (Pulse Analyzer Plus; YKC Corporation, Tokyo, Japan) for 5 minutes before and after gum chewing. The R-R interval was evaluated by power spectrum analysis using low-frequency (LF) and high-frequency (HF) band powers and their ratio (LF/HF). While chewing at their natural rate, the patients' unitary activity was plotted with respect to chewing rate and the differences in HR, LF band power, HF band power, and LF/HF ratio before and after chewing to obtain a correlation coefficient. Statistical analyses were performed using Friedman's test ( $P < 0.05$ ).

RESULTS: A significant positive correlation was noted between the natural chewing rate and LF band power, LF/HF ratio, and HR. There were no significant differences in HR, LF band power, HF band power, or LF/HF ratio among the chewing rates.

CONCLUSION: A faster rate of gum chewing increases sympathetic activity. Additionally, individual chewing rates affect ANS activity to a greater degree than controlled chewing rates.

### SP33 SATISFACTION WITH DENTAL APPEARANCE AND OCCLUSAL FUNCTION AMONG ADOLESCENTS WITH ANTERIOR CROSSBITE

Eliina Puijola<sup>1</sup>, Terttu Pietilä<sup>2</sup>, Ilpo Pietilä<sup>2</sup>, Juha Varrela<sup>1</sup>, Anna-Liisa Svedstöm-Oristo<sup>1</sup>, <sup>1</sup>Department of Oral Development and Orthodontics, Institute of Dentistry, University of Turku and <sup>2</sup>Health Centre of Pori, Finland

AIMS: To investigate the impact of an anterior crossbite on self-perceived satisfaction with occlusal function and dental appearance among adolescents.

SUBJECTS AND METHOD: Of all 2212 invited 16-18 year-olds, 995 (45.0%, 380 males and 615 females) adolescents participated in a clinical examination. Of these, 17 subjects with a posterior crossbite were excluded. Anterior crossbite was registered in 39 (4.0%) of the remaining 978 adolescents; five adolescents (12.8%) had slide between centric relation and intercuspal position. Before the examination, all participants were requested to fill in a semi-structured questionnaire asking about satisfaction with occlusal function and dental appearance. Satisfaction was analyzed between genders and between adolescents with and without a crossbite using a chi-square test.

RESULTS: Of adolescents with an anterior crossbite, 79 per cent were pleased or very pleased with occlusal function while the corresponding percentage among those without crossbite was 92 ( $P = 0.001$ ). No statistically significant difference was found between genders. Satisfaction with dental appearance was reported by 99 per cent of adolescents. Adolescents without an anterior crossbite were statistically significantly more pleased with the alignment of their anterior teeth than adolescents with a crossbite ( $P < 0.001$ ) and males were more pleased than females ( $P = 0.005$ ).

CONCLUSION: In general, an anterior crossbite seems to decrease adolescents' satisfaction with occlusal function and dental appearance.

#### SP34 EXTRACTION RATE AND IDENTIFICATION OF EVIDENCE BASED TREATMENT PREDICTORS IN CLASS I MALOCCLUSIONS

Dimitrios Konstantonis, Chrysi Anthopoulou, Margarita Makou, Department of Orthodontics, University of Athens, School of Dentistry, Greece

AIMS: The extraction rate in orthodontics shows great variability throughout the years. While the extraction decision is easily made or excluded in clear-cut cases, it still remains controversial as to what makes an orthodontist decide to extract in borderline cases. The aim of this retrospective study was to identify the percentage of extraction cases in a large group of Class I malocclusion subjects and to clarify which variables contributed most to the extraction decision.

MATERIALS AND METHOD: Five hundred and forty two randomly selected records of Class I patients treated in a university graduate programme and in five private orthodontic offices. Of these patients, 331 were female and 211 male. The mean age was 14.55 [standard deviation (SD) 5.36] for the non-extraction group and 14.52 (SD 4.86) for the extraction group. The extensive series of 32 linear and angular measurements derived from the cephalometric analysis and the dental casts, along with the variables of age and gender, fuelled a stepwise discriminant analysis.

RESULTS: The percentage of the patients treated with four first premolar extractions was 26.8. The results showed that the variables of lower crowding, lower lip to E-plane, upper arch crowding, and overjet accounted most for the decision to extract at a very significant level ( $P < 0.000$ ). The discriminant analysis assigned a classification power of 83.9 per cent to the predictive model ( $P < 0.0001$ ). Fisher's linear discriminant functions provided a mathematical model, according to which any case can be classified into the adequate treatment group.

CONCLUSION: In a large contemporary sample of 542 Class I patients, the extraction rate was 26.8 per cent. The most important measurements when the orthodontist decides extractions in Class I cases are lower arch crowding, lower lip to E-plane, upper arch crowding, and overjet. In clinical orthodontic practice, the findings facilitate treatment by providing evidence-based treatment predictors for Class I malocclusions.

#### SP35 THE EFFECT OF MANDIBULAR ADVANCEMENT SPLINT THERAPY IN MILD, MODERATE AND SEVERE OBSTRUCTIVE SLEEP APNOEA MEASURED WITH SLEEP REGISTRATION

Tuula Ingman<sup>1,2</sup>, Siru Riekkii<sup>2</sup>, Sirpa Arte<sup>2</sup>, <sup>1</sup>Department of Oral and Maxillofacial Diseases, <sup>2</sup>Helsinki University Central Hospital, Finland

AIMS: To evaluate the effect of a mandibular advancement splint (MAS) in mild, moderate and severe obstructive sleep apnoea (OSA) subjectively and clinically by sleep registration.

SUBJECTS AND METHOD: Seventy seven male and 25 female patients (mean age 52 years, 25-77 years) suffering from mild [32%, apnoea/hypopnea index (AHI) 5-<15/h), moderate (32%, AHI 15-30/h) and severe (35%, AHI >30/h) OSA. All patients were treated with MAS at the Department of Oral and Maxillofacial Diseases, HUCH in the years 2011-2012. At the beginning of treatment the MAS kept the mandible at approximately 70 per cent of maximal protrusion. Sleep studies, which were performed by a type III ambulatory polygraph Embletta, were done both at the beginning of treatment (without the MAS) and approximately 11 months from the beginning of MAS treatment. Body mass index (BMI) was initially 27.4 kg/m<sup>2</sup> and 27.9 kg/m<sup>2</sup> at the time of the second sleep registration. The results were analyzed using Mann-Whitney and Kruskal-Wallis tests and non-parametric Spearman correlation coefficients. The protocol of the study was reviewed and approved by the Institutional Research Ethics Board.

RESULTS: Seventy two per cent of the patients had tried continuous positive airway pressure (CPAP) therapy for approximately 9 months before the MAS treatment. The mean AHI in mild OSA patients was decreased from 10.2/h before treatment to 4.9/h after treatment. In moderate OSA patients the AHI decreased from 20.9/h to 9.7/h and in severe OSA patients from 46.4/h to 14.5/h. At the first three month evaluation, 16 per cent of the patients needed an additional 1-2 mm addition in the forward movement of MAS.

CONCLUSION: The sleep recordings along with the subjective indicators (degrees of snoring, daytime sleepiness, degree of apnoea) demonstrate that MAS could successfully treat severe, moderate and mild OSA. An experienced dentist using clinical evaluation and patient's subjective signs can mostly estimate the ideal amount of mandibular protrusion. The results suggest that MAS is a good treatment alternative for CPAP.

#### SP36 EVALUATION OF SOFT TISSUE CHANGES AFTER RAPID MAXILLARY EXPANSION TREATMENT WITH THE THREE-DIMENSIONAL STEREOPHOTOGRAMMETRY METHOD

Serkan Görgülü, Gökhan Serhat Duran, Furkan Dindaroğlu, Department of Orthodontics, Gülhane Military Medical Academy, Ankara, Turkey

AIMS: The skeletal and dental changes associated with rapid maxillary expansion (RME) are well documented, although effects on the soft tissues and the potential impact on facial aesthetics have not been well researched. The purpose of this study was to evaluate immediate changes in facial soft tissues as a result of RME by comparing three-dimensional (3D) digital photogrammetric images before and after RME treatment.

SUBJECTS AND METHOD: Twenty patients, diagnosed with transverse maxillary deficiency, requiring RME as part of their orthodontic treatment. The control group included 20 patients of a similar age range without transverse maxillary deficiency. 3D photographic data was obtained using the 3dMD trio System (3dMD, Atlanta, Georgia, USA). For the RME patients, images were obtained pre-treatment and immediately post-expansion. For the control subjects, an initial image was obtained pre-treatment and the second image after approximately 6 weeks. Each image was imported into 3dMd Patient, Geomagic Control and Mimics software for evaluation.

RESULTS: Significant increases in intercanthal width, the width of the nose, and intercommissural width were observed in patients with RME, but only the increase in intercommissural width was significant when compared with the control group.

CONCLUSION: The 3D stereophotogrammetry method is an accurate method to compare 3D photographs of the same patients at different time points.

#### SP37 EFFECTS OF OCCLUSAL HYPOFUNCTION ON PERIODONTAL LIGAMENT STRUCTURE AND EXPRESSION OF VASCULARENDOTHELIAL GROWTH FACTOR IN MICE

Toshitsugu Kawata, So Koizumi, Takero Otsuka, Department of Orthodontics, Kanagawa Dental University, School of Dentistry, Yokosuka, Japan

**AIMS:** To clarify whether occlusal hypofunction and its recovery affect the structure of the periodontal ligament (PDL) and expression of vascular endothelial growth factor (VEGF) in mice.

**MATERIALS AND METHOD:** C57BL/6J (Jackson Laboratory, Bar Harbor, Maine, USA) mice aged 5 weeks were used and randomly divided into three groups: a hypofunctional group (HG), a recovery group (RG), and a control group (CG). In the HG and RG, appliances were attached to the maxillary and mandibular incisors. In the HG, the appliances were set for 11 weeks and in RG for 7 weeks. The appliances were then removed at 0, 1, 3, 7, 14, and 28 days. Untreated rats served as the CG. Histological sections were prepared and immunohistochemically stained for VEGF. The PDL was evaluated in three groups together with the number of VEGF immunopositive cells in the PDL.

**RESULTS:** The number of immunopositive cells and PDL area in CG and RG were significantly larger when compared with the HG, and PDL area in the RG was similar to that in the CG. In the recovery process, PDL area and number of VEGF-positive cells in the PDL increased from days 0 to 7 and decreased from days 7 to 28.

**CONCLUSION:** The results suggest that occlusal stimuli regulate the PDL area through expression of VEGF in mice PDL. Clinically relevant occlusal stimuli are able to regulate the expression of VEGF in PDL cells, and these growth factors may lead to alveolar bone remodelling in the PDL.

### SP38 EFFECTS OF MANDIBULAR RETRUSIVE DEVIATION ON PREFRONTAL CORTEX ACTIVATION: A FUNCTIONAL NEAR-INFRARED SPECTROSCOPY STUDY

Takeo Otsuka, Tateshi Shimazaki, Kenichi Sasaguri, Toshitsugu Kawata, Department of Orthodontics, Kanagawa Dental University, Yokosuka, Japan

**AIMS:** To evaluate occlusal condition by assessing brain activity in the prefrontal cortex, which is associated with emotion.

**SUBJECTS AND METHOD:** Functional near-infrared spectroscopy (fNIRS) was used to detect changes in cerebral blood flow in the prefrontal cortex of 12 healthy volunteers. The malocclusion model was a custom-made splint that forced the mandible into retrusion. A splint with no modification was used as a control. Cortical activation during clenching was compared between the retrusive position condition and the control condition. A visual analogue scale (VAS) score for discomfort was also obtained during clenching and used to evaluate the interaction between fNIRS data and psychiatric changes.

**RESULTS:** Activation of the prefrontal cortex was significantly greater during clenching in the mandibular retrusive condition than during clenching in the control condition. Furthermore, Spearman rank-correlation coefficient revealed a parallel relationship between prefrontal cortex activation and VAS score for discomfort.

**CONCLUSION:** These results indicate that fNIRS can be used to objectively determine the occlusal condition by evaluating activity in the prefrontal cortex.

### SP39 PTHrP, TGFb-1 AND RANKL/OPG INTERACTIONS IN ORTHODONTIC TOOTH MOVEMENT. HOMEOSTASIS AND PHENOTYPE-RESCUE PATHWAYS WITHIN THE PERIODONTAL LIGAMENT

Jude Aarthi Joseph Antoniraj, Kerem Dalci, Oyku Dalci, Alexandra K Papadopoulou, M. Ali Darendeliler, Department of Orthodontics, University of Sydney, Surrey Hills, Australia

**AIMS:** Orthodontic force application alters expression levels of key molecules in periodontal ligament (PDL) cells and surrounding tissues. The aim of the present study was to quantify the temporal and spatial expression of PTHrP, TGFb-1, RANKL/OPG system in PDL cells following application of heavy orthodontic forces in an *in vivo* rat model in order to provide an insight into the early cellular phenomena taking place within the PDL.

**MATERIALS AND METHOD:** Thirty rats were divided into five groups (n = 6). A split-mouth design was adopted, where a force of 100 g was applied to the left maxillary first molar using a closed coil nickel titanium spring. The contralateral molar served as the control. The rats were sacrificed after 0 hours, 1 hours, 6 hours, 1 day and 7 days of force application. Mesial (compression) and distal (tension) sides of the PDL were evaluated immunohistochemically as percentages of cells being positively stained for the respective markers.

**RESULTS:** Percentages of cells expressing positively PTHrP and RANKL significantly increased gradually while TGF $\beta$ -1 and OPG decreased significantly in the compression zone after application of heavy orthodontic forces when compared to the control group. Contrary to this, TGF- $\beta$  and OPG expression were increased in the tension zone. On the tension side, no statistically significant differences were noticed at any time points between the force and control groups for PTHrP. PTHrP expression was significantly increased in the compression zone as compared to the tension zone within the force application groups.

**CONCLUSION:** Alterations in the percentages of PDL cells expressing key molecules, apart from facilitating orthodontic tooth movement, serve in the preservation and maintenance of cellular phenotype within the overall entity of the PDL.

#### SP40 AN *IN VITRO* STUDY ON THE EFFECT OF AN OSCILLATING STRIPPING METHOD ON ENAMEL ROUGHNESS

Stefan Baumgartner<sup>1</sup>, Anna Iliadi<sup>2</sup>, Theodore Eliades<sup>1</sup>, George Eliades<sup>2</sup>, <sup>1</sup>Clinic for Orthodontics and Paediatric Dentistry, Center for Dental Medicine, University of Zurich, Switzerland and <sup>2</sup>Department of Dental Biomaterials, School of Dentistry, University of Athens, Greece

**AIMS:** To assess changes in enamel roughness parameters before and after stripping with an oscillating diamond strip system by three-dimensional (3D) optical interferometric profilometry.

**MATERIALS AND METHOD:** Sound premolars extracted for orthodontic reasons were embedded up to their cervical area in a polyvinylsiloxane putty creating four groups of four teeth with three interproximal areas each (mesial/distal). The same regions of interproximal enamel surfaces were studied by 3D-optical interferometric profilometry before and after stripping with the Ortho-Strips system (Intensiv Dental, Montagniola, Switzerland) (teeth = 16, contact points = 12, sites measured = 36). The roughness parameters tested were the amplitude parameters Sa and Sz, the hybrid parameter Sdr, and the functional parameters Sci, Svi. The parameter differences ( $\Delta Sa$ ,  $\Delta Sz$ ,  $\Delta Sdr$ ,  $\Delta Sci$ ,  $\Delta Svi$ ) were calculated per region and statistically analyzed by one sample Mann-Whitney rank sum test ( $\alpha = 0.05$ ).

**RESULTS:** High statistically significant differences were found in  $\Delta Sa$ ,  $\Delta Sz$  and  $\Delta Svi$  median values (0.453  $\mu m$ , 3.870  $\mu m$  and 0.040  $\mu m$ , respectively), a significant difference in  $\Delta Sdr$  median value (1.514%) but no statistically significant difference in  $\Delta Sci$  (0.110 median value).

**CONCLUSION:** Under the conditions of the present study the Ortho-Strips system seems to significantly increase the amplitude parameters Sa and Sz, the hybrid parameter Sdr, associated with the developed interfacial area ratio, and the functional parameter Svi, which depicts the volume of the deepest valleys. The Ortho-Strips seem to significantly increase four of five measured roughness parameters.

#### SP41 ARE FUNCTIONAL APPLIANCES EFFECTIVE IN CLASS II PATIENTS IN EARLY TREATMENT? A LITERATURE REVIEW

Diego Sanchez, Josep Maria Ustrell, Department of Orthodontics, University of Barcelona, Spain

**AIMS:** To evaluate how significant is the use of mandibular advancement devices in Class II patients in the early dentition when compared with a control group.

**MATERIALS AND METHOD:** An online literature review of recent studies of Class II patients using mandibular advancement devices was performed in several academic search engines (PubMed, Google Scholar and Science Direct). The selected articles, published during the last 10 years, included experimental and control groups. The devices used were classified into two types: removable functional appliances (RFAs) and fixed-functional appliances (FFAs). The obtained results were separated into dentoalveolar and skeletal effects.

**RESULTS:** RFAs had common skeletal effects  $<ANB$ ,  $<SNA$ ,  $>SNB$ . A three-dimensional (3D) study showed an increase of intercondylar distance (Cor-Col) and condylar growth (Co-Gn) on both sides. Dentoalveolar effects included proclination of the lower incisors, retrusion of the upper incisors, overjet correction, mesial tipping of the lower first molars and clockwise

rotation of the occlusal plane. FFAs presented similar skeletal results adding mandibular clockwise rotation (S-Ar-Go) and an increase of lower face height. A 3D study showed anterior displacement of the condyle and glenoid fossa using the Herbst appliance while the use of Forsus® showed no significant skeletal effects. Similar dentoalveolar effects to the RFAs were found.

**CONCLUSION:** Both types of functional appliances have significant dentoalveolar and/or skeletal effects when used in patients in comparison to the control groups. Depending on the device, greater or lesser effects can be achieved. However, the lack of a clear protocol and the diversity of studies sometimes generate conflicting results. As a consequence, more scientific evidence is needed to support these findings. 3D imaging is changing the way functional appliances are studied. The results obtained for linear measurements are now being reassessed with these new techniques and interesting results may be obtained in the near future.

#### SP42 DIGITAL PHOTOGRAPHIC ASSESSMENT OF SOCIAL AND SPONTANEOUS SMILES

Ekrem Oral<sup>1</sup>, Suleyman Kutalmis Buyuk<sup>2</sup>, Ibrahim Yavuz<sup>1</sup>, Departments of Orthodontics, <sup>1</sup>Erciyes University, Faculty of Dentistry, Kayseri, and <sup>2</sup>Ordu University, Faculty of Dentistry, Turkey

**AIMS:** To retrospectively analyze the differences between social and spontaneous smiles.

**MATERIALS AND METHOD:** Pre-treatment digital photographs taken in the natural head position of 12 patients (6 girls, 6 boys; average age, 15.89 ± 4.80 years). The social and spontaneous smiling photographs were calibrated and measured using Dolphin Imaging software. Interlabial gap, smile width, width of all visible maxillary teeth, posterior corridor, upper lip height, upper lip thickness, lower lip thickness and eye width were measured for both social and spontaneous smiling photographs. All measurements were analyzed using the paired *t*-test.

**RESULTS:** Interlabial gap, smile width, posterior corridor and eye width increased significantly during spontaneous smiling ( $P < 0.05$ ), whereas the width of all visible maxillary teeth, upper lip thickness and lower lip thickness did not change significantly ( $P > 0.05$ ). Upper lip height decreased significantly during spontaneous smiling ( $P < 0.05$ ).

**CONCLUSION:** The outcomes of this study show the importance of diagnosing social and spontaneous smiles separately for successful aesthetic and treatment planning.

#### SP43 MAXILLARY INTRAORAL SCANS IN ORTHODONTICS. AN *IN VIVO* EVALUATION OF THE SCAN QUALITY

Milena Katzorke<sup>1</sup>, Susanne Wriedt<sup>1</sup>, Irene Schmidtmann<sup>2</sup>, Heinrich Wehrbein<sup>1</sup>, <sup>1</sup>Kieferorthopädie and <sup>2</sup>Institut für Medizinische Biometrie, Epidemiologie und Informatik, Universitätsmedizin der Johannes Gutenberg-Universität, Mainz, Germany

**AIMS:** To compare *in vivo* conventional alginate plaster models of the upper jaw with digital intraoral scans (Cerec® AC Bluecam, Sirona). The study was approved by the ethic commission of the LÄK Rheinland-Pfalz.

**SUBJECTS AND METHOD:** Ten patients (5 with and 5 without a fixed appliance). Seven intraoral scans and seven conventional impressions of the upper jaw were alternately taken on five consecutive days. Alginate impressions were poured with plaster and then digitized using the model scanner Activity 102 (smartoptics). The digital models were then superimposed with the intraoral scans (Comparison, 3D-Shape). Measurements were taken at 30 incisal and occlusal points. Means with 95 per cent confidence intervals were computed. Significance was assessed using linear mixed models. Soft tissue and palatal vault were evaluated clinically for both methods.

**RESULTS:** The mean differences between plaster models and intraoral scans were  $-0.11 \pm 0.38$  mm (teeth with fixed appliance  $-0.17 \pm 0.35$  mm, without  $-0.04 \pm 0.41$  mm). Tooth position had a significant impact on the differences ( $P < 0.001$ ); brackets had none. In general, visual results of the soft tissues were not satisfying for clinical use.

**CONCLUSION:** Intraoral scans of the upper jaw without a fixed appliance are valuable for clinical requirements. However, fixed appliances caused greater differences due to distortion

of the alginate impression. As long as no information is needed concerning soft tissues (palatal vault and buccal cavity), intraoral scanning is a valuable option to present the upper jaw with a fixed appliance (preparation of aligner or occlusal splint). Nevertheless, patient's comfort is reduced by scan spray and treatment time. Therefore, improvements of intraoral scanners are required.

#### SP44 ORTHOGNATHIC QUALITY OF LIFE, SELF-ESTEEM, AND PSYCHOLOGICAL FLEXIBILITY BEFORE AND AFTER STARTING ORTHODONTIC TREATMENT

Outi Alanko<sup>1</sup>, Anna-Liisa Svedström-Oristo<sup>2</sup>, Timo Peltomäki<sup>3</sup>, Tommi Kauko<sup>4</sup>, Martti T Tuomisto<sup>1</sup>, <sup>1</sup>School of Social Sciences and Humanities (Psychology), University of Tampere, <sup>2</sup>Department of Oral Development and Orthodontics, University of Turku, <sup>3</sup>Department of Oral and Maxillofacial Unit, Tampere University Hospital and <sup>4</sup>Department of Biostatistics, University of Turku, Finland

**AIMS:** To compare orthognathic quality of life, self-esteem, and psychological flexibility of prospective orthodontic-surgical patients before and after starting orthodontic treatment.

**SUBJECTS AND METHOD:** Thirty eight patients (27 females, 11 males; age range 18-55 years) from two university clinics. The patients filled in the Orthognathic Quality of Life Questionnaire, the Rosenberg self-esteem scale and the Acceptance and Action Questionnaire II on two occasions: before the first appointment at the clinic and two months after placement of fixed appliances. Comparisons between the time points were carried out using Wilcoxon's signed-rank test and paired samples *t*-test, depending on the quality of data.

**RESULTS:** After starting orthodontic treatment patients had more problems with their oral function ( $t = 2.77$ ,  $P = 0.000$ ), lower self-esteem ( $W = -2.71$ ,  $P = 0.007$ ) and were less flexible psychologically i.e., they were not as able to cope with their feelings as before ( $W = -2.49$ ,  $P = 0.013$ ). Patients' views on their facial aesthetics, social aspects of dentofacial deformity, and awareness of dentofacial aesthetics did not change during this time frame (all  $P > 0.05$ ).

**CONCLUSION:** Starting orthodontic treatment is hard for patients due to emotional and functional difficulties.

#### SP45 HEALTH ECONOMIC EVALUATIONS IN ORTHODONTICS A SYSTEMATIC REVIEW

Ola Sollenius<sup>1</sup>, Sofia Petrán<sup>2</sup>, Liselotte Paulsson Björnsson<sup>2</sup>, Anders Norlund<sup>3</sup>, Lars Bondemark<sup>2</sup>, <sup>1</sup>Department of Orthodontics, County Council, Halland, Halmstad, <sup>2</sup>Department of Orthodontics, Faculty of Odontology, Malmö University and <sup>3</sup>Department of Clinical Neuroscience, Karolinska Institutet, Section of Insurance Medicine, Stockholm, Sweden

**AIMS:** To systematically review the literature and assess the evidence for combined economic and orthodontic outcomes.

**MATERIALS AND METHOD:** The literature review was conducted in four steps according to Goodman's model. A literature search was conducted to identify all studies that evaluated the economics considering orthodontic interventions. The search, covering the period from 1966 to August 2014, was performed by applying the Medline, Cinahl and National Health Service Economic Evaluation Databases. The inclusion criteria were: randomized controlled trials or controlled clinical trials that compared at least two different orthodontic treatment interventions including evaluation of economic and orthodontic outcomes, study population of all ages. Study quality was assessed as limited, moderate, and high. The overall evidence was assessed following the GRADE system.

**RESULTS:** Based on applied terms for searches there were 1351 studies, eight of which continued to final analysis. Three studies had accomplished a cost effectiveness analysis while five studies used cost minimization analysis and two of these had a societal perspective, i.e. sum of direct and indirect costs. Because of disparities of aims of the majority of the studies and due to few studies of sufficient study quality covering comparison of equivalent treatment methods, evidence as regards economic aspects on orthodontic treatment could not be stated.

**CONCLUSION:** The evidence for combined economic and orthodontic outcomes in studies of health economics was insufficient, and consequently, more research is needed on this topic.

**SP46 THREE-DIMENSIONAL ANALYSIS OF MOLAR COMPENSATION IN PATIENTS WITH FACIAL ASYMMETRY AND MANDIBULAR PROGNATHISM**

Munkhshur Janchivdorj, Hyun-Hye Kim, Ki-Ho Park, Seong-Hun Kim, Hyo-Won Ahn, Department of Orthodontics, Kyung Hee University, Seoul, Korea, South

**AIMS:** To evaluate the characteristic transverse dental compensations in patients with facial asymmetry and mandibular prognathism, and clarify their relationship with mandibular asymmetry using three-dimensional (3D) cone beam computed tomography (CBCT).

**SUBJECTS AND METHOD:** This retrospective study involved 78 adults with skeletal Class I or Class III asymmetry, who received orthodontic treatment from September 2009 to December 2013. The patients were divided into two groups: group 1 (control, n = 33; 19 males, 14 females; mean age, 28.1 years) and group 2 (experimental group, n = 45; 23 males, 22 females; mean age, 21.2 years). CBCT data was acquired before orthodontic treatment for diagnosis. The raw data were further processed using an *in vivo* dental program (Anatmage, San Jose, California, USA).

**RESULTS:** With respect to skeletal measurements, the experimental group showed significant mandibular asymmetry (ramal length, body length, menton deviation), whereas, no significant difference was observed in the other parameters (maxillary height, maxillary canting, and transverse skeletal distance measurements). Regarding dental measurements, there were significant differences in the molar axes of both arches and the vertical height of maxillary molars, dental midline deviation, alveolar height of the maxillary first molar, and maxillary occlusal plane canting between the deviated and non-deviated sides in the experimental group. There was no significant difference in the transverse dental distance except for the distance between the palatal root apex of the maxillary first molar (deviated and non-deviated sides). In the experimental group, the roll type showed significantly greater differences in mandibular ramal length and menton deviation than the translation type.

**CONCLUSION:** The results of this study could serve as future guidelines for performing decompensation during pre-operative orthodontics, since they aid in the better understanding of facial asymmetry in skeletal Class III patients.

**SP47 HYOID BONE POSITION IN SUBJECTS WITH DIFFERENT SAGITTAL AND VERTICAL SKELETAL PATTERNS: A CEPHALOMETRIC RETROSPECTIVE STUDY**

Maria Pascual Prior<sup>1</sup>, José Mendes da Silva<sup>1,2</sup>, Josep Maria Ustrell Torrent<sup>1,2</sup>, José Duran von Arx<sup>1,2</sup>, <sup>2</sup>Master of orthodontics, <sup>1</sup>University of Barcelona - Hospital of dental medicine of Bellvitge, Barcelona, Spain

**AIMS:** To investigate possible differences in hyoid bone position among subjects with different sagittal and vertical skeletal patterns.

**SUBJECTS AND METHOD:** Sixty individuals aged between 7 and 21 years divided into three equal groups. All subjects in the same group had the same sagittal skeletal pattern of Class I, II, or III. Lateral cephalograms were traced and analysed to evaluate hyoid bone position. Analysis of variance and a Student's *t*-test were used for data analysis using SPSS software.

**RESULTS:** There was no statistical difference in hyoid bone position in skeletal groups I, II and III. The hyoid bone was positioned significantly forward in subjects with a short face when compared with long faced subjects, and forward and downwards in males when compared with females ( $P < 0.005$ )

**CONCLUSION:** Significant differences in hyoid bone position were found among subjects with different vertical skeletal patterns and between genders.

**SP48 THE POSTNIKOV APPARATUS FOR ORTHODONTIC TREATMENT OF DENTOALVEOLAR CLASS III MALOCCLUSIONS\*\*\***

Mikhail Postnikov, Grigoriy Stepanov, Dmitry Trunin, Alfia Hamadeeva, Alfia Ishmuratova, Department of Children Stomatology, Samara State Medicine University, Russia

AIMS: To investigate the Postnikov apparatus for expansion and elongation of the upper dentition in children.

SUBJECTS AND METHOD: Two thousand five hundred and eighty three children with different dentoalveolar anomalies. Nine per cent were aged 12-15 with a Class III malocclusion and reverse incisal occlusion. Clinical, anthropometric and roentgenographic methods were applied. For all patients before and after orthodontic treatment indices of lateral cephalograms were analyzed using the Dolphin Imaging program: N-Se, Go-Pg, A`-Snp, <SpPMP, < $\alpha$ , <ArGoMe, <NSeAr, <SArGo, <SNA, <SNB, <ANB, sum Bjork. Postnikov's apparatus (Patent No: 92323) was applied to the maxilla for expansion and extension of the upper dentition for 2-6 months combined with a bracket-system.

RESULTS: The Postnikov apparatus helps to expand and lengthen the upper dentition in the sagittal and transversal positions. Orthodontic treatment lasted 12-24 months. After orthodontic treatment the following percentage increases were observed: N-S 4.4, A-Snpy 9.25, Go-Pg 9.95, <SNA 3.17, <SNB 3.02, <ArGoMe 4.04 and Spp-Mp 12.69. <ANB decreased by 7.5 per cent. <ii by 5.33 per cent and <NSeAr by 1.88 per cent. In patients aged 12-15 a Class III malocclusion is caused by the mesial position of the mandible and it has dentoalveolar form. Significant increases of mandibular body length indicate more intensive mandibular growth probably because of the reverse overbite. The process of malocclusion normalization was achieved due to changes in interposition of the anterior maxillary and mandibular teeth and also because of the position of mandible.

CONCLUSION: The Postnikov apparatus is an effective method for orthodontic treatment of the dentoalveolar form of Class III malocclusion in children after replacement of teeth. Function, facial aesthetics, profile and occlusal contacts are improved after orthodontic treatment.

#### SP49 LONGITUDINAL INVESTIGATION OF NASOPHARYNGEAL AIRWAY DIMENSIONS IN DIFFERENT MALOCCLUSIONS

Cagatay Gunaydin, M Okan Akcam, Gokhan Yuksel, Orhan Ozdiler, Department of Orthodontics, Ankara University Faculty of Dentistry, Turkey

AIMS: To evaluate the interactions between nasopharyngeal airway dimensions and craniofacial morphology in different malocclusions.

MATERIALS AND METHOD: One hundred and eighty six lateral cephalometric radiographs obtained longitudinally from 62 individuals with different malocclusions (Class I: 30, Class II: 22, Class III: 10 subjects), were retrieved from the archives. Linear, angular and proportional measurements of the craniofacial region were carried out according to the reference points marked on the radiographs. Calculations were implemented by the PORDIOS computer software, while the nasopharyngeal area measurements were recorded using a digital planimeter. Statistical analysis included descriptive statistics followed by a paired *t*-test for investigating the differences between first-third, first-second and second-third years, in each group. For comparing the differences between the groups, ANOVA and Duncan's multiple range test were utilized.

RESULTS: Soft palate position (ANS-PNS/PNS-SPT angle) was higher and statistically significant in the first and second years in the Class II group when compared to other groups. In the Class III group this angle showed the lowest value, indicating that the soft palate was affected by the mandible's skeletal position. The decrease of ANS-PNS/PNS-SPT angle during the three year observation period might be the result of a compensatory mechanism for increasing airway dimensions. Naso-oro-pharyngeal area showed an increase in all groups during the observation period while the lowest value was observed in the Class III group, although it was statistically insignificant. Total airway space showed the lowest value in the Class III group during the observation period and did not show a statistically significant increase. Nasopharyngeal space increased, particularly in the Class II group, while oro- and hypopharyngeal spaces showed maximum increase in the Class III group. The increase in total airway space was lowest in the Class I group, while it was prominent in the Class II and III groups.

**CONCLUSION:** There is a conspicuous interaction between nasopharyngeal airway dimensions and malocclusions during the growth period and compensatory mechanisms occur during this process.

#### SP50 RAMAN SPECTROSCOPIC EVALUATION OF BIOCHEMICAL PROPERTY OF GINGIVAL CREVICULAR FLUID BY ORTHODONTIC FORCE

Kyung-A Kim, Seung-Hoon Lee, Yu-Jin Seo, Su-Jung Kim, Young-Guk Park, Department of Orthodontics, Kyung Hee University, Seoul, Korea, South

**AIMS:** To report the first human gingival crevicular fluid (GCF) biochemical characterization using Raman spectroscopy during the early phase of orthodontic tooth movement. This technique allows for label-free and non-invasive biochemical change monitoring in GCF during orthodontic tooth movement.

**SUBJECTS AND METHOD:** Ten orthodontic patients (7 females, 3 males,  $20.8 \pm 2.5$  years). GCF samples were obtained before (baseline, 0 days) and during orthodontic treatment at 1, 7 and 28 days. For Raman spectroscopic measurement, GCF samples (5  $\mu$ l) were deposited onto a gold-coated substrate, then dried at room temperature. Raman spectra were acquired using a Senterra confocal Raman system (Bruker Optics Inc., Billerica, Billerica, Massachusetts, USA). Data normality was confirmed with the Shapiro-Wilk normality test ( $P > 0.05$ ). After orthodontic force application, one-way ANOVA was used to analyze changes in the mineralization index and carbonate accumulation in GCF by time. In addition, Tukey's HSD *post-hoc* procedure and Pearson's correlation analysis were used. Data were analyzed using SPSS version 18 (Chicago, Illinois, USA).

**RESULTS:** Raman spectra GCF analysis during orthodontic treatment indicated that the hydroxyapatite to primarily collagen-dominated matrix band (phosphate 984  $\text{cm}^{-1}$ /amide I 1667  $\text{cm}^{-1}$ ) intensity ratio decreased at day 7 ( $P < 0.05$ ). The carbonate apatite to hydroxyapatite ratio (carbonate 1088  $\text{cm}^{-1}$ /phosphate 984  $\text{cm}^{-1}$ ) was significantly higher on day 7 compared to day 0 ( $P < 0.05$ ). These results indicate that demineralization occurs during the alveolar bone remodelling process. Notable peak shifts in the amide I range were also found during orthodontic tooth movement. The 1658  $\text{cm}^{-1}$  in baseline red shifted to 1667  $\text{cm}^{-1}$  at orthodontic treatment day 7. Curve fitting in the amide I (1615-1725  $\text{cm}^{-1}$ ) range demonstrated that increased random coil conformation was accompanied by a decrease in  $\beta$ -sheet structure during orthodontic tooth movement.

**CONCLUSION:** Raman spectroscopy could be used for label-free, non-invasive GCF quality assessment during orthodontic tooth movement. Furthermore, this method may prove to be a powerful diagnostic and prognostic tool for monitoring orthodontic tooth movement in a clinical setting.

#### SP51 EARLY PREDICTION OF MAXILLARY CANINE IMPACTION

Ali Algerban<sup>1,2</sup>, Ann-Sophie Storms<sup>2</sup>, Martine Voet<sup>2</sup>, Steffen Fieuws<sup>3</sup>, Guy Willems<sup>2</sup>,  
<sup>1</sup>Department of Dentistry, Alkharj Military Hospital, Riyadh, Saudi Arabia, <sup>2</sup>Department of Oral Health Sciences, KU Leuven, Belgium and <sup>3</sup>Department of Public Health KU Leuven and Universiteit Hasselt, Belgium, I-BioStat, Leuven, Belgium

**AIMS:** To establish validated prediction criteria for maxillary canine impaction in young patients, based on angular and linear measurements on panoramic radiographs.

**SUBJECTS AND METHOD:** From 828 patients having at least two panoramic radiographs, both taken between the ages of 7 and 14 years, with minimum 1- and maximum 3-year intervals (T1 and T2), a test group of 30 patients with unilateral canine impaction (12 males, 18 females) was selected. The patients' mean age was 10.1 years (SD 1.3 years) at T1 and 11.9 years (SD 1.1 years) at T2. The control group consisted of 30 maxillary canines from the contralateral sides of the test group and an additional 60 normal erupted canines from 30 patients. Those 30 patients were selected based on displaying bilateral maxillary canine eruption at T2 and being matched for gender and age with the patients of the test groups [12 males, 18 females, mean age at T1, 10.1 years (SD 1.3 years), and at T2, 11.1 years (SD 1.2 years)]. Angular and linear measurements were performed separately by two observers on the total study sample at T1. Linear measurements were expressed as a multiplication of

the maxillary central incisor width at the non-impacted side. A validation group was formed to confirm the outcome of the study.

**RESULTS:** Significant differences for linear and angular measurements and radiographic factors were found between the test and control groups. The three best-discriminating parameters were canine to first premolar angle, canine cusp to midline distance, and canine cusp to maxillary plane distance. These three parameters were combined in a multiple logistic regression model to calculate the probability of impaction, yielding a high c-index equal to 0.97 (95% CI: 0.94-0.99), with 90 per cent sensitivity and 94 per cent specificity. With the prediction formula in the validation sample, the c-index decreased to 0.80 (95% CI: 0.64-0.97), resulting in a decrease of sensitivity to 40 per cent, while the specificity increased slightly (96.7%).

**CONCLUSION:** Prediction of maxillary canine impaction from a combination of parameters relating to angles and distances measured on panoramic radiographs is weak. However, the final prediction model, based on canine-first premolar angle, canine cusp tip to midline distance, and canine cusp tip to maxillary occlusal plane distance, could be used to discriminate canine impaction for early intervention or regular follow-up.

#### SP52 MECHANICAL, MICROSTRUCTURAL AND ELEMENTAL CHARACTERIZATION OF HIGH GOLD ORTHODONTIC BRACKETS AFTER INTRAORAL AGEING

Sepp Hersche<sup>1</sup>, Spiros Zinelis<sup>2</sup>, Theodore Eliades<sup>1</sup>, <sup>1</sup>Department of Orthodontics and Paediatric Dentistry, University of Zurich, Switzerland and <sup>2</sup>Department of Biomaterials, National University of Athens, Greece

**AIMS:** To determine the mechanical, microstructural and elemental properties of high gold (Incognito) orthodontic brackets after clinical use.

**MATERIALS AND METHOD:** From different patients, 15 brackets were retrieved at the end of orthodontic treatment with a mean intraoral time of  $23 \pm 2$  months. They were compared with 15 new brackets as a reference. After preparing all brackets by embedding, polishing and cleaning for 10 minutes, the force indentation depth curve for each bracket was monitored by a Vickers indenter. Therefore a force of 10 N with a 15 second dwell time was applied. Afterwards the elastic index ( $\eta$ IT), Martens hardness (HM) and indentation modulus (EIT) were calculated, according to the ISO specification 14577-1. The microstructural and elemental composition of each bracket was quantitatively determined by X-ray EDS (EDX) analysis of the wing surface. The results were statistically analysed between the two groups by unpaired *t*-test at the 95 per cent level of significance ( $P = 0.05$ ).

**RESULTS:** The mean values and standard deviations for  $\eta$ IT, HM and EIT showed no statistical significant differences when measured before and after intraoral ageing ( $P > 0.05$ ). Both groups of tested brackets also showed a very similar surface, when imaged employing backscattered electron emission. The similarity also existed with quantitative EDX analysis of the elemental distribution.

**CONCLUSION:** Intraoral ageing of around 2 years of the tested high gold orthodontic brackets had no statistically significant effect on their mechanical, microstructural and elemental properties. For that reason it can be expected that the tested brackets will show similar mechanical properties during the whole orthodontic treatment.

#### SP53 A RETROSPECTIVE INVESTIGATION ABOUT PROGNOSIS PARAMETER CONCERNING CLASS III SYNDROME

Brigitte Wendl<sup>1</sup>, Peter Muchitsch<sup>1</sup>, Heinz Winsauer<sup>2</sup>, Margit Pichelmayer<sup>1</sup>, Thomas Wendl<sup>3</sup>, <sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics, University Graz, <sup>2</sup>Private Practice, Bregenz and <sup>3</sup>Institute of Biomedical Engineering, Technical University, Graz, Austria

**AIMS:** To provide certain parameters, by pre-therapeutic diagnosis, which could help to classify a prognosis for Class III malocclusion therapy.

**SUBJECTS AND METHOD:** Twenty five previously treated Class III patients with pre-therapeutic anamnesis, cephalometric radiographs, diagnostic models and photographs. Success at the end of treatment and after an observation period up to 25 years was verified by current documentation (cephalometric radiographs, diagnostic models and photographs).

The statistical depiction was performed by means of descriptive and explorative data analysis.

**RESULTS:** Certain parameters are related to therapy success, these are at the beginning of treatment: Go-Me, APDI, NSGn and overjet. Parameters at the end of therapy: the Max/Mand difference, occlusal plane-maxillary/mandibular plane, Ar-Go, FH:SGn, NSGn and at the 25 year observation period: the Max.Plane:Mand.Plane, Go-Me:SN, Ar-Go, APDI, NSGn, lower incisor 1er/ML and overjet. Except for Go-Me value, all other parameters were closer to the standard value in the group successfully treated. The combination of maxillary retrognathism and mandibular prognathism showed the biggest Max.Mand. difference after treatment and the group with maxillary retrognathism was closest to APDI and NSGn standard value. The younger and the female patients showed some more therapy success. The distribution of different types of Class III syndrome showed 32 per cent mandibular prognathism, 12 per cent maxillary retrognathism and 56 per cent a combination of both. In group 3 most of the failures occurred, independent of gender. Forty four per cent of the patients with a crossbite situation at the beginning were successfully treated at the end of therapy, but at long-term observation 16 per cent showed a relapse.

**CONCLUSION:** 1. Class III syndrome patients (especially males) should have early treatment. 2. The treatment success of patients having a combination of maxillary retrognathism and mandibular prognathism, of course depending to a certain extent, is unpredictable, here the diagnostic parameters should be particularly considered. 3. The transverse width of the upper jaw should be overcorrected and maintained accordingly.

#### SP54 THE INCIDENCE OF ENAMEL DEMINERALIZATION AFTER TREATMENT WITH FIXED ORTHODONTIC APPLIANCES

Pavλίna Černochová, Lydie Izakovičová Hollá, Masaryk University, St. Anne's Hospital, Brno, Czech Republic

**AIMS:** To assess the incidence of white spot lesions (WSL) in patients treated with fixed orthodontic appliances and to find out whether the frequency of their occurrence depends on gender, patient's age and treatment duration.

**SUBJECTS AND METHOD:** The retrospective study comprised 106 randomly selected patients (35 males, 71 females) who had completed treatment with fixed orthodontic appliances. The presence of WSL was assessed before placement and just after removal of the fixed orthodontic appliance. Classification after Gorelick was used for visual assessment of the severity of enamel demineralization.

**RESULTS:** Signs of enamel demineralization after removal of the fixed orthodontic appliances were recorded in 44 patients (41.5%), i.e. 23.9 per cent of teeth. The frequency of occurrence of enamel demineralization was the same in males as in females ( $P > 0.05$ ) but the number of teeth with WSL in males was significantly higher than that in females ( $P < 0.05$ ). The highest incidence of demineralization was found in the first molars and maxillary incisors, the lowest in the mandibular incisors. The statistically significant difference in the incidence of enamel demineralization depending on the patient's age at the start of treatment with fixed appliances was proven ( $P < 0.01$ ). However, dependence on total treatment duration was not found ( $P > 0.05$ ).

**CONCLUSION:** The incidence of enamel demineralization in patients treated with fixed orthodontic appliances was high, particularly in younger patients. Therefore, patient's age should be considered carefully before fixed appliance orthodontic treatment. Besides preventive measures, complex enamel demineralization care includes methods for remineralization of existing lesions.

#### SP55 COMBINED EFFECT OF LOW INTENSITY LASER THERAPY AND A MATRIX METALLOPROTEINASES INHIBITOR ON RELAPSE AFTER ORTHODONTIC TOOTH MOVEMENT

Sang-Hyun Lee, Hyun-Soo Kim, Kyung-A Kim, Seong-Hun Kim, Su-Jung Kim, Department of Orthodontics, Kyung Hee University, Seoul, Korea, South

**AIMS:** To determine and compare the combined effects of low intensity laser therapy (LILT) and doxycycline on the relapse rate, differential expression of matrix-remodelling enzymes,

including matrix metalloproteinases (MMP)-1, -2, -8, -9, and -13, and the co-relationship between relapse rate and MMPs mRNA expression.

**MATERIALS AND METHOD:** Fifty two rats divided into five groups according to treatment modality; baseline control group, control group, irradiated group, doxycycline group, and irradiated doxycycline group. The maxillary central incisors were moved distally by elastomeric rings followed by mechanical retention. After retention, LILT and doxycycline were administered to each group and MMPs mRNA expression, immunohistochemical analysis, and relapse rate were assessed. The main hypothesis was that the effect of LILT may have an influence on the inhibitory effect of doxycycline during relapse.

**RESULTS:** At day 5, there was a significant difference between the irradiated doxycycline group and the irradiated group in relapse rate. In terms of MMPs mRNA expressions, there were significant differences between the irradiated doxycycline group and the doxycycline group in MMP -1, -8, -13 and between the irradiated doxycycline group and the irradiated group in MMP -2, -8, -9, -13. At the protein level, there were significant differences between the irradiated doxycycline group and the irradiated group in all MMPs groups and differences between the irradiated doxycycline group and the doxycycline group was noted in MMP-8. This difference may be due to the time course event from mRNA to protein level. There was a positive relationship between MMP mRNA expression and relapse rate. An antagonistic effect between LILT and doxycycline was present, and the effect of doxycycline was more prominent.

**CONCLUSION:** LILT had an influence under the effect of MMPs inhibitor. Elucidating the mechanism of the effect of LILT on periodontal ligament remodelling during relapse with further studies may show a strong basis for developing biological retainers.

#### SP56 CAN MALLEUS POSITION AND PETROTYMPANIC MORPHOLOGY COUNT AS PROGNOSTIC FACTORS IN CLASS II SUBJECTS WITH TEMPOROMANDIBULAR JOINT DISORDERS?

Oana Almasan, Mihaela Hedesiu, Daniel Leucuta, Liana Lascu, Mihaela Baciut, 'Iuliu Hatieganu' University of Medicine and Pharmacy, Cluj-Napoca, Romania

**AIMS:** To assess malleus position, petrotympanic fissure (PTF) morphology, disk position, condyle morphology and their possible inference for prognosis of temporomandibular disorders (TMD) in Class II subjects.

**MATERIALS AND METHOD:** Fifty tempomandibular joints (TMJs) were evaluated with magnetic resonance imaging (MRI) using a 1.5T system (General Electric, Signa Excite HD) with a split head coil and cone beam computed tomography (CBCT; NewTom 3G, QR Verona, Italy) with a 12 inch field of view. The study group comprised 20 TMJs of Class II subjects with TMD; the control group included 30 TMJs of Class I subjects. The following criteria were evaluated on sagittal MRI slices: disk position, disk shape and condyle morphology. Condyle morphology, malleus position, length and diameter of the PTF were investigated on CBCT images. Osteophytes, osteosclerosis, cysts, flat condyle, or erosions were noted. Normally distributed data was presented with means and standard deviation, and compared with a *t*-test for independent samples. Non-normally distributed data was presented with median and interquartile range and compared with Mann-Witney *U* test.

**RESULTS:** There were 15 disk displacements in Class II and 21 in Class I subjects. The distance from malleus to tegmen tympani was 0.68 mm higher (95% CI 0.22-1.15,  $P = 0.006$ ) in Class II subjects ( $2.92 \pm 0.83$  mm) than in Class I subjects ( $2.24 \pm 0.8$  mm). The distance from malleus to PTF was 0.45 mm shorter in Class II subjects [2.25 mm (1.98-2.81)] than in Class I subjects [2.7 mm (2.27-3.4)]. PTF diameter was larger in Class II (0.27 mm) than in Class I. PTF length was 0.83 mm longer in Class II [4.65 mm (3.39-4.88)] than in Class I [3.83 mm (3.3-4.25)] ( $P = 0.02$ ). Condylar bone changes were encountered in both Classes.

**CONCLUSION:** In Class II patients malleus was situated farthest from tegmen tympani. Disk displacements were not found to be associated with condyle or PTF morphology. These findings can lead to consideration of malleus position as a prognostic factor for TMD in otherwise healthy Class II patients. The possible significance requires further in depth investigation.

#### SP57 ORTHODONTIC TREATMENT BEFORE OR AFTER ORTHOGNATHIC SURGERY IN TIRANE, ALBANIA

Irina Isufi<sup>1</sup>, Algen Isufi<sup>2</sup>, Gafur Shtino<sup>3</sup>, Ramazan Isufi<sup>2</sup>, <sup>1</sup>Orthodontics, Private Dental Centre, Tirane, <sup>2</sup>OMF Surgery, <sup>3</sup>Mother Theresa', University Hospital Centre, Tirane, Albania

AIMS: To compare, in a retrospective study of a descriptive nature, the pre- and post-surgery orthodontic treatment results in orthognathic patients.

SUBJECTS AND METHOD: From January 2010 to November 2014, n = 30 patients who underwent orthognathic, were divided into three groups: group I patients who had orthodontic treatment before surgery, group II patients who had orthodontic treatment before and after surgery, and group III patients who had orthodontic treatment only after orthognathic surgery. After clinical examination, study model and cephalometric analyses and patient psychosocial evaluations before and after surgery, the results in each group were compared.

RESULTS: 1. Patients in groups II and III had better occlusal stability after surgery than group I patients. 2. Cephalometric analyses showed that the skeletal parameters had changed and were close to normal values in all groups. 3. Patient satisfaction after surgery was higher in group III patients .4. Function and aesthetic improvement was greater in group II patients.

CONCLUSION: Orthodontic treatment after orthognathic surgery shortens overall treatment time, but better function and a stable occlusion can be obtained if the patient has orthodontic treatment before and after surgery.

#### SP58 TREATMENT EFFECTS OF MAXILLARY MOLAR DISTALIZATION WITH PALATAL MINISCREWS

Gökhan Serhat Duran, Furkan Dindaroğlu, Serkan Görgülü, Department of Orthodontics, Gülhane Military Medical Academy, Ankara, Turkey

AIMS: Recent advances in the application of three-dimensional (3D) imaging for dental purposes have made possible a more accurate assessment of tooth positional changes on dental casts. The aim of this prospective study was to analysis 3D tooth movements after distalization of the maxillary molars with a palatal mini-implant assisted memory screw.

SUBJECTS AND METHOD: Twenty patients (6 girls, 14 boys; mean age: 13.8 years) with bilateral Class II molar relationships were treated with a non-compliance, fixed intraoral appliance and received no treatment for the mandible during the examination period. The anchorage unit was prepared by placing two miniscrews in the anterior palatal region under local anaesthesia. Dental casts and lateral cephalometric radiographs were taken immediately before placement (T1) and after removal of the appliance (T2). The maxillary casts were scanned using a 3D dental scanner, digitized and superimposed on a predefined area in the palate. Data were analyzed by cephalometric and reverse engineering software

RESULTS: The maxillary first molars were successfully distalized into a Class I relationship in all patients. Both first and second molars were tipped distally during treatment. The mean distalization of the first molars was 4.32 mm. The maxillary first and second premolars were also tipped distally due to the tension of transseptal fibres.

CONCLUSION: Distalization with a palatal mini-implant assisted memory screw is an adequate compliance-free appliance which resulted in bodily molar movement without incisor flaring. It can be safely used for the correction of dental Class II malocclusions.

#### SP59 EVALUATION OF DENTAL ARCH DIMENSIONS IN CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA

Roza Haghgoo, Shahed University, Tehran, Iran

AIMS: To evaluate the association between dental arch dimensions and obstructive sleep apnoea (OSA) in children.

SUBJECTS AND METHOD: Forty eight children (25 males, 23 females, mean age 6.8 years) with diagnosed OSA and an age matched group of 48 non-obstructed control children. The children were matched for age and gender. Orthodontic examinations were carried out and dental impressions were taken. The length and breadth of the maxillary and

mandibular dental arches, palatal height, overjet and overbite, deep bites, open bites, crossbites and crowding were measured. The data was analyzed using an independent sample *t*-test.

**RESULTS:** Children with diagnosed OSA had a significantly increased overjet, a reduced overbite, narrower maxilla and shorter mandible compared to the children in the control group. There were more children with an anterior open bite in the OSA group ( $P = 0.021$ ) and a Class II relationship ( $P = 0.017$ ) compared with the control group. There were more subjects with mandibular crowding ( $P = 0.005$ ) and with anterior open bite ( $P = 0.016$ ).

**CONCLUSION:** OSA can have an effect on dental arch dimensions.

#### SP60 EVALUATION OF ORAL HEALTH-RELATED QUALITY OF LIFE IN ADOLESCENTS UNDERGOING ORTHODONTIC TREATMENT

Roza Haghighi, Shahed University, Tehran, Iraq

**AIMS:** To assess oral health-related quality of life (OHRQoL) in adolescents who have undergone orthodontic treatment

**SUBJECTS AND METHOD:** Two hundred and forty adolescents aged 13-15 years (120 males, 120 females). OHRQoL was assessed with the short form of the Oral Health Impact Profile 14, and malocclusion severity with the Index of Orthodontic Treatment Need. Finally the data was analyzed using Chi-square test.

**RESULTS:** Severity of malocclusion affected the OHRQoL. Orthodontic treatment affected the daily activities of both males and females. Orthodontic treatment had an effect on eating in both males and females but did not significantly affect pronunciation or taste in males or females.

**CONCLUSION:** Based on the results of this study, orthodontic treatment can affect OHRQoL.

#### SP61 EFFECTS OF FUNCTIONAL APPLIANCE THERAPY ON THE DIMENSIONS OF THE UPPER AIRWAY: HERBST VERSUS TWIN-BLOCK APPLIANCES

Min Gu<sup>1</sup>, Colman Patrick McGrath<sup>1</sup>, Ricky Wing Kit Wong<sup>2</sup>, Urban Hagg<sup>1</sup>, Yanqi Yang<sup>1</sup>,  
<sup>1</sup>University of Hong Kong and <sup>2</sup>United Christian Hospital, Hong Kong

**AIMS:** To compare, in a randomized controlled clinical trial, the treatment effects of Herbst and Twin-Block (TB) appliances on the dimensions of the upper airway in adolescents.

**SUBJECTS AND METHOD:** Twenty skeletal Class II patients (5 males, 15 females; aged  $13.1 \pm 1.3$  years) were randomized to receive either Herbst or TB treatment. The treatment times of the Herbst and TB appliances were  $12.7 \pm 1.9$  months and  $13.0 \pm 1.4$  months, respectively. Lateral cephalograms were obtained before and after treatment. Upper airway and craniofacial variables of the upper airway were analyzed.

**RESULTS:** Following functional appliance treatment, the angle of the soft palate was significantly decreased in the both Herbst and TB groups ( $P < 0.01$ ). Retropalatal pharyngeal depth was increased in the Herbst group ( $P < 0.01$ ) and the thickness of soft palate was increased in the TB group ( $P < 0.05$ ). When comparing the two groups, the only significant difference was in lower face height. The TB group had a greater increase (5.0 mm) than the Herbst group (3.5 mm;  $P < 0.05$ ).

**CONCLUSION:** Both Herbst and TB appliances led to some dimensional changes in the craniofacial region and upper airway. The difference between them was only in craniofacial structures but not in upper airway structures.

#### SP62 RATIO OF NON-EXTRACTION AND EXTRACTION TREATMENTS FOR PATIENTS WITH CLASS II MALOCCLUSIONS

Greta Yordanova, Palmira Alagiozova, Department of Orthodontics, Medical University of Sofia / Faculty of Dental Medicine, Sofia, Bulgaria

**AIMS:** To determine the ratio between Class II malocclusion subjects treated with extraction of two upper premolars and those with distalization of the first molars by the Pendulum appliance, and to determine the average age at which these treatments start and the distribution by gender.

**SUBJECTS AND METHOD:** One thousand four hundred and sixty patients treated for a period of 8 years, aged between 7 and 21 years. From these patients 230 were diagnosed with a Class II malocclusion related to a problem in the upper arch. In Class II malocclusions where the problem is associated with the maxilla, the treatment plan may include distalization of the upper molars to gain space in the middle and anterior segment or with extraction of premolars. Forty five of the 230 patients (19.60%) were treated with extraction of two upper first premolars and 185 (81.40%) with distalization of the upper molars. In this group of treated patients there were the following problems: upper anterior crowding, protrusion, impacted canines and premolars.

**RESULTS:** Every fifth patient was treated by extractions. The average age of patients treated with the Pendulum was 12.85 years (males: 12.55 years, females: 13.05 years), while the average age of patients treated with extractions was 15.6 years (males: 14.75 years, females: 16.05 years). Whether the treatment plan included or did not include extractions, there was a higher level of female than male patients. Sixty two per cent of female patients were treated compared with 38 per cent males. This may be due to the fact that females seek orthodontic treatment more often because of aesthetic problems. In 18 cases treatment with the Pendulum appliance was related to extraction of the upper third molars and in 13 patients the treatment was complicated by impaction of the upper canine.

**CONCLUSION:** With the techniques of contemporary orthodontics, non-extraction treatment is preferred more than extraction treatment. Non-extraction treatment is preferred because it does not change the transverse dimensions of the smile.

#### SP63 THE FREQUENCY OF EXTRACTIONS IN ORTHODONTIC TREATMENT

Greta Yordanova<sup>1</sup>, Martin Mladenov<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Medical University of Sofia / Faculty of Dental Medicine and <sup>2</sup>Private Practice, Sofia, Bulgaria

**AIMS:** To analyse extraction treatments carried out and to determine what percentage they represent of all treatments, what are the most commonly extracted teeth, how many teeth are most commonly extracted and at what age the patients are treated by this method. A further aim was to determine whether this is related to gender.

**MATERIALS AND METHOD:** A retrospective study of clinical data of patients treated over the past 8 years. The patients had different orthodontic problems and were treated only with fixed appliances. The treatment plans and final results of 1460 patients (552 males, 908 females) between the ages of 8 and 21 years (growing patients) were analysed.

**RESULTS:** One hundred and seventy eight of the 1460 patients (12.19%) had teeth extracted in their orthodontic plan treatment. The total number of extracted teeth was 529. The most common extracted teeth were: 14-133, 24-129, 34-77 and 44-76. The most common number of extracted teeth was four in 88 patients (49%), followed by two teeth in 64 patients (36%), and lastly by three teeth in 11 patients (6%). Very low levels of patients were treated with extraction of the second premolars. Even lower was the level of patients treated with extraction of molars or incisors. No statistically significant difference was found for extractions in the upper and lower arch. A single extraction was observed in 14 subjects (7.87%) as a compensatory mechanism in cases of hypodontia, etc. From all the extraction cases, 56 (31.50%) were male and 122 (68.50%) female. The total number of teeth extracted in the upper arch was 298 and in the lower 231.

**CONCLUSION:** After analysis of radiographs, models, function and patient's profile, sometimes there is an inevitable need to extract teeth. Nowadays that need is decreasing as a percentage in comparison with non-extraction therapy. Extraction treatments have significantly higher average starting ages of about 15.5 to 16 years.

#### SP64 LONG-TERM SKELETAL STABILITY (10-15 YEARS) AFTER MANDIBULAR SETBACK SURGERY USING INTRAORAL VERTICAL RAMUS OSTEOTOMY

Elisabeth Schilbred Eriksen, Ketil Moen<sup>2</sup>, Stein Atle Lie<sup>3</sup>, Sigbjorn Loes<sup>4</sup>, Per Johan Wisth<sup>5</sup>, <sup>1</sup>Section for Orthodontics, <sup>2</sup>Section for Oral Surgery and Oral Medicine, <sup>3</sup>Department of Clinical Dentistry and <sup>5</sup>Section for Orthognathic Surgery, University of Bergen and <sup>4</sup>Department of Head and Neck Surgery, Haukeland University Hospital, Bergen, Norway

AIMS: Surgical correction of mandibular prognathism is considered a stable technique, and the literature concludes that most relapse occurs during the first year after surgery. However, there is a need for long-term follow-up studies of more than 3 years. The aim of this study was therefore to elucidate the skeletal changes that occur 10-15 years after surgery.

SUBJECTS AND METHOD: Thirty seven patients treated for mandibular prognathism with intraoral vertical ramus osteotomy (IVRO) followed by 6 weeks of intermaxillary rigid fixation were willing to attend a 10-15 year follow-up session, and were included in the study. The mean age at surgery was 21.6 years. Lateral cephalograms from before the start of treatment (T0), 8 weeks post-surgery (T1), 1 year after surgery (T2) and 10-15 years after surgery (T3) were traced. Linear models with robust variance estimates adjusted for clustering of observations were performed. The results were presented with 95 per cent confidence intervals, and *P*-values less than 5 per cent were considered statistically significant. All calculations were performed using Stata/IC 13.1. The study was approved by the regional ethics committee.

RESULTS: SNB increased 0.4 degrees (*P* = 0.094) and SNPog 0.5 degrees (*P* = 0.018) between T2 and T3. Gonial angle increased 0.8 degrees (*P* = 0.651) and ML/NSL decreased 0.3 degrees (*P* = 0.822) during the same observation period.

CONCLUSION: IVRO as a surgical technique for treatment of mandibular prognathism shows stable skeletal results 10-15 years after surgery.

#### SP65 THREE-DIMENSIONAL FINITE ELEMENT ANALYSIS OF TOOTH DISPLACEMENT DURING MAXILLARY MOLAR DISTALIZATION IN VARIOUS STAGES OF THE MOLAR DENTITION

Moonbee Oh, Juman Kang, Yoon-ah Kook, The Catholic University of Korea / Seoul St. Mary's Hospital / Dentistry, Banpo-dong, Korea, South

AIMS: To evaluate the effect of eruption status of the maxillary second and third molars on the distalization of maxillary first molar with five different appliances using three-dimensional finite element (3D-FE) analysis.

MATERIALS AND METHOD: A 3D-FE model of the maxilla was constructed. Three eruption stages were made: erupting second molar at the cervical third of the first molar root (stage 1), fully erupted second molar (stage 2), and erupting third molar at the cervical third of the second molar root (stage 3). Five anchorage appliance models: modified C-palatal plate (MCP) without brackets and orthodontic archwire (device 1), MCP with brackets and orthodontic archwire (device 2), conventional pendulum appliance (device 3), bone-anchored pendulum appliance (device 4), and cervical-pull headgear (device 5), were designed. The retraction force was 150 g per side.

RESULTS: Anteroposteriorly, the maxillary first molar moved backwards with all devices. With device 1, movement of the first molar root was larger than movement of the crown, showing root movement tendency. With device 2, the first molar demonstrated backward bodily movement, while for devices 3, 4 and 5, the first molar showed distal tipping. Transversely, the first molar had mesial-out rotation with device 5 and mesial-in rotation with the other devices. Vertically, the first molar was intruded with devices 1 and 2 and extruded with the others. For device 2, root movement of the first molar in stages 2 and 3 was larger than that in stage 1.

CONCLUSION: During maxillary molar distalization, MCP resulted in bodily movement and intrusion of the first molar. MCP resulted in effective movement of first molar regardless of molar eruption stage. Therefore, the application of MCP for maxillary molar distalization might be an effective treatment option for patients with Class II malocclusions.

#### SP66 COMPARISON OF THE INFLUENCE OF CARIES AND MALOCCLUSION ON ORAL HEALTH RELATED QUALITY OF LIFE OF MAYAN AND NON-MAYAN MEXICAN TEENAGERS

Oscar Reyna-Blanco<sup>1</sup>, Kjeld Aamodt<sup>2</sup>, Maria Orellana<sup>1</sup>, <sup>1</sup>School of Dentistry and <sup>2</sup>Department of Orthodontics, University of California, San Francisco, USA

**AIMS:** To perform a comparison study on how malocclusion and caries independently affect Oral Health Related Quality of Life (OHRQoL) between Mayan and non-Mayan Mexican teenagers.

**SUBJECTS AND METHOD:** This was a cross-sectional, population-based, quantitative, epidemiological study. Two different states with varying levels of cultural demographic characteristics were chosen to provide an insight into Mayan and non-Mayan Mexican teenagers. Five hundred and seventy four students aged 12-17 years were recruited from across Mexico. The Child Oral Health Impact Profile (COHIP) was utilized to measure OHRQoL. Caries was quantified via visual inspection using the Decayed, Missing, and Filled Surface Index. Malocclusion was quantified using the Index of Complexity, Outcome, and Need. The association between measurements of caries, malocclusion, and the five conceptually distinct subscales of the COHIP were examined by adjusted and unadjusted association analysis between the outcomes and each of the predictors.

**RESULTS:** Overall, the COHIP showed that as a malocclusion becomes more severe, there is a decrease in OHRQoL. This was most apparent in non-Mayan communities, and yet nearly absent in Mayan communities. The oral health and social/emotional well-being domains appeared to drive these findings. With respect to dental caries experience, there was a small yet significant decrease in overall quality of life score driven by the oral health domain of the COHIP.

**CONCLUSION:** Whereas there has not been agreement in previous research on whether malocclusion affects quality of life, this study may suggest that the disagreement may be due to demographic characteristics of the sample and acculturation factors. Further studies are needed to elucidate factors that contribute to the finding that caries experience and malocclusion influence differently the quality of life of Mayan and non-Mayan Mexican populations.

#### SP67 FRICTIONAL RESISTANCE BETWEEN WIRES AND HOOKS FOR ORTHODONTICS

Kazutaka Fujita, Matsumoto Dental University, Shiojiri-shi, Japan

**AIMS:** To determine the frictional resistance between stainless steel wire and the inside of crimpable hooks with and without sandblasting were measured.

**MATERIALS AND METHOD:** The roughness of the surface of 0.017 × 0.025 inch stainless steel wire and the inside of crimpable hooks with and without sandblasting were measured using a confocal laser scanning microscope. The friction of these wires and hooks by crimping with 15, 20, 25, 30, 35 and 40 kgf were measured with a pulling test.

**RESULTS:** Although the roughness of the crimpable hooks did not change after sandblasting, the roughness of the wire surface significantly increased. The friction between wire and hooks increased with sandblasting for the wire surface but not for the inside of the hooks.

**CONCLUSION:** Sandblasting the surface of stainless steel wire significantly increases the friction between crimpable hooks and wires.

#### SP68 DIRECTIONAL SPECIFICITY FOR VOLUNTARY CONTROL OF LIP-CLOSING FORCE USING VISUAL-FEEDBACK

Takeshi Miyamoto, Matsumoto Dental University, Siojiri-shi, Japan

**AIMS:** Lip-closing function plays an important role in mastication and swallowing. However, maximum lip-closing force (LCF) varies among individuals. The present study investigated how to clarify the directional peculiarity and gender difference of adjusting ability for LCF during voluntary lip-closing movement in order to elucidate the functional properties of LCF.

**SUBJECTS AND METHOD:** Thirteen male and 17 female adult subjects with normal occlusion were measured for voluntary LCF (VLCF) using the multidirectional LCF meter and visual feedback system to evaluate the accuracy of VLCF. The subjects were instructed to keep at 50 per cent of maximum LCF in each direction of LCF for 5 seconds using a real time display. The accuracy rate of VLCF was calculated as the ratio of within 50 ± 8 per cent during 3 seconds after reaching 50 per cent VLCF.

**RESULTS:** The accuracy rates of VLCF in the upward and downward directions were higher than those of the four diagonal directions in both males and females. The accuracy rates of the four diagonal directions of VLCF were significantly lower in females than in males.

**CONCLUSION:** The adjusting ability of VLCF in the up and down directions is higher than that in the diagonal directions, and there were gender differences in the adjusting ability of VLCF.

#### SP69 TOOTH-BORNE DISTRACTION OSTEOGENESIS VERSUS CONVENTIONAL LE FORT I IN MAXILLARY ADVANCEMENT OF CLEFT LIP AND PALATE PATIENTS

Letizia Perillo<sup>1</sup>, Abdolreza Jamilian<sup>2</sup>, Rahman Showkatbakhsh<sup>3</sup>, Sarah Eslami<sup>2</sup>, Alireza Ghassemi<sup>4</sup>, Departments of Orthodontics, <sup>1</sup>Second University of Naples, Italy, <sup>2</sup>Islamic Azad University, Tehran, Iran, <sup>3</sup>Shahid Beheshti University of Medical Sciences, Tehran, Iran and <sup>4</sup>Department of Maxillofacial Surgery, University Hospital RWTH Aachen, Germany

**AIMS:** Distraction osteogenesis (DO) is rapidly becoming a mainstream surgical technique for correction of maxillary deficiency. It has also proved to be beneficial in the treatment of maxillary-deficient cleft patients. The aim of this study was to compare the effectiveness of a newly designed tooth-borne osteogenic distraction device with conventional Le Fort I osteotomy in maxillary advancement of cleft lip and palate (CLP) patients.

**SUBJECTS AND METHOD:** The control group consisted of 10 subjects (7 males, 3 females) with a mean age of 21.4 years (SD 1.2 years) treated by conventional Le Fort I osteotomy. Pre- and post-surgery lateral cephalograms were obtained. The experimental group consisted of 10 subjects (6 males, 4 females) with a mean age of 19.6 years (SD 1.3 years) treated with a tooth-borne osteogenic distraction device. In these patients, the newly designed distraction device, which exerted force anteroposteriorly, was cemented after mobilization of the maxilla. After a latency period of 7 days, the distractor was activated twice daily by a total amount of 0.5 mm per day. The activation continued for 3 weeks. After an 8-week consolidation period, the distraction appliance was removed. Cephalograms of DO patients were obtained at the start of distraction and at the end of consolidation. *t*- and paired *t*-tests were used to evaluate the data.

**RESULTS:** At the end of treatment, SNA angle of the Le Fort I patients increased by  $5 \pm 2.5$  degrees ( $P < 0.001$ ) and SNA angle of DO patients by  $4.2 \pm 2.1$  degrees ( $P < 0.001$ ).

**CONCLUSION:** Current evidence suggests that both conventional Le Fort I and a tooth-borne osteogenic distraction device can effectively advance the maxilla forward in patients with a CLP; however, with the latter technique, surgery is simple, and custom-made intraoral devices are easy to handle with minimal discomfort for the patients.

#### SP70 ORTHODONTIC SPACE CLOSURE VERSUS IMPLANTS IN CASES WITH MISSING MAXILLARY INCISORS: A FOLLOW-UP STUDY

Marco Rosa<sup>1</sup>, Abdolreza Jamilian<sup>2</sup>, Letizia Perillo<sup>3</sup>, Departments of Orthodontics, <sup>1</sup>Insubria University, Varese, Italy, <sup>2</sup>Islamic Azad University, Tehran, Iran and <sup>3</sup>Second University of Naples, Italy

**AIMS:** To compare the aesthetic, periodontal and functional outcomes of orthodontic space closure versus implant substitution in patients with missing maxillary incisors 5 years after completion of treatment.

**SUBJECTS AND METHOD:** Ten patients treated with orthodontic space closure (6 males, 4 females, mean age  $19 \pm 2.1$  years at the completion of treatment) and 11 patients treated with implant insertion (5 males, 6 females, mean age  $20 \pm 1.7$  years at the time of implant insertion). Tooth mobility, plaque index, probing depth, infraocclusion and temporomandibular joint (TMJ) function were recorded at the 5.6 years follow-up. Self-perceived dental aesthetic appearance was also evaluated through a visual analogue scale (VAS) questionnaire. A *t*-test was used to evaluate the data.

**RESULTS:** After completion of treatment at  $5.6 \pm 0.4$  years, all patients were equally satisfied with the appearance of their teeth. No statistically significant differences were found in relation to the VAS scores of the subjects ( $P < 0.844$ ). No significant differences were found in tooth mobility, plaque index ( $P < 0.478$ ) and the prevalence of signs and symptoms of temporomandibular disorders. However, significant infraocclusion was noticed in all

implant patients. ( $P < 0.001$ ) Probing depth was also significantly higher in implant patients. ( $P < 0.001$ )

**CONCLUSION:** Orthodontic space closure and implants for missing maxillary incisors produced similar, well accepted aesthetic results. Neither of the treatments impaired TMJ function. Nevertheless, infraocclusion was evident in implant patients. Space closure patients also showed better periodontal health in comparison with implant patients.

#### SP71 LONG-TERM STABILITY OF ORTHODONTIC TREATMENT OUTCOME IN RELATION TO RETENTION PRACTICES

Jeanett Steinnes, Gunn Johnsen, Heidi Kerosuo, UiT the Arctic University of Norway, Tromsø, Norway

**AIMS:** To evaluate long-term stability of orthodontic treatment outcome in relation to post-treatment or post-retention time and type and duration of retention.

**SUBJECTS AND METHOD:** One hundred and nine patients who had completed active orthodontic treatment with fixed appliances between 2000 -2007, were invited to participate in the study. Of these, 67 (24 males, 43 females) agreed to participate (mean age: 24.7 years; range 20-50 years). Participants underwent a follow-up clinical examination, during which impressions were obtained for follow-up (T2) casts and a questionnaire regarding self-reported progress of the retention period was completed. Data regarding previous occlusion, orthodontic treatment and retention practices were obtained from the patients' records and pre- (T0) and post- (T1) treatment casts. To evaluate the stability of orthodontic treatment outcome, the Peer Assessment Rating index (PAR) and Little's Irregularity index (LII) were used. All measurements were performed on casts. Differences between T0, T1 and T2 were analyzed with independent *t*-tests and the chi-square test.

**RESULTS:** The mean time from T1 to T2 in the study sample was 8.5 years. All participants received a fixed retainer or both a fixed and removable retainer at T1. At T2, 12 participants (18%) had no retainers, while the rest still had a fixed retainer in either one or both jaws. The mean PAR improvement from T0 to T1 was 73 per cent, indicating great improvement. From T0 to T2 the mean PAR improvement was 57 per cent, indicating a relapse of 22 per cent. At T2, participants with more than 1 year without retention in the mandible showed a significant increase in the mean LII value from T1 to T2 ( $P = 0.009$ ) as compared to those with a mandibular retainer, while the PAR index did not differ significantly among participants with or without a retainer at T2.

**CONCLUSION:** The post-treatment changes in PAR indicate that, despite fixed retainers, occlusal relapse after orthodontic treatment with fixed appliances occurs to a certain extent in the long-term. Having a fixed mandibular retainer in place seems to prevent the mandibular incisors from relapse.

#### SP72 HOW DOES CRANIOFACIAL AND UPPER SPINE MORPHOLOGY INFLUENCE MANDIBULAR ADVANCEMENT DEVICE TREATMENT OUTCOME IN OBSTRUCTIVE SLEEP APNOEA PATIENTS?

Palle Svanholt<sup>1</sup>, Niels Petri<sup>2</sup>, Gordon Wildschjødztz<sup>3</sup>, Liselotte Sonnesen<sup>1</sup>, <sup>1</sup>University of Copenhagen, <sup>2</sup>Danish Epilepsy Centre, Dianalund and <sup>3</sup>JT Psychological & Psychiatric Consultants, Copenhagen, Denmark

**AIMS:** To assess cephalometric predictive markers in terms of craniofacial morphology including posterior cranial fossa and upper spine morphology for mandibular advancement device (MAD) treatment outcome in patients with obstructive sleep apnoea (OSA).

**SUBJECTS AND METHOD:** Twenty seven OSA patients treated with MAD for 4 weeks. The apnoea-hypopnoea index (AHI) was recorded before and after MAD treatment. The criteria for treatment success was a reduction in AHI of 75 per cent. Accordingly two groups occurred: The success treatment group of eight patients and the no success treatment group of 19 patients. Before MAD treatment lateral cephalograms were taken and analyses of craniofacial morphology, including the posterior cranial fossa and upper spine morphology were performed. Differences between the groups were analysed by Fisher's exact test, *t*-test and multiple regression analysis.

**RESULTS:** Upper spine morphological deviations occurred non-significantly in 25 per cent of the successful treatment group and in 42.1 per cent in the no success treatment group. Body Mass Index (BMI;  $P < 0.05$ ), maxillary prognathism (s-n-ss;  $P < 0.01$ ), mandibular prognathism (s-n-pg;  $P < 0.05$  and s-n-sm;  $P < 0.01$ ) and the distance between sella turcica and the deepest point in the posterior cranial fossa (s-d;  $P < 0.05$ ) was significantly smaller in the successful treatment group. Maxillary prognathism ( $P < 0.05$ ) was the most important factor for MAD treatment outcome ( $R^2 = 0.47$ ).

**CONCLUSION:** The results indicate that BMI, posterior cranial fossa morphology and retrognathia of the jaws are factors related to MAD treatment outcome. Furthermore, OSA patients with upper spine morphological deviations may respond less well to MAD treatment. The results provide important new knowledge for prediction of MAD treatment in OSA patients.

### SP73 DOES THE COURSE OF TREATMENT AFFECT PATIENT COMPLIANCE AND ESTIMATION?

Dietmar Paddenberg, Christian Fode, Tobias Schütte, Bettina Paddenberg, Private Office, Paderborn, Germany

**AIMS:** In orthodontics there is often a gap between objective treatment needs and the aims of the patients, especially if the treatment is complex and of longer duration. Are there methods to close this gap and to lead those patients to an optimized orthodontic aim?

**SUBJECTS AND METHOD:** In a standardized questionnaire, patients aged  $>18$  years were asked about their perception of the course of treatment, the changes of their personal aims during treatment and the reasons of those changes. The questionnaire related to the analysis of the treatment documentation concerning patients  $>18$  years, who first rejected the full course of orthodontic treatment.

**RESULTS:** There was a lack of knowledge about the treatment possibilities of orthodontics. Many of the patients first refused complex orthodontic treatment depending on duration and methods such as fixed appliances. Some of them agreed with a stepwise treatment consent, others did not want to be confronted with more than their self-defined orthodontic problem. In reality, positive treatment effects and additional explanations concerning functional and aesthetic changes provided by the orthodontist often led to acceptance and realization of previously refused complex orthodontic treatment.

**CONCLUSION:** There is a major opportunity to affect adult patients' compliance and estimation, especially regarding complex treatment, if the course of treatment, the information about it and the demonstration include only the next step or steps.

### SP74 EVALUATION OF NASOLABIAL AESTHETICS IN PATIENTS WITH UNILATERAL CLEFT LIP AND PALATE

Ege Dogan, Kadir Işık, Servet Dogan, Orthodontic Department, Ege University School of Dentistry, Izmir, Turkey

**AIMS:** To evaluate the nasolabial appearance in unilateral cleft lip and palate (UCLP) patients using the Asher-McDade Scoring System.

**MATERIALS AND METHOD:** Eighty frontal and profile photographs of 40 patients with a UCLP. Nasal forms, nasal deviations, vermilion borders and nasal profiles were evaluated. Three different orthodontists evaluated the photographs from 1 to 5, 1: as good and 5: as very poor. Cronbach's alpha was calculated for each individual nasolabial component and for the sum of the four component scores to test for coherence among the three observers.

**RESULTS:** The nasal form mean was (A): 3.52 (2.5% A1, 15% A2, 32.5% A3, 27.5% A4, 22.5% A5), nasal deviation mean was (B): 3.27 (0% B1, 27.5% B2, 32.5% B3, 27.5% B4, 12.5% B5), vermilion border mean was (C): 2.87 (5% C1, 20% C2, 45% C3, 25% C4, 5% C5) and nasal profile mean was (D): 2.92 (12.5% D1, 22.5% D2, 27.5% D3, 27.5% D4, 10% D5).

**CONCLUSION:** Nasal forms, nasal deviations, vermilion borders and nasal profiles of the patients with a UCLP who had different primary surgery techniques were all poor. Primary surgery is one of the most important things in nasolabial aesthetics of patients with a UCLP.

#### SP75 THE PROBLEM OF TRANSVERSE MAXILLARY CONSTRICTION DURING GROWTH

Tetyana Zakalata<sup>1</sup>, Mariia Mizhura<sup>2</sup>, Ella Golik<sup>3,4</sup>, <sup>1</sup>Department of pediatric dentistry in Pirogov VNMU, Vinnitsa, <sup>2</sup>Kiev State Dental Hospital, Ukraine and Private practice, <sup>3</sup>Kiev, Ukraine and <sup>4</sup>Dubai, United Arab Emirates

**AIMS:** To study the dynamics of transverse anomalies that accompany constriction of the upper jaw and to select the optimal method of treatment based on the patient's age.

**SUBJECTS AND METHOD:** Ninety eight patients aged 6 to 15 years, divided into three groups. The first group consisted of 30 children aged 6 to 8 years, the second group 28 children aged 9 to 11 years and the third group, 40 teenagers aged 12 to 15 years. Clinical examinations using a standard technique, anthropometric and photometric measurements and analysis of diagnostic models were conducted during the study.

**RESULTS:** The prevalence of a transverse malocclusion caused by constriction of the upper jaw was 3 per cent in the first group, 12 per cent in the second group and 15.32 per cent in the third group.

**CONCLUSION:** Questions of diagnosis, prognosis of transverse anomalies and timely selection of the optimal method of treatment still remain relevant with the significant prevalence of transverse anomalies of the dental system in different age categories.

#### SP76 EFFECTIVENESS OF LOW-LEVEL DIODE LASER THERAPY ON ORTHODONTIC PAIN MANAGEMENT: A SYSTEMATIC REVIEW AND META-ANALYSIS

Chong Ren, Colman McGrath, Yanqi Yang, Department of Orthodontics, Faculty of Dentistry, University of Hong Kong, Hong Kong SAR

**AIMS:** There is controversy on the effectiveness of low-level laser therapy (LLLT) for orthodontic pain relief. Among various LLLT types, a diode laser is most widely employed. This review aimed to assess the effectiveness of diode LLLT for orthodontic pain control.

**MATERIALS AND METHOD:** A systematic and extensive electronic search was performed in the Cochrane Library (Issue 9, 2014), PubMed (1997), Embase (1947) and Web of Science (1956) for randomized controlled trials (RCTs) investigating the effects of diode LLLT for orthodontic pain up to October, 2014. Studies were included according to the selection criteria independently by two reviewers. Risk of bias was assessed by the Cochrane tool for risk of bias evaluation. Meta-analysis was conducted by RevMan 5.3. Effect of intervention was measured in relative risk (RR) for dichotomous outcome and in mean difference (MD) for continuous outcome with a 95 per cent confidence interval (CI).

**RESULTS:** Out of 186 results identified, 14 RCTs were included with a total of 659 participants from 11 countries. Except for three studies, assessed as 'moderate risk of bias', others were rated as having a 'high risk of bias'. Methodological weakness mainly lay in 'blinding' and 'allocation concealment'. Meta-analysis showed that diode LLLT significantly reduced orthodontic pain prevalence by 39 per cent in comparison with placebo groups (RR = 0.61, 95% CI range 0.41 to 0.92,  $P = 0.02$ ). Regarding pain intensity, a diode laser was shown to reduce maximum pain intensity with the difference significant in studies of parallel design (MD = -3.27, 95% CI range -5.40 to -1.15,  $P = 0.003$  versus placebo groups; MD = -3.25, 95% CI range -4.25 to -2.26,  $P = 0.000$  versus control groups), yet insignificant in studies of split-mouth design (MD = -1.29, 95% CI range -4.20 to 1.61,  $P = 0.38$  versus placebo groups).

**CONCLUSION:** The use of diode LLLT for orthodontic pain looks promising. However, due to methodological weakness and risk of bias, there was insufficient evidence to support or refute its effectiveness. RCTs with a better design and appropriate sample power are required to provide stronger evidence for its clinical application.

(Supported by Health and Medical Research Fund 01121056)

#### SP77 EVALUATION OF DENTAL ARC WIDTHS IN INDIVIDUALS HAVING A BILATERAL CLEFT LIP AND PALATE USING THREE-DIMENSIONAL DIGITAL MODELS

Servet Doğan, Abdulkadir Işık, Ege Doğan, Department of Orthodontics, Ege University, İzmir, Turkey

AIMS: To evaluate dental arc widths in individuals with either a unilateral (UCLP) or bilateral cleft lip and palate (BCLP) using three-dimensional (3D) digital models.

SUBJECTS AND METHOD: Fifty subjects (25 males, 25 females) aged between 14-17 years each having unilateral and bilateral primary and secondary CLP. Twenty three patients had a UCLP, whereas 27 (12 right, 15 left) had a BCLP. The maxillary dental models obtained prior to treatment were scanned using the Orthomodel program in order to obtain 3D images, and to measure the intercanine and intermolar widths, and also the ratio between these measurements. A Student's *t*-test was utilized in order to assess the data obtained.

RESULTS: In individuals with a BCLP, the average intercanine distance was 17.44 mm, the average intermolar distance 36.57 mm and the intercanine/intermolar ratio 0.47. In UCLP subjects, the average measurements were: average intercanine distance 25.10 mm, intermolar distance 42.20 mm, intercanine/intermolar ratio. The intercanine distance in unilateral clefts were found to be statistically significant ( $P < 0.01$ ), whereas intermolar widths were not statistically significant ( $P > 0.05$ ) even though there were differences in intermolar widths.

CONCLUSION: In order for orthodontic treatment to be stable, one of the most important points of consideration regarding treatment planning is for the arc form and widths to be coherent with each other. The findings in this study of an increase of intercanine distance in UCLP patients indicates that in the cleft region the maxillary arc is inclined to the back, while the same the situation in BCLP subjects suggests that the maxillary segments are collapsed inwards. This difference in the arcs is actively affected by primary surgical treatment.

#### SP78 EVALUATION OF THE EFFECTS OF PHOTOBIO-MODULATION AND ULTRASOUND APPLICATIONS ON ORTHODONTICALLY INDUCED ROOT RESORPTION

Nisa Gul<sup>1</sup>, Gökmen Kurt<sup>2</sup>, Enis Guray<sup>3</sup>, Haldun Dogan<sup>4</sup>, Serdar Ceylaner<sup>4</sup>, Departments of Orthodontics, Faculties of Dentistry, <sup>1</sup>Erciyes University, Kayseri and <sup>2</sup>Yeni Yüzyıl University, Istanbul, <sup>3</sup>Orthodontic Private Practice, Ankara and <sup>4</sup>Private Practice, Ankara, Turkey

AIMS: To evaluate and to compare the inhibition and repair effects of light emitting diode (LED) mediated photobiomodulation (PBM) and low intensity-pulsed ultrasound (LPU) applications on orthodontically induced root resorption (OIRR) on rats.

MATERIALS AND METHOD: Forty-nine Wistar albino rats were divided into four groups. OIRR was created for 14 days experimentally by applying a force of 100 g using a closed coil spring between the maxillary central incisor and first molar teeth. PBM was applied for 10 minutes ( $n = 14$ ) and LPU was used for 15 minutes ( $n = 14$ ), daily. A positive control group ( $n = 14$ ) with only orthodontic force and a negative control group ( $n = 7$ ) without any force or therapeutic application were also constructed. After decapitation of the rats at day 15 of the experiment, the upper first molar teeth were prepared for histological, genetic and scanning electron microscopy (SEM) analysis. The total number of cells (nTC), number (nOsC) and ratio of osteoclastic cells (rOsC), the number of lacunae (nL), resorption area ratio (RAR), SEM resorption area ratio (SRAR), OPG, RANKL, Cox-2 mRNA gene expression levels were investigated at the periodontal tissue of the teeth. Non-parametric data was evaluated with Kruskal-Wallis test and multiple comparisons with Dunn's method.

RESULTS: nOsC ( $P < 0.01$ ), rOsC ( $P < 0.01$ ), RAR, SRAR and nL ( $P < 0.001$ ) decreased and nTC ( $P < 0.001$ ) increased with PBM and LPU applications compared to the positive control group. No statistically significant difference was observed among PBM and LPU groups. RANKL mRNA gene expression levels of the PBM and LPU groups were lower ( $P < 0.001$ ) and OPG levels were higher ( $P < 0.001$ ) than in the control groups, but no significant difference was found between the LPU and PBM groups. Both PBM and LPU significantly reduced Cox-2 mRNA gene expression ( $P < 0.05$ ), so these applications may also reduce pain during orthodontic therapy.

CONCLUSION: PBM and LPU showed similar effects on OIRR. Both resulted in significant inhibition and repair effects on root resorption during orthodontic force application

#### SP79 JUDGMENT OF NASOLABIAL AESTHETICS IN CLEFT LIP AND PALATE IS NOT INFLUENCED BY OVERALL FACIAL ATTRACTIVENESS†††

Katharina Kocher<sup>1</sup>, Christos Katsaros<sup>1</sup>, Olga-Elpis Kolokhita<sup>2</sup>, Piotr Fudalej<sup>1</sup>, <sup>1</sup>University of Bern, Switzerland and <sup>2</sup>Aristotle University of Thessaloniki, Greece

**AIMS:** To investigate if judgment of nasolabial aesthetics in cleft lip and palate (CLP) is influenced by overall facial attractiveness.

**MATERIALS AND METHOD:** Seventy two fused images (36 for males, 36 for females) were constructed. Each image comprised (1) nasolabial region of a treated child with a complete UCLP and (2) external facial features, i.e. the face with masked nasolabial region of a non-cleft child. Photographs of the nasolabial region of six males and six females with a UCLP, representing a wide range of aesthetic outcomes, i.e. from very good to very poor appearance, were randomly chosen from a sample of 60 consecutively treated patients in whom nasolabial aesthetics had been rated previously. Photographs of external facial features of six males and six females without CLP with various aesthetics were randomly selected from patients' files. Eight lay raters evaluated fused images using a 100 mm visual analogue scale. Method reliability was assessed by re-evaluation of fused images after >1 month. A regression model was used to analyze which elements of facial aesthetics influence perception of nasolabial appearance.

**RESULTS:** Method reliability was good. A regression analysis demonstrated that only the appearance of the nasolabial area affected the aesthetic scores for fused images (coefficient = -11.44;  $P < 0.001$ ;  $R^2 = 0.464$ ). Appearance of external facial features did not influence perception of fused images.

**CONCLUSION:** Cropping facial images for assessment of nasolabial appearance in CLP seems unnecessary. Instead, aesthetic evaluation can be performed on images of full faces.

#### SP80 EFFECT OF EXTRACORPOREAL SHOCKWAVE THERAPY ON PULPAL BLOOD FLOW AFTER ORTHODONTIC TREATMENT: A RANDOMIZED CLINICAL TRIAL

Frank Falkensammer<sup>1</sup>, Wolfgang Schaden<sup>2</sup>, Christoph Krall<sup>3</sup>, Josef Freudenthaler<sup>1</sup>, Hans-Peter Bantleon<sup>1</sup>, <sup>1</sup>Department of Orthodontics, University Clinic of Dentistry Vienna, <sup>2</sup>Department of Traumatology, AUVA Trauma Center and Ludwig Boltzmann Institute for Experimental and Clinical Traumatology, Vienna and <sup>3</sup>Department of Medical Statistics, Medical University Vienna, Austria

**AIMS:** To investigate, in a clinical trial, the effect of non-invasive extracorporeal shockwaves on pulpal blood flow in orthodontic patients who had undergone active treatment.

**SUBJECTS AND METHOD:** Sixty adult patients were allocated by block randomization to a treatment or a placebo group at a 1:1 ratio. The patients were required to be otherwise healthy. Blinding was performed for the subjects and the outcome assessor. The region of interest was the mandibular incisors and canines, which were vital, unrestored, and had experienced no trauma. The active treatment group received a single shockwave treatment of 1000 impulses at 0.19-0.23 mJ/mm<sup>2</sup> while the placebo group was treated with a deactivated shockwave applicator but acoustic sham. Pulpal blood flow was evaluated four times over a period of 6 months starting from the day of bracket removal, using a laser Doppler device.

**RESULTS:** Thirty patients were evaluated in each group. Pulpal blood flow did not differ significantly over the 6 months between the placebo and treatment group. Shockwave treatment was associated with no significant effect with respect to tooth type, age, gender, or mean blood pressure, and had no unintended pernicious effects.

**CONCLUSION:** Orthodontic patients who have undergone active treatment tend to have high levels of pulpal blood flow, which decrease over a period of 6 months. Extracorporeal shockwaves had no statistically significant effect on pulpal blood flow.

#### SP81 SANDBLASTED AND ACID-ETCHED ENAMEL: AN IMPROVEMENT OF SURFACE AND INTERFACIAL PROPERTIES FOR ORTHODONTIC BONDING?

Raphael Patcas<sup>1</sup>, Spiros Zinelis<sup>2</sup>, George Eliades<sup>2</sup>, Theodore Eliades<sup>1</sup>, <sup>1</sup>Clinic for Orthodontics and Pediatric Dentistry, University of Zurich, Switzerland and <sup>2</sup>Department of Biomaterials, University of Athens, Greece

**AIMS:** Sandblasting and subsequently acid-etching enamel has been suggested to increase adhesive strength. The aim of this study was to characterize enamel surfaces treated with sandblasting and/or acid-etching and assess the enamel-adhesive interfaces.

**MATERIALS AND METHOD:** The buccal surfaces of 30 premolars were either sandblasted (SB), acid-etched (AE), sandblasted and subsequently acid-etched (SBAE), or left intact (IE) as the control. For two treatments (AE and SBAE), orthodontic brackets were bonded (AEB and SBAEB) for resin infiltration assessment. Optical profilometry was used to evaluate the surface roughness and differential enamel loss, a low-vacuum scanning electron microscope and an energy dispersive X-ray analysis was performed to examine surface morphology and elemental composition, and a high-vacuum scanning electron microscope to explore interfacial resin infiltration. Differences were statistically analysed by one-way ANOVA and Tukey-Kramer multiple comparison test or *t*-test ( $\alpha = 0.05$ ).

**RESULTS:** Surface roughness values were significantly higher in SB and SBAE compared to AE ( $P < 0.05$ ). SBAE removed more enamel (mean: 32  $\mu\text{m}$ ) than SB (mean: 26  $\mu\text{m}$ ) and AE (mean: 15  $\mu\text{m}$ ). SBAE demonstrated a more uniform type I etching pattern, without alumina particles implanted in enamel, unlike SB. No difference was found in the extent of resin infiltration between AEB and SBAEB ( $P > 0.05$ ), but resin tags extending to the subsurface inter-prismatic structure were thicker in SBAEB and the inter-diffusion zone more uniform than in AEB, indicating a better infiltration quality.

**CONCLUSION:** SBAE treatment produces a rough enamel surface, typical of type I etching, free of alumina interferences, although causing the greatest enamel loss. The depth of resin infiltration is similar to acid-etched enamel, but the infiltration qualities are improved.

#### SP82 RELATIONSHIP BETWEEN CLOSURE OF THE SPHENO-OCCIPITAL SYNCHONDROSIS AND HAND-WRIST MATURATION

Hitomi Maruyama, Ryuzo Kanomi, Kanomi Orthodontic Office, Himeji, Japan

**AIMS:** Synchondroses in the cranial base are important growth centres of the craniofacial skeleton. The speno-occipital synchondrosis (SOS) is particularly representative because of its late ossification and important contribution to post-natal growth of the cranial base. Growth at the SOS carries the maxilla upward and forward relative to the mandible, resulting in increased face height and depth. The reported age of complete closure of the SOS has varied, and the aim of this study was therefore to examine the time of closure of the SOS using cone beam computed tomography (CBCT), and to evaluate the relationship between time of closure and hand-wrist maturation.

**MATERIALS AND METHOD:** CBCT images and hand-wrist radiographs were obtained from 127 Japanese females between 8 and 15 years of age. Radiographs were taken before orthodontic treatment. When orthodontic treatment was started, all patients underwent routine CBCT for screening purposes before 2010. From then on, CBCT was performed in conformity with the Guidelines on Radiation Protection. The fusion status of the SOS was divided into four stages using CBCT images: stage 1, SOS was completely open; stage 2, SOS was partially closed; stage 3, SOS was not opened, but ossification remained incomplete; and stage 4, SOS was completely closed. Hand-wrist radiographs were analysed using Fishman's skeletal maturity indicators (SMIs).

**RESULTS:** Approximately 60 per cent of patients had ossification centres within the SOS at 10 years of age. The earliest complete closure of the SOS occurred in an 11-year-old girl. The SOS was closed in almost all patients by 13 years of age. Furthermore, the fusion status of the SOS correlated strongly with hand-wrist maturation. SMI was  $\leq 7$  in patients with fusion status of the SOS as stage 1 or 2, and  $\geq 7$  in patients with fusion status of the SOS as stage 3 or 4.

**CONCLUSION:** The time of closure of the SOS correlated with skeletal maturation. In addition, the SOS was completely closed by the time the pubertal growth spurt had almost ended. The SOS can thus be considered to play some role in pubertal maxillofacial growth.

#### SP83 A CROSS-SECTIONAL STUDY ON LIP AND TONGUE PRESSURE MEASURED IN YOUNG BELGIAN CHILDREN

Claire Van Dyck<sup>1</sup>, Steffen Fieuws<sup>2</sup>, Guy Willems<sup>1</sup>, <sup>1</sup>Department of Oral Health Sciences-Orthodontics, Katholieke Universiteit Leuven and <sup>2</sup>Interuniversity institute for Biostatistics and statistical Bioinformatics, Katholieke Universiteit Leuven, Belgium

**AIMS:** Young children present with diverse malocclusions and orofacial dysfunctions in orthodontic practice. The contribution of function and force of the lips, cheeks and tongue are of particular interest to orthodontists in correct treatment planning. Clinical assessment of myofunctional status is an indispensable part of a complete orthodontic diagnosis. The aims of the present study were to evaluate whether there are differences in maximum lip and tongue elevation pressure in young Belgian children as a function of gender, age, Angle classification, characteristics of occlusion, and oral habits.

**SUBJECTS AND METHOD:** This cross-sectional study comprised 57 children (35 girls, 22 boys), between 6.2 and 11.0 years of age (mean 8.8 years). The patients were characterized by the variables gender, age, Angle classification, characteristics of occlusion, and oral habits. Maximum lip and tongue elevation pressure were measured with the Iowa Oral Performance Instrument (IOPI Medical LLC, Redmond, Washington, USA). The obtained values were statistically analysed (Mann-Whitney *U* and Kruskal-Wallis tests) to highlight possible significant differences between the groups.

**RESULTS:** No evidence existed for a relationship between lip or tongue pressure with gender, age and occlusal characteristics. Although a significant relationship was found between lip pressure and Angle classification and oral habits (such as open lip rest position and lip interposition), no relationship was found concerning tongue pressure.

**CONCLUSION:** Lip pressure was significantly lower in Class II division 1 subjects and in subjects with lip interposition or an habitual open lip relationship. Tongue elevation pressure did not differ as a function of oral habits for any of the variables. It is important that parents and patients should be informed about the consequences of developing unphysiological functional patterns, such as an open lip rest relationship and lip interposition.

#### SP84 COMPUTERIZED TOMOGRAPHIC EXAMINATION OF ALVEOLAR BONE LOSS AROUND ANTERIOR TEETH IN PATIENTS TREATED WITH FIXED ORTHODONTIC APPLIANCES

Marija Ristic<sup>1</sup>, Mirjana Sasic<sup>2</sup>, <sup>1</sup>Millitary Medical Academy, Belgrade and <sup>2</sup>Faculty of Stomatology, Belgrade, Serbia

**AIMS:** To investigate the influence of fixed orthodontic appliances on cortical alveolar bone width.

**SUBJECTS AND METHOD:** A prospective, self-controlled study based on computerized tomography. Thirty-five patients with upper and/or lower fixed appliance underwent computerized tomography scanning of upper or lower teeth before and after orthodontic treatment. Tomography was performed using a multislice scanner Somatom Sensation 16 (Siemens, München, Germany). The width of the buccal and oral cortical alveolar bone was measured as the distance between the outer and inner lamellae of cortical bone.

**RESULTS:** Resorption of the cortical alveolar bone occurred both apically and gingivally around the roots of all teeth. The best perspective of both buccal and oral cortical bone lamellae was obtained using the axial computerized tomographic plane for all examined teeth, gingivally and apically.

**CONCLUSION:** During therapy of malocclusions with fixed orthodontic appliances the width of the buccal and oral cortical alveolar bone around decreases at all teeth in the both jaws.

#### SP85 EVALUATION OF ALVEOLAR BONE CHANGE BY CORTICOTOMY-FACILITATED ORTHODONTICS IN DENTOALVEOLAR PROTRUSION

Dong-Min Yang, Kang-Wook Bin, Hyo-Won Ahn, Young-Guk Park, Seong-Hun Kim, Department of Orthodontics, Kyung Hee University, Seoul, Korea, South

**AIMS:** To evaluate the effect of speedy surgical orthodontics (SSO) during *en masse* retraction on the changes of alveolar bone and root length of the maxillary central incisors using lateral cephalometric radiographs and cone beam computed tomographs (CBCT).

**SUBJECTS AND METHOD:** Thirteen Korean patients with bialveolar protrusion. The four first premolars were extracted and then *en masse* retraction was performed using the lingual retractor (C-palatal retractor) and titanium palatal plate with a wide horizontal arm (C-plate). The sample was divided into two groups according to the treatment method. Group 1 were treated with conventional orthodontic treatment and skeletal anchorage using the C-retractor and C-plate while group 2 were treated with corticotomy assisted orthodontic treatment and skeletal anchorage. Lateral cephalometric radiographs and CBCT were taken of all patients pre-treatment (T0) and post-retraction (T1). The angle between the palatal plane and the long axis of the maxillary central incisors and the distance of central incisor tip movement were measured. Alveolar bone thickness was measured at the 3, 6 and 9 mm levels from the cemento-enamel junction (CEJ) of the central incisors along the long axis. The vertical alveolar bone level was measured at the labial and palatal sides of the maxillary incisors from the CEJ to the alveolar crest. Root lengths were also measured.

**RESULTS:** The treatment duration for retraction was 8.4 months in group 1 and 6.3 months in group 2. Between T0 and T1, labial alveolar bone level was stably retained in both groups but, palatal alveolar bone level was significantly decreased. In the comparisons of variable change in palatal alveolar bone thickness; there was no significant difference between the groups.

**CONCLUSION:** Corticotomy assisted *en masse* retraction can be advantageous for achieving maximum retraction in a short treatment period compared with conventional *en masse* retraction treatment.

#### SP86 TREATMENT OF CLASS II MALOCCLUSIONS WITH AN ACTIVATOR AND A COMBINATION OF ACTIVATOR AND EXTRAORAL ANCHORAGE

Krasimira Gaidarova, Department of Orthodontics, Medical University Sofia; Dental Faculty, Bulgaria

**AIMS:** To compare the dental, skeletal and soft tissue profile changes in patients with Class II malocclusions treated with an activator and a combination of an activator and extraoral traction (EOT).

**SUBJECTS AND METHOD:** One hundred and four patients aged 8-15 years, who received treatment with an activator. Pfeiffer and Grobety, (n = 86) or combined treatment with an activator and EOT (n = 18). The skeletal changes were traced on a profile telerradiographs, taken before and after treatment. Cephalometric measurements, cited by different authors, were used before and after treatment in order to determine the skeletal structure and soft tissue changes. The cervical vertebral maturation stage (CVMS) of Baccetti was used to determine skeletal growth. Eleven statistical analyses were used to process the study data.

**RESULTS:** SNB increased and ANB decreased more in patients treated with the combined activator and EOT treatment. SN/M, Spp/M and Yos/SN decreased only in patients treated with a combination of activator and EOT. Co-B increased and overjet decreased in patients treated only with an activator.

**CONCLUSION:** With both methods maxillary growth was more restrained in patients treated with a combination of activator and EOT. The combined treatment is most suitable for Class II malocclusion patients who need blocking or a decrease in vertical craniofacial characteristics.

#### SP87 EVALUATION OF MANDIBULAR HARD AND SOFT TISSUES IN UNILATERAL AND BILATERAL CLEFT LIP AND PALATE PATIENTS

Işıl Aras, Derya Baykal, Merve Bulut, Servet Doğan, Department of Orthodontics, Ege University Faculty of Dentistry, İzmir, Turkey

**AIMS:** To compare the mandibular hard and soft tissues of unilateral and bilateral complete cleft lip and palate patients

**SUBJECTS AND METHOD:** Ten unilateral complete cleft lip and palate (UCCLP) patients, 10 bilateral complete cleft lip and palate (BCCLP) patients and 10 non-cleft (NC) patients aged 15-17 years. Measurements were carried out, based on the true vertical line (TVL) on the pre-treatment lateral cephalometric headfilms of these individuals. Fourteen linear measurements were done using Dolphin Imaging 11.7 software utilizing the Arnett-Gunson

module. One-way ANOVA was used to determine whether there were any significant differences between groups, followed by Tukey's test to resolve where the difference existed.

**RESULTS:** Mandibular incisor inclination (Md1-MdOP), lower lip length (LLL) and thickness (LLT), chin thickness (Pog-Pog'), menton soft tissue thickness (Me-Me'), throat length (NTP-Pog'), incisor tip to chin (Md1-Pog') and lower lip anterior to chin (LLA-Pog') values displayed no intergroup differences. On the other hand, the distance from lower incisor tip to TVL (Md1-TVL), from lower lip anterior to TVL (LLA-TVL), from soft tissue point B to TVL (B'-TVL) and from soft tissue pogonion to TVL (Pog'-TVL) showed statistically significant ( $P < 0.05$ ) differences between the NC individuals and CLP subjects. While there was no significant difference among the UCCLP and BCCLP patients, both groups showed similar significance of difference levels compared to controls.

**CONCLUSION:** In spite of the no observed difference among UCCLP and BCCLP patients concerning mandibular soft tissue parameters, CLP patients' measurements of mandibular projection are retrusive to the TVL. It has been pointed out in the literature that primary surgical interventions are effective on maxillary values, however no definite conclusion are drawn for mandibular development. Studies with more patients are required to reach precise verdicts on mandibular retrusion.

#### SP88 REVIEW OF TOOTH ANOMALIES IN CLEFT LIP AND PALATE PATIENTS

Hasan Cinarcik, Servet Doğan, Department of Orthodontics, Ege University, Faculty of Dentistry, Izmir, Turkey

**AIMS:** To evaluate tooth anomalies in patients in the permanent dentition with unilateral complete primary and secondary cleft lip and palate (CLP).

**SUBJECTS AND METHOD:** The number of missing and supernumerary teeth together with size and shape anomalies and any impacted teeth were evaluated in 80 patients between 14-17 years of age with unilateral complete primary and secondary CLP. Third molars were not included.

**RESULTS:** In 52 (65%) of the 80 patients with a unilateral complete CLP, the clefts were on the left side. On the cleft line some teeth were missing. The percentage of missing teeth was: 40 patients (50%) were missing tooth 22, 32 (40%) tooth 12, 17 (21%) tooth 11 and 12 (15%) tooth 24. The percentage of missing teeth outside of the cleft line was: 22 (28%) tooth 25, 16 (20%) tooth 15, 12 (15%) tooth 12 and 12 (15%) tooth 22. The percentage of impacted teeth was: 15 (19%) tooth 23, 12 (15%) tooth 22, 12 (15%) tooth 24, 8 (10%) tooth 12, 7 (8%) tooth 11 and 7 (8%) tooth 13. In 12 patients (15%) there was a mesiodens between the central incisors. In 10 patients (12.5%) 11 and in 22 patients (27.5%) 12 had shape anomalies.

**CONCLUSION:** In patients with a CLP dental anomalies are frequently observed. Left sided clefts occur more than right sided clefts. The most prevalent missing tooth on the cleft side is the permanent lateral.

#### SP89 EFFECT OF AGE, BODY MASS INDEX, AND IMAGING POSITION ON CRANIOFACIAL AND UPPER AIRWAY MORPHOLOGY IN OBSTRUCTIVE SLEEP APNOEA PATIENTS

Marjukka Kuuliala<sup>1</sup>, Mika Helminen<sup>2</sup>, Jorma Järnstedt<sup>3</sup>, Timo Peltomäki<sup>1,4</sup>, <sup>1</sup>Oral and Maxillofacial Unit, Tampere University Hospital, <sup>2</sup>Science Center, Pirkanmaa Hospital District and School of Health Sciences, University of Tampere, <sup>3</sup>Medical Imaging Center, Tampere University Hospital and <sup>4</sup>University of Tampere, Finland

**AIMS:** To study the effect of age, body mass index (BMI), and imaging position (upright versus supine) on craniofacial and upper airway morphology in obstructive sleep apnoea (OSA) patients.

**MATERIALS AND METHOD:** Good quality upright and supine lateral cephalograms of 52 consecutive, non-treated OSA patients (15 females, 37 males, mean age 47 years, range 22-68 years) examined with polysomnography. The subjects had an apnoea hypopnea index (AHI)  $\geq 15$  with a mean total AHI of 30, and mean supine AHI of 49. The craniofacial structure and the shortest distance from the soft palate and from the tongue base to the posterior

pharyngeal wall were measured on the digital lateral cephalograms with Planmeca Romexis 3.6.0.R software. AHI and BMI were obtained from the patients' records. Statistical analyses included Wilcoxon signed-rank test and Spearman rank correlation. The cephalograms had been obtained to study the suitability of the patients to mandibular advancement treatment as part of OSA therapy.

**RESULTS:** No significant correlations were found between craniofacial and upper airway structures, AHI or BMI. No correlation was shown between age, AHI and BMI. Statistically significant ( $P < 0.05$ ) differences were found in upper airway dimensions with the change in imaging position. The airway dimension behind the soft palate was reduced and the airway behind the tongue increased as the result of a change from upright to supine position.

**CONCLUSION:** Severe OSA may occur in variable craniofacial structures, and even in young, normal weight individuals. In a supine position the soft palate seems to drop back and reduce airway dimensions. Presumably due to genioglossus muscle activity retroglossal airway dimension is increased in the supine position when imaging is made in wakefulness, which adaptation may not occur during sleep.

#### SP90 UNIVERSITY VERSUS PRIVATE PRACTICE TREATMENT OUTCOMES EVALUATED WITH THE AMERICAN BOARD OF ORTHODONTICS OBJECTIVE GRADING SYSTEM

Barbara Mislik<sup>1</sup>, Dimitrios Konstantonis<sup>2</sup>, Theodore Eliades<sup>1</sup>, <sup>1</sup>Department of Orthodontics and Pediatric Dentistry, University of Zurich, Switzerland and <sup>2</sup>Department of Orthodontics, Dental School, University of Athens, Greece

**AIMS:** To compare treatment outcomes in university versus private practice of Class I patients, using the American Board of Orthodontics Objective Grading System (ABO-OGS), and to determine whether the treatment provider choice was a significant predictor of success for the ABO examination

**SUBJECTS AND METHOD:** A sample of 580 Class I patients treated with or without extractions of four first premolars was subjected to discriminant analysis in order to identify a borderline spectrum of 66 patients regarding the extraction modality. Of these patients, 34 were treated in private orthodontic practice and 32 in a university graduate orthodontic clinic. The treatment outcomes were evaluated using the eight variables of the ABO-OGS.

**RESULTS:** The total score ranged from 10 to 47 (mean, 25.44; SD, 9.8) for the university group and from 14 to 45 (mean, 25.94; SD, 7.7) for the private practice group. The university group achieved better scores for the variables of buccolingual inclination ( $P < 0.05$ ) and marginal ridges ( $P < 0.05$ ) and the private practice group achieved a better score in the variable of root angulation ( $P < 0.05$ ). However, no statistically intergroup differences were found between the total ABO-OGS scores. Additionally, no significant difference was found between the two treatment groups regarding the success rate of the ABO examination (odds ratio 0.53; 95% CI, 0.032, 8.93;  $P = 0.66$ ).

**CONCLUSION:** In private practice orthodontists are more successful in angulating the roots correctly whereas in the university clinic better torque control of the posterior segments and better marginal ridges are achieved. In this sample, 71.9 per cent of the university and 79.4 per cent of the private practice patients would successfully pass the ABO examination. The treatment provider was not a significant predictor of success to the ABO examination.

#### SP91 INFLUENCE OF ACTIVATION PROTOCOL ON PERCEIVED PAIN DURING RAPID MAXILLARY EXPANSION

Alessandro Nota, Claudia Santariello, Fabiana Ballanti, Alberto Baldini, Department of Orthodontics, University of Rome Tor Vergata, Italy

**AIMS:** Rapid maxillary expansion (RME) is a common clinical orthodontic procedure used for the treatment of maxillary arch constriction and many studies have cited pain as the most frequent experienced effect with a frequency of the 93.9 per cent. Few articles have analysed pain associated with RME. The aim of this study was to analyse the influence of two different activation protocols on pain timing and intensity during RME.

**SUBJECTS AND METHOD:** A total of 112 prepubertal patients (54 males, 58 females, mean age  $11.00 \pm 1.80$  years) with constricted maxillary arches underwent RME with two

different activation protocol (group 1: one activation/day; group 2: two activations/day). The patients were provided with a combination between a numeric rating scale (NRS) and a faces pain scale (FPS) for a correct daily pain assessment. Variables of primary interest and reported pain of treatment were summarised as the means or standard deviation and compared between the two treatment arms using Wilcoxon's rank-sum test. The trend of average pain over time for the two treatment arms was studied graphically and the differences were evaluated with Wilcoxon rank-sum tests. Secondary analyses, stratified by gender and cervical stage, were also performed.

**RESULTS:** Overall reported pain during treatment was significantly higher in group 2 (on average 0.8 versus 1.2,  $P < 0.01$ ). Stratified analyses led to similar findings in every subsection of the sample, and in particular in females and Class I patients (0.9 versus 2.2 and 0.9 versus 2.0, respectively,  $P < 0.01$  in both cases). Three subjects in group 1 and 10 in group 2 recorded, at least once, pain higher than 5. Among group 2 subjects the differences in terms of pain between genders was more evident. Less developed (CS1) subjects experienced greater different levels of pain in the two treatment arms.

**CONCLUSION:** The choice of activation protocol is able to change perceived pain during RME; the lower amount of daily expansion is correlated with less pain sensation. Pain reported during RME could be influenced by skeletal maturity and gender of the subjects under treatment.

### SP92 REPRODUCIBILITY OF REST POSITION OF THE ADOLESCENT FACE USING THREE-DIMENSIONAL STEREOPHOTOGRAMMETRY

Lydia Yong, Mimi Yow, Ming Tak Chew, Kelvin Foong, Department of Orthodontics, Faculty of Dentistry, National University of Singapore, Singapore

**AIMS:** The accuracy of image comparison using three-dimensional (3D) stereophotogrammetry depends on the standardisation of image acquisition and image acquisition error, image analysis software and techniques, and reproducibility of the face in repose. This prospective study quantified the soft tissue variations of the adolescent face captured in repose after two time intervals: 5 minutes, and 1-10 weeks.

**MATERIALS AND METHOD:** Using 3dMDCranial™, three images were taken of 23 adolescent subjects ( $15.8 \pm 2.2$  years) in repose (T0), 5 minutes after T0 (T1) and 1-10 weeks after T0 (T2). Comparisons were made for the whole face, forehead, eyebrows, eyes, nose bridge, upper lip, lower lip, chin and right and left cheeks between T0 and T1 images and between T0 and T2 for each subject, after surface-based registration with 3dMDVultus. Soft tissue variations measured in root-mean-square error and differences between T0 and T1 and T0 and T2 were tested using Wilcoxon's signed-rank and Student's *t*-tests. Twenty-two per cent of images were re-analyzed to examine intra-examiner agreement, using Bland-Altman plots. The error of the methods was tested using mannequin images.

**RESULTS:** There were statistically significant variations in all facial regions, although variation of the whole face was low (mean T0-T1 =  $0.23 \pm 0.05$  mm, median T0-T2 = 0.29 mm). The median or mean of all regions (except chin) were higher at T0-T2 compared to T0-T1 although statistically significant differences were only found for the whole face, forehead, eyebrows, right cheek and upper lip. Comparing T0 and T1 images, the eyebrows, eyes, upper and lower lips had higher variations (median = 0.23-0.26 mm) than the forehead, nose bridge, chin and cheeks (median = 0.09-0.13 mm). Comparison of T0 and T2 images demonstrated similar trends. The superimposed mannequin image variations were low (median range = 0.05-0.14 mm), indicating image acquisition and analysis errors were low. Excellent intra-examiner agreement was achieved.

**CONCLUSION:** Although statistically significant, the average variations of the adolescent face in repose are clinically small. The face in repose is more reproducible at 5 minutes than after intervals of weeks. The increased variability in reproducibility of the eyebrows, eyes, upper and lower lips must be considered in stereophotogrammetric image comparisons.

### SP93 PREVALENCE AND AETIOLOGY OF IMPACTED TEETH IN ORTHODONTIC PATIENTS. ITS IMPLICATIONS REGARDING COLLABORATION WITH DENTOALVEOLAR SURGEONS

**AIMS:** To investigate the prevalence of impacted teeth, excluding third molars, ratio values, suspected causes of impaction and the need for surgical intervention in orthodontic patients.  
**SUBJECTS AND METHOD:** A retrospective study of 604 patients treated in 2008-2014 between 7 and 50 years of age. Their records included documentation on the clinical and radiographic examinations (panoramic or three-dimensional computed tomography). The type of impacted tooth, suspected cause of retention and the need for surgical exposure or extraction of the impacted tooth was recorded.

**RESULTS:** Eighty two patients (52 females, 30 males) presented with at least one impacted tooth. The percentage ratio of impacted teeth in females was 13.6 and in males 13.5. Among the 106 impacted teeth, the canines were the most affected (66%), followed by the second premolars (30.2%), central incisors (2.8%) and first premolars (0.9%). The main causes of impaction were a lack of space in the dental arch (63.2%), abnormal position of the tooth (35.8%) and supernumerary teeth (0.9%). Of the impacted teeth, 64.2 per cent were treated using an orthodontic appliance and 29.2 per cent by combined orthodontic-surgical therapy. This comprised surgical exposure of the impacted tooth and application of orthodontic traction. Of the impacted teeth, 6.6 per cent were extracted prior to orthodontic treatment. In total 5.96 per cent of all 604 patients required combined orthodontic-surgical therapy. Due to insufficient space in the dental arch, 10.6 per cent of all patients suffered from impacted teeth.

**CONCLUSION:** There is a significant connection between impacted teeth and the lack of space in the dental arch due to early loss of primary teeth. Early detection of impacted teeth can lead to greater treatment success. A number of patients will require surgical intervention as an essential part of the orthodontic treatment plan.

#### SP94 LONG-TERM EVALUATION OF SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION WITH TOOTH-BORNE ANCHORAGE: MAXILLARY BENDING OR BODILY EXPANSION?

Pedro Carreiro<sup>1</sup>, Michel Dalstra<sup>1</sup>, Sven Erik Nørholt<sup>2</sup>, Thomas Jensen<sup>3</sup>, Thomas Klit Pedersen<sup>1</sup>, <sup>1</sup>Department of Orthodontic, Aarhus University and Departments of Oral and Maxillofacial Surgery, <sup>2</sup>Aarhus University Hospital and <sup>3</sup>Aalborg Hospital, Denmark,

**AIMS:** To assess the skeletal and dentoalveolar changes observed after surgically assisted rapid maxillary expansion (SARME) with tooth-borne (TB) anchorage in combination with orthodontic treatment using three-dimensional cone beam computed tomography (3D CBCT) evaluation.

**SUBJECTS AND METHOD:** Ten patients were included in this retrospective cohort study. CBCT scans were taken following the ALARA principle at two time points: the first (T1) before the start of orthodontic treatment and the second (T2) either when SARME/orthodontic treatment was finished or immediately before the second orthognathic surgery. The time span between T2-T1 was on average 28.6 months. The studied outcome variables were linear and angular measurements of maxillary width and tipping at different height levels at the first premolar (1PM), second premolar (2PM), first molar (1M) and second molar (2M). Using imaging software, the scan data were re-orientated according to the anatomical landmark planes. This enabled the definition of a 3D coordinate system which was used to measure the outcome variables. The Wilcoxon test was used to determine whether the observed differences in the variables were statistically different and the Dahlberg formula to assess observer reliability.

**RESULTS:** Skeletal expansion at the nasal floor region was  $1.5 \pm 1.3$  mm,  $1.7 \pm 2.4$  mm,  $1.0 \pm 0.8$  mm and  $1.2 \pm 0.7$  mm at 1PM, 2PM, 1M and 2M, respectively. Apart from 1PM, there were significant differences for all teeth. Hard palate expansion was  $2.9 \pm 0.6$  mm,  $2.7 \pm 1.0$  mm,  $2.6 \pm 1.3$  mm and  $2.9 \pm 2.6$  mm at 1PM, 2PM, 1M and 2M, respectively. Apart from 2M, these results were statistically significant. Alveolar expansion was  $6.3 \pm 2.5$  mm,  $5.7 \pm 1.7$  mm,  $5.4 \pm 2.1$  mm and  $4.3 \pm 2.5$  mm at 1PM, 2PM, 1M and 2M, respectively. Alveolar segmental tipping was shown to be statistically significant at 1PM, 2PM and 1M,

indicating more expansion at the alveolar crest than the hard palate. Dental tipping at 1PM and 1M was  $11.5 \pm 6.4$  and  $7.3 \pm 3.3$  degrees, respectively.

**CONCLUSION:** Maxillary bending is evident in SARME treatment combined with orthodontics. Relapse in the skeletal region was observed although the timing is unknown. A short-term follow-up study after SARME with TB-anchorage is recommended.

#### SP95 BIOFUNCTIONALIZATION OF ONPLANTS TO ENHANCE THEIR OSSEOINTEGRATION – A PILOT STUDY IN DOMESTIC PIGS

Johanna Schmid<sup>1</sup>, Silvia Brunold<sup>2</sup>, Michael Bertl<sup>3</sup>, Hanno Ulmer<sup>4</sup>, Adriano Crismani<sup>1</sup>,  
<sup>1</sup>Department of Orthodontics, <sup>2</sup>CMF Surgery and <sup>4</sup>Department of Medical Statistics, Informatic and Health Economics, Medical University of Innsbruck and <sup>3</sup>Department of Orthodontics, Medical University of Vienna, Austria

**AIMS:** Onplants are skeletal orthodontic anchorage devices that serve as alternatives to miniscrews and palatal implants. Since onplants are not placed in bone, immediate loading is not possible and treatment may be prolonged. The purpose of this study was to improve the onplant surface by nanocrystalline diamond (NCD) coating and bone morphogenetic protein-2 (BMP-2) biofunctionalization to enhance osseointegration.

**MATERIALS AND METHOD:** Forty eight onplants were placed on the palate and mandible of three domestic pigs. The onplants were divided into three groups of the same size: 1. uncoated, 2. coated with NCD, 3. coated with NCD and functionalized with BMP-2. After six weeks the pigs were sacrificed and the samples were subjected to radiographic, histologic and histomorphometric analyses. Data were subjected to the Mann-Whitney *U* test. *P*-values of  $< 0.05$  were considered to be significant.

**RESULTS:** Ten of the 48 onplants were lost. There was no significant difference between the samples in the upper and lower jaw. The BMP-2 functionalized onplants showed higher bone-to-implant contact than the other groups, albeit without significance.

**CONCLUSION:** Based on the results of this pilot study BMP-2 biofunctionalization of NCD coated onplants improves osseointegration and might suggest clinical use in orthodontics. Due to the high loss rate more investigations are required to confirm the beneficial effects. Meanwhile the data obtained should be interpreted with caution.

#### SP96 INFLUENCE OF UNILATERAL MAXILLARY FIRST MOLAR EXTRACTION TREATMENT ON SECOND AND THIRD MOLAR INCLINATION IN CLASS II SUBDIVISION CASES

Christos Livas<sup>1</sup>, Nikolaos Pandis<sup>2</sup>, Demetrios Halazonetis<sup>3</sup>, Christos Katsaros<sup>2</sup>, Yijin Ren<sup>1</sup>,  
<sup>1</sup>University of Groningen, University Medical Centre Groningen, Netherlands, <sup>2</sup>University of Bern, Switzerland and <sup>3</sup>National and Kapodistrian University of Athens, Greece

**AIMS:** To assess maxillary second (M2) and third (M3) molar inclination following orthodontic treatment of Class II subdivision malocclusion with unilateral maxillary first molar (M1) extraction.

**MATERIALS AND METHOD:** Panoramic radiographs of 21 Class II subdivision adolescents (8 boys, 13 girls; mean age, 12.8 years; SD, 1.7 years) before, after treatment with extraction of one maxillary first molar and Begg appliances, and on average 2.6 years in retention were retrospectively collected from a private practice. M2 and M3 inclination angles (M2/ITP, M2/IOP, M3/ITP, M3/IOP), constructed by intertuberosity (ITP) and interorbital planes (IOP) were calculated for the extracted and non-extracted segments. Random effects regression analysis was performed to evaluate the effect on the molar angulation of extraction, time and gender after adjusting for baseline measurements.

**RESULTS:** Time and extraction and extraction status were significant predictors for M2 angulation. M2/ITP and M2/IOP decreased by 4.040 (95% CI:  $-6.93, 1.16$ ,  $P = 0.001$ ) and 3.670 (95% CI:  $-6.76, -0.58$ ,  $P = 0.020$ ) in the extraction group compared to the non-extraction group after adjusting for time and gender. The adjusted analysis showed that extraction was the only predictor for M3 angulation that reached statistical significance. M3 mesial inclination increased by 7.38 degrees (95% CI:  $-11.2, -3.54$ ,  $P < 0.001$ ) and 7.33 degrees (95% CI:  $-11.48, -3.19$ ,  $P = 0.001$ ).

**CONCLUSION:** M2 and M3 uprighting significantly improved on the extraction side after orthodontic treatment with unilateral maxillary M1 extraction. There was a significant increase in mesial tipping of maxillary second molar crowns over time.

#### SP97 DECISION-MAKING CRITERIA FOR ORTHOGNATHIC SURGERY IN SKELETAL CLASS III

Yasushi Nishii, Chie Tachiki, Teruo Sakamoto, Kunihiko Nojima, Kenji Sueishi, Department of Orthodontics, Tokyo Dental College, Chiba, Japan

**AIMS:** To determine appropriate cephalometric criteria in the antero-posterior aspect of the hard and soft tissues for orthognathic surgery in skeletal Class III by analyzing retrospective data.

**SUBJECTS AND METHOD:** One hundred and twenty Class III surgical treatment subjects (group 1) and 125 Class III orthodontic treatment subjects (group 2) were randomly selected. Thirty two skeletal and nine soft tissue measurements were measured on the cephalometric radiographs before treatment and compared with the measurement values using an unpaired *t*-test. The Wits appraisal and the position of soft tissue pogonion (S.pog), were selected as criteria, because they showed the most significant difference ( $P < 0.01$ ). Wits and S.pog in the two groups were also evaluated by the sensitivity, the specificity, the positive predictive value and the negative predictive value to assess their criteria value.

**RESULTS:** The average Wits appraisal was  $-7.9 \pm 2.8$  mm in group 2 and  $-13.4 \pm 4.8$  mm in group 1. The *t*-test also revealed a greater protrusive mandible in group 1 than in group 2 ( $P < 0.01$ ). For S.pog, the average was  $-0.3 \pm 5.4$  mm in group 2 and  $4.3 \pm 7.2$  mm in group 1. Analysis of the difference in soft tissue mandibular protrusion showed significant differences at the 1 per cent level between the two groups, although the average difference was slightly less than that in Wits.

**CONCLUSION:** Wits appraisal, that reflects the skeletal factor, is a more precise criteria than S.pog; this implies cephalometric skeletal analysis is crucial even when the patient's chief complaint exists in the soft tissue.

#### SP98 ALTERED CRANIOFACIAL MORPHOGENESIS IN THE OFFSPRING OF RATS WITH GESTATIONAL DIABETES

Ippei Watari<sup>1</sup>, Katarzyna Anna Podyma-Inoue<sup>2</sup>, Ikuo Yonemitsu<sup>1</sup>, Mutsumi Miyazaki<sup>1</sup>, Takashi Ono<sup>1</sup>, Departments of <sup>1</sup>Orthodontic Science and <sup>2</sup>Biochemistry, Tokyo Medical and Dental University, Japan

**AIMS:** Although gestational diabetes causes various complications, there are few reports examining the effects of gestational diabetes on the craniofacial region. The aim of this research was to investigate the influence of gestational diabetes on craniofacial morphogenesis.

**MATERIALS AND METHOD:** Eight-week-old female Wistar rats were randomly divided into a control (C), gestational diabetes model (GDM), and pregnancy in diabetes model (PD) groups. The C group was fed normal food throughout the experimental period. The GDM group was kept on a high-fat diet after crossbreeding and during pregnancy. The PD group was fed a high-fat diet, starting from 2 weeks before crossbreeding which continued during the pregnancy period. Rats born from the C, GDM and PD groups were classified as CY, GDY and PDY groups, respectively, and were fed standard diets after weaning. Rats from the CY, GDY and PDY groups were subjected to cephalometric analysis using the method of Abbassy *et al.* (2008). Linear measurements of all cephalometric data were analyzed by ANOVA with a pairwise *t*-test for *post-hoc* comparison using statistical software (R for Windows 3.1.1).

**RESULTS:** From cephalometric analysis, measurements of the neurocranium, viscerocranium and mandible were found to be significantly lower in the GDY and PDY groups compared with the C group. In addition, a more profound skeletal phenotype was seen in the PDY group compared with the GDY group.

**CONCLUSION:** It is suggested that gestational diabetes affected growth of the craniofacial region of the neonatal rat.

## SP99 DIFFERENCES OF ATTITUDE FOR SMILES IN JAPAN AND THREE OTHER COUNTRIES

Junzo Funaki<sup>1</sup>, Seiko Funaki<sup>1</sup>, Kasumi Kuze Barouch<sup>2</sup>, Fajar H. Nasution<sup>3</sup>, <sup>1</sup>Orthodontics, Practice, Tokyo, Japan, <sup>2</sup>Periodontist, University, Boston, USA and <sup>3</sup>Orthodontics, University, Jakarta, Indonesia

**AIMS:** To clarify differences in attitudes for smiles between Japanese (JP), Indonesian (IN), Czech (CH) and American (AM) females.

**SUBJECTS AND METHOD:** The questionnaire was given to 41 JP, 24 IN, 19 CH, and 18 AM females. The different smiling mouth shapes were classified into 12 smiling patterns based on the position of the corner of the mouth and the number of teeth and amount of visible gum. In addition, smiling gesture, confidence in smiling, as well as the reason for lacking confidence were surveyed and compared among the four countries.

**RESULTS:** The ranking of the preferred smiling pattern was clearly different among the four countries. Significant differences were found in the frequency of covered smiles among the four countries. No significant difference was found in confidence for smiling, while the ranking of the reason for lacking confidence was markedly different among the four countries.

**CONCLUSION:** The present survey demonstrated characteristic attitude for smiles specific to each country, which suggests that such different attitudes may be due to cultural differences.

## SP100 GENDER VARIATIONS IN DENTOFACIAL CEPHALOMETRIC VALUES AMONG KUWAITI ADULTS WITH A MALOCCLUSION

Meshari Al Nafisi<sup>1</sup>, Maddi Shyama<sup>2</sup>, Sabiha Al-Mutawa<sup>3</sup>, <sup>1</sup>Department of Orthodontics, King's College London, U.K. and <sup>2</sup>National School Oral Health Program and <sup>3</sup>Dental Administration, Ministry of Health, Kuwait

**AIMS:** Cephalometric evaluation of the craniofacial structure plays an essential role as a diagnostic guide in orthodontic treatment planning. The objective of this study was to determine gender differences in dentofacial cephalometric values among Kuwaiti adults with a malocclusion.

**MATERIALS AND METHOD:** Standard lateral cephalometric radiographs of 120 Kuwaiti adults (58 males, 62 females) with an age range from 18 to 40 years, regardless of malocclusion, were digitally traced by a single examiner using Dolphin® version 11 and then analyzed using the Eastman Analysis. Data entry and analysis were performed using IBM SPSS statistical software version 21.0. Descriptive statistics, including mean and standard deviation, were calculated for all the cephalometric measurements. An independent samples *t*-test was used to compare the cephalometric measurements between males and females. The significance level used was  $P < 0.05$ .

**RESULTS:** Several statistically significant gender differences were noticeable. Of the skeletal parameters, Kuwaiti females had a significantly greater SNA angle than males ( $P = 0.022$ ). Both Kuwaiti males and females had an ANB angle  $>4$  degrees. Kuwaiti males had a significantly increased upper anterior face height ( $P = 0.001$ ) and also increased lower anterior face height ( $P < 0.001$ ) than females. Posterior face height was significantly increased in males compared with females ( $P < 0.001$ ). In addition, Kuwaiti males had significantly increased upper and lower posterior face height measurements than females ( $P = 0.004$ ). There were no significant gender differences for SNB, ANB, Wits appraisal, maxillo-mandibular plane angle and the ratio of lower anterior face height to total anterior face height. There were no significant gender differences in any of the cephalometric dental measurements. Males and females had a similar overjet, overbite, interincisal angle, U1-maxillary plane and L1-mandibular plane. Gender had no significant effect on soft tissue parameters; upper lip to Ricketts E-plane, lower lip to Ricketts E-plane and nasolabial angle.

**CONCLUSION:** An increased ANB angle indicated that both males and females had a tendency for a Skeletal II base relationship. Kuwaiti males had increased anterior and posterior face heights in relation to Kuwaiti females. It is recommended to use these cephalometric values in orthodontic treatment of Kuwaiti adults.

SP101 THE RELATIONSHIP BETWEEN SOMATOTYPE AND THE INDEX OF ORTHODONTIC TREATMENT NEED AMONG YOUNG PEOPLE.

Lyubov Smaglyuk, Dmytro Sheshukov, The Ukrainian medical stomatological academy, Poltava, Ukraine

AIMS: To determine the relationship between somatotype and the Index of Orthodontic Treatment Need (IOTN) among young people.

SUBJECTS AND METHOD: One hundred and seventy six young people aged 18-24 years. To determine the somatotype the Reese-Eisenk index was used and to assess the need for orthodontic treatment, the IOTN was used. Statistical analysis was carried out using the Student-Fischer test.

RESULTS: A normostenic body structure was observed in 47.7 per cent of the patients, an asthenic body structure in 26.7 per cent and a hypersthenic body structure in 25.6 per cent. Regarding the need for orthodontic treatment, 35.2 per cent of the patients did not need treatment, while little need was identified in 43.8 per cent and a borderline need in 14.7 per cent. For 6.3 per cent of the examined subjects orthodontic treatment was required.

CONCLUSION: In patients who did not need orthodontic treatment or who had little treatment need, a normostenic somatotype prevailed. Patients with a borderline need and in those with a need an asthenic somatotype prevailed.

SP102 OBJECTIVE VERSUS SELF-REPORTED ASSESSMENT OF TREATMENT COMPLIANCE IN PATIENTS TREATED WITH REMOVABLE ORTHODONTIC APPLIANCES. A PILOT STUDY

Saeed Sheikholeslami<sup>1</sup>, Jørgen Alne Johansen<sup>1</sup>, Rita Myrland<sup>2</sup>, Heidi Kerosuo<sup>1</sup>, The University of Tromsø - The Arctic University of Norway, Tromsø and <sup>2</sup>TkNN Public Dental Service Competence Center of Northern Norway, Tromsø, Norway

AIMS: To objectively evaluate measured versus self-reported compliance with instructions of wear of removable orthodontic appliances among patients of different ages.

SUBJECTS AND METHOD: Thirty-five orthodontic patients treated with various removable orthodontic appliances at the Public Dental Service Competence Center of Northern Norway and the University Student Dental Clinic of Tromsø were recruited to this prospective clinical trial. Objective measures of wear were obtained by an electronic microsensor (TheraMon®) that was attached to all appliances. Patients were made aware of the sensor before the follow-up period began. Self-reported measures of wear were recorded by each patient in a diary, as hours of daily wear. The patients were followed for 90 days. Objective and self-reported data were collected every 30 days during regular examinations. Self-reported wear time, objective wear time and instructed wear time were used as outcome measures. Hours of daily wear were summed and divided into wear times during the first (T1), second (T2) and third (T3) 30 days. Differences between objective, self-reported and instructed wear time were analyzed using independent *t*-tests and the related samples Wilcoxon signed rank test.

RESULTS: Ten patients dropped out while five patients are still undergoing the study. Therefore the preliminary results consisted of 20 patients, 10 females and 10 males (mean age: 11.2 years, SD 2.9). During the 90-day follow-up period, self-reported wear time was 7 per cent higher than objective wear time ( $P = 0.007$ ), and objective wear time was 31 per cent lower than instructed wear time ( $P < 0.001$ ). No significant gender difference was found.

CONCLUSION: Objectively measured and self-reported compliance with instructions of wear of removable orthodontic appliances varied. In general, patients seem to overestimate their wear time of removable orthodontic appliances, despite being aware of the monitoring device.

SP103 SHEAR BOND-STRENGTH OF ORTHODONTIC BRACKETS TO AGED MICRO-HYBRID COMPOSITE-RESIN SURFACES: EFFECT OF SURFACE ROUGHENING

Hatice Kubra Demirtas, Esra Ulusoy Mutluol, Mehmet Akin, Department of Orthodontics, Selcuk University, Konya, Turkey

AIMS: To determine, *in vitro*, the effects of different surface roughening methods on the shear bond strength (SBS) of orthodontic metal brackets to aged micro-hybrid composite resin surfaces.

MATERIALS AND METHOD: One hundred micro-hybrid composite resin-discs (3M filtek silorane) were prepared (each 6 mm in diameter and 3 mm in height), aged by thermocycling, and randomly divided into five surface roughening groups. Group I, control; group II, diamond-bur; group III, 37 per cent phosphoric acid gel; group IV, air-flow; group V, sandblasting. After surface roughening, metal brackets were bonded to aged composite surfaces with a light-cured orthodontic adhesive (Transbond XT). All specimens were stored in water for 1 day at 37°C prior to thermocycling (5000-cycles, 5-55°C) and then SBS tested. SBS values were evaluated by a shear test with a 0.5 mm/minute crosshead speed in megapascals (MPa) and failure types were classified using the Adhesive Remnant Index (ARI) scores. The data were analyzed with one-way analyses of variance (ANOVA), chi-square and *post-hoc* Tukey tests at the  $\alpha = 0.05$  level.

RESULTS: When the means of SBS values were compared using one-way ANOVA, there was a significant difference between the groups ( $P < 0.001$ ). No significant difference was found between group I ( $4.28 \pm 1.22$  MPa) and group III ( $4.81 \pm 1.38$  MPa), group II ( $9.32 \pm 2.19$ ) and group V ( $8.38 \pm 2.13$ ) with the *post-hoc* Turkey test. While lower SBS values were determined in groups I and III, significantly higher SBS values were recorded for group V ( $12.96 \pm 1.60$  MPa). Analysis of the chi-square test of ARI scores revealed significant differences among the five groups ( $P < 0.001$ ).

CONCLUSION: Although the diamond-bur and air-flow surface roughening methods are acceptable, the sandblasting surface roughening method is recommended as a more effective method of bonding orthodontic metal brackets to micro-hybrid composite resin surfaces.

#### SP104 TEMPORARY ANCHORAGE DEVICES IN THE TREATMENT OF THE SERIOUSLY COMPROMISED PATIENT WITH ECTOPIC TEETH

Alessio Bodini, Mario Greco, Aldo Giancotti, Department of Orthodontics, University of Rome Tor Vergata Fatebenefratelli Hospital, Italy

AIMS: To test the use of temporary anchorage devices (TADs) in the treatment of patients with wide prosthetic bridges and of ectopic teeth.

SUBJECTS AND METHOD: Thirteen adult patients aged 55 to 60 years, with Class I malocclusions, wide fixed prosthetic bridges, normal skeletal patterns, correct overjets and overbites and ectopic maxillary canines. Panoramic and lateral radiographs were obtained at the beginning (T1) and end (T2) of treatment. All patients were treated by means of fixed sectional appliances in order to correct the position of the ectopic maxillary canine and for use as an element to include in the prosthetic restoration. To reinforce anchorage control, one miniscrew (spider pin  $1.3 \times 10$  mm) was inserted in the edentulous space next to the first premolar. After surgical exposure, a nickel titanium closed coil spring (150 g) was connected from the canine to the TAD and then a fixed sectional connected to the TAD for indirect anchorage to perform extrusion.

RESULTS: All patients showed, at the end of treatment, a new prosthetic bridge configuration with a new element represented by the ectopic tooth completely erupted.

CONCLUSION: TADs can represent a valid anchorage method for ectopic teeth with fixed sectional appliances to perform both disinclusion with direct anchorage and complete extrusion with indirect anchorage.

#### SP105 EFFECT OF DIFFERENT WAVELENGTH OF LIGHT EMITTING DIODE PHOTOBIO-MODULATION ON CHONDROGENIC ATDC5 CELLS

Kanokwan Subrungraj<sup>1</sup>, Peerapong Santiwong<sup>1</sup>, Dutmanee Seriwatanachai<sup>2</sup>, Rochaya Chintavalakorn<sup>1</sup>, Tanakorn Osotchan<sup>3</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Oral Biology, Faculty of Dentistry and <sup>3</sup>Department of Physics, Faculty of Science, Mahidol University, Bangkok, Thailand

AIMS: To investigate the effect of different wavelengths of light emitting diodes (LEDs) emitting continuously on cell viability of the mouse chondrogenic ATDC5 cell line

**MATERIALS AND METHOD:** ATDC5 cells were grown in a 96-well culture plate in 1:1 Dulbecco's modified eagle medium (DMEM)/F-12 medium supplement with 5 per cent foetal bovine serum (FBS) and 1 per cent antibiotic antimycotics, maintained at 37°C in a humidified 5 per cent CO<sub>2</sub> incubator overnight. Energy density at each point of distance from LEDs to cultured wellplate was measured to define an optimal distance between LEDs and the wellplate. Afterwards, 3.5 J/cm<sup>2</sup> of energy density from LEDs was emitted on cells continuously for 20 minutes at wavelength. Cultured media was replaced with 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) reagent to investigate cell viability. The absorbance of each well was spectrometrically determined at 540 nm by a microplate-reader. A Student's *t*-test was used to evaluate statistical significance.

**RESULTS:** The optimal distance between LEDs and culture plate for generating 3.5 J/cm<sup>2</sup> of energy density was 62 mm. This study demonstrated that emitting ATDC5 chondrogenic cell by 630 nm LEDs for 20 minutes significantly decreased cell viability when compared to the control group (*P* < 0.001) whereas the wavelength of 830 nm LEDs did not alter cell viability.

**CONCLUSION:** The distance between LEDs and culture plates has a significant correlation on energy density. Continuously emitting ATDC5 cell with 630 nm LEDs decreased cell viability suggesting the photobiological activity of LEDs on chondrocytes.

#### SP106 CLINICAL EFFECTIVENESS OF LINGUAL ORTHODONTIC TREATMENT: A SYSTEMATIC REVIEW

Nikolaos Gkantidis<sup>1</sup>, Ilias Mistakidis<sup>2</sup>, Georgios Vasilakos<sup>3</sup>, Hattan Katib<sup>1</sup>, Dimitrios Kloukos<sup>1</sup>,  
<sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics, University of Bern, Switzerland,  
<sup>2</sup>Department of Orthodontics, Aristotle University of Thessaloniki, Greece and <sup>3</sup>Private practice, Cologne, Germany

**AIMS:** To assess the available evidence on the effectiveness of lingual orthodontic treatment and related clinical parameters through a systematic review of relevant clinical studies.

**MATERIALS AND METHOD:** Eligible clinical trials were identified through electronic and hand searches (last update: October 2014). A targeted electronic search, based upon various combinations of key words including: 'lingual orthodontics', 'lingual patients', and 'lingual brackets', was conducted of five major databases (Medline, Embase, Google scholar beta, all Cochrane Databases, and Conference Paper Index). All papers that were assessed for eligibility through full text reading and all reviews were subjected to a hand search of their references. Studies published before January 2000 were excluded. Risk of bias was assessed using the Cochrane risk of bias tool.

**RESULTS:** From the 4683 articles identified by the search, after application of specific inclusion and exclusion criteria, 24 papers were eligible for inclusion in the study. In detail, six studies evaluated differences in treatment outcome from the pre-treatment set-up prediction, four evaluated the effect of treatment on periodontal and microbial parameters, and 16 assessed various clinical treatment-related issues. The quality of evidence supporting lingual orthodontic treatment ranged from low to moderate in most cases.

**CONCLUSION:** There is some evidence that lingual orthodontic treatment can be a viable aesthetic alternative to conventional buccal appliances in terms of treatment outcome and periodontal health parameters. Overall, the results should be interpreted with caution given the small number, quality, and heterogeneity of the included studies.

#### SP107 HOW EFFECTIVE ARE REMOVABLE FUNCTIONAL APPLIANCES IN THE TREATMENT OF CLASS II MALOCCLUSION? A SYSTEMATIC REVIEW AND META-ANALYSIS

Vasileios Zymperdikas<sup>1</sup>, Vasiliki Koretsi<sup>2</sup>, Spyridon Papageorgiou<sup>3</sup>, Moschos Papadopoulos<sup>4</sup>,  
<sup>1</sup>Dental Unit, Medical Company, 71st Airmobile Brigade, Nea Santa, Greece, <sup>2</sup>Department of Orthodontics, School of Dentistry, University Medical Centre Regensburg, Germany,  
<sup>3</sup>Department of Orthodontics, Department of Oral Technology, School of Dentistry, University of Bonn, Germany, <sup>4</sup>Department of Orthodontics, School of Health Sciences, Faculty of Dentistry, Aristotle University of Thessaloniki, Greece

**AIMS:** Removable functional appliances (RFAs) stimulating mandibular growth are a common treatment approach for Class II malocclusion, yet their effectiveness is debated. The objective of this study was to assess the clinical effectiveness of RFAs in Class II patients.

**MATERIALS AND METHOD:** Unrestricted electronic and manual searches were performed up to October 2013. Prospective randomized or non-randomized controlled trials reporting on cephalometric angular measurements were included. Cephalometric measurements were annualized and stratified in the short- and long-term. Methodological limitations (i.e., publication bias, risk of bias, heterogeneity assessment, etc.) were evaluated with appropriate tools. The mean differences with their 95 per cent confidence intervals were calculated using random-effects meta-analyses. Subgroup and sensitivity analyses were also performed with mixed-effects models.

**RESULTS:** Seventeen studies were included in the meta-analysis evaluating only short-term effects. RFAs induced minimal reduction of SNA angle, minimal increase of SNB angle and a small decrease of ANB angle. RFAs produced, however, marked dentoalveolar and soft tissue changes. Skeletal and dentoalveolar changes were more pronounced with the Twin Block. Several patient- or appliance-related factors influenced the effects of RFAs, while sensitivity analyses indicated robustness.

**CONCLUSION:** RFAs are effective in improving a Class II malocclusion, mainly through dentoalveolar and secondarily through skeletal changes.

#### SP108 3-HYDROXY-FATTY ACIDS AS A TOOL TO EVALUATE CHANGES OF THE GRAM-NEGATIVE BACTERIAL BALANCE IN PATIENTS WITH BRACKETS. A PILOT STUDY

Raul Ferrando-Cascales<sup>1</sup>, Ascension Vicente<sup>1</sup>, Luis Alberto Bravo-Gonzalez<sup>1</sup>, Pedro Valero<sup>2</sup>,  
<sup>1</sup>Department of Orthodontics, Morales Meseguer, Murcia and <sup>2</sup>Department of Microbiology, Murcia, Spain

**AIMS:** To evaluate from the saliva of patients wearing orthodontic brackets, the changes between anaerobic gram-negative bacteria and the rest of the gram-negative bacterial species, whose endotoxins and other biological active lipids relate to gingival inflammation present 3-hydroxy fatty acids (3-OH FAs).

**SUBJECTS AND METHOD:** Five patients were selected. The inclusion criteria were: requiring fixed orthodontic treatment, non-smoker, good general health and healthy periodontium. All patients received oral hygiene instruction, a toothbrush and toothpaste. Samples of saliva (3-5 ml) were collected before bracket bonding and one month later. The ratio of 3-OH C14/3-OH iC17 was calculated. Gas chromatography-tandem mass spectrometry was employed to selectively detect the presence of the various 3-OH FAs present in the saliva.

**RESULTS:** 3-OH FAs varied between 12 and 17 carbon atoms; the major ones were identified as 3-OH tetradecanoic (3-OH C14: characteristic of aerobic and facultatively anaerobic gram-negative bacteria) and methyl-branched (iso) hexadecanoic acid (3-OH iC17: prevalent in anaerobic gram-negative bacteria). Three patients showed an increase of 3-OH iC17 acid in the period of the study; one kept the same ratio 3-OH C14/3-OH iC17 before and one month after bonding, and in the last patient, 3-OH C14 increased to 3-OH iC17.

**CONCLUSION:** Patients wearing fixed appliances increase the quantity of strict anaerobic bacteria that are related to periodontal disease. Further analyses are required to examine if different type of brackets influence the bacterial balance.

#### SP109 LONGITUDINAL EVALUATION OF DENTAL ARCH ASYMMETRY IN CLASS II SUBDIVISION MALOCCLUSIONS TREATED WITH ASYMMETRIC FORSUS FATIGUE APPLIANCES

Mehmet Akin, Emire Aybuke Erdur, Onur Ozturk, Faruk Ayhan Basciftci, Department of Orthodontics, Selcuk University, Konya, Turkey

**AIMS:** Contemporary Class II subdivision malocclusion treatment is mesialization of the distal segment of the mandible, instead of conventional three premolar extractions. The aim

of this retrospective study was to investigate treatment efficiency and follow-up stability of the asymmetric Forsus by evaluating longitudinal changes of dental arch asymmetry on digital dental models.

**SUBJECTS AND METHOD:** Twenty one ( $15.62 \pm 01.04$  years of age) patients treated with an asymmetric Forsus appliance. Maxillary and mandibular reference lines were constructed and used for intra-arch asymmetry measurements and evaluated pre- (T1) and post- (T2) treatment, and 4.2 years after treatment (T3). Maxillary and mandibular measurements were performed according to the dental midline and anterior reference line on dental models. To determine the amount of asymmetry between the Class I and Class II sides of a given arch, all maxillary and mandibular parameters were measured for each side of the models separately. A repeated measure analysis of variance and paired sample *t*-test were performed to evaluate dental arch asymmetries at the  $P < 0.05$  level.

**RESULTS:** The alveolar transverse dimensions of the posterior segment were increased during treatment in both arches ( $P < 0.05$ ) and remained stable during the retention period. All subjects had significant mandibular asymmetry before treatment between the Class I and Class II sides with the Class II subdivision malocclusion caused by distal positioning of the mandibular canine, premolars and first molar on the Class II side ( $P < 0.05$ ). Asymmetry was resolved following treatment with the asymmetric Forsus appliance. During the long-term retention period the resolved asymmetry remained stable. There were no significant differences between T2-T3 according to asymmetry ( $P > 0.05$ ).

**CONCLUSION:** Treatment resulted in a pleasing outcome and good follow-up stability with the asymmetric Forsus. The asymmetric Forsus can be used for treating dental arch asymmetry in patients with Class II subdivision malocclusions.

#### SP110 DOES A UNILATERAL IMPACTED CANINE AFFECT MAXILLARY TRANSVERSE DIMENSIONS? A CONE-BEAM COMPUTED TOMOGRAPHIC STUDY\*\*\*

Eren Isman<sup>1</sup>, Merve Nur Eglenen<sup>1</sup>, Ozlem Isman<sup>2</sup>, Cahide Aglarca<sup>3</sup>, Merve Goymen<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Dentomaxillofacial Radiology, Gaziantep University Dentistry Faculty and <sup>3</sup>Department of Orthodontics, Sifa University Dentistry Faculty, Izmir, Turkey

**AIMS:** To examine the relationship between unilateral impacted maxillary canines (UIMC) and the maxillary transverse dimension on the impacted and non-impacted side using cone-beam computed tomography (CBCT).

**SUBJECTS AND METHOD:** Twenty-two patients (10 males, 12 females mean age  $23 \pm 4.3$  years) with UIMC were matched with 15 skeletal Class I patients (9 males, 6 females mean age  $21 \pm 4.3$  years) without UIMC (control). For each patient maxillary basal bone widths and interdental widths in the canine, maxillary first molar and second molar regions were measured separately on the right and left sides on axial and coronal sections of CBCT images. Data were analyzed using SPSS V.19. A Student's *t*-test was used to compare the control and test groups and a paired sample *t*-test to compare the distances between impacted versus non-impacted maxillary bone width.

**RESULTS:** Similar maxillary transverse dimensions, both skeletally and dentally, were found between the UIMC and control groups ( $P > 0.05$ ). There was no significant difference between the impacted and non-impacted sides for any measurement.

**CONCLUSION:** UIMC does not affect the maxillary transverse dimensions in basal bone level on either the impacted or non-impacted sides. More studies are needed to evaluate maxillary bone volume between the two sides, including maxillary sinuses.

#### SP111 COMPARISON OF PHARYNGEAL AIRWAY CHANGES ON CONE-BEAM COMPUTED TOMOGRAPHS AFTER ORTHOGNATHIC SURGERY

Julia Neuschulz<sup>1</sup>, Sebastian Moellers<sup>2</sup>, Isabelle Graf<sup>1</sup>, Bert Braumann<sup>1</sup>, <sup>1</sup>Department of Orthodontics, University Hospital, Cologne and <sup>2</sup>Practise Lebensqualität Zähne, Cologne, Germany

**AIMS:** To investigate volume changes in posterior airway space (PAS) before and after orthognathic surgery.

**MATERIALS AND METHOD:** Pre- and post-operative cone beam computed tomographic (CBCT) scans of 82 adult patients requiring orthognathic surgery were visualized and three-dimensionally analysed (iPlan cranial 3.0.3, Brainlab AG, Feldkirchen, Germany). Of the 82 patients, eight underwent maxillary advancement only (group 1), 48 maxillary advancement and mandibular setback in adult Class III patients (group 2), and 26 combined maxillary and mandibular advancement (group 3) in adult Class II patients. The PAS was divided into three segments by three planes parallel and one plane perpendicular to the Frankfort horizontal plane. Total volume, partial volumes, and cross-sectional areas were calculated from the pre- and post-operative scans. Dahlberg coefficients were obtained to verify each parameter for measurement reliability. Statistical significance of the changes observed was analysed by Wilcoxon's rank-sum test.

**RESULTS:** A noticeable increase in total posterior airway volume (12.2%) was observed in group 1 whereas group 3 showed an increase of 13.96 per cent. Group-2 demonstrated a reduction in total posterior airway volume of 8.04 per cent.

**CONCLUSION:** It seems that the reduction of PAS volume change in mandibular setback of patients with a Class III malocclusion is minor compared with the effect and increase in the forward movement of the maxilla and the advancement of the mandible in Class II patients.

#### SP112 SHEAR BOND STRENGTH OF CERAMIC BRACKETS BONDED WITH DIFFERENT BONDING SYSTEMS

Alejandro Zaragoza-Ballester, Ascension Vicente, Luis Alberto Bravo-Gonzalez, Department of Orthodontics, Morales Meseguer, Murcia, Spain

**AIMS:** To evaluate the shear bond strength (SBS) of two types of ceramic brackets bonded with different adhesive systems and to compare it with the bond strength of metal brackets.

**MATERIALS AND METHOD:** Eighty bovine incisors divided into four groups: 1) Metal brackets Victory Series precoated with APC Plus system (3M Unitek) (n = 20); 2) Clarity metal-reinforced ceramic brackets precoated with APC system (3M Unitek) (n = 20); 3) Clarity Advanced ceramic brackets precoated with flash-free system (3M Unitek) (n = 20); 4) Clarity Advanced Ceramic Brackets precoated with APC system (3M Unitek) (n = 20). All brackets were bonded using Transbond Plus self-etching primer according to the manufacturers' recommendation. SBS was measured with a universal testing machine with a crosshead speed of 1 mm/minute (Autograph AGS-1KND, Shimadzu, Japan). After debonding, the amount of remaining adhesive on the enamel surface of each tooth was measured with the Adhesive Remnant Index (ARI) under a stereomicroscope (×10 magnification). SBS data were analyzed with the Kruskal-Wallis test ( $P < 0.05$ ) and the Mann-Whitney test, applying the Bonferroni correction ( $P < 0.008$ ). ARI scores were analyzed using a chi-square test ( $P < 0.05$ ).

**RESULTS:** The SBS of group 1 was significantly greater than that of group 2, but significantly less than both groups 3 and 4 ( $P < 0.008$ ). No significant differences were observed between groups 3 and 5 ( $P > 0.008$ ). No significant differences were observed between the four groups regarding the amount of remaining adhesive on the teeth ( $P > 0.05$ ).

**CONCLUSION:** The SBS Clarity Advanced brackets with the APC or flash-free system was greater than Clarity and metal brackets precoated with the APC Plus system. The different bonding systems did not influence the amount of remaining adhesive on the teeth.

#### SP113 EFFECTS OF ENAMEL DEPROTEINIZATION ON BRACKET BONDING

Alejandro Zaragoza-Ballester, Ascensión Vicente, Cristina Lapáz-Fernández, Luis-Alberto Bravo-González, Department of Orthodontics, Morales Meseguer, Murcia, Spain

**AIMS:** To evaluate the effect of enamel deproteinization with Papacárie (Fórmula & Ação, São Paulo, Brazil) and Cariosolv (Medi Team Dentalutveckling AB, Sweden), on bracket bonding with a resin adhesive system.

**MATERIALS AND METHOD:** Sixty bovine incisors were divided into three groups: 1) Control (n = 20): metal brackets (Victory Series, 3M Unitek Dental Products, Monrovia, California, USA) were bonded with 37 per cent phosphoric acid and the adhesive resin system Transbond XT (3M Unitek) according to the manufacturers' recommendations, 2)

Papacárie (n = 20): The enamel was treated during 30 seconds with Papacárie according to the manufacturers' recommendations following which the brackets were bonded as in group 1, 3) Cariosolv (n = 20): The enamel was treated for 30 seconds with Cariosolv according to the manufacturers' recommendations and the brackets were bonded as in group 1. Shear bond strength (SBS) was measured with a universal testing machine with a crosshead speed of 1 mm/minute (Autograph AGS-1KND, Shimadzu, Japan). The adhesive remnant on the tooth after debonding was quantified using image analysis equipment and MIP 4 software (Microm Image Processing Software, Digital Systems, Barcelona, Spain). SBS data were analyzed with one-way ANOVA ( $P < 0.05$ ) and the data for percentage of area of adhesive remaining on the tooth with the Kruskal-Wallis test ( $P < 0.05$ ) and the Mann-Whitney test, applying the Bonferroni correction ( $P < 0.016$ ).

RESULTS: No significant differences were observed in the SBS of the three groups evaluated ( $P > 0.05$ ). Deproteinizing agents left significantly less adhesive on the tooth than the control group and, amongst them, Papacárie left significantly less adhesive than Cariosolv ( $P < 0.016$ ).

CONCLUSION: Enamel deproteinization with Papacárie and Cariosolv did not increase the SBS of metal brackets bonded with a resin adhesive system. However, treatment of the enamel with these deproteinizing agents reduces the amount of adhesive on the tooth after debonding.

#### SP114 EVALUATION OF ENAMEL SURFACE ROUGHNESS AFTER VARIOUS FINISHING TECHNIQUES FOR DEBONDING OF ORTHODONTIC BRACKETS

Emire Aybuke Erdur, Mehmet Akin, Leyla Cime, Zehra Ileri, Department of Orthodontics, Selcuk Universitesi, Konya, Turkey

AIMS: Evaluation of enamel surface roughness after various finishing techniques for debonding of orthodontic brackets

MATERIALS AND METHOD: The buccal surfaces of 20 mandibular incisors for each group of bur were subjected to profilometry analysis and three parameters of surface irregularity (Ra, Rz, Rq) were recorded. After bracket debonding, adhesive remnants were removed with tungsten carbide burs at low and high speed, and with a stainbuster bur. The samples were evaluated pre- (on sound enamel; T1) and post- (T2) treatment by profilometry. The specimens were measured twice and the mean value was recorded. The results were analyzed in intra-group comparisons with paired *t*-tests, in inter-group comparisons with one-way ANOVA and *post-hoc* Tukey honestly significant difference test at  $P < 0.05$ .

RESULTS: All resin removal techniques significantly increased enamel surface roughness ( $P < 0.05$ ). According to one-way ANOVA there were significant differences on the effect of enamel surface roughness between all methods ( $P < 0.05$ ). The high speed bur caused maximum roughness values and the stainbuster bur the minimum roughness values for all parameters (Ra, Rz, Rq).

CONCLUSION: The three types of burs used for finishing methods, revealed significant differences on the enamel surface after debonding. However, the stainbuster bur created smoother surfaces than the other applied methods.

#### SP115 A NEW ERUPTION THEORY EXPLAINS THE AETIOLOGIES BEHIND ARREST IN ERUPTION AND PROVIDES GUIDELINES FOR TREATMENT

Inger Kjær, Louise Kieffer-Kristensen, Department of Orthodontics, Copenhagen University, Denmark

AIMS: To analyze eruption deviation cases for their aetiology and treatment outcome. Aetiology assessment was conducted based on recent studies (Kjær and Nolting, 2009 Acta Odontol Scand 67: 134-8; Bille *et al.*, 2012 Acta Odontol Scand 70: 109-13; Kjær, Scientifica Vol 2014. ID: 341905) revealing an eruption theory based on innervation of the root membrane and composition of the three-layer periroot sheet.

MATERIALS AND METHOD: Radiographic material from 321 referred patient cases was identified. Some had several radiographs. Some of these cases had thorough anamnestic records while others were less informative. Radiographs were visually inspected. Extracted teeth were investigated histologically.

**RESULTS:** The aetiology behind arrested eruption differed. Trauma, lack of space and non-shedding of primary teeth were common and the aetiology was apparent. Arrest of primary molars was a regular finding. Ninety one cases involved primary retention of permanent molars while 82 involved secondary retention, which are the focus of this presentation. In primary retention, the aetiology is the inability of the crown follicle to resorb overlying bone. The treatment is surgical exposure of the crown. Eruption occurs until shortly after closure of the apex. For successful eruption with or without orthodontic treatment, the tooth position should not be too deep and crowding not observed. In secondary retention, the aetiology is ankylosis or hypercementosis. In only one case was orthodontic treatment effective. In the remaining cases, the secondarily retained molars were extracted. The cause of ankylosis was unknown. Histological sections confirmed the ankylosis.

**CONCLUSION:** The new eruption theory includes the functional interdependence of three decisive factors: 1) crown follicle, 2) root membrane and 3) periroot sheet. The driving force comes from the innervation in the root membrane. Degradation of the overlying tissue is initiated by the crown follicle. The continuous rebuilding of the periodontal membrane during eruptive movement out of the alveolus depends on the periroot sheet (inner innervation, medial ectomesenchyme, outer ectoderm). Defective epithelium causes arrest in eruption (crown follicle/periroot sheet). Innervation causes arrest in the periroot sheet/root membrane. Inflammation followed by an ectomesenchymal reaction seems to be decisive for ankylosis in secondary retention.

#### SP116 ADHERENCE TO INSTRUCTIONS IN EXTRAORAL TRACTION USE

Tuula Talvitie<sup>1</sup>, Mika Helminen<sup>2</sup>, Susanna Karsila<sup>3</sup>, Luca Signorelli<sup>4</sup>, Timo Peltomäki<sup>1</sup>, <sup>1</sup>Oral and Maxillofacial Unit, Tampere University Hospital, Finland, <sup>2</sup>Science center, Pirkanmaa Hospital District and School of Health Sciences, University of Tampere, Finland, <sup>3</sup>Turku Municipal Health Care Services, Dental Teaching Unit, Finland, <sup>4</sup>Clinic for Orthodontics and Pediatric Dentistry, Center for Dental Medicine, University of Zurich, Switzerland

**AIMS:** To study how instructions are followed in extraoral traction use.

**SUBJECTS AND METHOD:** Subjects with Class II or end-to-end molar relationship, mixed dentition and moderate crowning to be treated with cervical headgear (HG) were recruited. Patients and parents signed an informed consent. The patients were asked to wear HG (force 300 g or 500 g) for 10 hours, i.e. during sleep, but the importance to treatment of wearing HG also in the early evening hours was emphasized. Patients were seen and the use of HG was controlled every 6-8 weeks until the end of the study at 10 months. The adherence to instructions in HG use was monitored by Smartgear (Swissorthodontics, Switzerland) module, which allowed monitoring the time the HG had been used and the active force. A day was set to start at 15.00 and end at 14.45, the following day. The study was based on 40 children (mean age 9.80 years,  $\pm 0.73$  SD, 15 males, 25 females). Thus, the total number of days monitored was 12,796.

**RESULTS:** HG was used  $\geq 9$  hours during a day in 74.1 per cent and was left out in 11.7 per cent of all monitored days. The median time for use was 10 hours with great individual variability. HG was not in use on Friday and Saturday evenings/nights more often than during rest of the week, 16.4, 18.7 and 9.3 per cent, respectively. The appliance was also worn less in the early evening (20.00-12.00) hours on Friday and Saturday than other days, 35.3, 29.4 and 52.9 per cent; respectively.

**CONCLUSION:** This clinical trial reveals diurnal variability in extraoral traction use. Adherence to instructions varied individually and the appliance was used less at weekends than other days of the week, even though patients (and parents) knew they participated in a study based on them giving informed consent.

#### SP117 ELEMENTAL COMPOSITION AND STRUCTURE STUDY OF A HEAT ACTIVATED MULTI-FORCE, NICKEL TITANIUM ARCHWIRE

Vladimir Petrunov<sup>1</sup>, Laura Andreeva<sup>1</sup>, Stanimira Terzieva<sup>2</sup>, Angelina Stoyanova-Ivanova<sup>2</sup>, Valdek Mikli<sup>3</sup>, <sup>1</sup>Department of Orthodontics, Faculty of Dental Medicine, Medical University Sofia, and <sup>2</sup>Institute of Solid State Physics, Bulgarian Academy of Sciences, Sofia, Bulgaria and <sup>3</sup>Centre for Materials Research, Tallinn University of Technology, Estonia

AIMS: To investigate the chemical composition and structure of the surface of a heat activated multi-force, nickel titanium (NiTi) archwire

MATERIALS AND METHOD: A heat activated, multi-force, NiTi archwire, Variable Force 3 (Ortho Organizer) with a cross-section of 0.016 × 0.022 inches was investigated. The archwire has three distinct force segments, anterior, premolar and posterior. The elemental composition was obtained from different segments of the wire segments by scanning electron microscopy and the energy dispersive X-ray method.

RESULTS: The surface microstructure was identical for all different parts of the wire and the average values of the element composition was approximately Ti 46.28 wt.% and Ni 53.72 wt.%. The analyzed cross-section part of wire showed good homogeneity of the proportion of elements with the exception of small 2-5 µm inclusions inside the compound, which composition is similar to Ti<sub>2</sub>Ni and could be result of the manufacturing process (especially different annealing process).

CONCLUSION: Heat-activated properties of the archwire were not obtained by components, such as copper and chromium. From the tests carried out it was established that the qualitative and quantitative difference in the chemical compound between the three segments of the archwire, both in length and cross-section, showed no statistical significance.

#### SP118 THE CONNECTION BETWEEN HYPODONTIA AND ANGLE'S CLASSIFICATION

Albena Reshitaj, Milaim Sejdini, Sokol Krasniqi, Blertë Zylfiu, Department of Orthodontics, University of Prishtina, Kosovo

AIMS: To evaluate the connection between hypodontia and malocclusions in orthodontia. The aim of the study was to find out if any connection exists between hypodontia and Angle's classification of malocclusions, to evaluate the distribution of hypodontia according to gender, the number of missing teeth and the role of genetics in orthodontia.

SUBJECTS AND METHOD: Three thousand three hundred and six children of lower secondary schools in Kosovo. The clinical examination included panoramic and periapical radiographs, study models and intraoral photographs of all patients with hypodontia. A family history for hypodontia for each patient was received from the father, mother, brothers and sisters. The sample was then divided into three groups according to Angle's classification of malocclusion Classes.

RESULTS: The classification most frequent in this sample regarding Angle's Classes was Class III (35.1%), followed by Class I (33.8%). More females were affected with hypodontia which was visible in Class III and Class I, while in Class II more males were affected (54.2% of all Class II was represented by males 13/24). Hypodontia prevalence in the selected samples was 2.3 per cent. The difference between the genders was 2.9 per cent for females and 1.8 per cent for males. The upper incisors were missing more often than other teeth. The maxilla was more affected by hypodontia than the mandible.

CONCLUSION: Hypodontia prevalence of the selected sample was 2.3 per cent. The most frequent classification regarding Angle's Classes was Class III (35.1%), followed by Class I (33.8%). Female were more affected, which was visible in Classes III and I, while in Class II more males were affected.

#### SP119 TO JIGGLE OR NOT TO JIGGLE? JIGGLING FORCES AND ROOT RESORPTION

Edina Eross<sup>1</sup>, Tamer Turk<sup>2</sup>, Selma Elekdag Turk<sup>2</sup>, Alexandra K Papadopoulou<sup>3</sup>, M Ali Darendeliler<sup>3</sup>, <sup>1</sup>School of PhD Studies, Semmelweis University, Budapest, Hungary, <sup>2</sup>Department of Orthodontics, University of Ondokuz Mayıs, Faculty of Dentistry, Samsun, Turkey and <sup>3</sup>Department of Orthodontics, University of Sydney, Faculty of Dentistry, Australia

AIMS: To evaluate orthodontically induced inflammatory root resorption (RR) in human premolars caused by light and heavy bucco-palatal jiggling in comparison with buccal tipping forces over a 12-week period.

MATERIALS AND METHOD: Sixty maxillary first premolars collected from 30 patients (15 females, 15 males, aged 13-18 years) who required orthodontic treatment with extractions. The patients were divided into three groups of 10 individuals. Light (25 g) or heavy (225 g)

buccal tipping orthodontic forces were randomly assigned to the right or left upper quadrant either in the mode of continuous buccal (positive controls) or bucco-palatal jiggling forces for 12 weeks. Thus, three groups were obtained: positive control versus heavy jiggling (PC-HJ), positive control versus light jiggling (PC-LJ) and heavy jiggling versus light jiggling (HJ-LJ). At the end of the experimental period the teeth were carefully extracted and processed for three-dimensional imaging and volumetric evaluation of RR craters. Data were analyzed with the Wilcoxon signed rank test.

**RESULTS:** There was no statistically significant difference between RR volume ( $0.355 \text{ mm}^3$ ) with heavy continuous buccal force and RR volume ( $0.278 \text{ mm}^3$ ) with heavy bucco-palatal jiggling force for group PC-HJ ( $P = 0.173$ ). RR volume ( $0.195 \text{ mm}^3$ ) caused by light continuous buccal force was not found to be statistically significant from RR volume ( $0.291 \text{ mm}^3$ ) caused by light bucco-palatal jiggling force for group PC-LJ ( $P = 0.173$ ). When calculating RR for group HJ-LJ, receiving only bucco-palatal jiggling forces, light forces and heavy forces resulted in a mean of  $0.265 \text{ mm}^3$  and  $0.710 \text{ mm}^3$  of RR, respectively. This difference was statistically significant ( $P = 0.038$ ).

**CONCLUSION:** Light and heavy jiggling forces in the bucco-palatal direction did not cause significantly different amounts of RR when compared to continuous forces of the same magnitude. On the other hand, light jiggling forces resulted in less RR compared to heavy jiggling forces.

#### SP120 ORTHODONTIC ROOT RESORPTION FOLLOWING HEAVY TRANSVERSE AND VERTICAL JIGGLING FORCES: A MICRO-COMPUTED TOMOGRAPHY STUDY

Carolyn Lian Tat Ng<sup>1</sup>, Fethiye Cakmak<sup>2</sup>, Selma Elekdag Turk<sup>3</sup>, Tamer Turk<sup>3</sup>, M Ali Darendeliler<sup>1</sup>, Departments of Orthodontics, <sup>1</sup>University of Sydney, Faculty of Dentistry, Australia, <sup>2</sup>University of Bulent Ecevit, Faculty of Dentistry, Zonguldak, Turkey and <sup>3</sup>University of Ondokuz Mayıs, Faculty of Dentistry, Samsun, Turkey

**AIMS:** Jiggling tooth movements may be responsible for root resorption in the absence of overt root displacement. This study aimed to quantify and compare the effects of controlled heavy transverse buccal and palatal, and vertical extrusive and intrusive jiggling forces applied over a 12-week period on root resorption, and to localize the sites of prevalence in premolars.

**SUBJECTS AND METHOD:** Ten patients who required bilateral maxillary first premolar extractions as part of their orthodontic treatment. The total sample consisted of 20 maxillary first premolars. Heavy (225 g) forces were applied to the right or left first premolar with the direction of force alternating along either the transverse or vertical plane every 4 weeks over a 12-week period. After the experimental period, the teeth were extracted and analyzed with micro-computed tomography.

**RESULTS:** Heavy vertical jiggling forces produced more resorption than transverse forces ( $1.51 \text{ mm}^3$  and  $0.92 \text{ mm}^3$ , respectively,  $P = 0.032$ ). The cervical regions appeared to have more resorption than the middle or apical regions; however, these were not statistically significant ( $P = 0.06$ ). Heavy vertical jiggling forces produced more resorption on the distal surface and less on the buccal and lingual surfaces ( $P < 0.001$ ).

**CONCLUSION:** As in continuous force applications, heavy vertical jiggling forces produce greater root resorption than heavy transverse jiggling forces. Heavy vertical orthodontic forces should not be used since they can cause severe root damage.

#### SP121 DENTAL SIDE EFFECTS AFTER TREATING OBSTRUCTIVE SLEEP APNOEA WITH A MANDIBULAR ADVANCEMENT DEVICE.

Ana M<sup>a</sup> López Plasencia<sup>1</sup>, Manuel Hernández Aliaga<sup>2</sup>, Ascensión Vicente<sup>1</sup>, Luis Alberto Bravo González<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Temporo-Mandibular Disorders, Morales Meseguer, Murcia, Spain

**AIMS:** To determine the amount of occlusal change in patients with obstructive sleep apnoea (OSA) treated with biobloc mandibular advancement device (MAD).

**SUBJECTS AND METHOD:** Twenty patients (7 females, 13 males) diagnosed with mild, moderate or severe apnoea [Apnoea Hypopnoea Index (AHI), baseline mean  $28.16 \pm 18$ ] by complete polysomnography, received treatment with an adjustable appliance at 60 per cent

of maximum protrusion; the device used was a bi-bloc, the Silensor® (Erkodent®, Germany). The protrusion was progressively increased until the minimum AHI possible was achieved. AHI measurements were made with Apnoealink®. The final mean protrusion was  $64.76 \pm 6.79$  per cent and the final AHI  $5.2 \pm 5.8$ . Plaster models were taken before and 2 years after MAD treatment. Overjet, overbite and midline deviation were measured on the pre- and post-treatment plaster models with a dental calliper (Leone® dental calliper with double tips). The Kolmogorov-Smirnov normality test was applied to the overjet, overbite and dental midline deviation data. As they showed normality ( $P > 0.05$ ), they were analyzed with a paired samples *t*-test. To evaluate the method error, 20 plaster models were measured again two weeks after the first measurement; Pearson correlation test showed a significant correlation between repeated measurements ( $P < 0.05$ ).

**RESULTS:** No significant differences ( $P > 0.05$ ) were observed in dental midlines pre- ( $0.62 \pm 0.68$  mm) or post- ( $0.6 \pm 0.64$  mm) treatment. Significant differences ( $P < 0.05$ ) were observed in both overjet and overbite pre- (overjet  $3.58 \pm 1.17$  mm, overbite  $4.01 \pm 1.47$  mm) and post- (overjet  $3.11 \pm 1.25$  mm, overbite  $3.59 \pm 1.67$  mm) treatment.

**CONCLUSION:** The continuous use of bi-bloc protrusion devices for OSA treatment will cause changes in the occlusion, decreasing significantly both overbite and overjet but not affecting the dental midlines.

#### SP122 RETRIEVAL ANALYSIS OF *IN VIVO* AGED LINGUAL FIXED RETAINERS

Jonas Gugger<sup>1</sup>, Nikolaos Pandis<sup>2</sup>, Spiros Zinelis<sup>3</sup>, George Eliades<sup>3</sup>, Theodore Eliades<sup>1</sup>,  
<sup>1</sup>Clinic for Orthodontics and Pediatric Dentistry, Center of Dental Medicine, University of Zurich, Switzerland. <sup>2</sup>Private Practice, Corfu, Greece and <sup>3</sup>Department of Biomaterials, University of Athens, School of Dentistry, Greece

**AIMS:** To analyse the alteration of clinically aged composites used for fixed retention.

**MATERIALS AND METHOD:** Twenty three lingual retainers bonded at different time periods (2.2-17.4 years) were retrieved from past orthodontic patients. Fifteen lingual retainers (MAXRet) had been cemented by chemical cured adhesive [Maximum Cure™ two-part liquid adhesive (Reliance Orthodontics, Illinois, USA)] and the rest (EXCRet) with photo-cured adhesive (Excel™ two-part paste (Reliance Orthodontics)]. The former group was aged for a period of 2.8-17.4 and the latter for 2.2-5.4 years. Two groups of five specimens from each material were prepared and used as control for Maximum cure (MAXCon) and Excel (EXCCon), respectively. Three specimens from each group were analyzed by Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy. The same samples were investigated using a variable pressure scanning electron microscope employing secondary and backscattered electron imaging and their elemental composition was investigated by X-ray EDS analysis (EDX). All specimens were embedded in acrylic resin and after metallographic grinding and polishing, the surfaces were used for the assessment of Vickers hardness (HV 0.5), indentation modulus (EIT) and elastic index ( $\eta$ IT) using a universal hardness-testing machine ZHU0.2/Z2.5 (Zwick Roell, Ulm, Germany) according to a standardized test method (ISO 14577-1, 2002). The values of HV 0.5, EIT and  $\eta$ IT were compared between retrieved and reference groups employing unpaired *t*-tests ( $\alpha = 0.05$ ).

**RESULTS:** FTIR and Raman analysis revealed that both composites consisted of aromatic dimethacrylate matrices while the surfaces of retrieved samples had retained oral integuments. Both contained a dispersed heavier phase while EDX analysis showed that they contained C, O, Na Al, and Si while Ba was identified only in EXCCon. No significant differences were found between the unused and retrieved groups in HV 0.5, (MAXCon =  $69.6 \pm 5.0$ , MAXRet =  $78.6 \pm 6.4$ , EXCCon =  $37.3 \pm 1.4$ , EXCRet =  $36.0 \pm 3.4$ ), EIT (MAXCon =  $8.3 \pm 0.7$ , MAXRet =  $8.8 \pm 1.4$ , EXCCon =  $5.2 \pm 0.3$ , EXCRet =  $4.7 \pm 0.2$  GPa) and  $\eta$ IT (MAXCon =  $43.5 \pm 2.4$ , MAXRet =  $47.4 \pm 3.7$ , EXCCon =  $44.8 \pm 1.4$ , EXCRet =  $46.2 \pm 1.3\%$ )

**CONCLUSION:** Despite the surface alternations, the mechanical properties of the materials tested remained unaffected by intraoral ageing.

#### SP123 TIMING OF ERUPTION OF MAXILLARY AND MANDIBULAR FIRST PERMANENT MOLARS IN RELATION TO JAW SIZE DISCREPANCY

Minna Merta, Marjut Evälahti, Janna Waltimo-Sirén, Department of Orthodontics, Institute of Dentistry, University of Helsinki, Finland

**AIMS:** The lower permanent molars generally erupt slightly before the upper ones. There is some evidence that the timing of molar eruption may correlate with skeletal Class. The aim of this study therefore was to investigate if timing of the emergence of either the upper or lower first molars, or the difference between them, correlates with the size of the jaws even in a random population.

**MATERIALS AND METHOD:** Cephalometric and tooth eruption data of 90 children (44 boys, 46 girls) from the Helsinki Longitudinal Growth Study. From a series of lateral cephalograms those taken closest to 6 years of age were chosen. The age at clinical eruption of the first molars was either calculated from exact eruption dates, reported by the parents, or from dates estimated between two clinical examinations. The means of eruption ages for the right and left sides were calculated and used for statistical analysis.

**RESULTS:** In the whole study group, timing of the eruption of the first permanent molars did not correlate with the cephalometric variables. Neither were there any statistically significant differences between the eruption ages in boys and girls. In children with Harvold's difference less than 15 ( $n = 14$ ) there was a modest correlation with the difference of eruption ages in upper and lower jaw and Harvold's difference ( $r = 0.5$ ), and a modest negative correlation with the age of eruption in the mandible with Harvold's difference ( $r = -0.5$ ). In children with Harvold's difference more than 19 ( $n = 38$ ), there was no correlation with the difference of eruption ages and Harvold's difference, but a weak negative correlation ( $r = -0.42$ ) between maxillary tooth eruption and the size of the maxilla.

**CONCLUSION:** The results support earlier findings that in skeletal Class II there is a tendency towards delayed eruption of the mandibular molars, and that in Class III there is a tendency for delayed eruption of the maxillary molars. Here, the phenomenon would probably have become clearer if second or third molars had been analyzed, since the difference in the age of eruption of the first permanent molars in the upper and lower jaws is generally small, or if the subjects had represented extremes of jaw size discrepancies.

#### SP124 PRESENCE OF SELLA TURCICA BRIDGING IN SUBJECTS WITH PALATAL CANINE IMPACTION

Alzbeta Kuklova, Petra Stepankova, Pavlina Cernochova, Department of Orthodontics, St. Anne's University Hospital and Faculty of Medicine, Masaryk University, Brno, Czech Republic

**AIMS:** To retrospectively evaluate the presence of complete sella turcica bridging in subjects with palatal canine impaction and those with normal canine eruption.

**SUBJECTS AND METHOD:** One hundred and twenty subjects with palatal canine impaction (mean age 18.8 years) and a control group of 120 subjects with a complete permanent dentition and skeletal Class I (mean age 18.1 years). The position of the permanent canines was evaluated with standard quality lateral cephalograms, dental panoramic radiographs and intraoral radiographs. The presence of complete sella turcica bridging between the anterior and posterior clinoidal processes of the sphenoid bone was evaluated using lateral cephalograms. Association of the presence of a sella bridge between the control and retention group was analyzed using chi-square tests.

**RESULTS:** The frequency of complete sella turcica bridging was significantly higher ( $P < 0.05$ ,  $P = 0.023$ ) in the retention group (22 bridges, 18.3%) than in the control group (10 bridges, 8.3%).

**CONCLUSION:** The presence of complete sella turcica bridging during the development and eruption of permanent canines should be the predictive factor of future palatal impaction.

#### SP125 CHANGES IN THREE-DIMENSIONAL LIP MORPHOLOGY FOLLOWING CORRECTION OF PSEUDO-CLASS III MALOCCLUSION

Chihiro Jogaki, Fumi Kuroyanagi, Noriyuki Kitai, Orthodontic Department, Asahi University, Mizuho, Japan

AIMS: To investigate changes in three-dimensional (3D) lip morphology following correction of pseudo-Class III malocclusions.

SUBJECTS AND METHOD: Fourteen Japanese patients (4 males, 10 females, mean age: 8.6 years) diagnosed with pseudo-Class III malocclusions. All patients showed a negative overjet of at least two incisors, including the bilateral central incisors, and functional mandibular prognathism due to premature contact of the anterior teeth. The anterior crossbite was corrected by labial movement of the upper anterior teeth within 6 months of diagnosis. 3D images of the face at rest were recorded for each patient using a 3D surface imaging device (3dMDcranial System, 3dMD, USA) before and after treatment. The images were superimposed at the forehead, and the mid-sagittal, axial, and frontal planes were defined based on several reference points using image processing software (3D-Rugle, Medic Engineering, Japan). Points around the lip were identified three-dimensionally as follows: pronasale, subnasale, labrale superius, right and left upper lip midpoints, stomion, right and left chellion, right and left lower lip midpoints, labrale inferius, labiomentale, and pogonion). Significant differences between the measured coordinates before and after treatment were calculated using the paired *t*-test.

RESULTS: Pronasale and subnasale positions did not change significantly after treatment. However, the upper lip positions (labrale superius and right and left upper lip midpoints) were significantly more anterior after treatment, while those for the lower lip and oral fissure (stomion, right and left chellion, right and left lower lip midpoints, labrale inferius, labiomentale, and pogonion) were significantly more posterior after treatment.

CONCLUSION: In pseudo-Class III malocclusion, 3D images of the face showed posterior repositioning of the lower lip structures after correcting the anterior crossbite. These results indicate that anterior crossbite correction causes backward rotation of the mandible.

#### SP126 REGISTRATION OF FACIAL IMAGES BEFORE AND AFTER CORRECTING PSEUDO-CLASS III MALOCCLUSION

Fumi Kuroyanagi, Chihiro Jogaki, Noriyuki Kitai, Orthodontic Department, Asahi University, Mizuho, Japan

AIMS: To investigate the accuracy of facial images registered before and after anterior crossbite correction of pseudo-Class III malocclusion.

SUBJECTS AND METHOD: Fourteen Japanese patients (4 males, 10 females, mean age: 8.6 years) with pseudo-Class III malocclusions, and a control group that included 10 mature adults (5 males, 5 females, mean age: 28.6 years). The malocclusion patients showed functional mandibular prognathism due to premature contact of the anterior teeth. Anterior crossbite correction was performed within 6 months of diagnosis. Three-dimensional (3D) images of the face at rest were recorded using a 3D surface imaging device (3dMDcranial System, 3dMD, USA) before and after treatment in the patient group, and twice at an interval of one day in the control group. Each image pair was superimposed at the forehead, and the mid-sagittal, axial, and frontal planes were determined based on several reference points using image processing software (3D-Rugle, Medic Engineering, Japan). Pronasale was identified three-dimensionally. Significant differences between the pronasale coordinate values within each image pair were assessed using a paired *t*-test.

RESULTS: There was no significant difference in the pronasale coordinates of the superimposed images in either group. The mean difference between the pre- and post-treatment images was within 1.0 mm for pronasale.

CONCLUSION: The accuracy of registration between pre- and post-treatment images was equally high in the treatment and control groups. These results suggest that registration of pre- and post-treatment images is valid when the interval between the images is within 6 months.

#### SP127 TRANSFECTION EFFICIENCY OF NUCLEAR FACTOR KAPPA-LIGHT-CHAIN-ENHANCER OF ACTIVATED B CELLS DECOY IN THE PERIODONTIUM USING ULTRASOUND MICROBUBBLE

Hiroyuki Yamaguchi<sup>1</sup>, Yuji Ishida<sup>1</sup>, Jun-ichi Suzuki<sup>2</sup>, Mitsuaki Isobe<sup>2,3</sup>, Takashi Ono<sup>1</sup>, Departments of <sup>1</sup>Orthodontic Science, <sup>2</sup>Cardiovascular Medicine, and <sup>3</sup>Advanced Clinical Science and Therapeutics, Tokyo Medical and Dental University, Japan

**AIMS:** The use of fixed orthodontic appliances such as brackets and archwires can cause gingival inflammation in patients during treatment. Decoy oligonucleotide (ODN) transfection is a strategy used for temporary suppression of gene expression by controlling transcription regulation. Previous studies have demonstrated that injection of nuclear factor kappa-light-chain-enhancer of activated B cells (NF- $\kappa$ B) ODN, which is an invasive technique, into the region with periodontitis is effective against inflammation and alveolar bone loss. An attempt was made to use the ultrasound system and microbubble solution, which is less invasive, for decoy transfection into the periodontal tissues. The objective of this study was to estimate the infiltrative efficiency of decoy introduction into the periodontium using the ultrasound-microbubble technique in mice.

**MATERIALS AND METHOD:** Thirty male mice (C57BL/6; aged 8 weeks) were divided into five groups: control (C), scrambled decoy conventional application (A-Sc), low ultrasound and microbubble (1 MHz, 0.5 W/cm<sup>2</sup>) scrambled decoy application (LUM-Sc), high ultrasound and microbubble (1 MHz, 2.0 W/cm<sup>2</sup>) scrambled decoy application (HUM-Sc), and high ultrasound and microbubble NF- $\kappa$ B decoy application (HUM-NF). A fluorescein-labelled scrambled decoy was used to investigate the infiltrative efficiency of the ultrasound-microbubble technique. The decoy was applied to both upper molar areas in the S, LUM and HUM groups. All the mice were killed 2 hours after the procedure, and 10  $\mu$ m thick frozen sections were used to analyse the efficiency of introducing a scrambled decoy into the gingival epithelium and connective tissues via fluorescent microscopic observation. Western blotting and reverse transcription polymerase chain reaction (RT-PCR) analyses revealed the expression of inflammatory cytokines and cell adhesion molecules in the gingival region.

**RESULTS:** The fluorescein-labelled scrambled decoy demonstrated that the ultrasound-microbubble helped deliver the scrambled decoy into the gingiva. The highest efficiency of introducing the decoy was observed in the HUM-Sc group. Western blotting and RT-PCR analyses revealed that NF- $\kappa$ B decoy could be transfected into the gingiva and suppress the expression of inflammatory cytokines and cell adhesion molecules in the HUM-NF group.

**CONCLUSION:** The ultrasound-microbubble (2.0 W/cm<sup>2</sup>) can transfect the decoy into the gingival region. Transfected decoy can prevent the production of inflammatory cytokines and cell adhesion molecules.

## SP128 EFFECT OF COATING ON FRICTIONAL PROPERTIES OF AESTHETIC ORTHODONTIC NICKEL-TITANIUM WIRES

Masahiro Iijima, Toshihiro Yuasa, Takeshi Muguruma, Kyotaro Kawaguchi, Itaru Mizoguchi, Division of Orthodontics and Dentofacial Orthopedics, Health Sciences University of Hokkaido, Ishikari-Tobetsu, Japan

**AIMS:** Friction between the bracket and archwire during orthodontic tooth movement is an important factor in clinical orthodontics. The purpose of this study was to investigate the frictional properties of two commercially available aesthetic orthodontic wires.

**MATERIALS AND METHOD:** Coated nickel-titanium (NiTi) wires with a diameter of 0.016 inches and 0.016  $\times$  0.022 inch cross-sections (EverWhite NiTi; American Orthodontics; Aesthetic Reflex NiTi, TP Orthodontics) were selected. Non-coated NiTi wires (Superelastic Titanium Memory, American Orthodontics; Reflex, TP Orthodontics) were used for comparison. The external surfaces of the wires with 0.016  $\times$  0.022 inch cross-sections were examined using atomic force microscopy (AFM) to characterize the surface morphology. A three-point bending test with a 12 mm span was carried out using a universal testing machine (n = 5). Static friction was measured by drawing the archwires through the bracket slots with an angulation of 10 degrees using a universal testing machine (n = 5). The results were compared with a Student's *t*-test.

**RESULTS:** Both aesthetic coated wires had similar surface morphologies and the values of surface roughness were significantly greater than those of non-coated wires. EverWhite with a diameter of 0.016 inches showed a lower elastic modulus than the non-coated product, whereas Aesthetic Reflex with a diameter of 0.018 inches showed a higher elastic modulus than the non-coated product. There was no difference in the elastic modulus of both wires with 0.016  $\times$  0.022 inch cross-sections. The frictional force of EverWhite with 0.016  $\times$  0.022 inch cross-sections was less than the non-coated wire, although the frictional force of

EverWhite NiTi with a diameter of 0.016 inches was higher than the non-coated wire, whereas similar values of frictional forces were found for coated and non-coated Aesthetic Reflex wires.

**CONCLUSION:** The aesthetic coating processes for EverWhite and Aesthetic Reflex influence surface roughness, which may influence frictional resistance.

#### SP129 FEATURES OF ORAL PSYCHOSOMATIC DISORDER IN ORTHODONTIC PATIENTS

Chisa Shitano<sup>1</sup>, Miho Takenoshita<sup>1</sup>, Takashi Ono<sup>2</sup>, Akira Toyofuku<sup>1</sup>, Divisions of <sup>1</sup>Psychosomatic Dentistry and <sup>2</sup>Orthodontic Science, Graduate School, Tokyo Medical and Dental University, Japan

**AIMS:** Oral psychosomatic disorders occur frequently during orthodontic treatment, although such cases are seldom reported in the literature. The aim of this study was to investigate the clinical characteristics of outpatients who developed dental psychosomatic disorders in association with orthodontic treatment.

**MATERIALS AND METHOD:** The clinical records of 22 patients who consulted the Division of Psychosomatic Dentistry between November 2012 and November 2014 were retrospectively investigated. All patients had complained about medically unexplained symptoms in the maxillofacial area in association with orthodontic treatment.

**RESULTS:** The mean age of the patients was  $38.7 \pm 12.7$  years (mean  $\pm$  standard deviation, range: 25-66 years). Seventeen patients (77.3%) were female. The main diagnoses were 'phantom bite' in 11 cases, 'body dysmorphic disorder' in five cases, and 'atypical odontalgia or facial pain' in four cases. Eleven cases were in active orthodontic treatment, nine were in retention, and two were in treatment intermission. The average score on the self-rating depression scale (SDS) at the first visit was 50.4. Seventeen patients (77.3%) had psychiatric conditions, and the most common psychiatric diagnosis was anxiety disorder (52.9%).

**CONCLUSION:** Patients with potential mental disorders may be likely to complain about medically unexplained oral symptoms during orthodontic treatment. This study suggests the importance of checking the psychiatric history before starting orthodontic treatment. Psychological testing such as the SDS would be useful for these patients.

#### SP130 OCCLUSAL FEATURES OF CHILDREN WITH ADENOID HYPERTROPHY

Katarzyna Lubińska<sup>1</sup>, Maria Syryńska<sup>1</sup>, M. Ali Darendeliler<sup>2</sup>, Krzysztof Woźniak<sup>1</sup>, Departments of Orthodontics, <sup>1</sup>Pomeranian Medical University, Szczecin, Poland and <sup>2</sup>University of Sydney, Australia

**AIMS:** To investigate the association between adenoid hypertrophy and overbite, overjet, molar relationship and crossbite.

**SUBJECTS AND METHOD:** The subjects in the adenoid hypertrophy group (AHG) were recruited from the Clinic of Otorhinolaryngology (n = 56), aged between 2 and 13 years, average age 5.95 years) with adenoid hypertrophy requiring adenoidectomy. The control group (CTG) (n = 56) was matched by age and gender, and none of the children had orthodontic treatment, adenoid hypertrophy, adenoidectomy or other laryngological surgery or a history of laryngological illnesses that might be causative factors for upper airway obstruction. Questionnaires in relation to patients' sleeping, breathing and airway conditions were completed by both groups. Dental measurements were carried out on dental casts. Groups were compared using the Student's *t*-, Fisher's exact and Mann-Whitney *U* tests.

**RESULTS:** There were statistically significant differences between the AHG and CTG. AHG children had a larger overjet ( $P = 0.001$ ) and deeper overbite ( $P = 0.037$ ) compared with the CTG. A crossbite occurred significantly more often in the AHG than in the CTG ( $P = 0.02346$ ). AHG children seem to demonstrate 4.18 times more a Class II malocclusion ( $P = 0.003$ ) and 3.37 times more a crossbite ( $P = 0.046$ ) than children from the CTG.

**CONCLUSION:** The occlusal features of children with adenoid hypertrophy differ from children without adenoid hypertrophy. Adenoid hypertrophy predisposes to the development of malocclusion especially crossbites and distal occlusion. Early adenoidectomy may help in avoiding future dental malocclusions.

SP131 SHORT-TERM EFFECTS OF CLEAR ALIGNERS ON SLEEP BRUXISM: A CASE-CONTROL STUDY WITH A DIAGNOSTIC NOCTURNAL PORTABLE DEVICE

Andrea Bargellini, Tommaso Castroflorio, Gabriele Rossini, Cesare Lorenzo Debernardi, Department of Orthodontics, Università degli Studi di Torino, C.I.R. Dental School, Italy

**AIMS:** To compare. in a preliminary case-control study, the effects of clear aligners (Invisalign®) in patients with sleep bruxism (SB) and a control group. The diagnosis of SB was conducted with a portable device.

**SUBJECTS AND METHOD:** Ten patients (5 males, 5 females,  $30 \pm 11$  years) with clinical SB were selected to constitute the control group and 12 patients (4 male. 8 females,  $15 \pm 3$  years) with clinical SB undergoing treatment with clear aligners (Invisalign®) were selected to form the clinical group. All patients underwent three nights' ECG and surface electromyographic recordings with the Bruxoff device (Bruxoff, Spes Medica, Battipaglia, Italy), a reliable instrument for SB diagnosis. A two-way ANOVA test was conducted on cases and controls ( $P < 0.05$ ) with Graph Pad Prism 5.0

**RESULTS:** No significant differences were observed during the three different nights in the control group ( $P > 0.05$ ), while significant statistical differences were found in all patients with clear aligners.

**CONCLUSION:** SB patients treated with clear aligners reduce their parafunction after the first week of application but, after 1 month their SB activity returns to baseline levels.

SP132 NON-INVASIVE AUGMENTATION TECHNIQUE FOR OPEN GINGIVAL EMBRASURE

Eui Seon Baek, Woo Kang Yoon, In-Sil Kim, Kyung-Ho Kim, Chooryung J. Chung, Gangnam Severance Dental Hospital, Seoul, Korea, South

**AIMS:** An open gingival embrasure, the so called 'black triangle', is one of the unsolved dilemmas in aesthetic dentistry. Although various techniques have been introduced to aesthetically improve black triangles in recent years, the lack of reproducible experimental models and clinical trials have prevented the development of successful protocols to regenerate or to compensate for the loss of the interdental papilla. Therefore, the objective of this study was to develop a reliable animal model of open gingival embrasure, and to validate a non-invasive augmentation technique to regenerate the interdental papilla.

**MATERIALS AND METHOD:** To reproduce an open gingival embrasure in SD rats, rapid tooth movement was induced between the loose incisors using a 0.016 inch stainless steel spring. The loss of interdental papilla height was morphologically evaluated and calculated using standardized serial photographs, periapical radiographs, microcomputed tomographs for 3-10 days. The changes in interdental papilla were evaluated after local injection of hyaluronic acid filler (40  $\mu$ l) or phosphate buffered saline for sham control into the open gingival embrasures.

**RESULTS:** The margin of interdental papilla between the lower incisors became irregular and flat as rapid tooth movement proceeded. There was a decrease of interdental papilla height following rapid tooth movement from day 3 compared to the normal controls. The height between the alveolar crest and the tip of the interdental papilla also decreased significantly following rapid tooth movement ( $P < 0.05$ ). The non-invasive injection of hyaluronic acid alone did not show a significant augmentation effect of the interdental papilla compared to the controls.

**CONCLUSION:** An open gingival embrasure was successfully reproduced in experimental animals by the application of non-physiologic rapid tooth movement between the lower incisors. Local injection of hyaluronic acid fillers alone was not enough to induce an augmentation effect on the open gingival embrasure.

SP133 THE INCIDENCE OF SOFT TISSUE SCAR REMAINING AFTER REMOVAL OF ORTHODONTIC MINISCREWS

Eui Seon Baek, Sung Ah Jung, Yoon Jeong Choi, Kyung-Ho Kim, Chooryung J. Chung, Gangnam Severance Dental Hospital, Seoul, Korea, South

AIMS: To investigate the incidence of soft tissue scar remaining after removal of temporary anchorage devices (TADs), and to analyze clinical factors associated with scar formation.

SUBJECTS AND METHOD: Two hundred and two removal sites in 66 patients were investigated for the presence of scar remaining after TAD removal. Clinical parameters were evaluated for their association with the presence of scar.

RESULTS: The incidence of scarring remaining after TAD removal was 44.6 per cent. Thick flat gingival biotypes showed a significantly higher incidence of scar tissue than thin scalloped gingival biotypes. Maxillary buccal miniscrews showed a significantly higher incidence of scar than those of the mandible or palatal slope. TADs placed at the mucosa showed a significantly lower incidence of scarring than those of the mucogingival junction and the attached gingiva.

CONCLUSION: The incidence of distinguishable scar tissue remaining after TAD removal was fairly high. Patients with a thick gingival biotype and buccal interdental gingival insertion sites are more susceptible to scar formation.

#### SP134 RELATIONSHIP BETWEEN BREASTFEEDING DURATION AND POSTERIOR CROSSBITE

<sup>1</sup>Hatice Akinci Cansunar, Rukiye Alcin, Siddik Malkoc, Inonu University, Malatya, Turkey

AIMS: To determine the relationship between breastfeeding duration and prevalence of unilateral and bilateral posterior crossbites.

SUBJECTS AND METHOD: Breastfeeding duration was determined in 142 subjects. The subjects were divided into three groups: group 1 (G1) comprised 33 subjects with a unilateral posterior crossbite, group 2 (G2) 38 subjects with a bilateral posterior crossbite and group 3 (G3) 71 subjects with a Class I malocclusion without a crossbite.

RESULTS: No statistically significant differences were found among the three groups in breastfeeding duration ( $P > 0.05$ ). Score 1 was observed in 6.3, 5.3 and 0.0 per cent in groups G1, G2 and G3, respectively. Score 2 was observed in 18.8, 21.1 and 21.4 per cent in groups G1, G2 and G3, respectively. Score 3 in 31.3, 34.2 and 28.6 per cent in groups G1, G2 and G3, respectively, and score 4 in 43.8, 39.5 and 50.0 per cent in groups G1, G2 and G3, respectively.

CONCLUSION: There was no relationship between breastfeeding duration and prevalence of a unilateral or bilateral posterior crossbite.

#### SP135 GINGIVAL CREVICULAR FLUID ANALYSIS DURING ORTHODONTIC TREATMENT: FIXED APPLIANCES VERSUS CLEAR ALIGNERS

Eugenio Federico Gambero, Andrea Bargellini, Tommaso Castroflorio, Cesare Lorenzo Debernardi, Dental School, Department of Orthodontics, University of Turin, Italy

AIMS: Previous studies hypothesized that intermittent forces produced by aligners determined the formation of new bone with different characteristics from the bone induced by fixed appliances. Since the conclusions of such studies were not corroborated by sound data, the objective of this trial was to examine the molecular mechanism in human periodontal ligament cells stimulated by intermittent and continuous force and to analyze gingival crevicular fluid (GCF) changes in humans undergoing orthodontic treatment with fixed appliances and with Invisalign aligners.

SUBJECTS AND METHOD: Ten patients were selected: five treated with Invisalign aligners (treatment group) and five with fixed appliance (control group). GCF sampling was executed at the mesial and distal sides of the considered teeth. GCF was obtained through the application of PerioPaper strips (Oraflow, New York, USA) for 30 seconds at a depth of 1 mm. Sampling was carried out before force application (T0) and after one hour (T1), one week (T2) and 3 weeks (T3) from the beginning of treatment. Quantitative analysis was obtained using an electronic analyzer (Periotron 8000, Oraflow). The strips were then placed in a buffered solution of NaCl, stored at  $-80^{\circ}\text{C}$  and analyzed by ELISA test to measure IL-1 $\beta$  concentration.

RESULTS: Orthodontic forces produced tissue-degrading enzymes and inflammatory mediators. An increase of GCF flow rate occurred before the biochemical changes. IL-1 $\beta$  concentration did not show significant differences between the two groups ( $P > 0.05$ ).

**CONCLUSION:** The findings from this pilot study suggest the hypothesis that the same biochemical response occurs with both aligners and fixed appliances, at least in the early stages of orthodontic treatment

#### SP136 DETERMINATION OF THE RELATIONSHIP BETWEEN CONDYLAR GUIDANCE AND ANTERIOR GUIDANCE IN DIFFERENT MALOCCLUSION GROUPS

Hatice Akinci Cansunar, Emine Toptan, Inonu University, Malatya, Turkey

**AIMS:** To determine the relationship between condylar guidance and anterior guidance in subjects with Class I, Class II division 1, Class II division 2 and Class III using cephalometric radiographs.

**SUBJECTS AND METHOD:** Sagittal condylar guidance was constructed by joining the heights of curvature in the glenoid fossa and the corresponding articular eminence. This was then related to the constructed Frankfort horizontal plane to determine the radiographic angle of sagittal condylar guidance. Anterior guidance is a function of the relationship between the maxillary and mandibular anterior teeth. Sagittal condylar guidance and anterior guidance were determined in 100 subjects with different malocclusions. The subjects were divided into four groups: group 1, 25 subjects with a Class I malocclusion, group 2, 25 subjects with a Class II division 1 malocclusion, group 3, 25 subjects with a Class II division 2 malocclusion and group 4, 25 subjects with a Class III malocclusion. One researcher evaluated all cases. The data were subjected to statistical analysis by paired *t*-test ( $\alpha = 0.05$ ).

**RESULTS:** There was a correlation between condylar guidance and anterior guidance in subjects with a Class II division 2, but, not in subjects with a Class I, Class II division 1 or Class III. No statistically significant differences were found among the four groups for condylar guidance but a statistically significant difference was found in anterior guidance in subjects with a Class II division 2.

**CONCLUSION:** There was good correlation between condylar guidance and anterior guidance in subjects with a Class II division 2 malocclusion but not for subjects with other malocclusions.

#### SP137 GENDER DIFFERENCES IN MANDIBULAR CONDYLAR VOLUME EVALUATED BY CONE BEAM COMPUTED TOMOGRAPHY

Veronica Pie de Hierro<sup>1</sup>, Maria Jose Viñas<sup>2</sup>, <sup>1</sup>Department of Stomatology, EHU University, Leioa and <sup>2</sup>Complutense University Madrid, Spain

**AIMS:** To assess possible differences between genders in mandibular condylar volume and surface using cone beam computed tomography (CBCT).

**MATERIALS AND METHOD:** CBCT scans of 60 young adult Caucasians (21 males, 39 females between 20 and 36 years of age) previously obtained for diagnosis and orthodontic treatment purposes, were randomly selected from the patient database at a private diagnostic imaging centre. CBCT were acquired with Icat (Imaging Sciences International Inc., Hatfield, Pennsylvania, USA). The protocol was 13 cm field of view, 20 seconds. and a voxel size of 0.3. Isolating the condylar area was performed according to two imaginary lines; Frankfort horizontal line and 'C plane' parallel line to Frankfort passing through the most caudal point (c point) of the sigmoid notch. Manual segmentation of the condyles was performed with Nemoscan software (Nemotec. Madrid, Spain). Statistical analyses were carried out with the Statistical Package for Social Sciences (SPSS. V. 17.0 Windows). Data were subjected to descriptive analysis for mean, range and standard deviation.

**RESULTS:** Statistically significant differences were found in mandibular condyle volume and area considering the whole sample with regards to gender ( $1202 \pm 329 \text{ mm}^3$  in females,  $1603 \pm 311 \text{ mm}^3$  in males). Females showed significantly lower mandibular condylar volume than males ( $P = 0.001$ ).

**CONCLUSION:** Statistically significant differences in mandibular condylar volume measured by CBCT technology with regard to gender were found, showing that females had significantly lower mandibular condylar volume than males.

## SP138 A RETROSPECTIVE INTERCENTRE COMPARISON OF EARLY TREATMENT OUTCOME OF UNILATERAL CLEFT PATIENTS

Laurent Thierens<sup>1</sup>, Arianne Lewyllie<sup>2</sup>, Guy De Pauw<sup>1</sup>, An Verdonck<sup>2</sup>, Department of Orthodontics, <sup>1</sup>Ghent University and <sup>2</sup>KU Leuven, Belgium

**AIMS:** To compare the dental arch relationship of patients with unilateral cleft lip and palate, (UCLP) treated in two different cleft centres of university hospitals.

**MATERIALS AND METHOD:** The dental arch relationship was evaluated on dental casts of 5-6 year old patients with a UCLP, who were treated in Ghent (centre 1) and Leuven (centre 2), Belgium. The study group comprised 75 subjects. The treatment protocol of both centres differed in timing and surgical techniques for lip closure and soft and hard palate closure. The dental arch relationship was assessed using the 5-year-old index and the modified Huddart/Bodenham scoring system. SPSS Statistics 22 was used to perform data analyses. Intra- and interobserver agreement were calculated using Cohen's Kappa coefficient. Significant differences in dental arch relationship between both centres were detected using the Mann-Whitney *U* test for the 5-year-old index and an independent samples *t*-test for the modified Huddart/Bodenham scoring system. Descriptive statistics included means and standard deviations of each index.

**RESULTS:** For the 5-year-old index, the intra- and interobserver agreement scores were good ( $\kappa = 0.73$ ) and excellent ( $\kappa = 0.83$ ), respectively. For the modified Huddart/Bodenham scoring system, Kappa values of 0.85 and 0.85 were found, indicating excellent agreement. The mean 5-year-old index score was 3.00 ( $\pm 0.58$ ) for centre 1 and 2.69 ( $\pm 0.97$ ) for centre 2. The mean Huddart/Bodenham score was  $-6.57$  ( $\pm 3.21$ ) for centre 1 and  $-6.71$  ( $\pm 5.13$ ) for centre 2. Comparative analysis showed no statistically significant differences between the two centres for both the 5-year-old index and the modified Huddart/Bodenham scoring system.

**CONCLUSION:** No statistically significant differences were found in dental arch relationships of patients treated in centre 1 or 2 despite the differences in timing of surgery and the surgical technique for lip and palate closure.

## SP139 EFFECTS OF BISPHOSPHONATES, IL-1 $\beta$ AND BIOMECHANICAL LOADING ON HUMAN PERIODONTAL FIBROBLASTS *IN VITRO*

Collin Jacobs<sup>1</sup>, Sabrina Schramm<sup>1</sup>, Isabelle Dirks<sup>1</sup>, Thomas Ziebart<sup>2</sup>, Heiner Wehrbein<sup>1</sup>, Departments of <sup>1</sup>Orthodontics, and <sup>2</sup>Oral-, Maxillo- and Facial Surgery, University of Mainz, Germany

**AIMS:** There is increasing evidence that inflammation and biomechanical loading can affect the effects of bisphosphonates (BP). The aim of this study was to investigate changes in human periodontal ligament fibroblasts (HPdLF) when tensile strain was applied combined with IL-1 $\beta$  and the presence of clodronate or zoledronate.

**MATERIALS AND METHOD:** Cyclic tensile strain (CTS) is thought to mimic that found *in vivo* during orthodontic tooth movement and mastication. HPdLF were cultured with 10 nM IL-1 $\beta$  and 5  $\mu$ M clodronate or zoledronate for 48 hours. Cells were applied to CTS (3% elongation) for 12 hours *in vitro*. Viability was verified by MTT assay. Gene expression of receptor activator of cyclooxygenase-2 (COX-2), matrixmetalloproteinase-8 (MMP-8) and TIMP-1 were investigated using real-time polymerase chain reaction. MMP-8, TIMP-1, PGE<sub>2</sub> and IL-6 were analyzed by ELISA. Statistical analysis was performed with SPSS (ANOVA,  $P < 0.05$ ).

**RESULTS:** Zoledronate led to reduced viability of HPdLF (60.3% versus 100%), which was significant when combined with IL-1 $\beta$ . Combined with 3 per cent STS this effect was abolished and viability increased over the level of the control cells. IL-1 $\beta$  led to a 10-fold increase of COX-2 gene expression. Combined with CTS and zoledronate this increase was enhanced to 70-fold of gene expression of control cells with a related PGE<sub>2</sub> synthesis. Clodronate did not reduce viability nor enhance COX-2 gene expression. CTS increased MMP-8 gene expression and protein synthesis. After incubation with BP this increase was abolished. TIMP-1 expression and protein synthesis were increased for all conditions under CTS.

**CONCLUSION:** High-potent BP combined with factors of inflammation strongly decrease the viability of HPdLF. Mechanical loading activates HPdLF and abolishes BP induced reduction of viability. A combination of mechanical loading, inflammation and high-potent BP however increase production of COX-2 dependent inflammation proteins with a risk of periodontal degradation.

#### SP140 CRANIOFACIAL AND DENTOALVEOLAR MORPHOLOGY: A NEW METHOD OF COMPARISON BY CEPHALOMETRIC ANALYSIS IN A SAMPLE OF UNTREATED SUBJECTS

Gaetano Isola<sup>1</sup>, Riccardo Nucera<sup>1</sup>, Maria Rosaria Contiello<sup>2</sup>, Alberta Femiano<sup>2</sup>, Giovanni Matarese<sup>1</sup>, <sup>1</sup>Department of Specialist Medical-Surgical Experimental Sciences and Odontostomatology, University of Messina and <sup>2</sup>Department of Orthodontics, School of Dentistry, Second University of Naples, Italy

**AIMS:** To examine whether or not dentoalveolar and craniofacial heights are related to vertical craniofacial features in a population of untreated growing subjects.

**SUBJECTS AND METHOD:** One hundred and ten untreated growing subjects with a complete permanent dentition. A lateral cephalogram was obtained for each subject. Cephalometric analysis was designed to evaluate the posterior and anterior dentoalveolar height and vertical, as well as sagittal, craniofacial dimensions. The maxillary and mandibular posterior dentoalveolar heights were considered as the dependent variables while gender, age and the cephalometric measurements were considered as independent variables. Dental casts were used to obtain comprehensive dental measurement including maxillary and mandibular intercanine, interpremolar, and intermolar widths, as well as the amount of crowding or spacing. Regression analysis was used to determine the statistical significance of the relationships between the dependent and independent variables.

**RESULTS:** An increase of ANS-Me and PP-MP, U6-PP, I6-MP and SN-occlusal plane had opposite effects on molar dentoalveolar heights. The lowest values for molar dentoalveolar heights were found in subjects with a wide PP-MP angle ( $P < 0.002$ ) and with a shorter ANS-Me distance ( $P < 0.001$ ). The other parameters had a slight opposite effect on molar dentoalveolar heights.

**CONCLUSION:** Individuals with a marked divergence of the jaws may also have reduced molar dentoalveolar vertical development. Moreover, the magnitude of the mandibular plane angle is an important diagnostic tool in determining the craniofacial pattern.

#### SP141 RELATIONSHIP BETWEEN OCCLUSAL CONTACTS AND STABILITY OF CORRECTED TOOTH IRREGULARITIES OF CANINES AND INCISORS: A LONGITUDINAL RETROSPECTIVE STUDY

Reinder Kuitert, Andrej Zentner, Sarah Alizadeh, Department of Orthodontics, ACTA, Amsterdam, Netherlands

**AIMS:** Overbite and overjet have been thoroughly studied but knowledge of the relationship between site and tightness of anterior interocclusal contacts and stability of corrected tooth irregularities is scarce. The aim of this study was to test the hypothesis that the stability of corrected tooth irregularities is warranted by a good and tight occlusion at the end of active treatment, and at least 3 years out of retention.

**MATERIALS AND METHOD:** Digitized plaster models of 75 successfully treated Class II division 1 malocclusion subjects from active treatment end (T2), and at least three years post-retention (T3). Interocclusal contacts or spacing mesial and distal to the upper incisors and canines were measured on digital models. The location and size of interocclusal contacts or spaces were assessed. Upper and lower anterior tooth irregularity was assessed on occlusal digital photographs and analyzed in a Viewbox program that distinguished between in- and outward tooth position with regard to a constructed ideal dental arch through the interdental contacts. Correlation tests, *t*-tests, and regression analyses were carried out to determine any possible relationship between interocclusal contacts or spaces and tooth irregularity.

**RESULTS:** A limited number of occlusal contacts (11 mesial, 12 and 22 distal) at T2 was significantly related to tooth irregularities at T3. There was a post-treatment tendency for

deterioration of irregularity and improvement of occlusion. However the 20 best occlusions at T2 showed the lowest lower anterior tooth irregularity at T3 and the 20 worst anterior crowding cases at T3 showed significantly more and larger interocclusal spaces at T2. At T2 and T3 significant correlations were found between tooth irregularity and occlusal contacts of antagonists. Significant correlations were also found at T2 and T3 between the irregularities of antagonists.

**CONCLUSION:** A relationship between tooth irregularity and interocclusal contacts was demonstrated at T2 and T3, however the possible relationship between occlusion at T2 and irregularity at T3 could not be fully confirmed.

#### SP142 COMPARISON OF DIETARY INTAKE BETWEEN FIXED ORTHODONTIC PATIENTS AND CONTROL SUBJECTS

Navid Kerayehchian<sup>1</sup>, Alireza Sarraf Shirazi<sup>2</sup>, Elham Nnik<sup>1</sup>, Majid Ghayour Mobarhan<sup>2</sup>, Gordon A Ferns<sup>3</sup>, <sup>1</sup>Hormozgan University of Medical Sciences, Bandarabbas, Iran, <sup>2</sup>Mashhad University of Medical Sciences, Iran and <sup>3</sup>University of Keele, Staffordshire, U.K.

**AIMS:** Adolescence is a period of rapid physiological and psychological development which is associated with changes in nutritional requirements. Orthodontic treatment is also commonly initiated during this phase of life, and nutritional intake may be affected by orthodontic therapy. The purpose of this study was to compare the nutrient intake between individuals with fixed orthodontic appliances and a control group matched for age and gender.

**SUBJECTS AND METHOD:** One hundred and eighty adolescents aged between 15 and 17 years (90 in the study group and 90 controls). Demographic data were collected by questionnaire and dietary intake was assessed using 24 hour recalls and analyzed by nutrition analysis software (Nutrition 4) to determine macro- and micro-nutrient intakes for both groups. Comparisons between groups were assessed by independent sample *t*-test and SPSS was used for statistical analysis.

**RESULTS:** Orthodontic patients consumed a similar amount of total calories, protein and carbohydrate ( $P > 0.05$ ). However, they had a greater intake of total, saturated, monosaturated, polysaturated, linolenic and linoleic fats and cholesterol, and a significantly lower intake of fibre, chromium and beta-carotene ( $P < 0.05$ ) than the control group. Other macro- and micro-nutrient intake did not differ significantly between groups.

**CONCLUSION:** Adolescents receiving orthodontic treatment have an altered dietary intake that can be harmful for their health. As adolescents are at a critical stage in their development, and dietary intake is of particular importance, it is suggested that targeted nutritional guidance is provided to patients during orthodontic treatment.

#### SP143 A COMPARISON OF SHEAR BOND STRENGTH OF IMMEDIATE AND DELAYED BONDING OF BRACKETS TO FIBRE REINFORCED COMPOSITE BARS USING VARIOUS ORTHODONTIC ADHESIVES

Navid Kerayehchian<sup>1</sup>, Farzin Heravi<sup>2</sup>, Mostafa Moazzam<sup>2</sup>, Elham Nik<sup>1</sup>, <sup>1</sup>Hormozgan University of Medical Sciences, Bandarabbas and <sup>2</sup>Mashhad University of Medical Sciences, Iran

**AIMS:** Fibre reinforced composite (FRC) bars have applications as bonded retainers, space maintainers and anchorage/movement units. However, the bond strength of attachments to FRC anchorage bars is unknown. The aim of this study was to compare the shear bond strengths (SBS) of brackets bonded immediately to FRCs with different orthodontic adhesive systems and bonded with the same adhesives after a 48-hour delay, abraded with a diamond bur and etched with phosphoric acid.

**MATERIALS AND METHOD:** One hundred and five recently extracted upper premolars were randomly assigned to seven groups (N = 15 teeth per group). FRCs were bonded to the buccal surfaces of the teeth and stainless steel orthodontic brackets were bonded to the FRCs with the following adhesive systems: Group 0 (Tetric Flow); groups 1, 2 and 3 (Immediate bonding with chemically cured, no-mix and light cured composites, respectively, the bars covered with Tetric Flow); and groups 4, 5 and 6 (bonding to FRCs delayed 48 hours, then bonded with chemically cured, no-mix and light cured composites, respectively,

the bars covered with Tetric Flow). The FRC bars in groups 4, 5 and 6 were abraded with a coarse-grit diamond bur before bonding the attachments to the bars. The SBS were measured with a universal testing machine, and the adhesive remaining on the teeth after debonding was scored with the Adhesive Remnant Index (ARI). Data were analysed using analysis of variance, Duncan's *post-hoc* and Fisher's exact test.

**RESULTS:** There were no statistically significant SBS differences between groups 0 (mean SBS: 9.56 MPa), 1 (mean SBS: 9.74 MPa), 2 (mean SBS: 10.72 MPa) or 3 (mean SBS: 9.54 MPa). Groups 4, 5 and 6 (bonding delayed by 48 hours) had SBS of 11.79, 11.63 and 13.11 MPa, respectively, which were significantly higher than the SBS in groups 1, 2 and 3 (Immediate bonding). There were no significant differences in ARI scores among the groups.

**CONCLUSION:** The mean SBS in all groups fell within the clinically acceptable range (>7 MPa). The combination of a 48-hour delay between placement of a FRC bar and bonding an attachment, abrading the FRC with a diamond bur and etching with phosphoric acid resulted in higher bond strengths.

#### SP144 PREVALENCE OF SELLA BRIDGE LIGAMENT CALCIFICATION AND TOOTH AGENESIS IN ORTHODONTIC PATIENTS

Alisa Tiro, Enita Nakas, Vildana Dzemic, Lejla Redzepagic-Vrazalica, Department of Orthodontics, University of Sarajevo, Bosnia and Herzegovina

**AIMS:** To test the null hypothesis that there is no increased prevalence of interclinoid ligament (ICL) or sella turcica bridge calcification evidenced on cephalometric radiographs in patients with congenitally missing teeth evidenced on dental pantomograms (DPTs).

**MATERIALS AND METHOD:** Lateral cephalograms and DPTs of 40 subjects between 12 and 18 years of age with congenitally missing teeth were collected and evaluated. Inclusion criteria was good-quality panoramic radiographs and lateral cephalometric radiographs with the sella turcica clearly visible. The anomalies recorded for each case included ICL calcification on the lateral cephalogram, and congenitally missing teeth on the DPT. The control group consisted of 60 subjects between 12 and 18 years of age, without congenitally missing teeth or other morphological and structural dental anomalies. Each radiograph was carefully inspected for the presence of ICL calcification. A direct visual method of examination was used.

**RESULTS:** In the congenitally missing tooth group, 12 of the 40 subjects (30%), showed ICL calcification (sella bridge). In the control group, 10 of the 60 subjects (16.6%) showed the presence of ICL calcification.

**CONCLUSION:** There is an increased prevalence of ICL calcification (sella bridge) in patients with tooth agenesis. These findings indicate an association between morphological variation of the sella turcica and tooth agenesis. The association between sella bridge ligament calcification and tooth agenesis are based on the influence of neurocrestal cells during the craniofacial development.

#### SP145 DIAGNOSTIC ACCURACY AND MEASUREMENT SENSITIVITY OF DIGITAL MODELS IN ORTHODONTICS: A SYSTEMATIC REVIEW

Gabriele Rossini, Tommaso Castorflorio, Eugenio Gambero, Andrea Deregibus, Cesare Debernardi, Specialization School of Orthodontics, University of Turin - CIR Dental School, Italy

**AIMS:** To assess the scientific evidence related to the accuracy and sensitivity of digital casts for common practice in orthodontics.

**MATERIALS AND METHOD:** PubMed, PMC, NLM, Embase, Cochrane Central Register of Controlled Clinical trials, Web of Knowledge, Scopus, Google Scholar and LILACs sources were searched in September 2014 to identify all peer-reviewed papers potentially relevant to the review. Methodological shortcomings were highlighted and the level of evidence was ranked using the SBU tool for assessing quality and the Cochrane Tool for Risk of Bias Assessment in Randomised Controlled Trials (RCTs).

**RESULTS:** Thirty relevant articles were selected (10 RCTs, 16 prospective non-randomized, 4 retrospective non-randomized). The quality of evidence was moderate among the selected sample, while low risk of bias was registered when analyzing RCTs. No

significant differences were observed for the majority of the studies in all the measured parameters. Comparison between digital and plaster models resulted in significant differences only in a few studies, regarding the mandibular first and second intermolar width, tooth size discrepancies, arch perimeter, Bolton analysis, torque, tip and rotation and the American Board of Orthodontics scoring.

**CONCLUSION:** Digital models are as reliable as traditional plaster models, presenting high accuracy, reliability and reproducibility. Furthermore, in view of their advantages in terms of cost, time and space required, they could be considered the new gold standard to achieve in current practice.

#### SP146 PLAQUE AND GINGIVAL BLEEDING INDEX OF ORTHODONTIC PATIENTS THAT RECEIVED REMINDERS ON THE IMPORTANCE OF ORAL HYGIENE. PRELIMINARY RESULTS

Juan-Guillermo Rojas-del Valle<sup>1</sup>, Ana López-Plasencia<sup>1</sup>, Ascensión Vicente<sup>1</sup>, Arturo Sánchez-Perez<sup>2</sup>, Luis-Alberto Bravo González<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Periodontics, Morales Meseguer, Murcia, Spain

**AIMS:** To evaluate, in a prospective, randomized, clinical trial, plaque and gingival bleeding of orthodontic patients who received oral hygiene instruction and active reminders.

**SUBJECTS AND METHOD:** At the present time nine patients have been selected following this inclusion criteria: aged between 12 and 18 years, need for treatment of upper and lower arch with fixed appliance, no medical or dental record related to periodontal disease and living with parents or legal guardian with a cellular mobile telephone. Patients were randomly assigned to three groups: Group 1. The patients were given oral hygiene instruction. Group 2. The patients received oral hygiene instruction and were instructed on how to brush their teeth. Group 3. The patients received oral hygiene instruction, were instructed on how to brush their teeth, and received a reminder text message weekly. Each patient was given an oral hygiene kit including toothbrush, toothpaste, interproximal toothpick and mouthwash. Oral hygiene was measured using the Plaque Index (PI) and Gingival Bleeding Index (GBI). The first measurements were taken before bracket bonding (T0) and the second measurements one month later (T1) by the same investigator who did not know to which group the subjects had been allocated. PI and GBI scores were compared within each group at T0 and T1 with a *t*-test for paired samples ( $P < 0.05$ )

**RESULTS:** For the three groups, no significant differences were detected between PI and GBI scores at T0 or T1 ( $P > 0.05$ ).

**CONCLUSION:** The preliminary results of this study show that for the three groups analyzed there were no significant changes in the indices carried out independently of the preventive method implemented. It is planned to increase the number of patients in each group, as well as the number of time-points during the course of treatment at which to measure these indices after the established baseline.

#### SP147 THE INFLUENCE OF DIAGNOSTIC RECORDS ON ORTHODONTIC TREATMENT PLANNING

Yazgi Ay, Özge Kiliç, Murat Kaptaç, Alev Yılmaz, Törün Özer, Department of Orthodontics, Adnan Menderes University, Aydin, Turkey

**AIMS:** To compare the diagnostic use of different incremental combinations of diagnostic information to a 'gold standard'.

**MATERIALS AND METHOD:** Pre-treatment archived diagnostic records of 51 Class I malocclusion subjects were randomly selected. Patients below 15 years of age were not included. Five diagnostic and treatment-planning sessions for every case were scheduled and six orthodontic postgraduates and four orthodontists planned orthodontic treatment of the subjects using the available diagnostic records. Five combinations of diagnostic information, or records, were presented with an approximate 1 month interval in the following order: (T1) study models only (S); (T2) S + facial photographs (F); (T3) S + F + panoramic radiograph (P); (T4) S + F + P + lateral cephalogram (C); and (T5) S + F + P + C + tracing. There was a period at least 1 month between each session to exclude (memory) bias. During each session a treatment planning questionnaire was provided that asked a number

of questions. A Mann-Whitney *U*-test was conducted to determine whether there was a difference between orthodontists and postgraduates. If no statistically significant difference was present, the data was pooled since the order in which the conditions were presented did not bias the results. Analysis of variance was conducted to determine whether the variation in outcome was because of differences in the combinations of diagnostic records employed. RESULTS: As the Mann-Whitney *U*-tests showed no statistically significant difference between orthodontists and postgraduates, the data were pooled for each session. The differences in means of the agreement between the five sessions were not statistically significant ( $P > 0.05$ ). This finding indicates that the diagnostic standard was not influenced by the number of diagnostic records.

CONCLUSION: The number of diagnostic records does not seem to have an influence on orthodontic treatment planning of patients with Class I malocclusions.

#### SP148 EFFECTS OF INCREASED OCCLUSAL VERTICAL DIMENSION ON THE JAW-OPENING REFLEX IN ADULT RATS†††

Mio Makiguchi, Yukiha Funaki, Chiho Kato, Satoshi Kokai, Takashi Ono, Department of Orthodontic Science, Tokyo Medical and Dental University, Japan

AIMS: Impaired occlusion and facial aesthetics are improved by the intentional increase in facial height by orthodontic extrusion of the posterior teeth when a deep overbite and a small mandibular plane angle are present. Thus, a better understanding of post-treatment stability of an increased occlusal vertical dimension in adult patients is important. However, few studies have investigated functional improvement of an increased occlusal vertical dimension in adults. In this study, the focus was on the jaw-opening reflex, which plays an important role in the control of jaw movements during mastication, as do the muscle spindles of the masseter muscle and temporomandibular joint mechanoreceptors. The purpose of this study was to investigate the effects of increased occlusal vertical dimension on the jaw-opening reflex using an electrophysiological technique.

MATERIALS AND METHOD: Thirty 13-week-old male Wistar rats randomly divided into control ( $n = 15$ ) and experimental ( $n = 15$ ) groups. The rats in the experimental group received a 2-mm build-up of composite resin on the maxillary molars at 13 weeks of age. The jaw-opening reflex was evoked by low-intensity electrical stimulation of the left inferior alveolar nerve. The electromyographic responses were recorded from the anterior belly of the digastric muscle at 15, 17 and 19 weeks of age. The latency, duration, and peak-to-peak amplitude were measured as the jaw-opening reflex properties for comparison between the two groups. Multivariate analysis of variance was used for inter- and intra-group comparisons. Simple main-effect analysis using the Sidak adjustment was used for multiple comparisons. Statistical significance was set at  $P < 0.05$ .

RESULTS: The latency of the jaw-opening reflex was significantly longer in the experimental group than in the control group at each time point, while the reflex duration was not significantly different. The peak-to-peak amplitude of the experimental group showed a significant decrease compared with the control group. Intra-group comparison of the latency and duration at 15, 17 and 19 weeks of age revealed no significant difference in either the control or experimental group.

CONCLUSION: The findings suggest that an increased occlusal vertical dimension causes a modification in the response properties of the jaw-opening reflex in adult rats.

#### SP149 COMPARISONS OF GENE EXPRESSION RELATED TO ANGIOGENESIS BETWEEN A COMPRESSED PERIODONTAL LIGAMENT WITH AND WITHOUT DEGENERATING TISSUE IN TOOTH MOVEMENT\*\*\*

Koji Noda<sup>1</sup>, Kyotaro Kogure<sup>2</sup>, Atsushi Tsuge<sup>1</sup>, Yoshiki Nakamura<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Tsurumi University, Yokohama and <sup>2</sup>Noda Orthodontic Dental Office, Tokyo, Japan

AIMS: To assess the difference of gene expression related to angiogenesis between a compressed periodontal ligament (PDL) with and without degenerating tissue (DGT) during experimental tooth movement.

**MATERIALS AND METHOD:** An elastic ring was inserted between the upper first and second molars of Wister rats, and the first molar was moved mesially. The experimental periods were 1, 3, 7, and 14 days after tooth movement. Seven rats were allocated to four experimental and control groups. Specimens including the first molars were processed for microcomputed tomography, light microscopy, and cyclopedic gene expression analysis (Agilent technologies, DNA microarray), selecting VEGF-A, FGF-2, MMP-9, and MMP-13 as angiogenesis factors.

**RESULTS:** Two different features were observed in the compressed PDL of an upper first molar. One was observed in a group with DGT in the PDL of the lingual distal root on days 1 and 3 (DGT/+), regarded as a heavy force condition. Another was in a group without DGT and with a narrow PDL width in the lingual central root on day 1 (DGT/-), regarded as a light force condition. Recovery of the PDL to the control level was observed on day 14 in both groups. Fold-change, gene expression ratio of each experimental group to control, of VEGF-A showed 2-fold on day 1 in DGT/+, while 3-fold on day 1 in DGT/-. FGF-2 showed near 2-fold on days 1 and 3 in DGT/+, while DGT/- was near the control level in all experimental periods. MMP-9 showed 4-fold on day 3 and 2.5-fold on day 7 in DGT/+, while DGT/- showed 4-fold on day 3. MMP-13 showed a decrease from 35-fold on day 1 to 3-fold on day 14 in both groups, and the fold-changes on days 3 and 7 were smaller in DGT/-.

**CONCLUSION:** It is suggested that angiogenesis genes appear in the early period after the start of tooth movement and the gene expression levels in the heavy force group were higher than in the light force group during recovery of the PDL to the control level.

#### SP150 COMPARISON OF GENE EXPRESSION RELATED TO INFLAMMATION BETWEEN A COMPRESSED PERIODONTAL LIGAMENT WITH AND WITHOUT DEGENERATING TISSUE IN TOOTH MOVEMENT\*\*\*

Kyotaro Kogure<sup>1</sup>, Koji Noda<sup>2</sup>, Atushi Tsuge<sup>2</sup>, Yoshiaki Nakamura<sup>2</sup>, <sup>1</sup>Noda Orthodontic Dental Office, Tokyo and <sup>2</sup>Department of Orthodontics, Tsurumi University, Yokohama, Japan

**AIMS:** To assess the difference in gene expression related to inflammation between a compressed periodontal ligament (PDL) with and without degenerating tissue (DGT) during tooth movement.

**MATERIALS AND METHOD:** An elastic ring was inserted between the upper first and second molars of Wister rats, and the first molar was moved mesially. The experimental periods were 1, 3, 7, and 14 days after tooth movement. Seven rats were allocated to four experimental and control groups. Specimens including the first molars were processed for microcomputed tomography, light microscopy, and cyclopedic gene expression analysis (Agilent technologies, DNA micro array), selecting HIF-1 $\alpha$ , TGF- $\beta$ 1, IL-1 $\beta$ , and IL-6 as inflammatory factors.

**RESULTS:** Two different features were observed in the compressed PDL of an upper first molar. One was a group with DGT that was observed in the PDL of the lingual distal root on days 1 and 3 (DGT/+). It was considered as a heavy force condition. Another was a group without DGT and with a narrow PDL width in the lingual central root on day 1 (DGT/-). This was considered as a light force condition. Recovery of PDL to the control level was observed on day 14 in both groups. Fold-change, gene expression ratio of each experimental group to control, of HIF-1 $\alpha$  showed near 3-fold on days 1 and 3 in DGT/+, while near 2-fold on day 1 and other period were near the control level in DGT/-. TGF- $\beta$ 1 showed less than 0.5-fold on days 1 and 3 and other periods were near the control level in both groups. IL-1 $\beta$  showed 6-fold on day 1 and 15-fold on day 3 in DGT/+, while 6-fold on day 1 and 3-fold on day 3 in DGT/-. IL-6 showed 6-fold on day 1 and 4-fold on day 3 in DGT/+, while all experimental periods were near or under the control level in DGT/-.

**CONCLUSION:** Heavy orthodontic force contributes to inflammatory gene expression in a period that appeared DGT and a light orthodontic force can moderate the inflammatory factors during tooth movement.

#### SP151 EARLY TREATMENT USING BONDED AND BANDED RAPID PALATAL EXPANDER – A COMPARATIVE SURVEY

Monika Králiková<sup>1</sup>, Miriam Alexandrová<sup>1,2</sup>, Simona Dianišková<sup>1,2</sup>, <sup>1</sup>Department of Orthodontics, Slovak Medical University, Bratislava and <sup>2</sup>Private Practice, Bratislava, Slovakia

**AIMS:** To identify the optimal protocol to improve treatment of maxillary compression using rapid palatal expanders (RPE) in the primary and early mixed dentition.

**MATERIALS AND METHOD:** Two types of questionnaires were completed by patients and orthodontists to determine subjective perception and objectives of treatment protocol of maxillary compression using RPE. The questionnaire for patients and their parents included questions about speech, mastication, hygiene and need for dental intervention. Questions for orthodontists were about their preference of RPE type and treatment protocols when using bonded or banded RPE.

**RESULTS:** Of the 60 Slovak and Czech orthodontists who responded to survey, 55.93 per cent reported that they used banded RPE, 45.76 per cent used bonded RPE, while 22.03 per cent did not use RPE for early treatment. When asked at what age they preferred to start RPE, 23.3 per cent said between 5-6 years of age, 30 per cent at 7-9 years of age, 14.97 per cent at 10-12 years and 6.67 per cent at the age of 13-14 years. Almost half of respondents preferred to activate the appliance one turn each day, one-third of them twice a day and 16.98 per cent once in two days. The alternate rapid maxillary expansion-constriction protocol was also used by 13.33 per cent. The RPE was left *in situ* by 43.4 per cent in the retention phase for 4-6 months. It was reported by 58.3 per cent that RPE treatment was unsuccessful in less than one-quarter of their patients. The reasons for treatment failure were: 63.89 per cent damage to the appliance, 41.67 per cent parent – non-compliance, 27.78 per cent child's intolerance. When complications were compared after removal of bonded and banded RPE, the most frequent complication (87.80%) in both cases was gingivitis in the area of the appliance/ Demineralisation was more common with bonded RPE. When patient's responses were considered, no significant difference was noticed. All reported mild difficulties with hygiene (parent's help needed mostly), slightly restricted speech, unlimited food intake (adjusted soft diet).

**CONCLUSION:** RPE is often selected as the first choice for early treatment in children with a crossbite and maxillary compression because of its positive attributes including fast-acting improvement of these malocclusions as prevention of restrained growth and temporomandibular problems, good retention and acceptable compliance with the appliance. Orthodontists describe less complications while removing banded RPE. Therefore its use is preferred as long as basic conditions are fulfilled (molars sufficiently erupted).

#### SP152 EVALUATION OF THE MODIFIED HUDDART BODENHAM INDEX AND GOSLON YARDSTICK FOR THE ASSESSMENT OF SURGICAL OUTCOME FOR CLEFT LIP AND PALATE

Yazeed Almuhizi, Anette Leser, Marie Pegelow, Department of Dental Medicine, Karolinska Institutet, Huddinge, Sweden

**AIMS:** The goals of surgical intervention for repair of a cleft lip and palate (CLP) are the restoration of normal morphology and speech without disruption of growth potential. Individuals who have had lip repair in early infancy show relatively normal maxillary growth, but maxillary hypoplasia is common when the palate has also been repaired early (Mars and Houston, 1990). The Goslon yardstick (Goslon) and the modified Huddart and Bodenham index (MHB) are two different indices for evaluating the surgical outcome and its effects on maxillary growth. Goslon ranks casts into one of five categories compared to a standard set of reference models reflecting the different categories. Category 1 which is favourable sagittal relationship to 5 which is poor sagittal relationship. The MHB has a continuous scale of severity of arch constriction between the jaws, measured for each tooth pair ranging from +1 to -3. The aim of this study was to identify the degree of correlation between the two different indices; Goslon and MHB, and to compare inter- and intra-examiner reliability.

**MATERIALS AND METHOD:** One hundred and seven plaster study models from 76 children diagnosed with unilateral CLP, taken at 5 and 10 years of age. Statistical analysis was performed using IBM SPSS Statistics 22,0 (IBM Corp., Armonk, New York, USA). The

MHB scores were correlated with the Goslon scores using Spearman's and Kendall's rank correlation coefficients.

**RESULTS:** The grouping of a continuous numerical scale (MHB) into the five categories of Goslon demonstrates that there is a trend from best to worst in a negative correlation. In the 5 year old group, Goslon groups 2 and 3 had an almost identical range for MHB. In age group 10 there were two dominating groups, groups 2 and 4, with different spreads in MHB but overlapping.

**CONCLUSION:** Moderate to high correlation was found between Goslon and MHB, with both MHB and Goslon having very good intra- and inter-examiner reliability. MHB grades small and more detailed information about the malocclusion in comparison with Goslon that has five broad categories.

#### SP153 DIFFERENCE IN JUDGMENT OF THE LOWER FACE BETWEEN ORTHODONTISTS AND LAYMEN

Sebahat Iskender, Reinder Kuitert, Department of Orthodontics, ACTA, Amsterdam, Netherlands

**AIMS:** To evaluate the difference between laymen and orthodontists in their judgment of the lower half of the face and the whole face

**MATERIALS AND METHOD:** Sets of three post-treatment photographs of 23 girls were judged by 36 laymen and 10 orthodontists. The laymen were 15 males and 21 females aged between 23 and 65 years, with a relatively high educational status; there were five male and five female orthodontists. The girls were between 11 and 13 years old at the start of orthodontic treatment with an overjet of at least 5 mm. At the end of treatment the girls were between 13 and 17 years and with an overjet between 1 and 3 mm. Each set of three photographs of one subject was shown on two occasions for 10 seconds. The first time only the upper part (above subnasale) of the face was shown and assessed on a visual analogue scale (VAS) from 0 (very unattractive) to 100 (very attractive). The second time the whole face was assessed. The reliability test was carried out to test the determine the reliability of the judgment of laymen and orthodontists; Paired samples *t*-tests were used to compare the VAS mean values of laymen and orthodontists

**RESULTS:** For the laymen there was no significant difference between judgment of the upper half of the face and judgment of the whole face. The orthodontists judged the whole face more positively than only the upper face. There was no significant difference between laymen and orthodontists when judging only the upper half of the face. However when judging the whole face a significant difference was found between these groups. Compared to the laymen, the orthodontists gave a significantly better judgment to the whole face

**CONCLUSION:** Laymen and orthodontist have the same opinion when judging attractiveness of the upper part of the face. The moment the whole face is shown the orthodontists have a different view; they are more positive then laymen. This seems to indicate that orthodontist compared to laymen look differently at the lower part of the face.

#### SP154 MECHANICAL PROPERTIES OF BISPHENOL-A FREE LINGUAL RETAINER ADHESIVES

Anna Iliadi<sup>1</sup>, Dimitrios Papadogiannis<sup>2</sup>, Theodore Eliades<sup>3</sup>, George Eliades<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Biomaterials, University of Athens, Greece and <sup>3</sup>Department of Orthodontics and Pediatric Dentistry, University of Zurich, Switzerland

**AIMS:** To comparatively evaluate the mechanical characteristics of two Bisphenol-A (BPA)-free versus conventional, with a BPA component, light-cured adhesives.

**MATERIALS AND METHOD:** The materials tested were: Transbond LR/TXA (BPA component) and two experimental adhesives based on PCDMA/EXA (aromatic, BPA-free) and on UDMA/EXB (aliphatic, BPA-free). The properties tested were: dynamic mechanical properties [shear modulus (SM), flexural modulus (FM), storage modulus (STM), dynamic viscosity (DV) and instrumented indentation properties [Vicker's hardness (HV), indentation modulus (EIT) and elastic index ( $\eta$ IT)]. Statistical analysis was performed by one-way ANOVA and Tukey tests ( $\alpha = 0.05$ ).

**RESULTS:** No statistically significant differences were observed in dynamic mechanical properties between TXA and EXA (corresponding mean values range SM: 2.9-3.2 GPa, FM: 7.8-10 GPa, STM: 3.2-3.3 GPa, DV: 11.4-12.9 MPa). However, EXB showed significantly lower values for all these parameters. For the instrumented indentation properties, TXA and EXA demonstrated significantly higher values than EXB (HV: 68-56 versus 34, EIT: 31-35 versus 7 GPa), except  $\eta$ IT (31-35 versus 40%).

**CONCLUSION:** From the two experimental materials tested, EXA performed similar to an already established material in the field, regarding an array of mechanical properties, without having a BPA-component.

#### SP155 COMPARISON OF HUMAN PERIODONTAL LIGAMENT RESPONSES TO CYCLIC AND STATIC MECHANICAL STIMULATION

Adamantia Papadopoulou<sup>1</sup>, Anna Iliadi<sup>2</sup>, Iosif Sifakakis<sup>2</sup>, Theodore Eliades<sup>3</sup>, Dimitris Kletsas<sup>1</sup>, <sup>1</sup>Laboratory of Cell Proliferation and Ageing, NCSR 'Demokritos', Athens, <sup>2</sup>Department of Orthodontics, University of Athens, Greece and <sup>3</sup>Department of Orthodontics and Pediatric Dentistry, University of Zurich, Switzerland

**AIMS:** To investigate the biochemical responses of human periodontal ligament fibroblasts (hPDLF) triggered by the application of cyclic and static tensile mechanical forces.

**MATERIALS AND METHOD:** Human PDL tissues explants were used to develop primary cultures of hPDLF. Cyclic and static tensile strain was applied to hPDLF with specifically designed devices. Western blot analysis was employed using specific antibodies against the phosphorylated forms of p38MAPK, JNK/SAPK, ERK and c-Jun. Gene expression of c-Fos, Runx2, Osterix (Osx), alkaline phosphatase (ALP) and osteopontin (OPN) was monitored by qRT-polymerase chain reaction analysis.

**RESULTS:** In the preliminary experiments it was found that both cyclic and static mechanical deformation immediately activates all three MAPK kinase signalling pathways (ERK, p38 and JNK), and also leads to rapid phosphorylation of c-Jun, one of the components of the activator protein-1 (AP-1) transcription factor. Moreover, the expression of the c-fos gene, a classical cellular response to mechanical stress, is also up-regulated. In all these experiments it seems that cyclic mechanical loading leads to a more intense and sustained activation. However, preliminary data indicate that the Osx gene, encoding for a transcription factor related to osteoblastic differentiation, was up-regulated only after static mechanical forces. On the other hand, the extended application of static loading, up to 15 days, on hPDLF does not seem to affect the expression of other gene markers of osteoblastic differentiation such as ALP.

**CONCLUSION:** hPDLF respond readily to both cyclic and static tensile deformation. However, there seem to be both quantitative and qualitative differences in the responses of hPDLF to these two types of stresses.

#### SP156 ROOT RESORPTIONS RELATED TO ECTOPIC AND NORMAL ERUPTION OF MAXILLARY CANINE TEETH – A THREE-DIMENSIONAL STUDY

Sigurd Hadler-Olsen<sup>1</sup>, Pertti Pirttiniemi<sup>2</sup>, Heidi Kerosuo<sup>1</sup>, Raija Lahdesmaki<sup>2</sup>, <sup>1</sup>Institute of Clinical Dentistry, University of Tromsø and <sup>2</sup>Institute of Dentistry, University of Oulu, Finland

**AIMS:** To assess the incidence and severity of root resorption of maxillary incisors caused by ectopically and normally erupting maxillary canines, and to analyse factors influencing root resorption of incisors using cone beam computed tomography

**SUBJECTS AND METHOD:** Fifty nine patients with a total of 80 canines. Forty-six of the canines in 37 patients were defined as ectopic, and 34 canines in 22 patients were defined as normal. The severity of root resorptions were analysed according to previously published studies by Ericson and Kurol. Multiple logistics regression was used to evaluate the association between various factors and root resorptions.

**RESULTS:** The prevalence of root resorptions was significantly higher in the ectopic canine group, 11 per cent of the central incisors and 67.6 per cent of the lateral incisors in comparison to 0 and 36.2 per cent in the normal erupting group. Most resorptions were defined as 'slight' and were located in the middle third of the root. There was a statistically

significant relationship between canines located mesial to the midline of the lateral incisor and root resorption on the maxillary incisors.

**CONCLUSION:** The present results indicate that root resorption of maxillary lateral incisors is common. Although significantly more frequent in patients with ectopically erupting canines, lateral incisor resorption is also found in association with approximately every third of normally erupting canines. The best predictor for root resorption seems to be location of the canine mesial in relation to the midline of the lateral incisor root.

#### SP157 ALVEOLAR BONE REMODELLING PATTERN AND POST-EMERGENT TOOTH ERUPTION OF UNOPPOSED MOLARS IN YOUNG AND ADULT RATS

Nikolaos Tzanidis, Domna Dorotheou, Ekaterini Giannopoulou, Stavros Kiliaridis, University of Geneva, Switzerland

**AIMS:** Previous clinical and animal studies have shown that overeruption of unopposed teeth is higher in young than adult individuals. The aim of this study was to investigate the eruption pattern and alveolar bone remodelling in unopposed molars of young and adult rats.

**MATERIALS AND METHOD:** In 16 animals, eight young (4-weeks old) and eight adults (22-weeks old), the right maxillary molar crowns were cut down. Eight animals of matched age were used as controls. Fluorochromes were injected at days 0, 13 and 28 of the experimental period (Calcein blue 30 mg/kg, Alizarin red 25 mg/kg, and Tetracycline 50 mg/kg, respectively). At the end of the experiment the animals were sacrificed and the mandibles were separated and embedded in methylmethacrylate. Standardized coronal sections, 150 µm thick, were obtained from the mandibular first and second molars. Evaluation of the eruption pattern and alveolar bone remodelling was based on the sites marked by the three fluorochromes.

**RESULTS:** Obvious displacement was detected in the unopposed molars of the young animals followed by equivalent bone apposition in the interradicular area and on the alveolar crest. Vertical displacement was also observed in the unopposed molars of the adult animals, although to a minor extent. The interradicular bone apposition in the adult animals was less marked than in the young rats.

**CONCLUSION:** The overeruption potential and alveolar bone remodelling of unopposed molars is higher in young than in adult rats. It is considered that the lower bone remodelling capacity in older animals may have contributed to impede the overeruption potential of the unopposed molars.

#### SP158 THE UTILISATION, CONTEXT AND FEATURES OF A SMILE IN ADVERTISING

Ana Lukez<sup>1</sup>, Iva Laus<sup>1</sup>, Visnja Katic<sup>1</sup>, Marijana Grbesa<sup>2</sup>, Stjepan Spalj<sup>1</sup>, <sup>1</sup>Department of Orthodontics, University of Rijeka and <sup>2</sup>Faculty of Political Science, University of Zagreb, Croatia

**AIMS:** To explore the utilisation, context and features of smile aesthetics in newspaper advertisements regarding the target audience.

**MATERIALS AND METHOD:** Three examiners analysed 600 advertisements from 46 magazines of various genres and publication periods using a conveniently made framing analysis form. The form consisted of 20 items regarding the presence of the people, the smile characteristics, the context of smile use, target audience, impression of success and health in both humans and advertisement. The  $\chi^2$  test and analysis of variance were used in statistical analysis.

**RESULTS:** Smile and its elements were often used in advertising (77.6% of the commercials with people present), as they connected the product or service with positive context and success ( $P < 0.001$ ). The advertisements with a smile present were rated as more successful than those with no smile, and no people ( $P < 0.001$ ). A spontaneous smile was related to more successful advertisements, when compared to a social smile ( $P < 0.001$ ). Elements of smile aesthetics (teeth and gingival visibility and exposure; presence and extent of buccal corridors) were not related to an advertisement's success.

**CONCLUSION:** A smile is often used in newspaper advertisements; a spontaneous smile contributes to the overall feeling of success and positive emotions more than a social smile.

It positively influences marketing communication, although the parameters of mini smile aesthetics have not as much influence on the success of an advertisement.

#### SP159 PULL-OUT STRENGTH OF WIRES FROM COMPOSITE ORTHODONTIC RETAINER ADHESIVES

Anna Iliadi<sup>1</sup>, Spiros Zinelis<sup>1</sup>, George Eliades<sup>1</sup>, Theodore Eliades<sup>2</sup>, <sup>1</sup>University of Athens, Greece and <sup>2</sup>University of Zurich, Switzerland

**AIMS:** To comparatively evaluate the pull-out strength of orthodontic wires from composite orthodontic adhesives used for bonding retainers.

**MATERIALS AND METHOD:** The material tested were: Transbond LR/TXA and two experimental Bisphenol-A (BPA)-free based on PCDMA/EXA (aromatic) and on UDMA/EXB (aliphatic). Material disks (Ø: 8 mm, h: 2 mm, n = 7) were prepared with a vertically orientated multistrand wire placed in the centre and cured for 30 seconds from the top and bottom surfaces employing a light emitting diode emitting 1,1 W/cm<sup>2</sup> in standard mode. The specimens were stored in water at 37°C for one week and then the wires were pulled-out (modified Shell-Nielsen test) employing a universal testing machine at 5 mm/minute crosshead speed. The results were expressed in N. The debonded wire regions were examined by stereomicroscopy to assess the failure mode. Statistical analysis was performed by Kruskal Wallis one-way ANOVA on ranks ( $\alpha = 0.05$ ).

**RESULTS:** The results of the pull-out strength test were as follows (N, median and 25-75% percentiles) TXA: 24.1 (23.1-24.2), EXA: 24.0 (21,2-24,2) and EXB: 24.2 (23.0-24,3). No statistically significant differences were found among the materials tested ( $P = 0.653$ ), with all specimens exhibiting adhesive failures at the metal-composite interface.

**CONCLUSION:** Regardless of the differences in the mechanical properties among the adhesives tested, the pull out strength of a stainless steel multistrand wire with these adhesives was of the same range.

#### SP160 MECHANICAL AND CHEMICAL ALTERATIONS OF CLEAR ALIGNER APPLIANCES AFTER INTRAORAL USE

Gerard Bradley<sup>1</sup>, Lauen Teske<sup>1</sup>, Spiros Zinelis<sup>2</sup>, George Eliades<sup>2</sup>, Theodore Eliades<sup>3</sup>, <sup>1</sup>Marquette University, Milwaukee, USA, <sup>2</sup>University of Athens, Greece and <sup>3</sup>University of Zurich, Switzerland

**AIMS:** To investigate the mechanical and chemical alterations of Invisalign appliances after intraoral ageing.

**MATERIALS AND METHOD:** Samples of Invisalign appliances (Align Technology, USA) were collected from a selected patient after intraoral placement for a mean period of 44 ± 15 days (group INV), whereas unused aligners of the same brand were used as reference (group REF). A small sample from the central incisor region was cut from each appliance and the buccal surface was analyzed by ATR-FTIR spectroscopy. The appliances were then cut and embedded in acrylic resin, ground/ polished in a grinding polishing machine, and the prepared surfaces were subjected to Instrumented Indentation Testing (IIT) under 4.9 N load and 2 second contact time. A total number of 25 force-indentation depth curves were recorded for each group and the following parameters were calculated according to ISO 14577-1;2002: indentation modulus (EIT), elastic to total work ratio. also known as elastic index ( $\eta$ IT) and Martens hardness (HM). Moreover, the indentation creep (CIT) was determined employing a tetragonal loading pulse (4.9 N force, 120 seconds). The mean values of the mechanical properties were statistically analyzed by unpaired *t*-test ( $\alpha = 0.05$ ).

**RESULTS:** ATR-FTIR analysis confirmed the urethane based structure of the appliances, without important chemical differences attributed to the ageing process. The INV group showed significantly lower EIT (REF: 2466 ± 20, INV: 2216 ± 168 MPa), HM (REF: 119 ± 1, INV: 110 ± 6 N/mm<sup>2</sup>) and higher  $\eta$ IT (REF: 40.0 ± 0.3, INV: 41.5 ± 1.2%) and CIT (REF: 3.7 ± 0.2 INV: 4.0 ± 0.1%). The increase in  $\eta$ IT indicates that INV is more brittle than REF, while the increase in CIT indicates a decrease in creep resistance.

**CONCLUSION:** Despite the lack of detectable chemical changes, intraoral ageing deteriorated the mechanical properties of the Invisalign appliance.

## SP161 MINI-IMPLANT RETAINED PONTICS IN GROWING PATIENTS: A NEW APPROACH

Roberto Ciarlantini<sup>1</sup>, Birte Melsen<sup>2</sup>, <sup>1</sup>Private practice, Recanati, Italy and <sup>2</sup>Section of Orthodontics, University of Aarhus, Denmark

**AIMS:** Temporary anchorage devices (TADs) have been used as support for a temporary pontic in growing patients with upper lateral incisor agenesis. However, both clinical observations and histologic studies demonstrate that this may lead to prevention of alveolar growth. The aim, based on a case series, is to demonstrate how an alternative use of TADs as support for temporary replacement of missing incisors can overcome the disadvantage.

**SUBJECTS AND METHOD:** Five patients (average age: 11 years 7 months) with agenesis of the upper lateral incisors were provided with a temporary pontic after orthodontic treatment. The pontics replacing six missing teeth were attached to Aarhus mini-implants with a bracket-like head inserted obliquely on the palatal side of the edentulous areas. A 0.021 × 0.025 inch stainless steel wire segment supported the construction of a pontic performed at the chairside on the day of insertion of the mini-implants. The patients were controlled annually for five years and the wire was adjusted for impingement. Intraoral and radiographic images were taken immediately after insertion of the mini-implants and at the annual visit five years following insertion.

**RESULTS:** No failures were observed and the soft tissues adapted well to the pontic over the years. The light pressure exerted to the central part of the mucosa due to the elasticity of the connecting wire, generated papillae between the pontic and the adjacent teeth. No inflammation of the soft tissues around the pontic was detected, as dental floss was used between pontic and mucosa due to absence of the mini-implant in the pontic area. Intraoral radiographs indicated alveolar development following eruption of the adjacent teeth.

**CONCLUSION:** A new technique for temporary replacement of missing lateral incisors allowing for vertical growth of the alveolar process has been developed. Inserted bicortical buccolingually, the mini-implants may contribute to preservation of both height and width of the alveolar process during growth, optimizing the later implant site.

## SP162 RANDO PHANTOM DOSIMETRY OF THREE-DIMENSIONAL CEPHALOMETRY

Maki Izawa, Naoki Kishida, Yasuo Harata, Noriyoshi Shiba, Yasuhiko Okumura, Department of Diagnostic & Therapeutic Sciences, Meikai University School of Dentistry, Sakado city, Japan

**AIMS:** To compare organ and tissue doses among scan protocols of cone-beam computed tomography (CBCT) and to recommend adequate scan protocols for three-dimensional (3D) cephalometry in orthodontics.

**MATERIALS AND METHOD:** Using 170 nanoDot optically stimulated luminescence dosimeters introduced to a female Rando phantom, organ and tissue doses were measured with the KaVo 3D eXam + CBCT unit in the 3D cephalometric mode with a field of view of 16 cm diameter and 13 cm height. The doses were compared among the protocols of HD (360° rotation, 620 frames, 120 kV, 5 mA, 7.4 seconds, 997 mGy cm<sup>2</sup>), Standard (360° rotation, 310 frames, 120 kV, 5 mA, 3.7 seconds, 495 mGy cm<sup>2</sup>), Quick (180° rotation, 170 frames, 120 kV, 5 mA, 2 seconds, 277 mGy cm<sup>2</sup>), and Quick+ (180° rotation, 170 frames, 90 kV, 3 mA, 2 seconds, 78.7 mGy cm<sup>2</sup>) scans. Display dose-area product (DAP) values for the scan protocols were calibrated using a PTW-Freiburg Diamentor E2 DAP meter.

**RESULTS:** The organ and tissue doses were proportional to the frames due to pulsed X-ray imaging between the HD and Standard scan protocols. The doses per DAP in a primary X-ray beam were similar between the Standard and Quick scans, and with both scans the values in a secondary beam were nearly equal, but with the Quick scan the values of some right and left organs were different. The doses per DAP in the primary beam were comparable between the Quick and Quick+ scans, however the values for the secondary beam were systematically lower with the Quick+ scan than with the Quick scan. The organ and tissue doses were roughly proportional to the DAP values among the scan protocols. The doses with the HD scan were almost 16-times higher than those with the Quick+ scan.

**CONCLUSION:** After orthodontic treatment planning with the Standard or HD scan the very low dose of the Quick+ scan is recommended especially for interim assessment of young patients.

#### SP163 THE THREE-DIMENSIONAL FINITE ELEMENT METHOD OF OCCLUSAL STRESS DISTRIBUTIONS OF FIRST MOLARS IN MICROMOVEMENT OF VARIOUS MOLAR RELATIONSHIPS

Kazuto Terada, Takashi Kameda, Natsuki Sano, Yukari Terashima, Department of Orthodontics, Nippon Dental University at Niigata, Niigata city, Japan

**AIMS:** Appropriate molar relationships should be indispensable for fragmentation of food for mastication and swallowing. The aim of this study was to investigate the relationship between contact patterns and occlusal relationships of the first molars to determine the biomechanical response during food crushing.

**MATERIALS AND METHOD:** Three-dimensional (3D) models were created for the 3D finite element method from plaster casts of normal Japanese upper and lower first molars without tooth roots (C4-304-#36, -#46, Nissin Dental Products Inc., Kyoto Japan). The models of the upper and lower molars consisted of 10,747 nodes and 7,156 elements, 12,727 nodes and 8,546 elements, respectively. Interocclusal clearance between the upper and lower molars, placed as a Class I relationship, were set at 2 mm. For various molar relationships, the lower first molar was placed at 0.5 mm and 1.0 mm from the buccal, lingual, mesial, and distal sides from the Class I relationship. A food model, consisting of 7,061 elements with 11,218 nodes, was inserted between the molars of various relationships. Young's modulus and Poisson's ratio of the molars and food models were set as 73,600 MPa and 0.3 and 112,400 MPa and 0.40, respectively. The upper molar model in each molar relationship was moved 1 mm downward for assessment of displacement and stress distribution of the lower molar (SolidWorks 2014, SolidWorks Corp., Massachusetts, USA).

**RESULTS:** Minimum displacement of the lower molars and uniform compression on their lower plane was observed in the Class I molar relationship. Compared to them, larger displacements of the lower molars toward the direction of the Class I molar relationship were observed in the occlusions of 0.5/1.0 mm deviated from the Class I molar relationship. Stress concentrations were observed in all molar relationships without a Class I relationship.

**CONCLUSION:** A Class I molar relationship plays an important role in the stability of the molar occlusion, leading to good oral function and health.

#### SP164 OCCLUSAL OUTCOME ASSESSMENT OF ORTHODONTIC TREATMENT PERFORMED AT AN EDUCATIONAL INSTITUTE IN DUBAI

Fadi Iyad Elshafee, Athanasios Athanasiou, Shazia Naser-ud-Din, Department of Orthodontics, Dubai College of Dental Medicine, Dubai Healthcare City, United Arab Emirates

**AIMS:** To assess occlusal outcome of comprehensive orthodontic treatment performed by postgraduate students at an educational institute in Dubai.

**MATERIALS AND METHOD:** Consecutive patient' files, including dental casts, were selected from the archives of the Boston University – Dubai (BU-D) (2008-2012), which had been transferred to the Dubai College of Dental Medicine. The final sample was formed following application of certain inclusion criteria and consisted of 30 patients in the permanent dentition who received comprehensive orthodontic treatment by means of fixed appliances in both dental arches. All pre- and post-treatment dental casts were blinded and assessed by the first author using the Peer Assessment Rating (PAR) and the Index of Complexity, Outcome, and Need (ICON). In order to test intra-examiner reliability, the examiner re-assessed 15 cases, which were randomly selected from the original sample, one week after the initial examinations. Statistical analysis included Student's *t*-, Mann Whitney *U* and X<sup>2</sup> tests and Spearman correlation coefficient. The level of significance was set at *P* < 0.05. Intra-examiner reliability, assessed using the root mean square error, was found to be high.

**RESULTS:** Occlusal outcome related to the orthodontic care provided was characterized by significant improvement. The mean PAR changed from 19.43 before treatment to 4.63 after

( $P < 0.001$ ) and the mean ICON from 53.96 before treatment to 19.06 after ( $P < 0.001$ ). According to PAR, 46.67 per cent of patients 'greatly improved' and 36.67 per cent 'improved'. According to ICON 23.33 per cent of patients 'greatly improved', 20 per cent 'substantially improved' and 20 per cent 'moderately improved'.

CONCLUSION: Patients treated at the Postgraduate Orthodontic Programme of BU-D demonstrated significant improvement of their occlusion.

#### SP165 *IN VITRO* SPECTROPHOTOMETRIC EVALUATION OF CLEAR THERMOPLASTIC RETAINER DISCOLOURATION\*\*\*

Anastasios A. Zafeiriadis<sup>1</sup>, Andreas Karamouzou<sup>1</sup>, Athanasios E. Athanasiou<sup>1</sup>, Theodore Eliades<sup>2</sup>, George Palaghias<sup>3</sup>, Departments of <sup>1</sup>Orthodontics and <sup>3</sup>Basic Dental Sciences, Faculty of Dentistry, School of Health Sciences, Aristotle University of Thessaloniki, Greece and <sup>2</sup>Department of Orthodontics and Pediatric Dentistry, Center of Dental Medicine, University of Zurich, Switzerland

AIMS: To investigate *in vitro* the effect of different staining solutions on colour stability of Vivera® retainers.

MATERIALS AND METHOD: Thirty flat specimens (50 × 23 mm) fabricated with Vivera® material (Align Technology Inc.) were equally divided into five groups, A, B, C, D and E. The specimens were immersed at 37°C in corresponding solutions of distilled water (control), coffee, tea, red wine, and Coca-Cola® that served as staining agents. A UV2400PC UV-VIS recording spectrophotometer was used to record the CIE colour parameters ( $L^*$ ,  $a^*$ ,  $b^*$ ) of each specimen before immersion in each solution (T0) as well as after 12 hours (T1), 3 days (T2) and 7 days (T3) of solution exposure. Colour differences ( $\Delta E$ ) between the interval groups were calculated. Statistical analysis included two-way repeated measures ANOVA and Bonferroni's test. Statistical significance was set at  $P < 0.05$ . The method error was assessed using Dahlberg's formula and Pearson's  $r$  correlation coefficient.

RESULTS: Statistically significant differences were observed concerning (a)  $L^*$  between T3 and T0, T1 and T2 for group B, (b)  $a^*$  between T0 and T1, T2 and T3 for groups B, C, D and E as well as between T1 and T2 for group C, and (c)  $b^*$  between T0 and T1, T2 and T3 for group B and between T0 and T2 and T3 for group C. The mean differences between  $\Delta E$  (T1-T0),  $\Delta E$  (T2-T0) and  $\Delta E$  (T3-T0) were statistically significant for groups B and C as well as the mean difference between  $\Delta E$  (T1-T0) and  $\Delta E$  (T2-T0) for group D. Total observed differences ranged from 0.03 to 2.86 units.

CONCLUSION: The colour of Vivera® retainers exhibited visible changes induced by several staining solutions, such as coffee, tea and red wine.

The present study was partially funded by the 2011 Clear Aligner Research Award Program of Align Technology, Inc.

#### SP166 CHEWING AMELIORATES AUTONOMIC NERVOUS RESPONSE TO STRESS AND PREVENTS ARRHYTHMIAS

So Koizumi, Shinjiro Miyake, Takero Otsuka, Kenichi Sasaguri, Toshitsugu Kawata, Department of Orthodontics, Kanagawa Dental University, School of Dentistry, Yokosuka, Japan

AIMS: To investigate whether chewing during stress acts as an active coping strategy which prevents stress-induced arrhythmias.

MATERIALS AND METHOD: Changes in electrocardiograms (ECG) and plasma catecholamine concentrations analyzed were in male Sprague-Dawley rats. In the experimental group, the rats were allowed to chew a wooden stick during a 1 hour period of immobilization stress. ECG activity was recorded using radiotelemetry and evaluated cardiac autonomic responses by fast Fourier transform of heart-rate variability before, during, and after the period of stress exposure. Low-frequency activity (LF) was determined as the total sum of spectrum power between 0.27-0.75 Hz, and high frequency activity (HF) as that between 0.75-3.3 Hz.

RESULTS: Chewing significantly reduced the occurrence of ventricular premature beats (VPBs) after immobilization and prevented stress-induced prolongation of the QT interval (a

measure of the time between the start of the Q wave and the end of the T wave) of the VPBs throughout the 10 hour experimental period. It also prevented the prolongation of QRS complex and the fluctuation of QT interval of the normal sinus rhythms preceding the VPBs during immobilization and the post-stress period, respectively. Heart-rate variability analysis of the ECG further showed that chewing significantly inhibited the stress-induced increase of the power ratio of LF/HF during immobilization, which is a marker of cardiac sympathetic activity. The reduced LF/HF ratio in the rats that chewed during immobilization was associated with the blunt responses of plasma noradrenaline at the termination of the stress. Similar suppressive effects on the occurrence of VPBs and the LF/HF ratio were observed in rats administered a beta-adrenergic blocker propranolol before immobilization.

CONCLUSION: These results suggest that chewing suppresses sympathetic hyperactivity, which in turn prevents post-stress arrhythmias.

#### SP167 METHODS TO ENHANCE WHITE SPOT LESION REMINERALIZATION IN ORTHODONTIC PATIENTS

Ahmed Samir Bakry<sup>1</sup>, Mona Aly Abbassy<sup>2</sup>, <sup>1</sup>Conservative Dentistry Department and <sup>2</sup>Orthodontic Department, King Abdulaziz University, Faculty of Dentistry, Jeddah, Saudi Arabia

AIMS: Development of white spot lesions (WSL) is one of the main problems associated with orthodontic treatment due to the difficulty in obtaining an excellent level of oral hygiene during the long periods of therapy. MI paste plus© is widely used to treat WSL associated with orthodontic treatment, however, there is still controversy regarding its efficiency to completely remineralize such lesions. Recently, a new method was introduced to facilitate prolonged application of MI paste plus© to remineralize caries enamel that involves protecting the MI paste by a layer of bonding agent, moreover, MI varnish© was introduced to improve enamel remineralization. This study aimed to compare the remineralization efficiency of a novel method of MI paste plus© application and MI varnish to the application MI paste plus©.

MATERIALS AND METHOD: Enamel specimens were obtained from the buccal and lingual surfaces of 80 extracted human non-carious third molars to obtain 160 enamel specimens. All specimens were immersed in a buffered demineralization solution with a pH of 4.5 for 4 days. Forty demineralized specimens had MI paste plus© applied for 4 minutes and then wiped out (MI), 40 specimens had MI paste© applied followed by application of SE-bonding agent (MI+SE), 40 specimens had MI varnish applied according to the manufacturers' instructions (MI-V), the rest of specimens served as controls (C). All specimens were stored for 5 days in artificial saliva. All specimens had their surface microhardness recovery (SMHR) measured with a microhardness tester (HMV-2 Shimadzu, Shimadzu, Japan) at 25 g load for 5 seconds to obtain Vicker's hardness number before and after the acidic challenge and after the remineralization procedures. One way ANOVA was used to compare the results ( $P < 0.05$ ).

RESULTS: The SMHR of the MI+SE group showed significantly higher values ( $P < 0.05$ ) when compared to the three other groups. The MI-V group had significantly higher values when compared to the MI and C groups ( $P < 0.05$ ).

CONCLUSION: The application of MI paste plus© in combination with bonding agent and MI varnish enhanced the remineralization capacity of enamel when compared to the application of MI paste plus©.

#### SP168 DETRIMENTAL EFFECTS OF TYPE 1 DIABETES MELLITUS ON TOOTH SIZE AND MINERAL CONTENT.

Mona Aly Abbassy<sup>1</sup>, Ippei Watari<sup>2</sup>, Ahmed Samir Bakry<sup>3</sup>, Ali Habib Hassan<sup>1</sup>, Takashi Ono<sup>5</sup>, <sup>1</sup>Orthodontic Department and <sup>3</sup>Conservative Dentistry Department,, King Abdulaziz University, Jeddah, Saudi Arabia and <sup>2</sup>Orthodontic Science, Department of Orofacial Development and Function, Division of Oral Health Sciences, Tokyo Medical and Dental University, Tokyo, Japan

AIMS: An Increasing number of orthodontic patients suffer from various systemic disorders affecting bone and tooth development. Understanding morphological tooth changes

associated with some systemic disorders may lead to early treatment of these problems and simplify orthodontic treatment. Type 1 diabetes is one of the most widely spread hormonal disturbances that affects various body tissues, however, the mechanism by which Type 1 diabetes mellitus (T1DM) affects the formation of enamel and dentine remains unclear. The goal of this study was to assess the effect of T1DM on enamel thickness, dentine thickness, dentine formation rate and dentine mineral apposition rate using the streptozotocin (STZ)-induced diabetic rat model.

**MATERIALS AND METHOD:** Experimental T1DM was induced in 3-week old male Wistar rats ( $n = 10$ ) by a single dose of 60 mg/kg body weight of STZ. Body weight, the presence of glucose in urine and blood glucose levels were recorded on days 0, 2, 7, 14, 21 and 28 after STZ injection. All rats were injected with calcein twice during the experiment and sacrificed at 7 weeks of age when the right mandibles were dissected. Micro-computed tomography ( $\mu$ CT) was used to compare the morphological changes in the tooth, enamel and dentine thickness of the T1DM group and the control group ( $n = 10$ ) at different regions of the crown analogue part along the axis of the mandibular incisor. Orientated sections of the rat incisor were obtained at the level of the mesial root of the second molar, allowing access to the maturation zone of the developing enamel and dentine. All results were compared using a Student's  $t$ -test ( $P < 0.05$ ).

**RESULTS:**  $\mu$ CT images showed that enamel and dentine thicknesses were significantly reduced (hypoplasia) by the T1DM. The histomorphometric study, using undecalcified sections, also showed significant deterioration of the dentine formation rate and the mineral apposition rate.

**CONCLUSION:** T1DM may have a detrimental influence on the formation of enamel and dentine during the early growth stage. A better understanding of how diabetes affects tooth structure will improve orthodontic treatment planning for diabetic patients.

#### SP169 EFFECTS OF THE TWIN BLOCK APPLIANCE ON JAWS AND FACIAL CHARACTERISTICS IN CLASS II MALOCCLUSIONS – A TWO- AND THREE-DIMENSIONAL EVALUATION

Stjepan Spalj<sup>1</sup>, Visnja Katic<sup>2</sup>, Bojana Krmeta<sup>2</sup>, Jasmina Primožic<sup>2</sup>, Maja Ovsenik<sup>2</sup>,  
Departments of Orthodontics, Schools of Medicine, <sup>1</sup>University of Rijeka, Croatia and <sup>2</sup>University of Ljubljana, Slovenia

**AIMS:** To evaluate dentoalveolar, skeletal and soft tissue changes induced by treatment of Class II division 1 malocclusions with the Twin Block (TB) appliance, in the pre-pubertal and peak pubertal growth stages.

**MATERIALS AND METHOD:** Lateral cephalograms and three-dimensional (3D) digital dental casts of 18 subjects aged 10-15 years (12 females) were analysed before treatment (T0) and after one year of treatment (T1) with the TB appliance. An expansion screw was incorporated in the maxillary plate and activated one quarter-turn each week for an average period of 6 months. Palatal volume and palatal surface area, palate height, maxillary and mandibular gingival surface area, premolar and molar widths and depths, overbite and overjet were measured on 3D dental casts. Sagittal and vertical skeletal maxillary and mandibular characteristics, incisor position and soft tissue features were analysed on cephalograms. Paired samples  $t$ -tests were used for statistical analysis.

**RESULTS:** Palatal volume, palatal surface area and maxillary gingival surface area increased significantly, while maxillary arch depth was reduced from T0 to T1 ( $P < 0.05$ ). Mandibular gingival surface area and molar depth were reduced ( $P < 0.05$ ) as a consequence of late mesial shift of the first permanent molar. Cephalometric analysis demonstrated stimulated mandibular growth and retrusion of both the maxillary incisors and upper lip ( $P < 0.05$ ).

**CONCLUSION:** Treatment with the TB appliance induces significant remodelling of the upper jaw and maxillary dental arch, and influences the soft tissue features, mainly due to retrusion of the upper incisors.

#### SP170 DEVELOPMENT AND VALIDATION OF A REFERENCE DATA SET FOR DENTAL AGE ESTIMATION OF THE MALTESE POPULATION

Waleed Elsnehawi<sup>1</sup>, Hani Alsaffar<sup>1</sup>, Graham Roberts<sup>2</sup>, Victoria Lucas<sup>2</sup>, Simon Camilleri<sup>1</sup>,  
<sup>1</sup>University of Malta, Msida, Malta and <sup>2</sup>King's College, London, U.K.

**AIMS:** To develop and validate a reference data set (RDS) for dental age estimation (DAE) of the Maltese population, and to evaluate any ethnic differences to a Northern European population through comparison with the United Kingdom (UK) Caucasian RDS.

**MATERIALS AND METHOD:** Dental panoramic tomographs (DPTs) of 1593 individuals aged between 4 and 26 years, taken from the archives of the Dental Department, Mater Dei Hospital, Malta were evaluated. Tooth development stages (TDS) were recorded for all 16 maxillary and mandibular permanent teeth on the left side and both third molars on the right, according to Demirjian's staging method (Demirjian *et al.*, 1973). Summary and percentile data were calculated for each TDS. The mean age of attainment was used with the unweighted average method to estimate the dental age (DA) of each subject as compared to the gold standard of the chronological age (CA). A separate study sample of 100 DPTs from the same database, composed of 100 males and 100 females aged between 4 to 26 years old of known CA, was used to validate the developed Maltese RDS and to test the DAE method. Student's tests were used to compare each paired TDS by gender for the Maltese and the UK Caucasians RDSs.

**RESULTS:** The mean difference between the CA and DA using the unweighted simple average method was 0.37 years (4.44 months) for females and 0.28 years (3.36 months) for males. The mean age of attainment was higher for Maltese than for UK Caucasians but there was no overall significant difference between the two RDSs.

**CONCLUSION:** DAE using the unweighted simple average method provides an accurate estimate of the age of Maltese subjects with an unknown date of birth. There is no significant difference between the Maltese and the UK Caucasian RDS.

#### SP171 THREE-DIMENSIONAL TREATMENT PLANNING IN ADULT PATIENTS WITH MODERATE CROWDING USING CLEAR ALIGNER THERAPY

Adele Riccio, Alessandro Carducci Arsenio, Antonella Maselli, Department of Orthodontics, San Pietro Hospital - University of Tor Vergata, Roma, Italy

**AIMS:** To illustrate three-dimensional (3D) treatment planning using clear aligner therapy (CAT) in adult patients with moderate crowding in the upper and lower arch.

**SUBJECTS AND METHOD:** Ten adults aged 25 to 35 years with a Class I malocclusion, normal skeletal pattern and moderate crowding. Lateral and panoramic radiographs were obtained of all patients at the beginning and end of treatment. The orthodontic treatment plan was carried out using CAT to programme expansion, alignment and levelling of the upper and lower arch performing interproximal reductions.

**RESULTS:** The mean treatment time was 11 months. At the end of treatment upper and lower crowding was corrected in all patients. Treatment resulted in correct inclination of the upper and lower incisors with optimization of the overjet and overbite and centred midlines.

**CONCLUSION:** CAT could represent a valid treatment option in adult patients with moderate crowding as a result of the staging of orthodontic movement, the biological force released and the possibility of minimum aesthetic impact.

#### SP172 EFFECTIVENESS OF EARLY COMBINED ORTHOPAEDIC AND FUNCTIONAL TREATMENT IN CLASS II PATIENTS WITH INCREASED OVERJET AND LABIAL INCOMPETENCE

Fabio Federici Canova<sup>1</sup>, Matteo Beretta<sup>2</sup>, <sup>2</sup>Practice, Monticelli Terme (PR) and <sup>2</sup>University of Insubria, Varese, Italy

**AIMS:** To assess the dental, skeletal, and soft tissue effects of early combined orthopaedic and functional treatment in Class II patients.

**SUBJECTS AND METHOD:** Twelve Class II patients (mean age  $7.4 \pm 1.5$  years) with maxillary transverse deficiency, mandibular retrusion, increased overjet and labial incompetence were treated with ERP followed by Sander bite jumping associated with a lip bumper. Lateral cephalograms were taken before therapy and at completion of orthopaedic and functional treatment. The mean duration of ERP was  $6 \pm 1$  month with an average

expansion of  $5 \pm 1.5$  mm, whereas for the bite jumping appliance the treatment duration was  $10 \pm 2$  months with a wax bite taken in an edge to edge position

**RESULTS:** All patients showed significant restraint in the sagittal skeletal position of the maxilla and an important mandibular response with an improvement in maxillo-mandibular sagittal skeletal relationships, also at the soft tissue level. The group exhibited a meaningful reduction in overjet and an increase in molar relationship. The upper incisors were significantly retruded while the lower incisors were slightly proclined so the lips became competent

**CONCLUSION:** This type of early treatment can be considered an effective protocol in reducing overjet and correcting labial incompetence in Class II patients with a combination of skeletal, dentoalveolar and soft tissue modifications, also for preventing dental trauma in growing patients.

#### SP173 MANDIBULAR FLEXURE MEASURED BY THREE-DIMENSIONAL DIGITAL CAST ANALYSIS: A PILOT STUDY.

Afroditi Kouli, Demetrios J. Halazonetis, Orthodontic Department, University of Athens, Greece

**AIMS:** Mandibular flexure is defined as the deformation of the mandible characterized by a decrease in arch width during jaw opening and protrusion movements because of the functional contraction of the lateral pterygoid muscles, causing high strain in the symphyseal area. The aim of this pilot study was to measure the arch width and mandibular flexure values at relative rest and maximum jaw opening in female Greek adolescents and young adults.

**SUBJECTS AND METHOD:** Twelve female subjects aged from 9 to 18 years. Impressions of the lower dentition were taken during relative rest at minimum mouth opening and at maximum jaw opening with a vinyl polysiloxane material of medium viscosity (Honigum® Handmix Mono-DMG) and CoE impression trays. The procedure was repeated for a total of four impressions per subject. The impressions were scanned and converted into digital casts with the use of a three-dimensional (3D) scanner. Superimposition of the digital casts at rest and maximum opening was performed at the level of the first molars. Mandibular flexure was measured as the difference in intermolar distance between the two casts.

**RESULTS:** The mean mandibular flexure in female Greek patients was found to be 0.08 mm (standard deviation: 0.08 mm). A large variation was noted between subjects. The error of measurements was significant and was mitigated by repeated impressions and measurements.

**CONCLUSION:** 3D digital cast superimposition was effective in measuring mandibular flexure.

#### SP174 CORRELATION BETWEEN THE FOLLICLE SIZE OF IMPACTED MAXILLARY CANINES AND ROOT RESORPTION OF LATERAL INCISOR

Abdullah Ekizer, Gülşen Cakmak, Süleyman Kutalmış Büyük, Department of Orthodontics, Erciyes University Faculty of Dentistry, Kayseri, Turkey

**AIMS:** To investigate effect of the follicle size of impacted maxillary canines to root resorption of the lateral incisor.

**MATERIALS AND METHOD:** Cone beam computed tomographs (CBCT) and panoramic radiographs of 20 children and adolescents aged  $15.80 \pm 6.05$  years with 22 palatally impacted maxillary canines to determine whether there is an association between widened dental follicles of the maxillary canines and resorption of the adjacent lateral incisors. All patients were in the permanent dentition and none had missing teeth. All of the impacted canines had a relationship with the lateral root. The width of the permanent maxillary canine follicle (cusp tip to the periphery of the follicle along the long axis) and the degree of resorption of the lateral incisor were measured on the CBCT and panoramic images. Four groups were formed according to the severity of resorption: no resorption (0); slight resorption: up to half of the dentine thickness to the pulp (1); moderate resorption: more than (2), pulp line intact (3) and severe resorption: the pulp is exposed (4). Spearman rank

correlation was used to verify the correlation between the follicle size of the impacted canine and lateral root resorption.

**RESULTS:** The mean follicle size was  $0.11 \pm 0.08$  mm on CBCT images and  $0.13 \pm 0.09$  mm on panoramic radiographs. There was a correlation between resorption of the lateral incisor and the width of the follicle size when determined both on CBCT ( $r = 0.46$ ;  $P < 0.05$ ) and panoramic radiographs ( $r = 0.44$ ;  $P < 0.05$ ). Significance was reached for the correlation between root resorption and follicle size of impacted maxillary canines.

**CONCLUSION:** Impacted maxillary canines cause mild to severe root resorption on the root of the lateral incisor. This resorption was associated with the follicle size of the impacted maxillary canines which had a relationship with the root of the lateral incisors.

#### SP175 COMPARISON OF ELECTRIC TOOTHBRUSH, PERSICA AND CHLORHEXIDINE MOUTHWASHES ON REDUCTION OF GINGIVAL ENLARGEMENT IN ORTHODONTIC PATIENTS

Nasrin Farhadian<sup>1</sup>, Mehdi Yaghoobi<sup>2</sup>, <sup>1</sup>Hamadan University of Medical Sciences and <sup>2</sup>Ahwaz University of Medical Sciences, Iran

**AIMS:** To compare the efficacy of chlorhexidine, Persica mouthwash and electric toothbrushes in improving gingival enlargement in orthodontic patients.

**SUBJECTS AND METHOD:** Seventy two orthodontic patients with at least two sites of gingival enlargement were randomly allocated to four equal groups: 1) manual toothbrush; 2) electric toothbrush; 3) manual toothbrush and Persica mouthwash; 4) manual toothbrush and chlorhexidine mouthwash. All participants were instructed to brush their teeth twice a day. and in groups 3 and 4 to use mouthwashes according to the manufacturers' instructions. Bleeding on probing, gingival, plaque and the hyperplastic indices were measured blindly at the start of the study and 2 weeks later. Data were analyzed using chi-square, ANCOVA and paired *t*-tests.

**RESULTS:** All groups showed significant improvements in the indices. Hyperplastic sites showed significant improvement of all indices except for the hypoplastic index in group 1 ( $P = 0.08$ ). No significant differences were found between groups 3 and 4.

**CONCLUSION:** The efficacy of Persica was similar to that of chlorhexidine in improving gingival conditions. Both were superior to toothbrushes but their clinical significance is questionable

#### SP176 *STREPTOCOCCUS MUTANS* COUNT IN PATIENTS WEARING RETAINERS WITH NANOSILVER INCORPORATED INTO THE ACRYLIC BASE VERSUS THOSE WEARING CONVENTIONAL RETAINERS

Nasrin Farhadian, Sajad Khanizadeh, Amirfarhang Miresmaeili, Hamadan University of Medical Sciences, Iran

**AIMS:** To evaluate the effect of silver nanoparticles incorporated into the acrylic base plate of orthodontic retainers on *S. mutans* counts.

**SUBJECTS AND METHOD:** Sixty six orthodontic patients at the debonding stage were randomly assigned to two gender-matched groups through stratified block randomization in a blind situation: group 1 received conventional removable retainers and group 2 removable retainers containing silver nanoparticles (about 40 nm in size and 500 ppm in concentration). Dental plaque samples were obtained 1 week after debonding, before placement of the removable retainer and 7 weeks later. Colony counts were assessed in a blind situation at baseline and at the end of the study. The results were analyzed using ANCOVA.

**RESULTS:** The number of *S. mutans* colonies increased in the control group at the 7 week interval but were not statistically significant. In group 2, colony counts decreased significantly compared with baseline and with the control group.

**CONCLUSION:** Adding silver nanoparticles to the acrylic plate of retainers had a strong antimicrobial effect against *S. mutans* under clinical conditions.

#### SP177 THREE-DIMENSIONAL ANALYSIS OF DISTAL MOVEMENT OF MAXILLARY FIRST MOLARS USING A MINI-IMPLANT AIDED TRANSPALATAL ARCH

Amirfarhang Miresmaeili, Ahmad Sajedi, Hamadan University of Medical Sciences, Iran

AIMS: To evaluate three-dimensional molar displacement after distalization using a mini-implant aided transpalatal arch (MIA-TPA).

SUBJECTS AND METHOD: This clinical study, approved by the ethics committee, WAS undertaken in 26 Class II patients who needed molar distalization. Miniscrews were inserted between the maxillary second premolar and first molar on the palatal side. Elastics were connected to the TPA with an average force of 150 g force/side parallel to the occlusal plane. A cone beam computed tomogram was taken to evaluate the precise position of the miniscrews relative to adjacent teeth, the maxillary sinus and the direction of force. When a Class I molar relationship was achieved, the distances from the incisive papilla to the mesiopalatal cusp of the first molars and intermolar width were measured on digital models.

RESULTS: Distalization, on average of  $2.33 \pm 1.1$  mm, was accomplished at a rate of  $0.4 \pm 0.2$  mm/month without significant rotation. The intermolar width of the molars increased  $2.86 \pm 1.8$  mm. The molars were intruded relative to the neighbouring teeth with a range of 0.05-0.84 mm.

CONCLUSION: MIA-TPA distalized the molars without extrusion and rotation, at a relatively slow rate.

### SP178 PREVALENCE AND CONCOMITANT APPEARANCE OF SOME DEVELOPMENTAL DENTAL ANOMALIES IN AN ORTHODONTIC POPULATION

Sofia Andrés, Josep Maria Ustrell, University of Barcelona, Spain

AIMS: To determine the prevalence of developmental dental anomalies (DDAs) existing in an orthodontic population, and observe any possible association among these entities.

MATERIALS AND METHOD: The records of 421 non-syndromic patients were evaluated. The anomalies observed were: agenesis of the maxillary lateral incisor, second premolar and third molar, supernumerary teeth, ectopic maxillary canines and crown-reduction of the maxillary lateral incisors. For statistical analysis the IBM SPSS statistics 20 program was used.

RESULTS: The prevalence of maxillary displaced canines was 8.8 per cent. Agenesis of the maxillary lateral incisors, second premolar and third molars was 4.3, 3.1 and 9.9 per cent, respectively. Lateral incisor microdontia was noted in 24.9 per cent and maxillary canine transposition in 1.4 per cent. Increases of maxillary lateral incisor microdontia and transposition of the maxillary canines related to a palatally displaced canine were observed. Crown-size reduction of the maxillary incisors influenced the absence of third molars. Individuals with palatally displaced canines showed a higher predisposition to tooth agenesis.

CONCLUSION: It seems that in patients with anomalous maxillary lateral incisors there is a higher probability of palatal canine impaction.

### SP179 MORPHOLOGY OF MANDIBULAR MUSCLES IN PATIENTS WITH DIFFERENT VERTICAL CRANIOFACIAL TYPES

Katrina Gardovska<sup>1</sup>, Ilga Urtane<sup>1</sup>, Zane Krisjane<sup>1</sup>, Gaida Krumina<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Institute of Stomatology and <sup>2</sup>Department of Radiology Riga Stradins University, Riga, Latvia

AIMS: To evaluate and compare the volume, cross-sectional area (CSA) and length of the masseter and medial pterygoid muscles between subjects with vertical, horizontal and neutral growth patterns

SUBJECTS AND METHOD: Seventy six patients with definite inclusion and exclusion criteria; 30 skeletal Class III and 26 skeletal Class II patients prior to the start of combined orthodontic treatment and orthognathic surgery and 20 Class I patients. Magnetic resonance imaging was performed for the mandibular muscles and the following two- and three-dimensional measurements were made: CSA, volume and longitudinal dimension for the masseter and medial pterygoid muscles. For the purpose of diagnosis and treatment planning, an examination was performed in the maxillofacial area, using cone beam computed tomography (iCAT) and cephalometric analysis was undertaken. All subjects were subdivided into three different growth type groups based on the mandibular plane-sella-

nasion angle (MP-SN) measurements: 19 subjects with a horizontal growth type (MP-SN <27°), 26 with a vertical growth type (MP-SN >37°) and 32 with a neutral growth type (MP-SN 27-37°). Data were analyzed using descriptive statistics, *t*-tests and correlation coefficients.

**RESULTS:** There was a statistically significant ( $P < 0.05$ ) difference between the vertical and horizontal groups in masseter muscle volume, CSA and length measurements. There was a difference between the study groups in medial pterygoid muscle volume and CSA with the highest values in the horizontal growth type group, but this was not statistically significant.

**CONCLUSION:** Differences exist in mandibular muscles between different growth type groups. Muscular values are higher in those with a horizontal growth type; masseter muscle has probably more relationship with growth type.

#### SP180 MOLECULAR EVENTS IN THE MID-PALATAL SUTURE DURING MAXILLARY EXPANSION

Sarah Alansari, Abdulmajeed Kaki, Renee Kojanis, Mani Alikhani, Consortium for Translational Orthodontic Research, New York University, USA

**AIMS:** Orthodontists routinely use tensile stresses along the maxillary suture to stimulate transverse growth of the upper arch. This mechanical stimulation is transformed into a biological response, which results in bone formation in the mid-palatal suture and a wider upper jaw. Based on these observations it is assumed that tensile forces are osteogenic. The aim was to investigate whether the application of tensile forces on the mid-palatal suture are directly osteogenic.

**MATERIALS AND METHOD:** Two hundred and forty growing rats (21 days old) were divided into control, sham and experimental groups. Experimental group animals were exposed to 100 g of tensile force across the mid-palatal suture using custom-designed and calibrated springs. Sham group animals received similar treatment but the spring did not produce any force. Control group animals did not receive any appliance. The animals were euthanized after 0, 1, 3, 7, 14, 28 and 56 days and the upper jaws were collected for micro-computed tomographic analysis, fluorescence and light microscopy and protein and reverse transcription polymerase chain reaction analyses. Comparisons between groups were assessed by analysis of variance. Pairwise multiple comparison analysis was performed with the Tukey *post-hoc* test.

**RESULTS:** Tensile forces significantly stimulate expression of inflammatory markers, accompanied by the recruitment of osteoclasts and development of temporary osteopenia. Bone formation was not observed until the later stages of expansion.

**CONCLUSION:** The bone formation observed in response to tensile forces is not a direct response to the forces but a consequence of the inflammatory response and extensive bone resorption that occur in the early stages after application of tensile forces. With this in mind, the mechanical regimen that is prescribed for expansion should focus on the activation of osteoclasts and expression of cytokines.

#### SP181 INFLUENCE OF LIPOPOLYSACCHARIDE ON EPHRIN/EPH EXPRESSION IN HUMAN PERIODONTAL LIGAMENT FIBROBLASTS

Minjie Li<sup>1</sup>, Chengfei Zhang<sup>1</sup>, Lijian Jin<sup>1</sup>, Koichi Matsuo<sup>2</sup>, Yanqi Yang<sup>1</sup>, <sup>1</sup>University of Hong Kong, Hong Kong SAR and <sup>2</sup>Keio University, Tokyo, Japan

**AIMS:** To clarify the mechanism of periodontitis-induced alveolar bone modification through ephrin/Eph signalling in periodontal ligament fibroblasts (PDLF) at the time-dependent level.

**MATERIALS AND METHOD:** Primary human PDLF were isolated from premolars extracted during orthodontic treatment in juvenile patients. PDLF were challenged with 0.1 µg/mL *P. gingivalis* lipopolysaccharide (LPS) for 6 to 48 hours. Untreated PDLF served as the control. Quantitative real-time polymerase chain reaction was performed to evaluate the expression of ephrinA2/EphA2 and ephrinB2/EphB4 released by PDLF.

**RESULTS:** After stimulation with LPS, the mRNA expression of ephrinA2 was significantly up-regulated in a time-dependent manner from 12 to 24 hours. At 48 hours, the ephrinA2 expression level was slightly decreased but remained markedly higher than the control.

EphA2 expression showed no change for the first 24 hours, after which there was a significant increase at 48 hours. EphB4 expressed lower mRNA at 12 and 24 hours compared to the control group, followed by an insignificant change at 48 hours. In contrast, the gene expression of ephrinB2 showed no dramatic change when treated with LPS up to 48 hours.

**CONCLUSION:** LPS has a suppressive effect on EphB4 expression contributing to osteogenesis inhibition and a stimulative influence on ephrinA2/EphA2 expression in PDLF leading to bone resorption. At the early stage of LPS challenge (12 and 24 hours), the up-regulation of ephrinA2 and down-regulation of EphB4 have a synergistic effect on bone resorption. However, the insignificant change of EphB4 and increase of ephrinA2 and EphA2 by 48 hours implies that ephrinA2/EphA2 may play a dominant role at the later stage of LPS stimulation. Elucidation of the PDLF communication stimulated by LPS sheds light on the difference between pathologic bone resorption caused by periodontitis and bone remodelling induced by orthodontic force loading, which contributes to a better understanding of the mechanism in orthodontic treatment with periodontal inflammation.

#### SP182 AN OVERVIEW ON THE PARAMETERS OF LOW-LEVEL DIODE LASER THERAPY FOR ACCELERATING ORTHODONTIC TOOTH MOVEMENT

Yanqi Yang, Chong Ren, Colman McGrath, Faculty of Dentistry, University of Hong Kong, Hong Kong

**AIMS:** The long duration of fixed appliance orthodontic treatment can put patients at high risk of dental caries, enamel demineralization, bone and root resorption and poor compliance. Recently, low-level laser therapy (LLLT) has been shown as a promising approach for accelerating orthodontic tooth movement, yet its efficacy remains unclear. The wide diversity in laser dosimetry and study methodology plays a critical role in determining treatment outcome. This study aims to provide an overview on the parameters of the low-level diode laser widely applied for speeding up orthodontic tooth movement.

**MATERIALS AND METHOD:** An extensive electronic search for randomized controlled trials (RCTs) and quasi-RCTs with a split-mouth design investigating the effectiveness of diode LLLT on accelerating tooth movement was performed through Cochrane Library (Issue 9, 2014), PubMed (1997), Embase (1947) and Web of Science (1956) up to October, 2014.

**RESULTS:** Out of 93 relevant results, five RCTs and three quasi-RCTs with a split-mouth design were selected. The parameters and regimens of diode LLLT were extracted and assessed. It was indicated that a diode laser with wavelength in the range of 780-810 nm, total energy within 0.2-2 J per treatment point or 2-8 J per tooth and 3-6 repeated applications each month after orthodontic force activation was more likely to have favourable accelerating effects.

**CONCLUSION:** A diode laser with optimal parameters was demonstrated to produce positive results. Future research with a better study design and appropriate laser dosimetry is required to confirm the efficacy of diode LLLT in accelerating orthodontic tooth movement.

(Supported by Health and Medical Research Fund 01121056)

#### SP183 MASSETER MUSCLE CHANGE AND STABILITY AFTER MANDIBULAR ADVANCEMENT SURGERY IN SKELETAL CLASS II HYPERDIVERGENT PATIENTS

Hyung-Seog Yu, Jee-Yeon Yoon, Jee-Hoon Moon, Han-Sol Song, Department of Orthodontics, Yonsei University, Seoul, Korea, South

**AIMS:** To evaluate skeletal relapse and to examine several factors, including the masseter muscle, contributing to skeletal relapse after mandibular advancement surgery.

**SUBJECTS AND METHOD:** Skeletal and masseter muscle changes were observed using three-dimensional computed tomography (3D-CT) and lateral cephalograms of patients with a skeletal Class II malocclusion with a hyperdivergent facial profile (1 male, 17 females) before surgery (T0), immediately post-operatively (T1), and 1 year after surgery (T2). Lateral cephalograms were used to measure mandibular body length (pGo-B), posterior face height (PFH; S-iGo), SNB, ANB, mandibular plane angle (MPA; SN/ML), gonial angle (Ar-pGo/ML),

ramus inclination (SN/Ar-pGo). 3D-CT were used to measure mandibular ramus height (RH) and the cross-sectional area (CSA) of the masseter and masseter angle.

RESULTS: 1. The initial advancement was on average 8.4 mm at point B. SNB was significantly increased and ANB decreased ( $P < 0.001$ ). The proximal segments, including the condyles, moved downwards ( $P < 0.05$ ) and mandibular body length and PFH increased significantly ( $P < 0.01$ ). There was a reduction of the MPA and ramus inclination ( $P < 0.001$ ). 2. At T2, the relapse measured at point B was 3.8 mm (45.4% of surgical advancement). SNB decreased and ANB increased ( $P < 0.001$ ). The proximal segments moved upwards ( $P < 0.001$ ) and mandibular body length and PFH significantly decreased ( $P < 0.001$ ). There was a significant increase of MPA ( $P < 0.001$ ) but no significant changes of ramus inclination. RH decreased significantly ( $P < 0.05$ ). 3. At T0, CSA and masseter angle were significantly lower than in the controls ( $P < 0.001$ ). At T2, there was no significant change in CSA but a significant increase was noted in masseter angle ( $P < 0.05$ ). 4. The amount of surgical advancement appears to be associated with skeletal relapse ( $P < 0.001$ ). No significant relationships were found between pre-operative MPA, counterclockwise rotation of the proximal segments, pre-operative CSA of the masseter muscle and skeletal relapse.

CONCLUSION: Osteotomy slippage, condylar resorption and insufficient intraoperative positioning of the condyle, resulting in subsequent condylar displacement, are thought to contribute to skeletal relapse. The amount of surgical advancement appears to be associated with skeletal relapse.

#### SP184 RELATIONSHIP BETWEEN THE POSITION OF THE MANDIBULAR PROXIMAL SEGMENT AND TEMPOROMANDIBULAR JOINT DISORDER AFTER SURGERY IN CLASS III ASYMMETRY USING THREE-DIMENSIONAL COMPUTED TOMOGRAPHY

Hyung-Seog Yu, Seung-Ah Seo, Jee-Yeon Yoon, Jee-Hoon Moon, Han-Sol Song, Department of Orthodontics, Yonsei University, Seoul, Korea, South

AIMS: To identify predictive factors in temporomandibular dysfunction (TMD) prognosis after intraoral vertical ramus osteotomy (IVRO) in Class III skeletal malocclusion subjects with asymmetry who had pre-operative temporomandibular joint (TMJ) sounds and pain.

MATERIALS AND METHOD: Computed tomographic (CT) images were obtained 1 month before surgery and 1 year after surgery of 29 Class III asymmetry patients. The subjects were reclassified according to joint sound, TMJ pain. Group I included patients whose symptoms improved or were unchanged and group II those whose symptoms worsened. Reconstructed three-dimensional CT images were used to measure intergonial distance (IGD), ramus height (RH), horizontal condylar angle (HCA), coronal condylar long axis angle (CCLA), coronal condylar vertical axis angle (CCVA), sagittal condylar angle (SCA), coronal ramus angle I (CRA) and TMJ space distances (A-B and C-D) on the deviated and non-deviated sides.

RESULTS: 1. There was no statistically significant difference in transverse and vertical asymmetry between sound-groups I and II and TMJ pain-groups I and II. 2. In the pre-operative period, the CCLA on the non-deviated side was greater ( $P < 0.01$ ) in sound-group II than in sound-group I, as was CCLA difference between the deviated and non-deviated side ( $P < 0.05$ ). 3. In the post-operative period, the HCA on the deviated side was smaller on the deviated side in sound-group II compared to sound-group I ( $P < 0.01$ ), as was the deviated CCVA ( $P < 0.05$ ). 4. The HCA had a greater post-operative increase on the non-deviated side than on the deviated side in sound-group II compared to sound-group I ( $P < 0.01$ ). 5. Post-operatively, the HCA was smaller on the deviated side ( $P < 0.05$ ) in TMJ pain-group II compared to TMJ pain-group I, as was the A-B distance (superior joint space) on the deviated side ( $P < 0.05$ ).

CONCLUSION: Class III malocclusion subjects with asymmetry that had a smaller post-operative increase of the HCA and superior joint space on the deviated side than on the non-deviated side, had worsened TMJ sound and pain after IVRO.

#### SP185 EVALUATION OF FACTORS AFFECTING PERCEPTION OF SMILE AESTHETICS IN DIFFERENT AGE GROUPS

Mohamed Bayome, Ji-Ah Yoo, Yoon-Ah Kook, Department of Orthodontics, The Catholic University of Korea, Seoul, Korea, South

**AIMS:** To evaluate the effect of combining several smile aesthetic characteristics (namely, the level of gingival display, the smile arc, and the buccal corridor) on the perception of smile, and to assess the differences of perception according to age groups of the Korean population.

**MATERIALS AND METHOD:** A photograph of the smile of a female volunteer was manipulated to create 12 grey scale photographs having all possible combinations of excessive, normal, or no gingival display, with a consonant or non-consonant smile arc, and with or without a buccal corridor. Each photograph was graded on a visual analogue scale by a panel of raters consisting of 51 young adults, 91 middle-aged, and 81 senior Korean layperson volunteers. Three-way analysis of covariance was performed to evaluate the effect of each variable and their interactions on the perception of smile as well as the effect of the age group. Regression analysis was performed to assess the importance of each factor.

**RESULTS:** The smile arc and the level of gingival display showed significant main effects on smile perception. Moreover, there was a significant interaction between these two factors. The senior group showed greater grades for the smiles compared to the other groups. Regression analysis demonstrated that the consonant smile arc had a coefficient of 1.36, and importance of 0.60, followed by the normal gingival display (0.30 and 0.40, respectively), meanwhile, the gummy smile had a negative coefficient of -1.0. There were no significant main effects of gender and buccal corridor on the perception of smile

**CONCLUSION:** The senior group had slightly more tolerance for smiles than the other groups. The smile arc was the main factor contributing to smile aesthetics, while the gummy smile had a negative effect. Therefore, it is recommended that clinicians pay further attention to the alignment of the anterior teeth and the vertical dimension of the anterior area in order to improve the smile aesthetics of orthodontic patients.

#### SP186 SKELETAL CHANGES IN CLASS III PATIENTS WITH DIFFERENT VERTICAL RELATIONSHIPS

Roberta Lione, Giuseppina Laganà, Valeria Paoloni, Lorenzo Franchi, Paola Cozza, Department of Clinical Sciences and Translational Medicine, University of Rome 'Tor Vergata', Italy

**AIMS:** To evaluate the dentoskeletal short-term effects of rapid maxillary expansion and facemask therapy (RME/FM) in a sample of Class III patients showing different vertical skeletal relationships.

**SUBJECTS AND METHOD:** Seventy-nine patients (35 females, 44 males) with a Class III malocclusion consecutively treated using RME/FM therapy with application of the protraction force in a downward and forward direction and inclination of about 30 degrees to the occlusal plane. All patients were evaluated at the beginning (T1; mean age, 7.7 years) and at end (T2; mean age, 9.2 years) of orthopaedic therapy and divided into three groups according to their vertical skeletal relationships: normal, hypodivergent and hyperdivergent. Statistical comparisons between the three groups were performed on the starting forms (T1), the final forms (T2), and the treatment changes (T1-T2) using ANOVA with Tukey's *post-hoc* tests.

**RESULTS:** Favourable modification in terms of maxillary advancement (changes in SNA ranging from 1.4 to 1.8°) and intermaxillary sagittal skeletal relationships (changes in Wits appraisal ranging from 2.5 to 3.5 mm) were recorded in all groups. The three groups showed no statistically significant differences in changes in either the sagittal or vertical skeletal variables.

**CONCLUSION:** Different vertical skeletal features do not influence the short-term outcomes of RME/FM therapy. All three groups exhibited the same amount of maxillary advancement and correction of the intermaxillary sagittal relationship along with similar changes in mandibular size and position, and they showed no differences in the vertical skeletal effects of RME/FM therapy.

#### SP187 IMPROVEMENTS OF THE LINGUAL-HERBST APPLIANCE\*\*\*

Dirk Wiechmann, Rainer Schwestka-Polly, Department of Orthodontics, Hannover Medical School, Hannover, Germany

**AIMS:** A possible issue during Class II treatment with the Herbst appliance and a completely customised lingual appliance (CCLA) is undesired debonding of the anchorage units on the first upper molars and lower canines. When using the next generation of CCLA, a modified Herbst appliance is used in combination with the lingual appliance according to an enhanced anchorage design. The associated question is: Will this reduce the number of possible complications?

**SUBJECTS AND METHOD:** Group A patients (n = 53) were treated with a standard Herbst design in combination with a CCLA of the first generation, Group B patients (n = 72) with a next generation CCLA and a modified anchorage unit involving labially bonded attachments which ensure more flexibility of movement for the telescoping Herbst tubes. Complications occurring during the Herbst phase were recorded and subsequently analyzed.

**RESULTS:** Group B patients exhibited significantly less complications than group A patients. When complications arose, they could be corrected in most cases, as opposed to group A, by minor clinical adjustments.

**CONCLUSION:** Using a modified lingual-Herbst appliance with the novel anchorage design will make lingual Class II treatment more reliable.

#### SP188 CHARACTERISTICS OF MALOCCLUSION AMONG SAUDI SPECIAL NEED GROUPS

Thamer Alkhadra, King Saud University, Riyadh, Saudi Arabia

**AIMS:** To determine the prevalence of malocclusions, occlusal traits, and their gender distribution in Saudi special needs school children such as Down Syndrome (DS) and autism.

**SUBJECTS AND METHOD:** Two hundred DS and autistic individuals equally divided into two groups with ages ranging from 6-14 years from five rehabilitation centres were examined for malocclusion (utilizing Angle's classification for diagnosis of malocclusion). Out of the 200 patients examined, 131 were male and 69 females, One hundred had DS and 100 had autism.

**RESULTS:** In the permanent molar relationship, the autism patients had more prevalence of Class I (40% right, 41% left) and Class II (16% right, 15% left), but the DS patients had more prevalence of Class III (66% right, 66% left). Likewise, in the permanent canine relationship, children with autism had a greater prevalence of Class I (11% right, 25% left) and Class II (3% right, 2% left) but the DS patients had more prevalence of Class III (30% right, 30% left). The left primary molar mesial shift in the autism subjects (32%) was more than in the DS (12%). The majority of the DS and autism groups had a 2 mm overjet (49% DS, 53% autism) and 20% an overbite (49% DS, 53% autism). Posterior right (26%) and left (24%) crossbites were highly persistent in the DS group. The DS and autism subjects generally had poor oral hygiene.

**CONCLUSION:** The DS patients studied had a Class III malocclusion in the molars and canine while the autistic patients had high left primary molar mesial shift with high Class I right and left permanent molar relationship.

#### SP189 COMPARISON OF DIRECT AND INDIRECT ORTHODONTIC BONDING TECHNIQUES IN TERMS OF DEMINERALIZATION: AN *IN VIVO* STUDY

Yasemin Nur Korkmaz, Ahmet Yağci, Department of Orthodontics, Erciyes University, Kayseri, Turkey

**AIMS:** Indirect bonding techniques were developed to reduce chair time and to ensure correct bracket positioning. Placing brackets in the right position facilitates the treatment process, thus enhancing patient comfort. The aim of this clinical study was to compare the enamel decalcification percentages in patients bonded with direct and indirect techniques using quantitative light induced fluorescence (QLF).

**SUBJECTS AND METHOD:** A total of 27 patients that met the inclusion criteria of a Class I malocclusion, no missing teeth or previous orthodontic treatment, minimum to moderate

crowding with no need for extractions. QLF images of 10 patients treated with indirect bonding (6 females, 4 males) and 17 patients treated with direct bonding (12 females, 5 males) were obtained at the beginning of treatment before bonding (T0) and at the end of treatment after debonding (T1). The existence and depth of pre- and post-treatment white spot lesions (WSL) on the buccal surfaces of the maxillary incisors, canines and premolars were interpreted by percentage fluorescence loss with respect to the fluorescence of sound tissue ( $\Delta F$ ) with QLF software. Analysis of the measurements was carried out by means of Wilcoxon signed rank test.

**RESULTS:** In the indirect bonded group, no significant difference of fluorescence loss was found for any of the evaluated teeth between T0 and T1 ( $P > 0.05$ ). Significant increases of fluorescence loss were found for the maxillary right central incisors ( $P = 0.017$ ), right first premolars ( $P = 0.049$ ), left canines ( $P = 0.016$ ) and left first premolars ( $P = 0.016$ ) buccal surfaces between T0 and T1 in the direct bonded group.

**CONCLUSION:** WSL formation is not unusual during fixed orthodontic treatment. Patients treated with the direct bonding technique were found to be more prone to WSL development during treatment than patients treated with the indirect bonding technique. The indirect bonding technique could be preferable considering the demineralization side effects of orthodontic treatment.

#### SP190 QUANTITATIVE LIGHT INDUCED FLUORESCENCE ASSESSMENT OF WHITE SPOT LESION EXTENT IN DIRECT AND INDIRECT ORTHODONTIC BONDING TECHNIQUES

Ahmet Yağci, Yasemin Nur Korkmaz, Department of Orthodontics, Erciyes University, Kayseri, Turkey

**AIMS:** White spot lesion (WSL) formation adjacent to brackets is frequent in patients receiving fixed orthodontic treatment since as brackets, wires and other attachments form plaque accumulation areas, brushing becomes difficult and natural cleaning mechanisms such as saliva and muscles are limited. Indirect bonding is a technique that allows bracket positioning in the right location on orthodontic dental casts, resulting in a less challenging treatment period. Indirect bonding resins are also different to those used in direct bonding. The aim of this study was to evaluate the extent of WSL areas with quantitative light induced fluorescence (QLF) and to compare the findings between two bonding groups.

**SUBJECTS AND METHOD:** Twenty seven non-extraction patients with a Class I malocclusion, were divided into two groups according to the bonding technique. Group 1 comprised 10 patients (6 females, 4 males) treated with indirect bonding and group 2, 17 patients treated with direct bonding (12 females, 5 males). Assessment was carried out on QLF images obtained at the beginning (T0) and end (T1) of treatment. The presence of pre- and post-treatment WSL and their area sizes on the buccal surfaces of the maxillary incisors, canines and premolars were calculated by QLF software. Differences were examined for significance by Wilcoxon signed rank test.

**RESULTS:** In the indirect bonded group, no significant difference of lesion area alteration was found for any of the evaluated teeth between T0 and T1 ( $P > 0.05$ ). Significant increases of WSL area sizes were found for the buccal surfaces of the maxillary right canines ( $P = 0.008$ ), left canines ( $P = 0.001$ ) and right first premolars ( $P = 0.012$ ) between T0 and T1 in the direct bonded group.

**CONCLUSION:** Direct bonding patients are more likely to have increased WSL area sizes at the end of treatment compared to indirect bonding subjects. The indirect bonding technique seems more favourable in order to avoid WSL.

#### SP191 COMPARISON OF CEPHALOMETRIC CRANIOFACIAL MORPHOLOGY AND DENTAL ARCH RELATIONSHIPS IN 5-YEAR-OLD CHILDREN WITH A UNILATERAL CLEFT LIP AND PALATE

Arja Heliövaara, Junnu Leikola, Department of Plastic Surgery, Helsinki University Central Hospital, Cleft Palate and Craniofacial Center, Helsinki, Finland

**AIMS:** To compare cephalometric craniofacial morphology with dental arch relationships in 5 year-old-children with a unilateral cleft lip and palate (UCLP).

**MATERIALS AND METHOD:** The Helsinki Cleft Palate and Craniofacial Center of the Scandcleft randomized trial participated with 92 patients operated on by two methods of primary surgery. Lateral cephalograms, study models, and dental photographs of 85 patients (30 girls, 55 boys) at a mean age of 5.1 years (range 4.9-5.9 years) were available. Twelve cephalometric angular and proportional measurements were obtained. Study models were assessed using the 5-year index by a blinded panel of 16 orthodontists of the Scandcleft study. The index, with five categories from excellent to very poor, is designed to rate dental arch relationships in children with UCLP. Pearson's correlation and Kappa statistics were used in the statistical analyses.

**RESULTS:** A highly significant negative correlation ( $r = -0.867$ ) was found between the cephalometric angle ANB (sagittal maxillomandibular relationship) and the 5-year index. Twenty per cent ( $n = 17$ ) of the lateral cephalograms were excluded because of poor quality ( $n = 2$ ) or inaccurate occlusion ( $n = 15$ ). Good to very good levels of intra- and interexaminer reliability were obtained for the model ratings.

**CONCLUSION:** Cephalometric angle ANB is highly associated with the 5-year index of dental arch relationships. The co-operation of the child and the need for lateral cephalograms to evaluate craniofacial morphology in 5-year-old children with UCLP has to be carefully considered.

#### SP192 A COMPARATIVE STUDY OF ANTERIOR TOOTH MOVEMENT BETWEEN SLIDING AND LOOP MECHANICS BASED ON SIMULATION OF LONG-TERM TOOTH MOVEMENT

Noriaki Yoshida, Ryo Hamanaka, Jun-Ya Tominaga, Hiroya Ozaki, Yoshiyuki Koga, Department of Orthodontics and Dentofacial Orthopedics, Nagasaki University Graduate School of Biomedical Sciences, Japan

**AIMS:** To verify whether sliding or loop mechanics could provide more effective torque control of the anterior teeth when varying the length of the lever arm in sliding mechanics or degree of gable bend in loop mechanics based on a newly developed simulation system for long-term tooth movement using the finite element (FE) method.

**MATERIALS AND METHOD:** A FE model of a maxillary dentition simulating *en masse* retraction was constructed. Orthodontic forces were applied while the model was restrained at the outer surface of the periodontal ligament (PDL). The PDL was then restored to its original configuration and width by displacing the nodes of its outer surface. The procedure was repeated to carry out long-term tooth movement. In the sliding mechanics model, a retraction force of 3 N was applied to lever arms of 0, 2, 4, 6 and 8 mm. In the loop mechanics model, a gable bend of 0, 5, 10, 15, 20, 25, or 30 degrees was placed into a closing loop and activated by 1 mm. The movement patterns of the anterior teeth in sliding and loop mechanics were analyzed and compared.

**RESULTS:** In the sliding mechanics model, bodily movement was not achieved even if the retraction force passed through the centre of resistance of the anterior segment. Lingual crown tipping of the anterior teeth was observed within the height level of 8 mm. In the loop mechanics model, lingual crown tipping of the anterior teeth was remarkable immediately after activation even if gable bends were included. On the other hand, once the horizontal and vertical legs of a loop came in contact, the moment-to-force ratio created by the loop became large enough to achieve controlled anterior tooth movement.

**CONCLUSION:** Bodily movement is considered to be difficult in sliding mechanics with a lever arm height shorter than 8 mm. In loop mechanics, as long as the loop is opened during activation, lingual crown tipping of the anterior segment is more likely to occur even if gable bends are included in the loops. However, after the loop is closed, a substantial amount of moment-to-force ratio is generated and root movement can be achieved.

#### SP193 ORTHODONTIC RETENTION PROCEDURES IN SWITZERLAND – A SURVEY OF GENERAL DENTAL PRACTITIONERS

Michael Habegger<sup>1</sup>, Anne-Marie Renkema<sup>2</sup>, Ewald Bronkhorst<sup>3</sup>, Piotr Fudalej<sup>1</sup>, Christos Katsaros<sup>1</sup>, <sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics, University of Bern, Switzerland and <sup>2</sup>Nijmegen Medical Centre and <sup>3</sup>Department of Dentistry, Radboud University Nijmegen, Netherlands

**AIMS:** Many patients who have completed orthodontic treatment and wear fixed retainers are routinely seen by general dentists. The aim of this study was to explore how general dentists deal with the occasional complications associated with fixed retainers (such as loose, broken or so-called `active` retainers). A further aim was to find out the dentists` opinion regarding who they think should be responsible for patients in the retention phase: orthodontists or dentists and finally, to explore whether dentists would like to have clinical guidelines for patients in the retention phase.

**MATERIALS AND METHOD:** A structured questionnaire containing mainly multiple choice questions was sent to 201 randomly chosen dentists. The questionnaire comprised questions regarding the dentist`s education, experience in placement and repair of retainers, advantages and disadvantages of the different types of bonded retainers, with whom responsibility lies for a patient in retention, and communication between dentists and orthodontists. Descriptive statistics were performed.

**RESULTS:** The response rate was 61 per cent. Thirty three per cent of the respondents had experience with bonding retainers and the majority of the dentists were familiar with follow-up and repair of fixed retainers. If a complication was found they communicated with the orthodontist and the more severe the complication, the more intense was the communication. Most dentists hesitated to remove retainers upon the patient`s request and attempted to convince their patients otherwise by warning them of possible long-term effects. Retainers bonded on all six anterior teeth were judged as being more efficient than those bonded on canines only; however, their possible side-effects (e.g. inadequate torque-control), were not well known. Sixty six per cent of dentists were willing to take responsibility for patients in retention as early as 6 months after retainer placement. Almost half of the dentists (44%) would like to obtain information regarding fixed retainers, while the vast majority (93%) would prefer establishment of standardized guidelines.

**CONCLUSION:** Swiss general dentists have a good knowledge of retainers and follow-up procedures. Nevertheless, they would welcome further training and creation of clinical guidelines.

#### SP194 OCCLUSAL OUTCOME ASSESSMENT OF ORTHODONTIC TREATMENT PERFORMED AT THE POSTGRADUATE ORTHODONTIC PROGRAMME OF ARISTOTLE UNIVERSITY OF THESSALONIKI

Anastasia G. Pariskou<sup>1</sup>, Athanasios E. Athanasiou<sup>2</sup>, <sup>1</sup>Orthodontic Specialist, Lagadas, Greece and <sup>2</sup>Department of Orthodontics, Aristotle University of Thessaloniki, Greece and Dubai College of Dental Medicine, U.A.E.

**AIMS:** To assess occlusal outcome of treatments performed at the Postgraduate Orthodontic Programme of Aristotle University of Thessaloniki during 1998-2009.

**MATERIALS AND METHOD:** Consecutive orthodontic patient files, including dental casts, were selected from the archives. Following application of certain inclusion criteria the final sample consisted of 109 patients in the permanent dentition who received orthodontic treatment by means of fixed appliances. The records were divided into two groups depending on the period when treatment took place (group 1: 1998-2003; group 2: 2004-2009). All pre- and post-treatment dental casts were blinded and assessed by the first author using the Peer Assessment Rating (PAR) Index and the Index of Complexity, Outcome and Need (ICON). In order to test intra-examiner reliability, the examiner re-assessed 10 cases randomly selected, one week after the initial examinations. Statistical analysis included Student`s *t*-test, Mann Whitney *U* test, X<sup>2</sup> test and Spearman correlation coefficient. The level of significance was set at  $P < 0.05$ . Intra-examiner reliability was assessed using the root mean square error and was found to be high.

**RESULTS:** In group 1 the mean PAR index changed from 28.6 before treatment to 5.5 after treatment and the mean ICON from 71.9 before treatment to 23.5 after treatment. In group 2 the mean PAR index changed from 23.6 before treatment to 4 after treatment and the mean ICON from 62.8 before treatment to 19.8 after treatment. The mean PAR score reduction was 78.4 per cent for the group 1 and 81.4 per cent for group 2. Ninety per cent of cases in group 1 and 89.8 per cent of cases in group 2 had a post-treatment ICON score <31. The occlusal outcome of treatment was not correlated to the gender and age of the patients, the

number of postgraduate students involved or the presence or absence of tooth extractions in the treatment plan. On the contrary the severity of initial malocclusion was found to be positively correlated with the treatment occlusal outcome. When the treatment plan included extractions and there was more than one postgraduate student involved, there was significant lengthening of treatment duration.

**CONCLUSION:** Patients treated at the Postgraduate Orthodontic Programme of Aristotle University of Thessaloniki during 1998-2009 demonstrated significant improvement of their occlusion.

#### SP195 A MOLECULAR LANDSCAPE FOR OROFACIAL CLEFTING

Michelle Thonissen<sup>1</sup>, Christian Schoen<sup>1</sup>, Hans Von den Hoff<sup>1</sup>, Carine Carels<sup>1</sup>, Geert Poelmans<sup>2</sup>, Departments of <sup>1</sup>Orthodontics & Craniofacial Biology and <sup>2</sup>Human Genetics, Radboud University Medical Center, Nijmegen, Netherlands

**AIMS:** To gain insights into the biological processes underlying orofacial clefts (OFCs).

**MATERIALS AND METHOD:** A bioinformatics and systematic literature analyses of the 169 top-ranked genes (*P*-value for association < 10<sup>-4</sup>) from five published genome-wide association studies (GWASs) of sporadic OFC were combined to build a molecular landscape of functionally interacting proteins. Proteins implicated in OFCs through syndromic OFC candidate gene studies as well as gene expression and genetic animal studies into the landscape were also integrated.

**RESULTS:** The landscape was located in palatal epithelial cells and contained a number of molecular signalling cascades involving 86 of 169 GWAS genes (51%) and 68 other OFC candidates. These cascades regulate all of the key processes involved in normal palatogenesis.

**CONCLUSION:** In addition to providing important novel and more detailed insights into the molecular mechanisms underlying OFCs, the landscape can be further explored for clues towards novel diagnostic biomarkers, including environmental triggers that could be instrumental in developing preventative measures against the occurrence of OFCs.

#### SP196 ASSESSMENT OF METHODOLOGICAL QUALITY OF ORTHODONTIC STUDIES REGARDING EXTRACTION/NON-EXTRACTION PATIENTS – A SYSTEMATIC REVIEW

Maria Mitus-Kenig<sup>1,2</sup>, Daria Nowak<sup>2</sup>, Elzbieta Pawlowska<sup>3</sup>, <sup>1</sup>Department of Stomatological Prevention and Hygiene, <sup>2</sup>Jagiellonian University Medical College, Krakow and <sup>3</sup>Department of Orthodontics, Medical University, Lodz, Poland

**AIMS:** The extraction of teeth for orthodontic purpose has always been a controversial subject in the speciality. There are a substantial number of published papers regarding this topic. However, its evidence based quality remains questionable. Therefore, the aim of this systematic review was to assess the methodological quality of these studies.

**MATERIALS AND METHOD:** The literature available in two electronic databases (PubMed and Ovid Embase) was systematically reviewed by searching using combinations of keywords and citations from January 2009 to October 2014. The Oxford Centre for Evidence-Based Medicine (CEBM) level of evidence and the Methodological Index For Non-Randomized Studies (MINORIS) criteria were used to grade the articles.

**RESULTS:** A total of 697 papers were found in the initial search. Fifty-eight studies were included in the final analysis with 5057 patients. There were two randomised studies, 24 were prospective and 34 retrospective. The majority of the studies were level 4 evidence according to the CEBM. Only two studies met the criteria for level 3a and two for level 2b. The median MINORS score was 12 (range 7-21), demonstrating significant methodological heterogeneity among studies.

**CONCLUSION:** Extraction and non-extraction protocols are two different methods of treatment but they seem to show similar orthodontic results. However, to obtain reliable scientific evidence better controlled and well-designed randomised controlled trials are needed. Future studies should also include assessment of patient satisfaction, quality of life and pain experience as well as analysis of the costs of treatment.

## SP197 ORTHODONTIC MANAGEMENT AFTER TRAUMA AND MULTIPLE FAILURE OF INCISORS DURING CHILDHOOD AND ADOLESCENCE – THE PART OF INTEGRATED CARE

Winfried Harzer, Eve Tausche, Lilian Bauer, Tomas Gedrange, Department of Orthodontics, Technical University of Dresden, Germany

**AIMS:** Severe traumatic injuries of the teeth and midface in children are increasing. The multiple failures of anterior teeth and traumatic injuries of alveolar bone are more frequent. The aim of this retrospective study was to determine the best option for orthodontic and interdisciplinary treatment to prevent inhibition of growth and development.

**SUBJECTS AND METHOD:** Twenty three patients (13 girls, 10 boys, between 7 and 14 years of age). Eleven of them suffered from multiple tooth failure immediately after an accident (>2). In two patients loss of the primary incisors was followed by loss of damaged permanent teeth. Three teeth were intruded and after eruption either the root was ankylosed or resorption had started. In the other patients a subluxation crown fracture and severe subluxation occurred.

**RESULTS:** The gender relationship for severe tooth trauma is contrary to the prevalence of single tooth injuries which are more prevalent in boys. Multiple trauma of the teeth and alveolar bone has to be part of integrated orthodontic and paediatric care. The options of space closure, space opening for implants, tooth transplantation and root extrusion have to be combined for optimal treatment outcome. For instance tooth transplantation and space closure was used in one patient with loss of two incisors. In another case the combination of space closure with one implant was the best option in a patient with failure of three teeth. Space closure, combined with unilateral maxillary distraction for stimulation of midface growth and development, was used in a third case.

**CONCLUSION:** Orthodontic management after multiple tooth failure and alveolar trauma should be an integrated part of general dental care. The combination of orthodontic or prosthodontic space closure and/or tooth transplantation could be the best treatment option.

## SP198 CLEAR ALIGNERS IN THE MULTIDISCIPLINARY TREATMENT OF HOPELESS MAXILLARY LATERALS

Mario Greco, Gianluca Mampieri, Aldo Giancotti, University of Rome Tor Vergata Fatebenefratelli Hospital, Rome, Italy

**AIMS:** To illustrate and test the use and efficacy of customized clear aligner therapy (CAT) to produce tooth translation movements and radicular control in cases of extraction of maxillary lateral incisors and space closure mechanics.

**SUBJECTS AND METHOD:** Sixteen young adults aged 22 to 30 years, with a Class II subdivision malocclusion (full Class II on one side, Class I on the other), severe localized maxillary anterior crowding, a hyperdivergent skeletal pattern and altered overjet and overbite. Panoramic and lateral radiographs were obtained at the beginning and end of treatment. All patients were treated by means of CAT to correct the malocclusion based on maxillary lateral extractions (because of crowding and decay) and anterior space closure by means of mesial movement of the lateral and posterior teeth. To achieve translation movement of the posterior teeth (on the Class I relationship side) with correct root control, fixed sectional appliances were bonded on the lingual side of the maxillary first molars and premolars. A stainless steel 0.018 × 0.018 inch archwire was inserted in the brackets and the planned aligners were customized with precision cuts to best fit the teeth and the sectional during lateral space closure. The maxillary canines were extruded, while the maxillary premolars were intruded and restored.

**RESULTS:** All patients showed, at the end of treatment, a full Class II molar relationship and a Class I canine relationship with a correct overjet and overbite. Mesial movement of the mid maxillary arch was achieved with a combined appliance.

**CONCLUSION:** Modified CAT with fixed sectional appliances is an efficient technique to manage root movements in anterior space closure treatment.

## SP199 ASSESSMENT OF THE BOND STRENGTH OF A RESIN-MODIFIED GLASS IONOMER VERSUS COMPOSITE: AN EXPERIMENTAL STUDY

Nassiba Fatene<sup>1</sup>, Nassiba Errabti<sup>2</sup>, Zakaria Bentahar<sup>3</sup>, Mohammed Malek<sup>3</sup>, L. Tourissa<sup>4</sup>,  
<sup>1</sup>Department of Dento-Facial Orthopedic, <sup>3</sup>Hassan II University, Faculty of Dentistry, Casablanca, <sup>2</sup>private practice, Casablanca and <sup>4</sup>Plasturgy technical center, Casablanca, Morocco

**AIMS:** To evaluate the shear bond strength (SBS) and debonded interfaces of a resin-modified glass ionomer cement (RMGIC; Fuji Ortho LC) under different enamel etching conditions and different contaminations; and to define the best protocol for use of a RMGIC.

**MATERIALS AND METHOD:** One hundred and eighty freshly extracted bovine permanent incisors were randomly divided into 18 equal groups. After etching and contamination, two control groups were bonded with conventional composite resin. The 16 experimental groups were bonded with a RMGIC. SBS was determined with a testing machine (Lloyd Instruments LR50K) at a crosshead speed of 1 mm/minute. The simplified adhesive remnant index (ARI) scores were assigned to the bracket base using a scanning electron microscope. SBS data were analyzed with analysis of variance ANOVA-1 and *post-hoc* tests. Simplified ARI scores were analyzed by the Chi2 test.

**RESULTS:** There were significant differences ( $P < 0.05$ ) among the control and experimental groups except among T1 and E16. Transbond XT had overall significantly greater SBS than Fuji Ortho LC. The RMGIC bonded without enamel conditioning produced the lowest SBS. The highest SBS was found after self-etching primer treatment under all enamel contaminations except water. With water contamination, 10 per cent polyacrylic acid showed higher SBS. Under etched conditions, saliva was the best contaminant; however, blood negatively affected bonding. ARI scores showed that Fuji Ortho LC had significantly greater incidences of enamel-adhesive failure unlike conventional resin. When enamel etching was established, the adhesive showed more retention to enamel.

**CONCLUSION:** Compared with conventional resin, Fuji Ortho LC has overall significantly less SBS, however, it provides acceptable bond strength *in vitro* especially when enamel is treated with self-etching primer and saliva contaminated. Further clinical research is needed to validate this laboratory finding. The weaker chemical bonding between this adhesive and enamel might make it easier for adhesive clean-up of the enamel surface after debonding.

#### SP200 INFLUENCE OF THE HYDROSPLINT ON POSTUROSTABILOMETRIC BALANCE AND MASSETER TONUS IN PATIENTS WITH NORMAL, DISTAL OCCLUSION AND CROSSBITE

Victoria Brishten, Irina Rubleva, Zuhra Shaipova, Leonid Persin, Anna Slabkovskaya, Department of Orthodontics, MSUMD, Moscow, Russia

**AIMS:** To determine the level of influence of the hydrosplint on posturostabilometric balance and masseter tonus in patients with normal, distal occlusion and crossbite.

**SUBJECTS AND METHOD:** Forty eight subjects: group 1, 24 children 8-12 years of age (12 with physiological occlusion, 12 with crossbite); group 2, 24 subjects aged 15-35 years (12 with physiologic occlusion, 12 with the crossbite). Stabilometric balance and masseter tonus were examined in all patients using a stabilometric platform (BioPosturalSystem, Galbiati, Italy) and a miotonometer (Miotonus - 3c, Russia). Muscle tonus was measured before adjustment of the hydrosplint, during wear and 15-20 minutes after wear.

**RESULTS:** No clinically significant changes in stabilometry and during miotonometry were observed in either of the two age groups with a physiological occlusion. However, in patients with a crossbite all parameters improved significantly: crossbite before treatment  $18.36 \pm 2.0$  mm, after treatment  $12.062 \pm 1.2$  mm; for the sway area and ellipse surface the findings were  $2848.2 \pm 105.4$  mm<sup>2</sup> and  $1920.37 \pm 126.1$  mm<sup>2</sup>; and  $4.097 \pm 0.4$  mm<sup>2</sup> and  $0.9447 \pm 0.1$  mm<sup>2</sup>, respectively. Moreover there was equalization of right and left masseter muscle tonus during miotonometry (before treatment tonus at maximum contraction on the right side was  $75.75 \pm 1.80$ , left  $89.50 \pm 1.30$ ; after treatment right  $79.00 \pm 2.00$ , left  $82.33 \pm 1.80$ ).

**CONCLUSION:** Hydrosplint wear in patients with a crossbite leads to improvement in postural balance and equalization of masseter tonus on both sides. The splint can be recommended as an addition to the differential diagnosis of various forms of crossbite (dentoalveolar and musculo-articular).

## SP201 EVALUATION OF DISTAL OCCLUSAL TREATMENT IN CHILDREN WITH THE GNATHOPositionER APPLIANCE

Victoria Brishten, Leonid Persin, Irina Rubleva, Department of Orthodontics, MSUMD, Moscow, Russia

**AIMS:** To determine the effectiveness of distal occlusal treatment in children with the gnathopositioner appliance and its influence on postural balance and masseter tonus.

**SUBJECTS AND METHOD:** Thirty children, 7-11 years of age, all with a distal occlusion with mandibular retrognathia. They were trained to place the mandible forward into a constructive occlusion and recommended to wear the gnathopositioner appliance every day, 75 per cent of the time when they felt fatigue. The gnathopositioner is an extraoral appliance that produces a sound signal when the mandible is in any position, except constructive occlusion. Time wear was determined during the appointment. Every three weeks wear time was controlled and increased. Stabilometric balance and masseter tonus were examined with a stabilometric platform (BioPosturalSystem, Galbiati, Italy) and a miotonometer (Miotonus - 3c, Russia) before and after treatment.

**RESULTS:** Using the gnathopositioner showed good treatment results. In 73.3 per cent of subjects significant improvement was observed on the cephalograms. SNB angle increased  $5.26 \pm 0.94$  degrees and SNPg  $5.43 \pm 0.86$  degrees. Improvement was also observed in the main stabilometric parameters in 63 per cent of cases: the crossed distance decreased by 2 times, the sway area by 2.8 times and the ellipse surface by 5.2 times. Moreover, in 56.6 per cent of cases there was equalization of masseter tonus on both sides during miotometry after treatment.

**CONCLUSION:** The gnathopositioner can be recommended for treatment of children with distal occlusion and mandibular retrognathia.

## SP202 EFFECTS OF DIFFERENT LASER IRRADIATIONS AND ADHESIVES ON ENAMEL DEMINERALIZATION AROUND ORTHODONTIC BRACKETS

Serpil Çokakoğlu<sup>1</sup>, Ruhi Nalçacı<sup>2</sup>, Sıddık Malkoç<sup>3</sup>, Serdar Üşümez<sup>3</sup>, Departments of Orthodontics, Faculties of Dentistry, <sup>1</sup>Süleyman Demirel University, Isparta, <sup>2</sup>Karadeniz Teknik University, Trabzon, <sup>3</sup>İnönü University, Malatya and <sup>4</sup>Bezmialem Vakıf University, İstanbul, Turkey

**AIMS:** To evaluate the effects of different Er:YAG laser irradiation and adhesive systems on enamel demineralization around orthodontic brackets.

**MATERIALS AND METHOD:** Fifty-four human non-carious premolar teeth. The teeth were covered with nail varnish, except for two 4 x 4 mm windows on both the buccal and lingual surfaces. The samples were randomly divided into three groups (control, 1 W laser and 2 W laser) according to the etching procedure. Control (no laser etching); 1 W laser group, Er:YAG laser (Lightwalker AT, Fotona, Slovenia) etching at 100 mJ, 10 Hz, 15.72 J/cm<sup>2</sup>; 2 W laser group etching at 200 mJ, 10 Hz, 31.44 J/cm<sup>2</sup>. Laser irradiation was performed using water cooling. The main groups were divided into three subgroups according to the application of total etch (Transbond XT Primer), self-etch (Transbond Plus SEP) or two-step self-etch (Clearfil Protect Bond) adhesive systems. After enamel conditioning, brackets were bonded with light cured composite resin (Transbond XT paste). The teeth were then subjected to an *in vitro* pH cycling process for 14 days to induce caries-like lesions. After pH cycling, lesion depth values were measured using a non-invasive method, micro-computed tomography (SkyScan, Kontich, Belgium). A Kolmogorov-Smirnov test was used to determine normal distribution of parameters. The results were analyzed with one-way ANOVA and *post-hoc* Duncan tests.

**RESULTS:** The control (only Clearfil Protect Bond) and 1 W Er:YAG laser and Clearfil Protect Bond groups showed decreased enamel demineralization. In the 2 W laser groups lesion depth values were increased although the differences were not statistically significant ( $P > 0.05$ ).

**CONCLUSION:** The combination of 1 W Er:YAG laser etching and the Clearfil Protect Bond adhesive system seem to be a favourable bonding procedure for preventing enamel demineralization when laser etching is used.

## SP203 EFFECTS OF DIFFERENT BONDING PROCEDURES ON THE MINERAL DENSITY OF ENAMEL

Serpil Çokakoğlu<sup>1</sup>, Ruhi Nağacı<sup>2</sup>, Sıddık Malkoç<sup>3</sup>, Serdar Üşümez<sup>4</sup>, Departments of Orthodontics, <sup>1</sup>Süleyman Demirel University Faculty of Dentistry, Isparta, <sup>2</sup>Karadeniz Teknik University Faculty of Dentistry, Trabzon, <sup>3</sup>İnönü University Faculty of Dentistry, Malatya, and <sup>4</sup>Bezmialem Vakıf University Faculty, İstanbul, Turkey

**AIMS:** To evaluate the effects of different bonding procedures, including different Er:YAG laser irradiations and adhesive systems, on the mineral density of enamel.

**MATERIALS AND METHOD:** Fifty four extracted premolar teeth were covered with nail varnish except for two windows (4 × 4 mm) on the labial and lingual enamel surfaces. The samples were divided into control (no laser etching), 1 W (100 mJ, 10 Hz) and 2 W (200 mJ, 10 Hz) Er:YAG laser (Lightwalker AT, Fotona, Slovenia) groups according to the etching procedure. The main groups were divided into three subgroups according to the application of different adhesive systems. Study groups: G1: 37 per cent phosphoric acid etching and Transbond XT Primer (3M Unitek, California, USA); G2: 1 W Er:YAG laser and Transbond XT Primer; G3: 2 W Er:YAG laser and Transbond XT Primer; G4: Transbond Plus SEP (3M Unitek); G5: 1W Er:YAG laser and Transbond Plus SEP; G6: 2 W Er:YAG laser and Transbond Plus SEP; G7: Clearfil Protect Bond (Kuraray, Tokyo, Japan); G8 1 W Er:YAG laser and Clearfil Protect Bond; G9: 2 W Er:YAG laser and Clearfil Protect Bond. Premolar brackets were then bonded with light cured Transbond XT composite paste (3M Unitek) on the enamel surfaces. Artificial enamel demineralization was performed using pH cycling with 6 hour demineralization followed by 17 hour remineralization for 14 days. Micro-computed tomography (Skyscan 1172) at settings of 100 kV and 100 µA was used to determine enamel mineral density (MD) after the demineralization process. The results were analyzed with one-way ANOVA and *post-hoc* Tukey tests.

**RESULTS:** The lowest MD values were found in G5 and the highest in G8. There were no significant differences between the MD values of the 2 W laser groups ( $P > 0.05$ ). Significant differences were found between the MD values of groups G1-G4, G4-G7, G2-G5 and G5-G8.

**CONCLUSION:** Different bonding procedures affect the MD of enamel. It is suggested that the highest MD with 1 W Er:YAG laser and Clearfil Protect Bond may be linked to higher enamel demineralization resistance around orthodontic brackets.

## SP204 THE IMPACT OF EARLY OR LATE ORTHODONTIC TREATMENT ON THE HEALTH STATUS OF THE TEMPOROMANDIBULAR JOINT

Angelica Bencze, Elina Teodorescu, Viorica Milicescu, Ecaterina Ionescu, Olivia Popoviciu, Department of Orthodontics and Dento-Facial Orthopaedics, University of Medicine and Pharmacy 'Carol Davila', Bucharest, Romania

**AIMS:** The optimal time for orthodontic treatment depends on the patient's age at presentation, the type of dental anomaly, and potential associated complications [periodontal, temporomandibular disorders (TMD)].

**SUBJECTS AND METHOD:** Eighty four patients with various anomalies, aged between 7-33 years. For each subject the evolution of temporomandibular joint (TMJ) health was monitored during early (50% of cases) or late orthodontic treatment. Fifty per cent of the entire number of patients showed signs of TMD before treatment. After one year of orthodontic therapy, TMJ status was compared to the initial situation and quantified using Helkimo's classification.

**RESULTS:** The therapeutic appliances used varied depending on requirements. During early treatment functional devices were used together with mechanical orthodontics and functional rebalancing; in late orthodontic treatment mainly fixed appliances were used, accompanied by rebalancing and physiotherapy. After the first year of orthodontic treatment, physical function of the TMJ was within normal range in 42.8 per cent of patients presenting signs of TMD before treatment, most of them aged under 13 years. A substantial reduction of the maximum values of Helkimo's indices was noted, indicating serious forms of dysfunction (only 1.2% of patients had this score after one year, related to muscle damage). The prevalence of unitary scores decreased, especially in patients younger than 13 years,

In 7.2 per cent of patients, initially diagnosed with TMD, had after one year higher values of the Clinical Dysfunction Index of Helkimo, maintaining however the extent of moderate dysfunction.

**CONCLUSION:** Analyzing the entire group, orthodontic treatment favourably influenced the health of the TMJ, regardless of the time of initiation (early or late). The effect over articular structures is more important, however, if treatment is established at an earlier age when both the anomaly is detected in its early stages and therapeutic responsiveness and adaptation are at their maximum.

#### SP205 OBJECTIVE ASSESSMENT OF PATIENTS' COMPLIANCE DURING CERVICAL HEADGEAR TREATMENT. A PILOT STUDY

Konstantinos Karamesinis, Alina Cocos, Alexios Katsadouris, Lydia Schoretsaniti, Elias Bitsanis, Department of Orthodontics, National and Kapodistrian University of Athens, Greece

**AIMS:** To record and objectively assess orthodontic patients' compliance levels regarding the wear time of the cervical-pull headgear appliance.

**SUBJECTS AND METHOD:** Twenty three patients (8 males, 15 females; mean age: 12.1 years, range: 9.7 to 14.7 years). All patients presented with a Class II molar relationship and the treatment plan included application of cervical headgear. A Theramon microchip was incorporated into the headgear appliance in order to record the wear time and the patients were instructed to use the appliance for at least 12 hours per day. Based on studies in the literature, the Theramon software was initially adjusted to record wear hours based on a temperature range of 28 to 38°C. However, because of high ambient temperatures during the summer, this range resulted in false positive readings. Therefore raw data from each patient was retrieved and the temperature range was individualized.

**RESULTS:** High variability was observed among patients regarding daily use of the appliance. During a mean observation period of 115 days (range 33-218 days), recordings revealed that patients wore the cervical headgear for an average 9.7 hours per day, with 43 per cent of the patients having applied the headgear between 11.00 to 13.00 hours on a daily basis. However, 70 per cent of patients used the appliance less than the prescribed time (12 hours).

**CONCLUSION:** The results of this pilot study show that the majority of patients do not comply with the required wear time. With the application of Theramon microsensors, orthodontists are capable of objectively quantifying and assessing their patients' compliance. Moreover, it becomes possible to correlate the effectiveness of cervical headgear appliance with real wear time. However, individualization of temperature range is required in order to avoid false positive recordings during the summer.

#### SP206 MAXILLARY FIRST MOLAR MOVEMENT UNDER APPLICATION OF CERVICAL HEADGEAR. A PILOT STUDY

Alina Cocos, Konstantinos Karamesinis, Alexios Katsadouris, Lydia Schoretsaniti, Demetrios Halazonetis, Department of Orthodontics, National and Kapodistrian University of Athens, Greece

**AIMS:** To measure movement of the maxillary first molars with application of cervical headgear during correction of Class II malocclusion.

**SUBJECTS AND METHOD:** Thirteen patients (5 males, 8 females; mean age: 11.9 years, range: 9.7 to 14.5 years) all with a Class II molar relationship. The treatment plan included application of cervical headgear. Orthodontic bands were placed on the maxillary first molars and an initial alginate impression was taken. The headgear appliance was adjusted and the patients were instructed to wear the appliance for a minimum of 12 hours per day. A final alginate impression was taken at the end of the observation period, when a Class I relationship was established or prior to placement of fixed appliances. The initial and final casts were scanned in a three-dimensional scanner and superimposed on stable structures on the palate using the iterative closest point algorithm. Two researchers assessed and quantified bilateral maxillary molar movement in the three dimensions.

**RESULTS:** During a mean treatment period of 68 days (range 28 to 105 days) the maxillary first molars exhibited an average 0.9 mm of distal movement and 0.3 mm of extrusion. However, almost no movement was detected in the transverse plane. Linear regression analysis showed that right and left maxillary first molar distalisation correlated to treatment time ( $r^2 = 0.39$  and  $r^2 = 0.14$ , respectively).

**CONCLUSION:** The use of cervical headgear produced distalisation and extrusion of the maxillary first molars. This methodology can detect and measure the direction and amount of minute tooth movements under the application of orthodontic forces acting within a limited time period.

#### SP207 EVALUATION OF QUALITY OF LIFE IN PATIENTS THAT RECEIVED SURGICAL ORTHODONTICS AT EACH STAGE OF TREATMENT

Chie Tachiki, Reiko Abe, Yasushi Nishii, Kunihiko Nojima, Kenji Sueishi, Department of Orthodontics, Tokyo Dental College, Chiba, Japan

**AIMS:** It has been reported that quality of life (QoL) in patients that received surgical orthodontic treatment improve post-treatment. On the other hand, at the stage of pre-orthognathic surgery, their profile and function temporarily become worse. The disease specific QoL (oral health) was investigated in patients who underwent surgical orthodontics at each treatment stage.

**SUBJECTS AND METHOD:** The subjects, who received surgical orthodontics were divided into three groups based on their treatment stage: namely, 20 patients at pre-treatment (T1), 22 patients at pre-orthognathic surgery (more than 4 months after appliance insertion; T2), 15 patients at post-orthognathic surgery (more than 3 months post-orthognathic surgery to removal of appliance; T3). The subjects in each groups completed a disease specific QoL (oral health) assessment questionnaire [The Orthognathic Quality of Life Questionnaire; (OQLQ) Cunningham *et al.*, 2000]. The instrument, developed for orthognathic patients, consists of 22 statements, and contributed four domains: 'social aspects of dentofacial deformity', 'facial aesthetics', 'oral function', 'awareness of dentofacial aesthetics'. Evaluation was undertaken using a visual analogue scale (VAS), which was marked from 0 to 10; 0 being 'no problem' and 10 being 'the worst problem'. The Kruskal-Wallis and Mann-Whitney *U* test were performed for statistical evaluation.

**RESULTS:** The scores of 'social aspects of dentofacial deformity', 'facial aesthetics' and 'oral function' at T2 were larger than that at T1, and significant differences were especially noted in the domain of 'facial aesthetics'. The scores of these domains between T2 to T3 decreased. However, the score for 'awareness of dentofacial aesthetics' was significantly increased between T1 and T2 to T3.

**CONCLUSION:** The disease-specific QoL of patients who received surgical orthodontics were lower as their dentofacial deformity and oral function were worsened by pre-orthognathic surgery treatment. Post-treatment, QoL improved far more than the pre-treatment values. However, 'awareness of dentofacial aesthetics' of QoL was lower than post-treatment. It was considered that the patient's sense of dentofacial aesthetics were higher than pre-treatment.

#### SP208 OCCLUSAL AND FACIAL FEATURES IN INDIGENOUS AMAZONIANS: AN INSIGHT INTO THE ROLE OF GENETICS AND ENVIRONMENT IN THE AETIOLOGY OF DENTAL MALOCCLUSION

David Normando<sup>1</sup>, Bento Souza<sup>1</sup>, Livia Bichara<sup>1</sup>, João Guerreiro<sup>2</sup>, Célia Quintão<sup>3</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Human and Medical Genetics, Federal University of Pará, Belém, and <sup>3</sup>Department of Orthodontics, State University of Rio de Janeiro, Brazil

**AIMS:** The indigenous people of Xingu villages present a similar tooth wear pattern, practise exclusive breast-feeding, no pacifier use, and have a large intertribal genetic distance. The aim of this research was to revisit the aetiology of dental malocclusion features considering these population characteristics.

**SUBJECTS AND METHOD:** Occlusion and facial features of five semi-isolated Amazon indigenous populations (n = 351) were evaluated and compared to previously published data from urban Amazonians.

**RESULTS:** Malocclusion prevalence ranged from 33.8 to 66.7 per cent. Overall this prevalence was lower when compared to urban people mainly regarding posterior crossbite. A high intertribal diversity was found. The Arara-Laranjal village had a population with a normal facial profile (98%) and a high rate of normal occlusion (66.2%), while another group from the same ethnicity presented a high prevalence of malocclusion, the highest occurrence of Class III malocclusion (32.6%) and a long face (34.8%). In Pat-Kró' village the population had the highest prevalence of Class II malocclusion (43.9%), a convex profile (38.6%), increased overjet (36.8%) and deep bite (15.8%). Another village's population, from the same ethnicity, had a high frequency of anterior open bite (22.6%) and anterior crossbite (12.9%). The highest occurrence of bi-protrusion was found in the group with the lowest incidence of dental crowding, and *vice versa*.

**CONCLUSION:** Great intertribal diversity in occlusal and facial features suggests that genetics substantially influences the morphology of facial bones and the dentition. Therefore, the results do not give support to diet consistency being a determinant factor for the increase of malocclusion in modern human populations, mainly in dental crowding. The role of the environment seems to be related to deleterious oral habits - a common feature in urban populations.

#### SP209 GEOMETRIC MORPHOMETRIC ANALYSIS SHOWS DIFFERENT CRANIOFACIAL SHAPE IN SUBJECTS WITH TOOTH AGENESIS

Alina Cocos, Apostolos Tsolakis, Demetrios Halazonetis, Department of Orthodontics, National and Kapodistrian University of Athens, Greece

**AIMS:** To compare the shape of the craniofacial complex between a group of patients with congenitally missing teeth and a control group.

**SUBJECTS AND METHOD:** The subjects were allocated to two groups, the agenesis group comprised 28 patients with agenesis of more than one tooth (excluding third molars) and the control group was composed of age and gender-matched subjects (10 males, 18 females, mean age 10.5 years, range: 8 to 11 years). The main craniofacial structures depicted on lateral cephalograms were digitized and traced with 15 curves and 127 landmarks, of which 118 were semi-landmarks and nine fixed landmarks. Procrustes alignment and Principal Component Analysis were applied to the craniofacial landmarks in order to assess shape variability of the whole craniofacial complex and the structures that is composed of (anterior cranial base, maxilla and mandible).

**RESULTS:** The first three principal components accounted for 50 per cent of the sample's variability while approximately 80 per cent of the variability was depicted in the first 12 components. The comprehensive description of shape allowed detection of statistically significant differences between the two groups (permutation test, 100,000 permutations,  $P = 0.006$ ), whilst sexual dimorphism was not detected. Specifically, according to the first two principal components, patients with tooth agenesis presented with a Class III tendency and hypodivergent skeletal pattern. Regarding the shape variability of each structure, statistically significant differences in the shape of the maxilla and mandible were found between the two groups (permutation test, 100,000 permutations,  $P = 0.02$  and  $P = 0.01$ , respectively), while there were no differences in the shape of the anterior cranial base.

**CONCLUSION:** Craniofacial shape, as well as the shape of maxilla and mandible, differ between preadolescent patients with tooth agenesis and their matched controls. These results indicate that the factors associated with tooth agenesis may also affect the shape of the craniofacial complex and its structures.

#### SP210 A NOVEL METHOD FOR FUSION OF INTRA-ORAL SCANS AND CONE-BEAM COMPUTED TOMOGRAPHY SCANS FOR ORTHOGNATHIC SURGERY PLANNING

Olivier de Waard<sup>1</sup>, Frank Baan<sup>2</sup>, Hero Breuning<sup>1</sup>, Anne Marie Kuijpers-Jagtman<sup>1</sup>, Thomas Maal<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and Craniofacial Biology and <sup>2</sup>Oral and Maxillofacial Surgery, RadboudUMC, Nijmegen, Netherlands

**AIMS:** To assess the feasibility of a new method to augment the three-dimensional (3D) virtual skull model with a detailed dental surface produced by intra-oral scans obtained with a Trios intra-oral scanner, compared to the conventional triple scan procedure. This new

method should reduce the radiation exposure required for the planning of orthognathic surgery cases.

**MATERIALS AND METHOD:** In addition to the conventional triple scan procedure, an intra-oral scan was made for four patients. The accuracy of the intra-oral scans (Trios 3D models) was assessed by surface-based registration of the Trios 3D scans to the AlgiNot 3D models. The distances between the registration of the Trios 3D models into the cone beam computed tomographic (CBCT) scan and the augmented model were measured using a distance kit.

**RESULTS:** The mean differences between the new registration method and the augmented model were 0.30 mm (SD 0.20) and 0.27 mm (SD 0.20) for the upper and lower jaw, respectively. For the upper jaw the mean distance ranged between 0.22 and 0.45 mm and for the lower jaw between 0.12 and 0.38 mm. Concerning the accuracy of the Trios 3D models, in the upper jaw the mean distance error was 0.12 mm (SD 0.13 mm) and in the lower jaw 0.14 mm (SD 0.16 mm). Overall, for all four patients the mean distances ranged between 0.10-0.16 mm and 0.07-0.20 mm for the upper and lower jaw, respectively.

**CONCLUSION:** The intra-oral scans (Trios 3D models) give an accurate representation of the dental arches compared to the AlgiNot 3D models. The fusion of the intra-oral scans and the CBCT scans compared to the triple scan procedure is accurate.

#### SP211 THE EFFECT OF CERVICAL HEADGEAR ON MOLAR POSITIONS – A RANDOMIZED CLINICAL TRIAL

Matti Hannula<sup>1</sup>, Johanna Julku<sup>2</sup>, Pertti Pirttiniemi<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Oulu University and <sup>2</sup>University Hospital of Oulu, Finland

**AIMS:** To find out the effect of early or later started cervical headgear on the first maxillary and mandibular molar position.

**SUBJECTS AND METHOD:** Sixty seven children (28 girls, 39 boys) with a Class II occlusion randomly divided into two groups. In the first group headgear treatment was started immediately or after eruption of the first maxillary molars (mean age 7.3 years, SD 0.53). In the second group active headgear treatment was started later (mean age 9.5 years, SD 0.56). The active headgear treatment was continued in both groups until a normal Class I occlusion on the first molars was achieved. Dental casts were taken and scanned with a 3Shape® three-dimensional (3D) scanner from both groups at the beginning of follow-up (T0), at the beginning of treatment of the second group (T1) and at the end of treatment of the second group (T2), mean age 11.5 years (SD 0.57). 3D landmarks describing the position of first maxillary and mandibular molars were compared between the early and later treatment groups. An independent samples *t*-test was used to compare the means of the groups. The difference between time points was calculated and compared.

**RESULTS:** The first maxillary molars were rotated at T1 in the early treatment group by 7.4 degrees (SD 5.9); a smaller degree of rotation was seen in the late treatment group at T2. Significant changes were found in mandibular first molar position with a more vertical orientation of the tooth in the early treatment group at T2, when compared to the late treatment group.

**CONCLUSION:** Both early and later headgear use cause rotation of the first maxillary molar, the effect of early treatment being more stronger. The position of the first mandibular molar is significantly affected by early headgear treatment, with less lingual and mesial angulation of the crown, causing more space gain in the mandibular arch.

#### SP212 LONG-TERM RESULTS OF A NEW APPROACH FOR SIMULTANEOUS EXPANSION OF THE MAXILLA AND DISTALIZATION OF THE UPPER MOLARS.

Maria Mitus-Kenig<sup>1</sup>, Magdalena Durka-Zajac<sup>2</sup>, Agata Marcinkowska-Mitus<sup>3</sup>, <sup>1</sup>Department of Stomatological Prevention and Hygiene, Jagiellonian University Medical College, Krakow, <sup>2</sup>The Specialist Orthodontic Practice, Szczecin and <sup>3</sup>Specialist Dental Clinic, 5th Military Research Hospital with Polyclinic, Krakow, Poland

**AIMS:** A new appliance (Patent No 392545) was designed combining features of the Haas appliance with acrylic splits and the Pendex appliance with TMA distalizing springs. It was designed for simultaneous expansion of the maxilla and distalization of the upper permanent molars. The aim of this study was to prospectively assess the long-term safety, efficacy and

stability of treatment using this new appliance for simultaneous expansion of the maxilla and distalization of the upper molars.

**SUBJECTS AND METHOD:** Between 2009 and 2013, 38 patients with an average age of 12.2 years were enrolled in the study. In an average follow-up of 30 months (range 24-42 months) no adverse effects were observed. The average treatment time was 4.8 months. In all patients a narrow maxilla and crowded maxillary teeth were observed. In 12 patients there was complete absence of space for the upper permanent premolars, and in the remainder of patients complete or partial absence of space for the upper canines. Ten patients had a Class III malocclusion and the rest a Class II malocclusion. Moreover, 10 patients were diagnosed with a so called 'high-angle'.

**RESULTS:** In the main treatment time distalization of the upper permanent molars was 3.7 mm in comparison with the control group treated with the Pendex appliance (3.8 mm;  $P > 0.05$ ). There were also no statistically significant differences in anterior and posterior maxillary expansion (in comparison to Haas appliance: 2.8 versus 2.6 mm and 3.7 versus 4.0 mm, respectively;  $P > 0.05$ ). At the 2-year follow-up the results were stable and there was no significant change in the achieved primary distalization and expansion.

**CONCLUSION:** The new appliance was safe and effective, both at the short and long-term observation. It reduces anchorage loss (hyrax screw action) and extrudes the upper molars and premolars (acrylic splits). Additionally, teeth 16 and 26 have the tendency to buccal crossbite which later increases the stability of the treatment results.

#### SP213 COMPARISON OF THREE METHODS TO MEASURE THE DIFFERENCE BETWEEN THE MESIODISTAL WIDTHS OF THE PRIMARY CANINES AND MOLARS AND THEIR SUCCESSORS

Rosa Rossi, Eduardo Dualilibi<sup>2</sup>, Nelson Carrieri Rossi<sup>3</sup>, Nelson Rossi<sup>4</sup>, Shirley Pignatari<sup>1</sup>, Departments of <sup>1</sup>Otorrhinolaryngology, <sup>2</sup>Radiology and <sup>4</sup>Translational Surgery, Universidade de São Paulo and <sup>3</sup>Orthodontics, Funorte, São Paulo, Brazil

**AIMS:** In mixed dentition treatment spacing or crowding of the developing dentition is a prime concern. The objective of this study was to compare three methods to determine the discrepancy between the primary teeth and their permanent successors.

**MATERIALS AND METHOD:** From the files of 20 patients from the otorhinolaryngology clinic of the Federal University of São Paulo, measurements of the mesio-distal diameters of erupted lower permanent incisors were made on plaster cast models using a digital calliper, whereas assessment of the size of non-erupted permanent premolars and canines was performed using Moyers' table. Virtual models were obtained and measured with the tools from the Maestro software. For tomographs, the dental units were gauged by means of Osirix software resources to compare the sizes of three primary teeth in each arch and their permanent successors.

**RESULTS:** Statistical analysis revealed high agreement between the plaster and virtual model methods, and low agreement between tomographs and the other methods being evaluated.

**CONCLUSION:** Although Moyers' analysis cannot be universally adopted without question, both virtual and plaster models have a strong agreement between measurements. The tomographic method is accurate and has some advantages in relation to the other evaluated methods. It considers individual variations of dental anatomy, easy identification of points, no superposition of structures, and three-dimensional movement of an image, which allows visualization at different angles.

#### SP214 INFLUENCE OF TOOTH CROWN SIZE ON MALOCCLUSION

Amila Vujacic, Vladanka Vukicevic, Jasna Pavlovic, Sanja Simic, Predrag Janosevic, Department of Orthodontics, Medical faculty, Department of Dentistry, Nis, Serbia

**AIMS:** Malocclusion is an increasingly common, multifactorial problem. The most prevalent malocclusion results from excess tooth size compared with the size of the supporting bone; this creates a tooth-size arch-size discrepancy. Although the causes of malocclusion are, in most instances obscure, a contributing factor appears to be tooth size. The aim of this study

was to verify whether the mesiodistal diameters of permanent teeth are different in patients with a naturally good occlusion compared to those who need orthodontic treatment.

**SUBJECTS AND METHOD:** The mesiodistal diameters of teeth in the upper and lower jaw were measured in two groups of patients. One group (n = 30) had a naturally good occlusion; the other group (n = 50) required orthodontic treatment to correct tooth-size arch-size discrepancy.

**RESULTS:** Statistical analysis showed that the mesiodistal diameter of the teeth in both arches was significantly larger in subjects with a malocclusion compared with those with good occlusions. In the upper dental arch the most significant difference was found for the canines, while in the lower dental arch that difference was found for the first premolar.

**CONCLUSION:** Tooth size is not necessarily the foremost cause of malocclusion in a patient, but it should be evaluated.

#### SP215: COMPARISON OF DIFFERENT POLYMERIZATION TECHNIQUES ON THE AMOUNT OF RESIDUAL MONOMER LOSS FROM COLD-CURE ACRYLIC RESINS

Atefe Saffar Shahroudi<sup>1</sup>, Tahereh Hosseinzadeh Nik<sup>1</sup>, Farzaneh Aghajani<sup>2</sup>, Zeinab Eraghizadeh<sup>3</sup>, <sup>1</sup>Department of Orthodontics, School of Dentistry and <sup>2</sup>Department of Dental Materials, Dental Research Center, Tehran University of Medical Sciences and <sup>3</sup>Private practice, Tehran, Iran

**AIMS:** To assess and compare residual monomer release from removable orthodontic appliances constructed by the sprinkle-on and dough techniques.

**MATERIALS AND METHOD:** In an *in vitro* study, 120 acrylic samples made of orthodontic autopolymerized acrylic resins were divided into three groups according to the processing method: sprinkle-on without polyclave, sprinkle-on with polyclave and the dough technique. The specimens of each group were divided into four categories and were tested for residual monomer content by means of high performances liquid chromatography (HPLC) after being immersed in distilled water for 24, 48 and 72 hours and 1 week, respectively. Two-way ANOVA was used to compare the residual monomer of the three techniques and since the interaction was significant, the analysis continued using one-way ANOVA and Tamhane multiple comparison.

**RESULTS:** The maximum observed residual monomer was  $1284.91 \pm 129.07$  ppm measured for the sprinkle-on technique without polyclave after 24 hours of water immersion. At that time, the level of residual monomer was significantly different among the three applied techniques ( $P < 0.05$ ). In all immersion time groups, the sprinkle-on technique with polyclave released the least amount of residual monomer. Within each group, the maximum monomer release was observed after the first 24 hours and decreases were observed in subsequent time groups. The reduction over time was not significant in the polyclave groups ( $P > 0.05$ ).

**CONCLUSION:** The sprinkle-on technique with polyclave and longer water immersion reduces residual monomer release from acrylic orthodontic appliances.

#### SP216 CORRELATION BETWEEN DENTAL ARCH WIDTH AND SAGITTAL DENTO-SKELETAL MORPHOLOGY IN UNTREATED ADULTS

Atefe Saffar Shahroudi<sup>1</sup>, Tahura Etezadi<sup>2</sup>, Departments of Orthodontics, School of Dentistry, <sup>1</sup>Tehran University of Medical Sciences, Tehran and <sup>2</sup>Mazandaran University of Medical Sciences, Saari, Iran

**AIMS:** Dental arch form is one of the most important characteristic of the dentition. However this dimension usually receives less attention in diagnosis and treatment planning and orthodontic patients are traditionally classified with regard to their sagittal characteristics. The objectives of this study were to investigate if a relationship exists between dental arch width (transverse dimension) and sagittal skeletal and dental parameters in orthodontic patients.

**MATERIALS AND METHOD:** Dental casts and lateral cephalograms of 108 consecutive untreated Iranian patients (47 males, 61 females) between 16 and 31 years of age were evaluated. Arch width (AW) parameters, including upper and lower intermolar width (UIMW and LIMW) and upper and lower intercanine width (UICW and LICW) were measured with a

digital calliper. Sagittal parameters included SNA and SNB angle and Wits' appraisal obtained from lateral cephalograms in addition to upper and lower arch length (UAL and LAL) obtained from dental casts. The correlation between the measured parameters was evaluated applying Pearson's correlation coefficients. Molar and canine relationship, according to Angle's classification, was also recorded and the means of all parameters were compared between three occlusal relationship Classes and two gender groups by means of two-way ANOVA

**RESULTS:** A significant positive correlation between sagittal parameters and arch width measurements existed between SNA and UICW and between LICW and LAL. Upper and lower ICW were significantly correlated; the relationship between upper and lower IMW and between UAL and LAL were significant. Among sagittal measurements, both UAL and LAL were correlated with ANB angle. The means of arch width parameters in the three occlusal Classes were not significantly different.

**CONCLUSION:** The only significant correlation between arch width and sagittal parameters existed between UICW and SNA angle and between LICW and LAL. No significant difference in arch width parameter was observed between the three occlusal Classes.

#### SP217 PERIODONTAL LIGAMENT SPACE AND ALVEOLAR BONE THICKNESS CHANGES IN THE RAT USING POSTERIOR BITE-BLOCKS

Balazs Denes<sup>1</sup>, Anestis Mavropoulos<sup>1</sup>, Andrea Bresin<sup>2</sup>, Stavros Kiliaridis<sup>1</sup>, <sup>1</sup>Department of Orthodontics, University of Geneva, Switzerland and <sup>2</sup>Specialist Clinic of Orthodontics, University Clinics, Public Dental Service Region Västra Götaland, Göteborg, Sweden

**AIMS:** Posterior bite-blocks have been used in growing rats to influence their growth pattern. The aim of the present investigation was to study the effect of this appliance on the teeth, the periodontal ligament (PDL) space and alveolar bone thickness.

**MATERIALS AND METHOD:** Twenty-six Sprague-Dawley 6-week-old rats were divided into two groups, bite-block (BB) and control (CTRL). The experimental period was 4 weeks. The animals were then sacrificed and their heads were scanned by microcomputed tomography (Bruker microCT, Kontich, Belgium) and the results analyzed with Osirix (Geneva, Switzerland). A Student's *t*-test was used to compare the groups.

**RESULTS:** The average PDL space width was 145.1  $\mu\text{m}$  ( $\pm 11.3$ ) for the CTRL group and 114.8  $\mu\text{m}$  ( $\pm 12.6$ ) for the BB group ( $P < 0.001$ ). The PDL space was evenly distributed along the root in the CTRL group, but in the BB group, the apical level was considerably wider than the cervical and mid-root levels ( $P < 0.001$ ). The total width of the alveolar process ( $P < 0.001$ ) and the buccal region ( $P = 0.004$ ) were smaller in the BB group, 2721.1  $\mu\text{m}$  ( $\pm 209.4$ ) and 198.6  $\mu\text{m}$  ( $\pm 54.2$ ) than in the CTRL, 3047.1  $\mu\text{m}$  ( $\pm 124.7$ ) and 261.8  $\mu\text{m}$  ( $\pm 48$ ). No differences were detected in the palatal region between the groups.

**CONCLUSION:** The use of BB led to smaller PDL space and thinner alveolar bone thickness mainly in the buccal region of the alveolar process. The splinting effect of the BB on the molars may have influenced their functional mobility and thus resulted in the lack of stimulation of the surrounding tissues.

#### SP218 THE EFFECTIVENESS OF UPPER MOLAR TORQUE VALUES OF DIFFERENT BRACKET SYSTEMS: A COMPARATIVE TYPODONT STUDY.

Sabahat Yazıcıoğlu, Semiha Arslan, A. Alper Oz, A. Zeynep Oz, Nursel Arici, Ondokuz Mayıs, Samsun, Turkey

**AIMS:** To investigate *in vitro* the capacity of different bracket and tube systems for torque control of molar teeth.

**MATERIALS AND METHOD:** Three types of metal brackets and molar tubes bonded to upper typodont teeth (16 to 26) were seated in wax. In group 1, 0.022 inch Damon brackets with molar tubes ( $-18^\circ$  torque) were used. In group 2, 0.022 inch Victory series conventional metal brackets with molar tubes ( $-14^\circ$  torque) and in group 3, 0.022 inch Smart Clip metal brackets with molar tubes ( $-14^\circ$  torque) were used. The teeth were aligned using 0.014 inch heat activated nickel titanium (NiTi), 0.019  $\times$  0.025 inch heat activated NiTi, and 0.0215  $\times$  0.025 inch stainless steel archwires in sequence, with a water bath at 45°C for 30 minutes at each stage. When aligning and levelling of teeth was complete, a vinyl polysiloxane

impression, used to record the initial form of the upper arch, was used for repositioning the teeth at the beginning of levelling of each repeated experiment. Metal markers were inserted at the molar crown and apex to measure the angular changes of crown and apex. Cone beam computed tomographic (CBCT) records were taken at the beginning and after each archwire application. Sixteen CBCT records were obtained for each bracket group. The movement of the upper molar apex and crown was measured and molar torque changes were evaluated within and between the groups.

**RESULTS:** All bracket systems created significant crown movement with 0.0215 × 0.025-inch stainless steel arch wires ( $P < 0.05$ ). However, there was no significant movement at the molar apices in any group. There were significant differences between the groups for molar crown movements ( $P < 0.05$ ).

**CONCLUSION:** The type of molar tube (self-ligating/conventional) and prescription of the bracket system have significant effects on molar crown position with 0.0215 × 0.025 inch stainless steel archwires.

#### SP219 COMPARISON OF TWO- AND THREE-DIMENSIONAL MEASUREMENTS

Elif Pişgin, Ibrahim Yavuz, Department of Orthodontics, Erciyes University, Kayseri, Turkey

**AIMS:** To retrospectively establish the differences or similarities between two- (2D) and three-dimensional (3D) cephalometric analysis.

**MATERIALS AND METHOD:** The 2D cephalometric images of 14 patients were traced using the Dolphin imaging program and the 3D tomographic images were traced in Siplant pro 2011. Six angular and six linear variables were measured by one investigator. The measurements determined with each method were compared with a paired *t*-test.

**RESULTS:** Significant differences were observed for lower face height (mm) ( $P = 0.02$ ), upper face height ( $P = 0.008$ ), U1-NA ( $P = 0.046$ ) and Co-Gn ( $P = 0.001$ ). However any angular measurements (SNA, SNB, SN-PP, SNGoGn, IMPA, U1-SN) showed statistically significant differences. There were no statistically significant differences for L1-NB (mm) and Co-A (mm).

**CONCLUSION:** High correlations were observed for all variables except for lower face height, upper face height, U1-NA and Co-Gn.

#### SP220 MOST AESTHETIC FACIAL PROFILE SELECTED BY ROMANIAN YOUNG ADULTS

Magdalena Enache, Roxana Luţic, Filip Boeru, Sînziana Constantinescu, Dan Mărîi, Faculty of Dental Medicine, University of Medicine and Pharmacy 'Carol Davila', Bucharest, Romania

**AIMS:** To study facial profile perception (for Romanian males and females) by dentists, people with a background in art and laypersons.

**MATERIALS AND METHOD:** The profile photographs of two post-pubertal patients (one female, one male) were used in order to obtain digital images of the profile by modifying the anteroposterior position of the mandible by one unit ( $3^\circ$  of SNB). The anteroposterior position of the maxilla was normal and the same for all digital images. The facial profile was analyzed by three groups, who rated each digital image with a score, on a scale from 1 to 8.

**RESULTS:** The profile chosen as the most attractive was the normal profile. The most convex male profile and the most concave female profile were considered the least attractive.

**CONCLUSION:** The normal profile was considered the most attractive by the young adult population of Romania.

#### SP221 ORTHODONTIC ADHESIVES OF A NEW FORMULATION – INVESTIGATION OF POLYMERISATION RATE AND BIOCOMPATIBILITY

Magda Trinajstić Zrinski<sup>1</sup>, Snezana Miljanic<sup>2</sup>, Danijela Marovic<sup>3</sup>, Davor Zeljezic<sup>4</sup>, Stjepan Spalj<sup>1</sup>, <sup>1</sup>Department of Orthodontics, School of Medicine, University of Rijeka, <sup>2</sup>Division of Analytical Chemistry, Department of Chemistry, Faculty of Science, University of Zagreb, <sup>3</sup>Department of Endodontics and Restorative Dentistry, School of Dental Medicine,

University of Zagreb and <sup>4</sup>Mutagenesis Unit, Institute for Medical Research and Occupational Health, Zagreb, Croatia

**AIMS:** To test the degree of conversion of orthodontic adhesives of different chemical composition in relation to two curing times, and to assess the genotoxicity of such adhesives.

**MATERIALS AND METHOD:** Three adhesives, one primer and three adhesive-primer combinations were tested: bisphenol-A glycidyl dimethacrylate based Transbond XT adhesive and primer (3M Unitek, USA) and two experimental ethoxylated bisphenol-A dimethacrylate based adhesives, one with 40 wt.% of amorphous calcium phosphate filler (ACP 40%) and another with 70 wt.% of strontium glass filler (Sr 70%). Ten samples of the primer, each adhesive and adhesive-primer combinations were prepared in a simulation of the clinical procedure under a premolar metal bracket and illuminated with the Bluephase Syle curing unit (Ivoclar Vivadent, Liechtenstein) at 1100 mW/cm<sup>2</sup> for 10 and 20 seconds, which totalled 140 samples. Fourier transform infrared spectroscopy was used to assess the degree of conversion (DC) of the samples. The genotoxicity of the adhesives was tested on human gingival fibroblasts (HGF-1 ATCC® CRL-2014TM, ATCC, USA) with the micronucleus test and comet assay. Analysis of variance and the Student-Neuman-Keuls *post-hoc* test were used for statistical analysis.

**RESULTS:** After 10 seconds of illumination, Transbond XT and ACP adhesive-primer combinations showed a significantly higher DC ( $56.6 \pm 11.3$  and  $52.2 \pm 9.7$ ) in comparison with Sr 70% adhesive-primer combination ( $39.1 \pm 12.7$ ) and independent adhesives ( $P < 0.05$ ), while the Transbond XT primer showed the highest DC ( $57.7 \pm 2.3$ ). After 20 seconds of illumination, the highest DC was shown by ACP 40% adhesive both independently and combined with the primer ( $76.9 \pm 2.8$  and  $73.3 \pm 2.9$ , respectively;  $P < 0.05$ ), while Transbond XT adhesive showed the lowest DC ( $47.5 \pm 3.2$ ). An increase of DC correlated significantly with longer illumination time for all tested materials with the exception of Transbond XT adhesive-primer combination. Genotoxicity was related to a lower DC.

**CONCLUSION:** After 20 seconds of illumination, the bioactive adhesive containing ACP shows a DC that is comparable to that of Transbond XT. Transbond XT, considered the gold standard, achieves good properties after a shorter illumination time.

#### SP222 MICRORNA SEQUENCING OF PALATAL FIBROBLASTS FROM INFANTS WITH CLEFT PALATE AND AGE MATCHED CONTROLS.

Christian Schoen<sup>1</sup>, Armaz Aschrafi<sup>1,2</sup>, Hans Von den Hoff<sup>1</sup>, Carine Carels<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and Craniofacial Biology and <sup>2</sup>Neuroinformatics, Radboud University Nijmegen, Netherlands

**AIMS:** To investigate if there is a differential expression of microRNAs.

**MATERIALS AND METHOD:** A palatal biopsy was obtained from five non-syndromic cleft palate only patients, three non-syndromic cleft lip and palate patients and eight age-matched controls. The fibroblasts were excised and expanded in tissue culture. MicroRNAs were isolated using the miRNeasy mini kit. The purity of all microRNA samples were analyzed using the TapeStation System. MicroRNAs were sequenced using Ion Proton chip-based semiconductor sequencing. Read counts were normalized and differential expression was analyzed using the beta binomial test. The false discovery rate procedure was used to correct for multiple testing.

**RESULTS:** Differential expression of several microRNAs was identified between all three groups ( $P < 0.05$ ). None of the identified microRNAs have been associated with a cleft palate.

**CONCLUSION:** This study has identified microRNAs which are dysregulated in patients with non-syndromic cleft palate only and cleft lip and palate.

#### SP223 THE EFFECT OF IMMERSION AND INTRAORAL USE ON THE MECHANICAL PROPERTIES AND SURFACE CHARACTERISTICS OF BETA-TITANIUM ORTHODONTIC ARCHWIRES

Silvia Izabella Pop<sup>1</sup>, Mircea Dudescu<sup>2</sup>, Dana Cristina Bratu<sup>3</sup>, Reka Gyergyay<sup>4</sup>, Mariana Pacurar<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and <sup>4</sup>Pedodontics, UMF Tg Mures, Tргу Mures,

<sup>2</sup>Department of Mechanical Engineering, Technical University, Cluj Napoca and <sup>3</sup>Department of Orthodontics, Victor Babes University, Timisoara, Romania

**AIMS:** To evaluate and compare the mechanical parameters of as-received, immersed and as-retrieved beta-titanium archwires. A further aim was to observe the surface characteristics for evidence of corrosion and alteration using a scanning electron microscope.

**MATERIALS AND METHOD:** Using an Instron universal testing machine, tensile and three point bending tests were performed on 40 beta-titanium archwires (Resolve, GAC Company): 10 as received, 10 as retrieved and 20 immersed archwires. Immersion solutions included a topical fluoride agent and a soft drink. The as-retrieved archwires were intraorally used for a mean period of 2 months. The investigated mechanical properties included: ultimate tensile strength, yield strength, modulus of elasticity and the load deflection characteristics (activation and deactivation forces) of the orthodontic wire. A Student's *t*-test (level of significance  $P < 0.05$ ) was used to statistically analyse the results. The wires were also subjected to scanning electron microscopic (SEM) analysis.

**RESULTS:** Significant differences in ultimate tensile strength, yield strength and modulus of elasticity were observed among the immersed and as-retrieved wires. Immersion and intraoral use produced greater loading and lower unloading forces of the deflected wires. For the as-received archwires SEM analysis revealed surface irregularities caused by the manufacturing process. Following immersion in a topical fluoride agent, corrosion changes were more obvious on wires than following acidic soft drink immersion. Intraoral use of the archwires resulted in increased rugosity and obvious signs of crevice corrosion.

**CONCLUSION:** Immersion and intraoral use cause changes in wire surface topography and alteration in the load deflection characteristics due to increased surface rugosity.

#### SP224 CORRELATION BETWEEN THE CRANIAL BASE AND MAXILLARY AND MANDIBULAR SKELETAL VARIABLES IN CLASS III MALOCCLUSION.

Maria Jose Viñas<sup>1</sup>, Veronica Pie De Hierro<sup>2</sup>, Leonor Muelas<sup>1</sup>, <sup>1</sup>Department of Orthodontics, UCM, Madrid and <sup>2</sup>Department of Dentistry, UPV, Bilbao, Spain

**AIMS:** To analyze cranial base morphology in a sample of adults with a Class III malocclusion, and to evaluate correlations between the cranial base and maxillary and mandibular skeletal variables.

**SUBJECTS AND METHOD:** Eighty nine adult Class III malocclusion subjects and a control group of 69 adult Class I subjects with excellent occlusion. Different angular and linear variables of the cranial base, the maxilla and mandible were measured on lateral cephalograms. To analyze differences between the groups, a Student's *t*-test was performed. In the study group, Pearson correlation coefficients were used to assess the association between the variables.

**RESULTS:** Statistical differences were found between both groups in the following cranial base measurements; anterior cranial base length, articular angle, porion location and cranial deflection. No statistical differences were found for saddle angle or posterior cranial base length. Several correlations were found between cranial base and skeletal variables.

**CONCLUSION:** 1. A diminished anterior cranial base length, a decrease in articular angle and an increase of cranial deflection was registered in Class III patients. All of these factors contribute to the development of a Class III malocclusion. 2. Correlation analysis suggests a relationship between a diminished articular angle and a forward position of the mandible. This angle was also correlated with gonial angle and saddle angle. 3. Correlation was found between saddle angle and anterior cranial base length, and between articular angle and ramus height. 4. No correlation was found between cranial base angles and jaw lengths.

#### SP225 CONCORDANCE BETWEEN MEASUREMENTS PERFORMED ON PLASTER AND DIGITAL MODELS

Maria Jose Viñas<sup>1</sup>, Veronica Pie De Hierro<sup>2</sup>, Department of Orthodontics, <sup>1</sup>UCM, Madrid and <sup>2</sup>UPV, Madrid, Spain

**AIMS:** With the development of digital analysis of three-dimensional (3D) dental models, it is of interest to evaluate whether the evaluation can reproduce the results based on measurements performed on dental plaster casts, which is the traditional gold standard. The aim of this study was to compare the accuracy of dental measurements performed on plaster study models with those obtained with digital models.

**MATERIALS AND METHOD:** Twenty maxillary plaster models on which measurements were performed with a digital calliper. These models were scanned with an optical scanner (Maestro 3D scanner). The models in .stl file format were imported to Nemoscan software (Nemotec) in order to obtain digital measurements. Measurements included intermolar width, intercanine distance, the distance from the mesiovestibular cusp of the first molar, the mesiodistal distance of the upper right incisor and the height of the upper right incisor measured from the gingival margin to the incisal border. Lin's concordance correlation coefficient (CCC) was used to measure concordance between both methods.

**RESULTS:** Excellent agreement was obtained between both methods for all variables. CCC ranged from 0.88 to 0.99 for the measurements.

**CONCLUSION:** 1. Measurements taken on digital models reproduce those obtained for plaster models, which is the gold standard. 2. Digital analysis of 3D dental models may be used for diagnosis.

#### SP226 PELOID THERAPY IN COMPLEX TREATMENT OF ORTHODONTIC PATIENTS IN THE RETENTION PERIOD

Grigoriy Stepanov, Mikhail Postnikov, Irina Ayupova, Lyudmila Uliyanova, Samara State Medical University, Russia

**AIMS:** To increase the stability of the results of orthodontic treatment using the method of peloid therapy.

**SUBJECTS AND METHOD:** A solution of 0.01 per cent isotonic humic acids of peloids NaCl (pH 7, 36) was used. Peloid preparation applications were carried out for 10 minutes daily during 14 days, following which there was a break of 14 days. The course was repeated three times. Treatment lasted for 2.6 months. Forty six patients (aged 25 to 35 years) were examined (16 males, 30 females). On completion of the active period of orthodontic treatment the subjects were divided into two groups: group 1, patients with classic treatment during the retention period; group 2, patients using humic acids peloids. Biochemical analysis of blood serum, oral and gingival crevicular fluid and Doppler ultrasound were taken during treatment.

**RESULTS:** Improvement of peripheral blood flow was demonstrated. Metabolic processes in the bone tissue under the action of peloid humic acids were improved 21.5 per cent compared with the control group. Dynamics of the parameters of studied markers of bone resorption demonstrated the effectiveness of treatment in patients in group 2.

**CONCLUSION:** Peloid use optimized bone formation during the retention period of orthodontic treatment which was confirmed by an increase in blood supply to the jaw bones in group 2 compared with group 1.

#### SP227 PHARYNGEAL AIRWAY CHANGES AFTER TWIN BLOCK TREATMENT IN PATIENTS WITH SKELETAL CLASS II MALOCCLUSIONS

Gökhan Türker, Gamze Yazıcı, İbrahim Yavuz, Department of Orthodontics, Erciyes University Faculty of Dentistry, Kayseri, Turkey

**AIMS:** To evaluate and compare pharyngeal airway dimensions and area in subjects with skeletal Class II malocclusions treated with Twin Block (TB) appliances.

**MATERIALS AND METHOD:** The initial (T0) and after TB treatment (T1) archived lateral cephalometric radiographs of 19 patients with skeletal Class II malocclusions (7 males, 12 female; mean age  $13.77 \pm 1.64$  years). For angular measurements SNA, SNB, ANB and SN-GoGn were measured. For pharyngeal airway measurements, D1 (the PNS-Ba line intersected the pharyngeal airway), D2 (the narrowest distance between the soft palate and posterior pharyngeal wall), and D3 (narrowest distance between the base of the tongue and the posterior pharyngeal wall) were measured. The pharyngeal airway area was measured

as the area between D1 and D3. A paired *t*-test was used to compare changes between T0 and T1.

RESULTS: At T1, SNB ( $P < 0.001$ ) and ANB ( $P < 0.001$ ) angles were statistically significant compared with T0 values, whereas, there was no statistically significant difference in SNA and SN-GoGn angles. D1 was similar at T0 and T1. However, D2 ( $P < 0.001$ ), D3 ( $P < 0.001$ ) and pharyngeal airway area ( $P < 0.001$ ) were significantly increased at T1 compared with at T0.

CONCLUSION: Through appropriate TB appliance treatment, an improvement in the skeletal relationship may be advantageous with respect to pharyngeal airway dimensions.

#### SP228 PATIENTS' EXPECTATIONS OF ORTHODONTIC TREATMENT – A PILOT STUDY Özge Çelik, Siddık Malkoç, Department of Orthodontics, University of Inonu, Malatya, Turkey

AIMS: Quality of life is an important component of the evaluation of treatment outcome and has been described as the disagreement between expectation and experience. The objective of this study is to describe patients' expectations before treatment.

SUBJECTS AND METHOD: Inclusion criteria were new patients presenting to an orthodontic consultation clinic, aged between 12-18 years, without a history of orthodontic treatment. The questionnaire was tested on 40 new patients. The time for completing the questionnaire was approximately 5 minutes. There were 22 questions and three options to answer them (yes, no, don't know). Pearson chi-square test were used to evaluate the answers.

RESULTS: At the initial appointment, 84.6 per cent of patients expected to have a check-up and 87.2 per cent of them to have a diagnosis and interview about treatment ( $P < 0.001$ ). They imagined having a better smile, making it easier to eat and giving them confidence socially.

CONCLUSION: This questionnaire is a useful method for determining patients' expectations about orthodontic treatment. By focusing on patients' expectations, clinicians can better understand the concerns of patients.

#### SP229 EFFECT OF ORAL ANTISEPTICS ON THE CORROSION AND MECHANICAL PROPERTIES OF NICKEL-TITANIUM ORTHODONTIC WIRES

Marijana Rincic Mlinaric<sup>1</sup>, Sven Karlovic<sup>2</sup>, Helena Otmacic Curkovic<sup>3</sup>, Visnja Katic<sup>4</sup>, Stjepan Spalj<sup>5</sup>, <sup>1</sup>School of Dental Medicine, <sup>2</sup>Faculty of Food Technology and Biotechnology and <sup>3</sup>Faculty of Chemical Engineering and Technology, University of Zagreb, and <sup>4</sup>Department of Orthodontics, School of Medicine University of Rijeka, Croatia

AIMS: To evaluate the effect of oral antiseptics on the corrosion and mechanical properties of nickel-titanium (NiTi) wires, depending on the wire's surface treatment.

MATERIALS AND METHOD: Uncoated, rhodium-coated and nitrified NiTi wires were immersed in artificial saliva (pH value 4.8) during 28 days, incubated at 37°C. Every week, for a period of 5 minutes, the wires were taken out of the artificial saliva and immersed in antiseptic agents based on chlorhexidine (Curasept), essential oils (Listerine) and hyaluronic acid (Gengigel). One set of every wire type was immersed only in artificial saliva, and served as negative controls. The as-received wires were used as the absolute control. Mechanical properties were measured by a three-point bending test, at 37°C. The corrosion resistance was measured by electrochemical impedance spectroscopy. Electrochemical testing was performed in a solution prepared from equal volumes of oral antiseptics and artificial saliva, at 37°C. ANOVA was used for statistical analysis.

RESULTS: Oral antiseptics and artificial saliva had a similar effect on the mechanical properties of all three wire types. Listerine and Gengigel caused a greater decrease in spring back ratio and moduli of resilience during unloading, when compared to Curasept ( $P < 0.05$ ). Gengigel caused the highest corrosion resistance in all wires. The rhodium-coated wires had the lowest corrosion resistance in Curasept, and uncoated and nitrified NiTi wires in Listerine. Corrosion resistance was partially related to the working properties.

**CONCLUSION:** Reduction of the corrosion resistance and mechanical properties make Listerine the least favourable as an additional oral hygiene product, when NiTi wires are employed.

### SP230 HOW PRECISE IS THE PRODUCTION OF MODELS BY THREE-DIMENSIONAL LOW BUDGET PRINTERS?

Barbara Paal<sup>1</sup>, Michael Bertl<sup>2</sup>, Wolfgang Peter<sup>3</sup>, Wolfgang Recheis<sup>4</sup>, Adriano Crismani<sup>1</sup>,  
<sup>1</sup>Orthodontic Department and <sup>4</sup>Department of Radiology,, Medical University Innsbruck,  
<sup>2</sup>Orthodontic Department, Medical University Wien and <sup>3</sup>Data Engineering & Statistics, Völs,  
Austria

**AIMS:** In recent years digital imaging has found its way into dentistry. Intraoral scans enable the digital recording of dental structures and with three-dimensional (3D) printing devices there is the possibility to remake the matching casts. This study evaluated the advantages and disadvantages of 3D low budget printing and compared the accuracy of dental plaster casts with models built by two different 3D printers.

**MATERIALS AND METHOD:** The 3D shapes of a collection of plaster casts (Orthodontic Department, Medical University Innsbruck, Austria) were digitalized with the structured light scanner S600 ARTI (Zirkonzahn GMBH, Gais). Two different low budget 3D printers, the Formlabs Form1 (Formlabs Inc., Somerville, USA) and Makerbot Replicator 2 (MakerBot® Industries, Brooklyn, USA) recreated copies of the plaster casts. Those copies were finally rescanned with the structured light scanner and digitally compared with their corresponding plaster cast sample, using the GOMInspect software (GOM - Gesellschaft für Optische Messtechnik mbH, Braunschweig, Germany).

**RESULTS:** The Replicator 2 was able to produce more precise replicas of plaster casts than the Form 1. The deviations of the casts printed by Form 1 ranged from -2.74 mm to 2.4 mm and the deviations of the casts printed by the Replicator 2 from -0.26 mm to 0.21 mm. The 95 per cent confidence interval also showed that the deviations of the casts produced by the Replicator 2 were lower and at a smaller range than the deviations of the casts produced by the Form 1. The expenditure of time to produce a cast was longer for Form 1 than for Replicator 2. The Form1 printer also had higher running costs.

**CONCLUSION:** 3D casts can be a valuable alternative to traditional plaster casts as they meet the quality standards for orthodontics. When the two printers were compared. the Replicator 2 produced more accurate dental casts than the Form 1.

### SP231 EARLY TREATMENT OF SKELETAL CLASS II AND III WITH THE FRÄNKEL FUNCTIONAL REGULATOR

Vanja Raickovic, Zorana Stamenkovic, Natasa Randjelovic, Emira Lazic, Borislav Novakov,  
Department of Orthodontics, School of Dentistry, University of Belgrade, Serbia

**AIMS:** To determine the extent of changes of skeletal, dentoalveolar and soft tissue structures during early treatment of skeletal distal and mesial bite using Fränkel's functional regulator.

**SUBJECTS AND METHOD:** Forty patients in the early mixed dentition, who had previously indicated that they did not wish to have orthodontic treatment. A skeletal Class II was diagnosed on the basis of an increase of ANB angle due to mandibular retrognathism, and a skeletal Class III on the basis of a decrease of ANB angle due to maxillary retrognathism. Changes were determined on lateral cephalograms obtained before and after treatment. The following parameters were measured and analyzed: SNA angle, SNB angle, ANB angle, cmax, cmand, I/SpP, i/MP, parameters of Pancherz's analysis, angle H, angle T, height of the upper lip and positions of the upper and lower lips to the aesthetic line. Statistical analysis included calculation of the mean, maximum, minimum, standard deviation and correlation coefficient, one- and two-factor analysis of variance, Bonferroni test and t-test.

**RESULTS:** In subjects with a skeletal distal bite the Fränkel functional regulator caused anterior displacement of the lower jaw, an increase of mandibular corpus length, a decrease of ANB, retrusion of the upper and protrusion of the lower incisors, a decrease of T and H angles and height of the upper lip. In patients with a skeletal mesial bite the Fränkel functional regulator caused stimulation of sagittal growth of the upper jaw, an increase of

maxillary corpus length, an increase of ANB, protrusion of the upper and retrusion of the lower incisors, an increase in height of the upper lip and an increase of T and H angles.

**CONCLUSION:** The Fränkel functional regulator is the method of choice in the early treatment of skeletal distal and mesial bites. With its application, morphological and functional disorders as well as skeletal discrepancies are corrected, preventing the occurrence of subsequent developmental disorders.

#### SP232 ORIGINAL ONE-STEP MAXILLARY SURGICAL CORRECTION CALLED 'LE FORT I-TPD' WITH USE OF A BONE-ANCHORED DEVICE FOR TRANSVERSE STABILITY.

Michal Charezinski<sup>1</sup>, Alain Balon-Perin<sup>1</sup>, Régine Glineur<sup>2</sup>, <sup>1</sup>Clinique d'Orthodontie and <sup>2</sup>Service Stomatologie et Chirurgie Maxillo-Faciale - Hôpital Erasme - Université Libre de Bruxelles, Brussels, Belgium

**AIMS:** Transverse relapse in maxillary multi-directional surgical correction is a well-known issue. The purpose of this retrospective study was to evaluate the transverse stability of an original one-step surgical approach. The goal was to obtain greater posterior palatal expansion.

**SUBJECTS AND METHOD:** Twenty one patients all with moderate posterior transverse maxillary deficiency associated with a sagittal and/or vertical skeletal anomaly. An orthodontic phase was undertaken prior to the surgical phase. During the one-stage surgical procedure, two- or three-dimensional anomalies were corrected and the maxillary expansion was guided and stabilized with a transpalatal bone-anchored device called the 'TPD'. The TPD was maintained for 3 to 4 months after surgery. Expansion measurements were made on study models obtained 1-2 months pre-surgery (T1) and at 6 (T2) and at least 12 (T3) months post-surgery.

**RESULTS:** At T3 the gingival landmarks revealed a mean expansion of 1.86 mm for the canines, 3.95 mm for the premolars and 4.61 mm for the molars. For the occlusal landmarks, the mean expansion was 1.86 mm for the canines, 3.96 mm for the premolars and 4.95 mm for the molars. Canine expansion was significantly less than for the premolars and molars. Antero-posterior expansion ratio was 1 to 2.5. This increase in posterior expansion was achieved through surgery and the use of a continuous orthodontic wire.

**CONCLUSION:** All cases were treated successfully, especially in terms of the transverse occlusion. The transverse stability obtained with the aid of the bone-anchored TPD was very satisfying. This study supports the principle of an original one-step surgical approach, called 'Le Fort I-TPD', which combines a Le Fort I osteotomy with controlled maxillary expansion.

#### SP233 THE RELATIONSHIP BETWEEN BODY MASS INDEX AND DENTAL DEVELOPMENT USING DEMIRJIAN'S METHOD IN 4- TO 15-YEAR-OLD CHILDREN IN MASHHAD

Anousheh Rashed Mohassel<sup>1</sup>, Najmeh Anbiaee<sup>2</sup>, Ali Bagherpour<sup>2</sup>, <sup>1</sup>Department of Pedodontics, Birjan University of Medical Sciences and <sup>2</sup>Faculty of Dentistry, Mashhad, Iran

**AIMS:** To evaluate the relationship between the body mass index (BMI) and dental development.

**SUBJECTS AND METHOD:** The dental ages of 196 children were calculated according to Demirjian's method. The chronological age, weight, and height were recorded. Dental development was defined as dental age minus chronological age. The children were classified into three groups according to their BMI: underweight, normal, or overweight and obese. One-way analysis of variance and Pearson correlation tests were used to analyze the data (significance level 0.05).

**RESULTS:** There was a significant correlation between BMI and dental development in girls ( $P = 0.03$ ,  $r = 0.205$ ). There was no significant correlation between BMI and dental development in boys ( $P = 0.08$ ,  $r = 0.18$ ). There was no significant difference between mean dental development and BMI groups in girls ( $P = 0.07$ ). There was a significant difference between mean dental development in different BMI groups in boys ( $P = 0.018$ ).

**CONCLUSION:** Dental development in overweight and obese boys is significantly accelerated.

## SP234 COMPARATIVE ANALYSIS OF CEPHALOMETRIC FEATURES OF CLASS I, II AND III MALOCCLUSIONS

Jasna Pavlovic<sup>1</sup>, Mirjana Janosevic<sup>2</sup>, Amila Vujacic<sup>1</sup>, Vladanka Vukicevic<sup>1</sup>, Sanja Simic<sup>1</sup>,  
Clinic for Orthodontics, Faculties of Medicine, <sup>1</sup>Kosovska Mitrovica and <sup>2</sup>Nis, Serbia

**AIMS:** To more closely study the morphological characteristics of malocclusions.

**MATERIALS AND METHOD:** Ninety pre-treatment lateral cephalometric radiographs of 18-30 year old patients. Based on clinical examination and morphological analysis, they were classified into three groups: Class I, Class II and Class III malocclusion. Seven linear and 15 angular measurements were analysed.

**RESULTS:** No significant gender differences were observed for the majority of angular and linear measurements for the three skeletal types. No statistically significant differences were found for cranial base angle (SNBa). Anterior cranial base length (S-N) did not show a significant difference among the three skeletal Classes. Maxillary prognathism was not statistically different between subjects with a Class II malocclusion and the Class I control, but SNB and SNPg angles were significantly smaller. The length of the maxillary base (A-SnP) was longer and the length of the mandible (Pg`-MT1/MT) significantly smaller. Gonial angle (Ar-Go-Me) was smaller with an open articular angle (GoArSN). In Class III SNBa and the maxillary prognathism angle were significantly smaller. The length of the mandible, mandibular prognathism angle SNB i NSGn, gonial angle and upper gonial angle (NGoAr) were significantly greater in Class III than Class I subjects.

**CONCLUSION:** Most angular and linear measurements indicated that the skeletal differences between Class I, II and III subjects are in maxillary and mandibular morphology and in their sagittal and vertical relationships.

## SP235 SECULAR TRENDS IN THE TIMING OF THE PUBERTAL GROWTH SPURT IN GIRLS

Mona Montasser<sup>1</sup>, Grace Viana<sup>2</sup>, Carla Evans<sup>2</sup>, <sup>2</sup>Mansoura University, Egypt and <sup>2</sup>UIC, Chicago, USA

**AIMS:** To detect the presence of secular trends in puberty timing in girls based on assessment of cervical vertebral maturation (CVM) from lateral cephalographs.

**MATERIALS AND METHOD:** One hundred and fifty six lateral cephalographs of high quality and good contrast for girls from UIC orthodontic department taken during the period from 1990 to 2010 and from the records of the Denver growth study taken during the period from 1930 to 1960. The age range of the subjects was from 7 to 18 years. CVM stages were assessed directly from the cephalographs according to the method described by Hassel and Farman which adopted a visual subjective assessment of the skeletal changes and used three parts of the cervical vertebrae, namely: the odontoid process of CV2, the body of CV3, and the body of CV4. The method classified CVM into six stages; initiation, acceleration, transition, deceleration, maturation, and completion.

**RESULTS:** For the UIC group; the acceleration stage (CVM2) of the growth spurt occurred at a mean age of 11 years 6 months, the deceleration stage (CVM4) at a mean age of 14 years 7 months (M) and the completion stage (CVM6) at a mean age of 15 years 6 months. For the Denver group; CVM2, CVM4 and CVM6 ages were 11 years 4 months, 14 years 3 months and 15 years 9 months, respectively.

**CONCLUSION:** The results of this study did not indicate a tendency for earlier pubertal skeletal maturation of girls nowadays.

## SP236 EVALUATION OF SEQUELAE AFTER ORTHOGNATHIC SURGERY IN COMBINATION WITH PRE- AND POST-OPERATIVE MANUAL LYMPH DRAINAGE

Michaël De Baets<sup>1</sup>, Gwen Swennen<sup>2</sup>, Guy De Pauw<sup>1</sup>, <sup>1</sup>Department of Orthodontics, University of Ghent and <sup>2</sup>Department of Maxillo-Facial Surgery, Academic Hospital St Jan, Bruges, Belgium

**AIMS:** Orthognathic surgery is associated with post-operative symptoms of severe facial swelling, pain and dysfunction. The aim of this study was to prospectively evaluate sequelae

after orthognathic surgery in combination with pre- and post-operative manual lymph drainage (MLD) using a three-dimensional (3D) laser scanner and patient questionnaires.

**SUBJECTS AND METHOD:** Sixty patients treated with orthognathic surgery received pre- and post-operative MLD of the face. All patients were scanned with a laser scanner (Proface, Planmeca, Finland) 3 weeks before and 1, 7, 14, 21 days after surgery to assess changes in facial swelling. Facial scans were semi-automatically superimposed on the forehead to visualize soft tissue changes. During 21 days all patients answered post-operative questionnaires measuring their satisfaction, pain levels and dysfunction. Data were analysed statistically with SPSS 20.

**RESULTS:** The amount of facial swelling and its reduction after orthognathic surgery varied widely among patients. All patients showed a significant reduction of swelling between the first day and 1 week after surgery and between the first and the second week after surgery. Facial scans were more sensitive to detect residual swelling compared to patient questionnaires. More than 80 per cent of the patients experienced MLD as pleasant and calming and would recommend MLD to other patients.

**CONCLUSION:** It was found that pre- and post-operative MLD of the face had a beneficial effect on swelling although the amount and reduction of swelling varied widely.

### SP237 DOES SELF-ESTEEM CHANGE AFTER ORTHODONTIC TREATMENT? A SYSTEMATIC REVIEW

Maria Kourakou<sup>1</sup>, Eleftherios G Kaklamanos<sup>1</sup>, Christina Vlachou<sup>2</sup>, Smaragda Kavvadia<sup>1</sup>,  
<sup>1</sup>Department of Orthodontics, Aristotle University of Thessaloniki and <sup>2</sup>Private Practice, Thessaloniki, Greece

**AIMS:** To systematically investigate the available literature regarding self-esteem changes before and after orthodontic treatment.

**MATERIALS AND METHOD:** Appropriate electronic database searches of published and unpublished trials were performed to identify studies of any type that prospectively investigated self-esteem before and after orthodontic treatment. No restrictions were applied on publication year or language of the retrieved citations. The following electronic databases were searched: Medline (via Pubmed), Embase (via Ovid), Central, Pro-Quest Dissertation and Theses and ClinicalTrials.gov. Moreover, the reference lists of all eligible studies were hand-searched. Using specific selection criteria related to study design, participants' and intervention characteristics, as well as principal outcome measures, eligible studies were identified and the risk of bias was assessed following the Cochrane Collaboration guidelines.

**RESULTS:** After selection, only four prospective studies qualified for inclusion in the systematic review, assessing self-esteem before and at various time points after orthodontic treatment with a variety of instruments, such as the Tennessee Self Concept Scale, the Coopersmith Self-Esteem Inventory, the Global Negative Self Evaluation Scale and the Rosenberg Self-Esteem Scale. While one study did not observe significant changes before and immediately after treatment, the rest, that involved longer observation periods, reported improvements in self-esteem that were attributed mainly to age or other psychological factors, rather than treatment. Risk of bias assessment identified various drawbacks in the included studies.

**CONCLUSION:** Orthodontic treatment may have a minor contribution to an individual's perception of self-worth, in conjunction with other psychological factors. Further high-quality randomized controlled trials are necessary to clarify the impact of orthodontic treatment on self-esteem.

### SP238 COMPARISON BETWEEN VARIOUS WEAR REGIMENS FOR THERMOPLASTIC VACUUM-FORMED RETAINERS: A SYSTEMATIC REVIEW

Maria Kourakou<sup>1</sup>, Ioannis Doulis<sup>2</sup>, Dimitrios Kloukos<sup>2</sup>, Eleftherios G Kaklamanos<sup>1</sup>, Smaragda Kavvadia<sup>1</sup>,  
<sup>1</sup>Department of Orthodontics, Aristotle University of Thessaloniki and <sup>2</sup>Department of Orthodontics and Dentofacial Orthopedics, 251 Hellenic Air Force V.A. General Hospital, Athens, Greece

**AIMS:** To systematically investigate the available literature regarding comparison between the various wear regimens advocated for thermoplastic vacuum-formed retainers (VFRs) used after removal of fixed orthodontic appliances.

**MATERIALS AND METHOD:** Appropriate electronic database searches of published and unpublished trials were performed to identify randomized controlled trials (RCTs) comparing the various wear regimens advocated for VFRs. No restrictions were applied on publication year and language of the retrieved citations. The following electronic databases were searched: Medline (via Pubmed), Embase (via Ovid), Central, Pro-Quest Dissertation and Theses and ClinicalTrials.gov. Moreover, the reference lists of all eligible studies were hand-searched. Using specific selection criteria related to study design, participants' and intervention characteristics, as well as principal outcome measures, the finally eligible studies were identified and the risk of bias was assessed following the Cochrane Collaboration guidelines.

**RESULTS:** After selection, only three RCTs qualified for inclusion in the systematic review, comparing VFRs part- and full-time wear regimens at various time points into retention. No statistically significant differences were observed regarding overjet, Little's Irregularity Index or intercanine and intermolar width. Only one study found overbite to be statistically significantly increased in the part-time wear group at 6 months and 1 year into retention. Risk of bias assessment identified low and unclear risk for the domains under investigation.

**CONCLUSION:** No statistically significant differences regarding occlusal characteristics were noted between full- and part-time VFRs wear regimens, with the exception of overbite. However, the small number of eligible studies, as well as the heterogeneity of the interventions under investigation, precludes any inferences for clinical practice. Further RCTs are necessary before any conclusions can be safely drawn.

#### SP239 SEVERE INCISOR ROOT RESORPTION ADJACENT TO IMPACTED MAXILLARY CANINES – IS EARLY PREDICTION OF UTMOST IMPORTANCE?

Karolina Kaczor-Urbanowicz<sup>1</sup>, Adrian Becker<sup>1</sup>, Małgorzata Zadurska<sup>2</sup>, Stella Chaushu<sup>1</sup>, Departments of Orthodontics, <sup>1</sup>Hebrew University- Hadassah School of Dental Medicine, Jerusalem, Israel and <sup>2</sup>Medical University of Warsaw, Poland

**AIMS:** The existence of root resorption is highly correlated with maxillary canine palatal impaction. Early studies with plane film radiography indicated that canine-related incisor root resorption occurs in approximately 12 per cent of patients (Ericson and Kurol, 1987). With the advent of more advanced imaging techniques such as computerized tomography (CT) or cone-beam computed tomography (CBCT), detection capability increased to 67 per cent of cases (Walker *et al.*, 2005). Severe incisor root resorption (SIRR) associated with impacted maxillary canines is rare, but, when it appears, it threatens the long-term survival of the affected tooth. Therefore, the aim of this study was to investigate potential predictive factors for this condition.

**MATERIALS AND METHOD:** Radiographic records of 55 untreated patients (aged 11.95 ± 1.41 years; 77 impacted maxillary canines), generating 96 severely resorbed maxillary incisors. The control sample consisted of 57 consecutive control volunteers (72 impacted maxillary canines). The amount of SIRR was measured directly on the radiographs. The following variables were recorded: age, gender, position of the impacted canine, size of the dental follicle, and incidence of anomalous lateral incisors. Root resorption was considered severe when it affected at least one third of the length of the root of the incisor. Multivariate statistical analysis was undertaken for assessment of risk factors.

**RESULTS:** SIRR occurred among individuals with impacted maxillary canines, which are severely mesiodistally displaced and vertically positioned in the middle third of the adjacent incisor root. Maxillary lateral incisors were more often affected than central incisors. Apart from the above-mentioned results, female patients with enlarged dental follicles and normal maxillary lateral incisors were at much higher risk for developing SIRR than control subjects.

**CONCLUSION:** Screening for maxillary incisor root resorption is recommended especially for females with normal lateral incisors, but with severely displaced and mesially angulated impacted maxillary canines, which are vertically positioned in the middle third of adjacent incisor root and have enlarged dental follicles.

## SP240 WHICH OF THE THREE-DIMENSIONAL METHODS MOST USED FOR OBTAINING DIGITAL MODELS IS MORE ACCURATE: INTRAORAL DIGITAL SCANNER OR CONE BEAM COMPUTED TOMOGRAPHY?†††

Veronica San Jose Quilis, Natalia Zamora Martinez, Beatriz Tarazona Alvarez, Mariu Peirã<sup>3</sup> Guijarro, Jose Luis Gandía Franco, Orthodontic Department, Universidad de Valencia. Facultad de Medicina y Odontología, Spain

**AIMS:** To analyze inter- and intra-examiner reproducibility between an intraoral scanner method and a cone beam computed tomographic (CBCT) segmented method in order to study the accuracy of both methods.

**MATERIALS AND METHOD:** Three dimensional (3D) images of 21 adults who had both a CBCT scan and study models were selected. The plaster models were then scanned using the intraoral scanner iTero™ (3D). Similarly, a segmentation of the CBCT scan was performed using Invivo5 software (Anatomage®) in order to obtain 3D models. The program OrthoCad™ Cadent was used for measurement of the 3D digital models obtained from the intraoral scanner and with the segmented CBCT.

**RESULTS:** Intra- and inter-examiner error varied from excellent to good. The validity and accuracy of the 3D intraoral scanner was high for mesiodistal tooth sizes and intercanine widths and acceptable for intermolar widths and arch lengths.

**CONCLUSION:** Measurement of mesiodistal tooth sizes and the widths and lengths of the arches with the iTero™ 3D scanner and with the CBCT are good alternatives to traditional methods, as they are accurate and reproducible.

## SP241 AGE AND GENDER RELATED CHANGES IN FGFR-3 AND SOX-9 EXPRESSION IN RAT MANDIBULAR CONDYLAR CARTILAGE

Riikka Hauru<sup>1</sup>, Sakari Laaksonen<sup>2</sup>, Aune Raustia<sup>1</sup>, Pertti Pirttiniemi<sup>3</sup>, <sup>1</sup>Department of Prosthetic Dentistry and Stomatognathic Physiology, University of Oulu, <sup>2</sup>Laboratory Animal Centre, Faculty of Medicine, Oulu and <sup>3</sup>Department of Oral Development and Orthodontics, Oulu, Finland

**AIMS:** The temporomandibular joint is able to adapt to changes caused by mandibular growth, masticatory loading and ageing. The aim of this study was to examine FGFR-3 and Sox-9 expression in the mandibular condylar cartilage of rats in different age and dietary groups under masticatory loading.

**MATERIALS AND METHOD:** Eighty Sprague-Dawley rats fed on dietboard until the age of 1- or 2-years. The feeding method forced rats to gnaw wood in order to acquire food and the mandibular joints workload was higher. One hundred and sixty samples were examined. Eight groups were formed according to diet, gender and age. The samples were stained with FGFR-3 and Sox-9 antibodies.

**RESULTS:** The 1 year old dietboard rats of both genders had more Sox-9 stained cells than the control groups. The 2 year old female rats had more positively stained Sox-9 cells than the corresponding group, also 2-year old male rats had more Sox-9 cells than their controls. For FGFR-3 staining the 2-year old dietboard group female rats had more positively stained cells.

**CONCLUSION:** Sox-9 and FGFR-3 cell expressions are influenced by loading, age and gender related changes in rat mandibular condylar cartilage.

## SP242 THE EFFECT OF ENAMEL REDUCTION DURING ORTHODONTIC TREATMENT ON THE STABILITY OF ANTERIOR MAXILLARY AND MANDIBULAR ALIGNMENT: A PROSPECTIVE PILOT STUDY

Sarah Vandenecker, Guy De Pauw, Liesbeth Temmerman, University, Ghent, Belgium

**AIMS:** To investigate the influence of enamel reduction during orthodontic treatment on the stability of anterior tooth alignment before and after bracket removal.

**SUBJECTS AND METHOD:** In the experimental group (n = 5), enamel was reduced on a regular base (every 6 months) during active orthodontic treatment on the approximal surfaces of the upper and lower anterior teeth. The anterior teeth of the control subjects (n = 14) had no approximal enamel reduction during orthodontic treatment. At the end of the

finishing stage (T1), in both groups, the wires were removed for 1 month in the upper and lower arch. In the case of a stable tooth position after 4 weeks (T2), the fixed appliance was removed and a suitable retainer was placed. However, if irregularities appeared (T2-T1), extra enamel reduction in the experimental group was performed. The archwires were replaced in both groups and teeth were realigned before debonding (T3). Digital casts were obtained at the start of treatment (T0) and at T1, T2 and T3. The following dental variables were measured in both arches: intercanine distance, Little's irregularity index and the sum of the individual mesio-distal widths of the incisors and canines. Data analysis was performed with SPSS 22 and significance levels were set at  $P = 0.05$ .

**RESULTS:** In the experimental group, enamel reduction of  $0.27 \pm 0.46$  mm was found. There was more enamel reduction of the upper anterior than the lower. In the control group, no enamel reduction was carried out during active treatment. The irregularity index increased  $0.04 \pm 0.72$  mm for the control group in the upper anterior region and  $1.73 \pm 1.30$  mm in the lower;  $0.38 \pm 0.44$  mm and  $1.10 \pm 0.69$  mm for the experimental group between T1 and T2, respectively. This increase showed no significant difference between the control and experimental group. No correlation was found between the irregularity index at T2 and the amount of enamel reduction.

**CONCLUSION:** Enamel reduction does not influence the amount of relapse of the upper and lower anterior teeth.

#### SP243 THE INFLUENCE OF MEDICATION ON THE RATE OF ORTHODONTIC TOOTH MOVEMENT: A LITERATURE REVIEW

Eveline Kerckhof, Guy De Pauw, Department of Orthodontics, University of Ghent, Belgium

**AIMS:** To investigate the influence of medication on the rate of orthodontic tooth movement (OTM).

**MATERIALS AND METHOD:** A literature review of this subject was carried out using the following databases: PubMed (1980-September 2014), Web of Science, reference lists of reviews, completed by hand searching. Twenty-five articles of different medications met the inclusion criteria. A large diversity in application of medication, orthodontic appliances, study design etc., impeded the comparison.

**RESULTS:** Vitamin D3, (para)thyroid hormones, therapeutic administration of eicosanoids, and corticosteroids might increase the rate of OTM. Non-NSAID (Paracetamol) seems to have no effect. NSAID, oestrogens, dietary supplement calcium and exogenous opioid analgesics might decrease the rate, while bisphosphonates have a strong inhibitory effect.

**CONCLUSION:** Further research is needed considering the effect of corticosteroids, exogenous oestrogens, exogenous opioid analgesics and therapeutic administration of eicosanoids. According to the results of this review, treatment time can be better estimated and the best therapeutic strategy can be implemented.

#### SP244 EARLY DIAGNOSIS OF THE TENDENCY FOR IMPACTION OF THE LOWER CANINES

Hristina Arnautska, PDM and Orthodontics, Faculty of Dental Medicine, MU- Varna, Varna, Bulgaria

**AIMS:** Impacted lower canines are those with a delayed eruption time or that are not expected to erupt completely, based on clinical and radiographic assessment. The objective of this study was to ascertain indicators for early diagnosis of the tendency for impaction of the lower canines in the early mixed dentition.

**MATERIALS AND METHOD:** Retrospective, longitudinal studies analysed 68 dental pantomograph (DPT) of 34 subjects. Three analyses were used to predict the impaction of the lower canine: the inclination of the germ of the permanent mandibular canine to the axis of the primary canine (angle  $\lambda_1$ ), angulation to the midline (angle  $\lambda$ ) and the degree of resorption of the primary canine. These indicators have high prognostic value even in the early mixed dentition and render high statistical reliability with regard to the altered route and tendency to canine impactions ( $P < 0.0001$ ).

**RESULTS:** There was a significant increase in the inclination of an impacted permanent canine to the midline in the mandible of over 25 degrees in the early mixed dentition. The

designed DPT methodology established that the inclination of impacted permanent to primary canines in the mixed dentition had a significant increase above 31 degrees. Delayed resorption of the root of the primary canine was established in the case of canine impaction. CONCLUSION: Early diagnosis and prediction of the tendency towards impaction of lower canines is important in the prevention of serious complications. The use of DPTs for early detection of impaction of lower permanent canines has good sensitivity and specificity. Delayed resorption of the root of the primary canine, the positive evaluation of impaction angles, angle  $\lambda$  greater than 25 degrees and angle  $\lambda_1$  greater than 31 degrees, are indicative of a tendency towards permanent lower canine impaction. Early extraction of the primary canine will lead to a change in the eruption path of the permanent canine, its straightening and growth in the correct position in the dental arch.

#### SP245 IS THERE A RELATIONSHIP BETWEEN REVERSE HEADGEAR WITH RAPID MAXILLARY EXPANSION AND ROOT RESORPTION?

Ahmet Yağci, Kevser Kurt Demirsoy, Dilara Åžeker, Department of Orthodontics, Erciyes University, Faculty of Dentistry, Kayseri, Turkey

AIMS: To retrospectively analyse the first molars, premolars and anterior teeth in 20 adolescents and young adults with an Angle Class III malocclusion treated with a Petit type reverse headgear with rapid maxillary expansion (RME+RvHG) to check for inhibited root development and apical root resorption.

MATERIALS AND METHOD: Panoramic radiographs were taken of every patient at the beginning and after completion of orthopaedic treatment. The magnification of the area of the anterior and posterior teeth was determined individually for every radiograph. The vestibular root lengths and area of the first molars, premolars and anterior teeth were then assessed. To assess root length and root area changes, the difference between the lengths and area of the teeth before and after treatment was calculated. The distribution of data was assessed using the Shapiro-Wilk test and Q-Q plots. A paired samples *t*-test was used to compare the length and area measurements at the beginning and end of treatment.

RESULTS: After treatment with RME+RvHG appliance, there was no decrease in root length or area but there was a significant increase in upper right canine length ( $3.15 \pm 6.46$  mm), lower left first premolar length ( $2.23 \pm 3.73$  mm) and area ( $15.9 \pm 32.2$  mm<sup>2</sup>) and all second premolar lengths (upper right  $3.12 \pm 5.02$  mm; upper left  $2.32 \pm 4.77$  mm; lower left  $3.18 \pm 5.25$  mm; lower right  $3.88 \pm 5.76$  mm).

CONCLUSION: Orthopaedic facemask treatment is suitable for individuals that are underage and have not completed root development. According to the results the RME+RvHG appliance did not lead to root resorption of either maxillary or mandibular teeth or have an inhibitory effect on teeth with incomplete root development. The Petit type facemask combined with RME is a reliable appliance with regard to aspects of root resorption in the early dentition stages.

#### SP246 ROOT PULP VISIBILITY AND ROOT CANAL WIDTH AS MATURITY MARKERS IN AGE ESTIMATION AT THE 18 YEAR THRESHOLD

Graham Roberts, Fraser McDonald, Victoria Lucas, Department of Orthodontics, King's College London, U.K.

AIMS: To determine the applicability of root pulp visibility (RPV) and root canal width (RCW) as co-variables to identify subjects >18 years of age.

MATERIALS AND METHOD: The archives of the Department of Dental Radiology at Guy's Dental Hospital provided 2,000 dental panoramic radiographs of healthy Caucasian subjects. The age range was 16 to 25.99 years comprising 50 females and 50 males in each half year age band. 1. The RPV of the lower left third molar (LL8) was assessed using criteria based on the remaining visibility of the partially obliterated radicular pulp<sup>1</sup>. 2. The RCW of the three permanent molars was assessed using criteria comprising the postero-anterior gradient of RCW discernible<sup>2</sup>.

RESULTS: For RPV the grades were: 1. mean = 23.5 (sd 3.1, range  $\pm 3$  sd from 14.2 to 32.8 years), 2. mean = 28.0 (sd 5.4, range  $\pm 3$  sd from 11.8 to 44.2 years), 3. mean = 32.4 (sd 4.6, range  $\pm 3$  sd from 18.6 to 46.2 years) and 4. mean = 34.6 (sd 3.9, range  $\pm 3$  sd from 23.8 to

45.4 years). For RCW the grades were: 1. mean = 18.1 (sd 4.1, range  $\pm 3$  sd from 5.8 to 30.4 years, 2. mean = 19.4 (sd 2.6, range  $\pm 3$  sd from 11.6 to 27.2 years and 3. mean = 19.8 (sd 2.5, range  $\pm 3$  sd from 12.3 to 27.3 years)

CONCLUSION: The establishment of stage H does not, in itself, indicate a subject is over 18 years. The only biological markers that link the maturity of pulp development to a realistic estimate of a subject's age to be >18 are RPV stages 3 and 4. These have a minimum value of 18.6 years and 23.8 years, respectively.

<sup>1</sup>Parekh S 2011 Dental age assessment. Setting standards for UK subjects. Thesis, University College London

<sup>2</sup>Olze A *et al.* 2010 International Journal of Legal Medicine 124:183-186

#### SP247 SKELETAL AGE IN PATIENTS WITH TURNER'S SYNDROME

Cvetanka Bajraktarova Mishevska, Lidija Kanurkova, Gabriela Curcieva Cuckova, Marija Maneva, Emilija Bajraktarova Valjakova, Faculty of Dentistry, Ss. Cyril and Methodius University-Skopje, Former Yugoslav Republic of Macedonia

AIMS: Skeletal maturity, expressed as bone age, is one of the common indices for age estimation. The aim of this study was to assess skeletal age in patients with Turner syndrome using the Tanner-Whitehouse method (TW2).

SUBJECTS AND METHOD: Forty Turner syndrome patients, aged from 9.2 to 18 years. Skeletal maturity was assessed from radiographs of the left hand using the TW2 method. The difference between skeletal age and chronological age was tested by a Student's paired *t*-test.

RESULTS: A significant difference ( $P < 0.001$ ) was found between chronological age and skeletal age. Skeletal maturity was significantly retarded compared with the standards of Tanner-Whitehouse. The mean retardation was 2.2 years (range 0.8-4.5).

CONCLUSION: Delayed skeletal maturity in Turner syndrome patients is caused by hormonal factors. Age estimation plays an important role in orthodontics, and therefore skeletal and chronological ages must be determined for correct diagnosis and treatment planning.

#### SP248 NEOCLASSICAL CANONS IN TODAY'S FACES OF ADOLESCENTS AND YOUNG ADULTS AND POTENTIAL PSYCHOSOCIAL REPERCUSSIONS OF DEVIATIONS FROM CANONS

Andrej Pavlic, Visnja Katic, Magda Trinajstic Zrinski, Stjepan Spalj, Department of Orthodontics, School of Medicine, University of Rijeka, Croatia

AIMS: To explore the current presence of neoclassical canons and to investigate potential psychosocial effects occurring as a result of deviations from canons.

SUBJECTS AND METHOD: The study was cross-sectional and the sample included 249 subjects (60% female) aged 12-39 years (median 20, interquartile range 16-22 years). The subjects were pupils, students and patients of the University Dental Clinic in Rijeka, Croatia. *En face* and profile photographs were obtained in the natural head position and a gauge was used. Photogrammetry included analysis of nine neoclassical canons originating from the 5th century BC (relations between proposed equal facial proportions including head height, facial height, facial thirds, facial quarters, widths of eye, nose, intercanthal width, nose and ear length, and lower face thirds). Psychometric instruments included the Self-Esteem Scale and three domains of the Orthognathic Quality of Life Questionnaire: social aspect of dentofacial aesthetics, facial aesthetics concern and awareness of dentofacial aesthetics. In order to classify examinees into two groups (those with a significant deviation from canons and those with an insignificant deviation), *Z* values of deviation were calculated for each examinee and the results were dichotomised based on deflection from one standard deviation from canons (0 = no significant deviation, 1 = significant deviation). A *t*-test was used for statistical analysis.

RESULTS: Significant deviation from neoclassical facial beauty canons were observed in 55-65 per cent of adolescents and young adults. Gender and age had no correlation with deviations. Examinees with significant deviation in the nose-ear proportion canon (nose

length = ear length) reported higher aesthetic concerns compared to those with no significant deviation (4.1 versus 3.2;  $P < 0.05$ ). Significant deviation in the equal facial quarters canon, precisely in upper face height (distance between glabella and subnasale) correlated with higher social aspect (4.8 versus 3.2;  $P < 0.05$ ). Subjects who demonstrated significant deviation from the nose-mouth canon (mouth width = 1.5 nose width) had less awareness of dentofacial aesthetics (4.9 versus 5.8;  $P < 0.05$ ). No correlation between deviations from canons and self-esteem was found.

**CONCLUSION:** It seems that neoclassical canons of beauty are still present in roughly half of young adults and adolescents. Subjects with deviations from canons appear to be most bothered by disproportions of the nose compared to other facial features.

#### SP249 MEDIATION AND MODERATION EFFECT OF PERSONALITY TRAITS ON THE RELATIONSHIP BETWEEN SELF-PERCEIVED MALOCCLUSION AND PSYCHOSOCIAL IMPACT OF DENTAL AESTHETICS

Andrej Pavlic<sup>1,2</sup>, Philipp Bilobrk<sup>2</sup>, Alenka Novsak<sup>2</sup>, Visnja Katic<sup>1,2</sup>, Stjepan Spalj<sup>1,2</sup>,  
<sup>1</sup>Department of Orthodontics, <sup>2</sup>School of Medicine, University of Rijeka, Croatia

**AIMS:** With the relationship of self-perceived malocclusion and psychosocial impact of dental aesthetics already having been demonstrated, the aim was to explore the mediating and moderating effects of the big five personality traits on that relationship.

**SUBJECTS AND METHOD:** The study was cross-sectional on a convenient sample that consisted of 252 subjects (62% female) aged 12-39 years (median 20, interquartile range 16-22 years). The subjects were in the permanent dentition and were pupils, students and patients of the University Dental Clinic in Rijeka, Croatia. Self-perceived malocclusion was estimated using the 10-point scale of the Aesthetic Component of the Index of Orthodontic Treatment Need (1 = no malocclusion, 10 = the most severe malocclusion). The Psychosocial Impact of Dental Aesthetics Questionnaire and the Big Five Inventory were used to assess psychological impact and personality traits. Moderation and mediation effect of personality traits were evaluated with Pearson correlations and stepwise regression analysis, respectively.

**RESULTS:** Self-perceived malocclusion ranged from 1-8 and was the most significant predictor of psychosocial impact of dental aesthetics, whose unique contribution accounted for 11-36.4 per cent variability, while age and gender accounted for 1.2-2.5 per cent variability. Personality traits had no mediating effect on this relationship. The moderating effect of agreeableness was present in the relationship between self-perceived degree of malocclusion and social impact (SI), psychological impact (PI) and aesthetic concern ( $\Delta R^2 = 0.035, 0.020$  and  $0.013$ ;  $P < 0.001$ ) while conscientiousness affected the relationship between perception of malocclusion and SI and PI ( $\Delta R^2 = 0.018$  and  $0.016$ ;  $P < 0.05$ ). Extraversion, neuroticism and openness did not have a mediating effect.

**CONCLUSION:** High agreeableness and conscientiousness may make patients prone to dissatisfaction with dental aesthetics and potentially more critical about treatment results.

#### SP250 COMPARATIVE EVALUATION OF MOLAR DISTALIZATION THERAPY BETWEEN CONVENTIONAL VERSUS TEMPORARY ANCHORAGE DEVICES

Alessandra Cafagna<sup>1</sup>, Mattia Fontana<sup>2</sup>, Mauro Cozzani<sup>2</sup>, Alberto Caprioglio<sup>1</sup>, <sup>1</sup>University of Insubria, Varese, and <sup>2</sup>University of Cagliari, La Spezia, Italy

**AIMS:** To compare dentoalveolar and skeletal changes produced by the Pendulum appliance (PA) and distal screw (DS) appliance in Class II patients.

**SUBJECTS AND METHOD:** Forty-three Class II malocclusion subjects (19 males, 24 females) retrospectively selected. Twenty four patients (mean age  $12.2 \pm 1.5$  years) were treated with the PA and 19 patients (mean age  $11.3 \pm 1.9$  years) with the DS. The mean distalization time was 7 months for the PA and 9 months for the DS group. Lateral cephalograms were obtained before treatment (T1) and at the end of distalization (T2). A Mann-Whitney  $U$  test was used for between-group statistical comparisons between T1-T2.

**RESULTS:** PA and DS were equally effective in distalizing the maxillary molars (4.7 mm and 4.2 mm, respectively) between T1-T2; however, the maxillary first molars showed less distal tipping ( $3.2$  versus  $9^\circ$ ) in the DS group than in the PA group. Moreover, significant

premolar anchorage loss (2.7 mm) and incisor proclination (5°) were noted in the PA group, whereas premolar distal movement (1.9 mm) and no significant changes of the incisors (0.1°) were observed in the DS group. No significant sagittal or vertical skeletal change was detected between the two groups during the distalization phase.

CONCLUSION: PA and DS seem to be equally effective in distalizing maxillary molars; however, greater distal molar tipping and premolar anchorage loss can be expected using the PA.

#### SP251 PERIODONTAL LIGAMENT VISIBILITY AND THE 18 YEAR THRESHOLD. THE REQUIREMENT FOR A BIOLOGICAL MARKER OTHER THAN STAGE H OF ROOT DEVELOPMENT

Victoria Lucas, Fraser McDonald, Graham Roberts, Department of Orthodontics, King's College London, U.K.

AIMS: To determine the applicability of periodontal ligament visibility (PLV) as a co-variable in identifying subjects over 18 years of age.

MATERIALS AND METHOD: Two thousand archived dental panoramic radiographs of healthy Caucasian subjects. The age range was 16 to 25.99 years, with 50 females and 50 males in each half year age band. The lower left third molar (LL8) was assessed for two developmental characteristics: 1. The state of development of the roots of LL8 classified using the tooth development stages<sup>1</sup>. 2. The periodontal ligament of LL8 assessed using the defined categories<sup>2</sup>.

RESULTS: The category 2 age range for PLV was 20.1 to 26.4 years which, together with the probability values for the balanced age bands<sup>3</sup> showed that the probability of a subject with a stage H LL8 from an age band greater than 20 years was  $P = 1.0$  (100%). The category 1 age range for PLV was 17.60 to 21.3 years which, together with the probability values for balanced age bands, showed that the probability of a subject with a stage H LL8 from an age band beginning at 17.50 years was  $P = 0.70$  (70%). The probability of being incorrectly assigned an age >18 years was 0.30 (30%).

CONCLUSION: The establishment of stage H does not itself indicate that a subject is under 18 years. A second biological marker is necessary to provide compelling statistical evidence that a subject is over the 18 year threshold.

<sup>1</sup>Demirjian *et al.* 1973 Human Biology 45: 211-227

<sup>2</sup>Olze *et al.* 2010 International Journal of Legal Medicine 124: 445-448

<sup>3</sup>Lucas *et al.* 2015 American Academy of Forensic Sciences, Orlando, USA

#### SP252 UNILATERAL CANINE SUBSTITUTION FOR MISSING MAXILLARY LATERAL INCISORS: AN AESTHETIC EVALUATION

Bavo Verhoeven, Guy De Pauw, Ghent University, Belgium

AIMS: To determine whether variations in size, morphology and colour of a unilateral substituted maxillary canine have an influence on smile attractiveness perceived by dentists and laypeople.

MATERIALS AND METHOD: A frontal photograph of a hypodontia patient with orthodontic space closure and unilateral canine substitution was modified for the variables canine width, gingival height, crown tip morphology and colour, and gingival height of the neighbouring premolar. Five series were created, each consisting of five modified images including the standard image. One hundred and twenty seven observers (orthodontists, periodontists, dentists and laypeople) ranked the photographs on attractiveness. The most unattractive image from each of the five series was grouped in a separate series for the overall ranking.

RESULTS: Overall, a darker canine colour and canine tip morphology were significantly found as most unattractive ( $P < 0.05$ ). Premolar gingival height was found to be the least unattractive. All dental professionals showed good observer agreement ( $\kappa = 0.50$ ). In contrast, laypeople showed poor agreement for all ranks ( $\kappa = 0.25$ ).

CONCLUSION: Size, shape and colour have a marked influence on perception of smile aesthetics, although, this perception is different for dentists and laypeople.

## SP253 A PROSPECTIVE STUDY TO ASSESS THE QUALITY AND RELIABILITY OF THE INTERNET AS A SOURCE OF INFORMATION FOR HYPODONTIA PATIENTS

Roopa Kukadia, Amandeep Johal, Orthodontic Department, Institute of Dentistry, Bart's & The London School of Medicine & Dentistry, Queen Mary College, London, U.K.

**AIMS:** Whilst Internet use by patients can influence healthcare, no evidence to-date exists assessing its quality in relation to hypodontia, despite the latter's relatively high prevalence in the population. This study examined the quality and reliability of the Internet as a source of information for hypodontia patients.

**MATERIALS AND METHOD:** A survey of hypodontia patients helped identify both keywords and search platforms. The first five pages of search results were analysed, to meet the selection criteria. Selected sites were then examined using five validated tools, which assessed: the reliability and quality (DISCERN); accessibility, usability and reliability (LIDA); authorship, attribution, disclosure and currency (JAMA-Benchmarks); certification of authenticity (HON-seal) and readability [Flesch reading-ease score (FRES)]. Intra-examiner reliability was carried out by re-evaluating 15 randomly selected sites.

**RESULTS:** Forty two hypodontia patients were surveyed and 100 per cent reported that they used the Internet. A web-based investigation identified 1,576 websites of which 36 were judged suitable. Private institutions developed 33 per cent, 61 per cent were developed in the USA and 50 per cent in 2014. No website scored highly overall. The mean LIDA score was 59 per cent, with all scoring below its regarded gold standard of 90 per cent. Average DISCERN score was 40 per cent. JAMA-benchmarks obtained a maximum 75 per cent and only two websites displayed the HON-seal. The average FRES was 47. No correlations were found between the total scores but were identified between the individual domains. Intra-examiner reliability and internal consistency was high for all tools except LIDA.

**CONCLUSION:** The Internet as a source of information for hypodontia patients is lacking in both quality and quantity and patients should interpret these sites with caution. There is a need for a specifically designed website for hypodontia patients.

## SP254 A THREE-YEAR REVIEW OF SURGICAL EXPOSURE AND ORTHODONTIC MANAGEMENT OF IMPACTED CANINE TEETH AT A DISTRICT GENERAL HOSPITAL: A RETROSPECTIVE AUDIT

Roopa Kukadia, Bhavin Soneji, Maryam Izadi, Sumithra Hewage, Orthodontic Department, London North West Healthcare NHS Trust, London, U.K.

**AIMS:** Ectopic canine teeth are frequently encountered in orthodontic practice and represent a significant proportion of referrals to hospital orthodontic departments. Their treatment often involves a multidisciplinary approach with surgical intervention, resulting in lengthy treatment times. The aims of this study were to determine the prevalence, demographics, surgical exposure, care pathway, orthodontic management, success and time taken for the treatment of impacted canines in a district general hospital orthodontic unit.

**MATERIALS AND METHOD:** A retrospective audit of 88 clinical case notes between January 2008 and January 2011 was carried out. Radiographs, clinical notes and correspondence were assessed. The success of treatment was set at 100 per cent with all patients undergoing surgery within the 18 week referral guidelines.

**RESULTS:** Eighty eight cases of impacted canines were referred between January 2008 and January 2011. All patients underwent surgical intervention. Forty per cent of the referred cases were treated in the hospital orthodontic department with the others referred back to specialist orthodontists following surgical exposure. The mean time taken for canine exposure following referral was 36 weeks. The mean overall treatment time was 3 years and 9 months. Eight per cent of subjects failed to complete their orthodontic treatment.

**CONCLUSION:** Only 26 per cent of patients underwent surgery within the 18 week guideline and treatment times for the management of impacted canines was lengthy due to the delay in referral, surgical intervention and orthodontic appointments. A review of the care pathway is required.

## SP255 INFLUENCE OF TONGUE POSTURE ON JAW MORPHOLOGY AND TREATMENT OUTCOME IN UNILATERAL FUNCTIONAL CROSSBITE – A CONTROLLED STUDY

Jasmina Primožic<sup>1</sup>, Jure Volk<sup>2</sup>, Stephen Richmond<sup>3</sup>, Alexei Zhurov<sup>3</sup>, Maja Ovsenik<sup>1</sup>,  
<sup>1</sup>University of Ljubljana and <sup>2</sup>Community Health Center Ljubljana, Slovenia and <sup>3</sup>University of Cardiff, U.K.

AIMS: To evaluate maxillary and mandibular morphology and tongue posture in a group of unilateral functional crossbite (XB) subjects before and after active palatal expansion in comparison to a group of non-crossbite (non-XB) subjects in the primary dentition phase.

SUBJECTS AND METHOD: Twenty two XB (10 males, 12 females,  $5.2 \pm 0.9$  years) and 23 non-XB (13 males, 10 females,  $5.4 \pm 0.4$  years) subjects. Maxillary and mandibular morphology was assessed by measuring the gingival surface area, the palatal/lingual surface area, and volume of the palatal vault and mouth floor on three-dimensional (3D) digital models. Tongue posture was assessed using a 3D ultrasound system. The XB subjects were treated by palatal expansion, and the groups were compared at baseline and at 1 and 2 years follow-up. The Mann-Whitney *U*-test was used to assess the differences in morphological characteristics of the upper and lower jaws between the two groups, while the differences in the frequency of low tongue posture were evaluated by the chi-square test.

RESULTS: The maxillary morphological characteristics were smaller ( $P < 0.05$ ), while the mandibular gingival surface area ( $P < 0.01$ ) and mouth floor volume ( $P = 0.03$ ) were significantly larger in the XB group at baseline. Furthermore, low tongue posture was significantly more frequently seen among the XB group. At 1 year, no significant differences were observed between the two groups, while at the 2 year follow-up, low tongue posture was significantly more frequent in the XB group. Relapse occurred in 27.3 per cent of the XB subjects and all had their tongue postured on the mouth floor with a significantly larger mandibular gingival surface area ( $P = 0.01$ ) as compared to successfully treated subjects.

CONCLUSION: Beside the well-known palatal constriction among subjects with unilateral functional XB, a wider mandibular arch is also characteristic for this malocclusion together with a low tongue posture. This should be considered in early treatment planning, also with regard to relapse, frequently occurring after early correction of this malocclusion.

#### SP256 MASTICATORY FUNCTION EVALUATION BEFORE AND AFTER ORTHOGNATHIC SURGERY OF CLASS III PATIENTS

Maria Grazia Piancino, Corrado de Biase, Teresa Vallelonga, Guglielmo Ramieri, Cesare Debernardi, Department of Surgical Sciences, University of Turin, C.I.R. Dental School, Italy

AIMS: To investigate the functional outcome of orthognathic surgery of adult skeletal Class III patients, comparing the prevalence of anomalous (reverse) sequencing chewing cycles before and after surgery.

SUBJECTS AND METHOD: Twenty skeletal Class III adult patients (11 males, 9 females,  $22.7 \pm 3.0$  years old). Inclusion criteria were: the presence of a severe skeletal and dental, surgical Class III and the presence of all natural teeth (with the exception of third molars). All patients underwent the following: 1) Chewing cycles before orthodontic treatment (T0); 2) Orthodontic pre-surgical treatment for  $36 \pm 12$  months with fixed appliance; 3) Surgical correction of the skeletal Class III malocclusion: four patients received a bilateral sagittal split (BSSO), three a Le Fort I osteotomy, and 13 a combined BSSO and Le Fort I osteotomy. 4) Orthodontic refinement; 5) Post-orthodontic chewing cycle evaluation (T1). Chewing cycles were recorded with a K7 Kinesiograph (Myotronics Inc.). The patients were instructed to chew soft and hard boluses on the right and left sides. Statistical analysis was performed with the chi square test to compare data at T0 and T1.

RESULTS: A significant decrease in the number of reverse chewing cycles after surgical correction was shown in all recordings (soft bolus right side: 267 pre and 120 post,  $P < 0.05$ ; soft bolus left side: 276 pre and 144 post,  $P < 0.05$ ; hard bolus right side: 346 pre and 143 post,  $P < 0.05$ ; hard bolus left side: 258 pre and 123 post,  $P < 0.05$ ).

CONCLUSION: The decrease of reverse chewing cycles, that are anomalous and dyskinetic cycles, could be considered an indicator of functional improvement after orthognathic surgery; also, it could be a method for the early detection of functional non-responding patients who may require individual therapy to prevent relapse.

## SP257 TEMPOROMANDIBULAR JOINT EVALUATION WITH COMPUTERIZED AXIOGRAPHY BEFORE AND AFTER ORTHOGNATHIC SURGERY OF CLASS III PATIENTS

Maria Grazia Piacino, Corrado de Biase, Francesca Antonella Bianchi, Guglielmo Ramieri, Cesare Debernardi, Department of Surgical Sciences, University of Turin, C.I.R. Dental School, Italy

**AIMS:** To evaluate the functional outcome of the temporomandibular joint (TMJ) in adult skeletal Class III patients after orthognathic surgery.

**SUBJECTS AND METHOD:** Eleven adult patients (6 males, 5 females; mean age  $\pm$  SD:  $23.1 \pm 3.1$  years) requiring correction for mandibular excess. Inclusion criteria were: skeletal and dental Class III, anterior and posterior bilateral crossbite and presence of all natural teeth (with the exception of third molars). Each patient received pre- and post-surgical orthodontic treatment with fixed appliances ( $36 \pm 12$  months). Six patients were corrected exclusively through mandibular setback, whereas five patients received combined mandibular setback and maxillary advancement. All patients were investigated before (T0) and 2 years after treatment (T1) through: clinical examination (according to RDC/TMD) and computerized axiography (CA) to measure border condylar movements. Statistical analysis was performed with the chi squared test to compare data at T0 and T1.

**RESULTS:** The incidence of clinical TMJ signs and symptoms was reduced at T1. CA showed a significant improvement of TMJ border movements [improvement of tracings superimposition ( $P = 0.0001$ ), increase of length of protrusive tracings ( $P < 0.05$ ) and decrease of tracings with irregularities ( $P < 0.05$ )].

**CONCLUSION:** Correction of Class III malocclusion seems to improve clinical and CA signs of TMJ function. This functional improvement may be considered a sign of good adaptation of the neuromuscular system to the new occlusal condition and a good method for detecting non-responding patients who might require further treatment.

## SP258 TREATMENT OF SKELETAL CLASS II MALOCCLUSIONS WITH A HERBST OCCLUSAL HINGE APPLIANCE: CRANIOFACIAL AND DENTOALVEOLAR CHANGES

Daniel Aragón<sup>1</sup>, Jose Alberto Moliner<sup>2</sup>. <sup>1</sup>Department of Orthodontics, Universidad de Zaragoza and <sup>2</sup>Private Practice, Zaragoza, Spain

**AIMS:** A contemporary strategy for the treatment of Class II malocclusion features is an initial phase of functional appliance therapy followed by a phase of fixed appliance treatment. The skeletal discrepancy is corrected during the first phase of treatment, and detailed tooth alignments are performed during the later fixed appliance phase. Among all types of functional appliances available today, the Herbst occlusal hinge appliance is thought to be an effective device to correct Class II malocclusions. The purpose of this study was to evaluate the skeletal and dentoalveolar changes occurring during two-phase orthodontic treatment.

**MATERIALS AND METHOD:** A cephalometric study of Class II correction was carried out in 50 subjects (25 females, 25 males) treated with the Herbst occlusal hinge appliance immediately followed by a second phase of preadjusted edgewise therapy.

**RESULTS:** The Class II correction achieved during phase I treatment with the Herbst appliance was due mainly to an increase in mandibular length, as well as distal movement of the maxillary molars and mesial movement of the mandibular molars and incisors.

**CONCLUSION:** The Herbst occlusal hinge is an effective appliance to correct skeletal Class II malocclusions, improving also the facial hard and soft tissue profile.

## SP259 COMPARISON OF LADANYI SPRINGS AND REVERSE CLOSING LOOPS IN SEGMENTAL CANINE RETRACTION\*\*\*

Hatice Kök<sup>1</sup>, Yaşar Bedii Göyenc<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Faculty of Dentistry, Necmettin Erbakan University, Konya and <sup>2</sup>Balıkesir, Turkey

**AIMS:** Extraction is a treatment method for patients who have anterior crowding or an increased overjet. According to treatment requirements, generally, two upper first premolars or upper and lower first premolars are extracted. Canine retraction is the main stage in

extraction cases. Orthodontists use lots of methods to retract canines. The aim of this study was to compare the effects of Ladanyi springs and reverse closing loops in segmental canine retraction.

**SUBJECTS AND METHOD:** The study group included nine females and three males whose ages were between 12.51-16.94 years (average 15.82 years). The springs were used for upper canine retraction. All reverse closing loops were bent on squared paper to obtain standard loops. The canine parts of the reverse closing loops included 20 degree antitip, 20 degree antirotation, and 20 degree toe-in bends were included on the molar parts. Pre-fabricated Ladanyi springs, which did not contain any bends, were used directly. Ladanyi springs were inserted on the right side and reverse closing loops on the left side. The patients were seen at monthly intervals when the extraction force was defined as 75 g and measured with a gauge. Special wires inserted in the canine brackets and molar tubes to determine a specific dot for radiographic measurements. Dental pantomograms were taken at the beginning and end of treatment (when retraction was achieved on one side) with the reference wires *in situ* and the left and right sides compared. So as not to delay treatment, the decision was taken not to wait until the end of retraction on the other side.

**RESULTS:** Spontaneous correction of the overjet was 1.83 mm and statistically important. Ladanyi Spring retraction was always faster than that with the reverse closing loop and completed within  $5.15 \pm 0.75$  month. The canines were retracted 3.58 mm, intruded 0.12 mm and the axial inclination changes were 7.08 degrees in the Ladanyi springs group. For the closing loops the canines were retracted 1.08 mm, extruded 1 mm, and axial inclination changes were 3.54 degrees.

**CONCLUSION:** A Ladanyi spring is more effective than a reverse closing loop. Antitip and antirotation bends may prevent canine tipping.

#### SP260 DOES DENTAL DEVELOPMENT AFFECT CLASS III FACIAL MORPHOLOGY IN THE PRE-PUBERTAL STAGE?

Bojana Krneta<sup>1</sup>, Alexei Zhurov<sup>2</sup>, Stephen Richmond<sup>2</sup>, Mojca Lajh<sup>3</sup>, Maja Ovsenik<sup>1</sup>, <sup>1</sup>Medical Faculty, University of Ljubljana, Slovenia, <sup>2</sup>School of Dentistry, Cardiff University, U.K. and <sup>3</sup>Health Centre Maribor, Slovenia

**AIMS:** To evaluate the effect of the dentition period on the facial soft tissue characteristics in Class III (CIII) children compared to children without a CIII malocclusion (non-CIII) in the pre-pubertal stage.

**SUBJECTS AND METHOD:** Four groups of Caucasian children (20 CIII aged  $5.4 \pm 0.5$  years and 43 non-CIII aged  $5.7 \pm 0.8$  years in the primary dentition, and 48 CIII aged  $7.2 \pm 0.8$  years and 91 non-CIII aged  $7.3 \pm 0.7$  years in the early mixed dentition). Images were obtained using a three-dimensional (3D) laser scanner (Konica Minolta VIVID 910) and then processed and landmarked using Rapidform software. Four average facial templates were constructed for the non-CIII male and female groups. All faces were superimposed on the corresponding average template. Differences were quantified as the mean distance and its standard deviation between respective facial areas restricted by the horizontal planes through inner canthi and subnasale (upper face), subnasale and commissures of the lips (mid-face) and commissures of the lips and pogonion (lower face). The parameters for the CIII and non-CIII groups were statistically evaluated with analysis of variance. *P* values of less than 0.05 were considered statistically significant.

**RESULTS:** The facial characteristics in the upper and lower face in CIII and non-CIII were not significantly different ( $P > 0.05$ ) regardless of dentition phase. However, the mid-face of CIII children was found to be more retrusive than that of non-CIII children in both the primary ( $P = 0.006$ ) and early mixed ( $P < 0.001$ ) dentition; larger retrusion was found in the later developmental stage. Analysis of variance revealed no statistically significant effect of the dentition period on any of the observed parameters.

**CONCLUSION:** CIII facial characteristics in the pre-pubertal stage exhibit greater differences, as compared to non-CIII, between the groups in the early mixed dentition than in the primary dentition. Although the effect of the dentition period did not reach statistical significance, the timing of treatment for CIII malocclusions should arguably be considered appropriate in the primary dentition.

### SP261 BOLTON INDEX IN A SPANISH POPULATION

Clara Casar Castro, Raquel Baeza Blanco, Iván Nieto Sánchez, Javier De la Cruz Pérez, Department of Dentistry, University Alfonso X El Sabio, Villanueva de la Cañada (Madrid), Spain

**AIMS:** To evaluate, in a sample of Spanish patients, the association of the Bolton index (anterior and total) and gender, biotype and skeletal Class.

**MATERIALS AND METHOD:** One hundred and ninety four initial study models were measured (109 female, 85 male). According to Jarabak, 11.9 per cent were brachyfacial, 38.1 per cent mesofacial and 50.0 per cent dolychofacial. Of the subjects, 51.5 per cent were skeletal Class I (ANB), 37.1 per cent Class II and 11.3 per cent Class III. ANOVA was performed to compare the means for biotype and skeletal Class. A *t*-test was used to compare anterior and total Bolton indices between genders.

**RESULTS:** No association was found for Bolton total or anterior or for skeletal Class or facial biotype ( $P > 0.05$ ). Gender did not show an association with anterior or total Bolton indices ( $P > 0.05$ ).

**CONCLUSION:** In this sample, Bolton anterior or total indices were not associated with skeletal Class, facial biotype or gender.

### SP262 EVALUATION OF THE INFLUENCE OF ORTHODONTIC TREATMENT WITH FIXED APPLIANCES ON THE DAILY LIFE ACTIVITIES OF ADOLESCENTS: A PROSPECTIVE STUDY

Abdullah Alanazi, Department of Orthodontics, Karolinska Institutet, Huddinge, Sweden

**AIMS:** Many adolescents with orthodontic problems undergo treatment with fixed orthodontic appliances which can affect their life and daily activities. The aims of this prospective study were to monitor the impact of fixed orthodontic appliances on the patient's daily life activities and evaluate the influence of information given to the patient prior to treatment. Specific self-administered log-books covered aspects of pain sensation, oral hygiene, eating habits, sleep, speech and social activities.

**SUBJECTS AND METHOD:** Twenty adolescent patients of both genders who were treated with fixed orthodontic appliances. Data were collected, coded and analyzed by descriptive statistics.

**RESULTS:** Pain was the major feature during the first week, which was experienced by 80 per cent of participants. The pain had almost completely disappeared by the end of the first week. Improvement in oral hygiene habits was reported by 80-90 per cent of patients.

**CONCLUSION:** An impact of orthodontic treatment with fixed appliances on the daily life activities of adolescents is expected to occur, mainly during the first week of treatment, primarily because of pain and discomfort. These outcomes can be controlled and managed by good communication between patient and clinician.

### SP263 INTEGRATED ASSESSMENT OF MUSCULOSKELETAL DISORDERS IN TEMPOMANDIBULAR JOINT DYSFUNCTION PATIENTS WITH A VERTICAL TYPE OF POSTURAL ADAPTATION

Maria Markova<sup>1</sup>, Liudmila Polma<sup>1</sup>, Leonid Persin<sup>1</sup>, Anna Debelaya<sup>1</sup>, Nikolay Markov<sup>2</sup>,  
<sup>1</sup>Department of Orthodontics, Moscow State University of Medicine and Dentistry and  
<sup>2</sup>Department of Functional Diagnostic, 1Central Research Institute of Dental and Maxillofacial Surgery, Moscow, Russia

**AIMS:** To determine musculoskeletal disorders in temporomandibular dysfunction (TMD) patients with a vertical type of postural adaptation and the effectiveness of complex treatment.

**SUBJECTS AND METHOD:** Fifteen patients (12-30 years of age) with midline mandibular asymmetry due to temporomandibular joint disorders. The data from photographs (extra-, intraoral, full-length), lateral cephalograms, computer optical topography (COT), stabilometry, magnetic resonance imaging (MRI) of the TMJ, kinesiography, functional tests (to determine limb length) were studied to reveal the severity of the problems and identify the need for orthodontic treatment or postural/podiatric correction.

**RESULTS:** All patients had asymmetry of the shoulders and pelvis, shortening of the legs or arms, cervical hyperlordosis and flexion. On MRI the position of the articular disc was dislocated in all patients. Kinesiographic analysis showed that 79.2 per cent had changes in the lumbosacral, 66.7 per cent in the cervical and 20 per cent in the thoracic part of the spine. All subjects were flatfooted. In the first phase they were treated by a podiatrist and posturologist. Customized insoles and complex therapeutic exercises were recommended. After treatment the COT data was analysed with the patients wearing customized insoles. The findings showed improvement in 66.7 per cent of the patients.

**CONCLUSION:** TMD patients with a vertical type of postural adaptation should be treated by a posturologist and podiatrist before orthodontic treatment is undertaken. Customized insoles and complex therapeutic exercises are favourable treatments for these patients followed by orthodontic correction.

#### SP264 FUNCTIONAL MAGNETIC RESONANCE IMAGING AS A DIAGNOSTIC TOOL FOR ORTHODONTIC TREATMENT ASSESSMENT IN PATIENTS WITH DISTAL OCCLUSION

Nikolay Markov<sup>1</sup>, Vadim Ivanov<sup>2</sup>, Maria Markova<sup>3</sup>, Elena Krechina<sup>1</sup>, Konstantin Lyadov<sup>4</sup>,  
<sup>1</sup>Functional Diagnostic Department, <sup>1</sup>Central Research Institute of Dental and Maxillofacial Surgery, Moscow, <sup>2</sup>Department of Peripheral Nervous System Disease Treatment, Federal Medical and Rehabilitation Center, Moscow, <sup>3</sup>Department of Orthodontics, Moscow State University of Medicine and Dentistry and <sup>4</sup>Federal Medical and Rehabilitation Center, Moscow, Russia

**AIMS:** To evaluate the functional activity of the motor areas of the cerebral cortex in patients with distal occlusion (Class II) before, during and after orthodontic treatment, and to compare superficial electromyography data with functional magnetic resonance imaging (fMRI) results to reveal adequate treatment predictors.

**SUBJECTS AND METHOD:** Twenty five patients (17 females, 8 males), mean age 25.5 years. All were Class II (due to retroposition of the mandible) and orthodontic treatment was indicated for them. Based on radiographic examination (lateral cephalograms) data and simulation of occlusion in an articulator, individual splints or fixed orthodontic devices for mandibular advancement were constructed. Before treatment, directly after mandibular advancement fixation, during one month and after treatment, superficial electromyography was undertaken of the following muscles: temporalis, masseter, sternocleidomastoideus, and trapezius, and fMRI was also conducted with mastication. The asymmetry of muscular work according to superficial electromyography data; lateralization, volume and area of brain activation during a tooth clenching test, - according to fMRI results (tomograph General Electric Discovery MR 750 field density 3 T) was assessed.

**RESULTS:** Superficial electromyography data, showed a more symmetrical muscle work trend after treatment. In some cases fMRI demonstrated asymmetrical brain cortex activation including the supplementary motor area. On the basis of this observation it can be suggested that the appearance of supplementary brain cortex activations during orthodontic treatment is a negative factor reflecting non-adequate motor pattern organization of masticatory and neck muscles.

**CONCLUSION:** Use of fMRI and superficial electromyography helps to assess relevant orthodontic treatment and neuromuscular system adaptation to jaw position changes.

#### SP265 EFFECTS AND BENEFITS OF PRE-ORTHODONTIC TRAINER TREATMENT IN DEVELOPING DENTITION PATIENTS

Gabriela Kjurchieva Chuchova<sup>1</sup>, Radmila Dimovska<sup>2</sup>, Cvetanka Bajraktarova Misevska<sup>1</sup>, Lidija Kanurkova<sup>1</sup>, Marija Maneva<sup>1</sup>, <sup>1</sup>Department of Orthodontics, University Ss. Cyril and Methodius, P.H.O. Unuversity Dental Clinical Center 'St. Panteleimon', Skopje and <sup>2</sup>Private practice KrunaMS, Skopje, Former Yugoslav Republic of Macedonia

**AIMS:** To evaluate the effects of pre-orthodontic trainer (POT) treatment in children with impaired nasal breathing, and to estimate the role of functional forces on head posture, airway dimensions, and the position of the tongue and hyoid bone

**SUBJECTS AND METHOD:** Thirty children with nasopharyngeal obstruction, between 8 and 11 years of age, divided into two groups: first group randomly selected for POT

treatment; second group underwent conventional therapy with removable appliances. Both groups underwent a cephalometric evaluation, measuring six cranio-cervical angles and five linear dimensions to determine pharyngeal airway adequacy. Dental casts and lateral roentgencephalograms, in the natural head position, were obtained at the first visit and 6 months later for all subjects.

**RESULTS:** Children treated with myofunctional appliances showed optimal jaw alignment achievement, and correct or reduced maxillary incisor protrusion. In the group treated with POT there was a statistically significant increase of airway dimensions at three levels (PNS-ad1, ve-pve, and uv-puv), and a decrease in cranio-cervical angulations. No significant changes were seen in the control group.

**CONCLUSION:** Clinical results as such establish muscular balance; eliminate oral dysfunction made the POT appliance remarkable tools that offer the greatest benefits for patients in the most effective way.

#### SP266 CLINICAL INVESTIGATION OF IMPACTED TEETH AT THE DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY, UNIVERSITY OF RYUKYUS HOSPITAL

Keiichi Kataoka<sup>1</sup>, Kazuhide Nishihara<sup>1</sup>, Keiji Moriyama<sup>2</sup>, Akira Arasaki<sup>1</sup>, <sup>1</sup>Department of Oral and Maxillofacial Functionnal Rehabilitation, Graduate School of Medicine, University of the Ryukyus, Okinawa and <sup>2</sup>Department of Maxillofacial Orthognathics, Tokyo Medical and Dental University, Tokyo, Japan

**AIMS:** Impacted teeth occur due to a variety of reasons, such as eruption space deficiency, and result in malocclusion and oral diseases, requiring surgery. Moreover, impacted teeth have many variations for the site, the direction and the timing of the eruption, and the factors may be difficult to treat orthodontically. The expression status of impacted teeth over the past 10 years was investigated, and the diagnostic and therapeutic methods were evaluated.

**MATERIALS AND METHOD:** Data was compiled using panoramic radiographs and medical records of 157 non-syndromic patients (age at first visit, 4-87 years; 91 males; 66 females) who were diagnosed with impacted teeth (except third molars). The following parameters were investigated: (1) advent sites of impacted teeth, (2) advent sites of impacted supernumerary teeth, (3) treatment methods for impacted teeth, and (4) treatment methods for impacted supernumerary teeth.

**RESULTS:** The maxilla showed more impacted teeth than the mandible [77 teeth (76.2%) versus 24 teeth (23.8%)], respectively). (1) The most commonly encountered area for an impacted tooth was the maxillary canine (32.7%), followed by the maxillary central incisor (23.5%). (2) Similarly, the maxillary midline (75.6%) and the maxillary mesial lateral incisor (4.8%) were the most common areas showing impacted supernumerary teeth. (3) Of all impacted teeth 27.3 per cent were treated with extraction. However, 29.5 per cent of the impacted teeth were allowed to erupt, followed by extraction of the adjacent teeth, and 18.2 per cent erupted following orthodontic extraction after fenestration. In 18 cases (20.4%), eruption failure occurred owing to oral pathology such as odontoma, dentigerous cysts, and fibrous dysplasia. (4) Most supernumerary teeth were treated by extraction (95.8%).

**CONCLUSION:** Consistent with previous reports, impacted and supernumerary teeth were most commonly encountered in the areas of the maxillary canine and maxillary midline, respectively. Of impacted maxillary canines 45.8 per cent were treated with extraction. However, early diagnosis and intervention by timely orthodontic examinations may help preservation of the teeth.

#### SP267 EVALUATION OF FACTORS THAT AFFECT THE DIMENSIONAL STABILITY OF ALGINATE IMPRESSION MATERIALS

Nurhat Ozkalayci<sup>1</sup>, Aysegul Koroglu<sup>2</sup>, Cagla Borekci<sup>1</sup>, Departments of <sup>1</sup>Orthodontics, and <sup>2</sup>Prosthodontics, University of Bulent Ecevit, Zonguldak, Turkey

**AIMS:** To evaluate the effects of the holding solution and storage period on dimensional stability of five different alginate impression materials.

**MATERIALS AND METHOD:** Impressions were taken from a master maxillary typodont with a newly designed device and five different alginate materials were used. A total of 210 impressions were taken and divided into two groups. The impressions in group 1 were

stored in holding solution whilst those in group 2 were stored in sealed plastic bags. These two groups were then divided into three subgroups and poured in stone models at three different storage periods. The dimensions of the stone models were measured and statistically compared with each other. The effects of alginate material, time and storage condition were evaluated.

**RESULTS:** All of the stone models had different dimensions from the master model. Statistically significant differences were found between the main two groups in some subgroups. However the dimensional differences were small.

**CONCLUSION:** Alginate impressions can be stored in holding solution or sealed plastic bags for up to two weeks. The type of alginate impression material and storage conditions can affect the stone model dimensions. However, these effects are small and do not change the accuracy of the orthodontic model.

#### SP268 EVALUATION OF FACTORS THAT AFFECT ORTHODONTIC COMPLAINTS AND AWARENESS OF AESTHETIC PROBLEMS OF PATIENTS

Nurhat Ozkalayci, Fethiye Cakmak, Hakan Yilmaz, Department of Orthodontics, University of Bulent Ecevit, Zonguldak, Turkey

**AIMS:** To evaluate factors that affect orthodontic complaints about the face and dentition.

**MATERIALS AND METHOD:** A questionnaire regarding patient information and complaints was compiled. The questions that concerned gender, age, educational level, worst-looking tooth (upper incisor, upper canine, upper premolar, upper molar, lower incisor, lower canine, lower premolar and lower molar) and worst-looking facial section (nose, lip, chin, cheeks, eyebrows, eyes or other) were asked to the patients and parents. Information about the patient's malocclusion was added to the questionnaire. Skeletal relationships, asymmetries, dental relationships, dental crowding sites, most important dental problems, possible treatment procedure, oral hygiene level and cooperation level were noted. Two hundred orthodontic patients were included in this survey. Data were analyzed using SPSS software. Relationships between patient information and complaints were evaluated in detail. In addition, the awareness level of patients was also studied.

**RESULTS:** Fifty seven per cent of patients were female. Sixty per cent of patients were between 11 and 15 years of age and 35 per cent between the ages of 15 and 20 years. According to the questionnaire data, the complaints of patients about dental appearance were: upper incisor crowding (45%), upper canine crowding (39%), lower canine (6%) and lower incisor (3%) crowding. The worst-looking facial section according to the patients answers were: nose (38%), eyebrows (19%), chin (11%), cheeks (10%) and lips (8%). Seventy four per cent reported that function was more important than aesthetics. According to the data of the study; 33 per cent had severe canine crowding and 20 per cent severe upper incisor crowding. Males had more complaints about their chin than females. Girls especially wanted to change their noses.

**CONCLUSION:** Upper incisor crowding, upper canine crowding, the appearance of the nose and good function are very important for patients. Soft tissue appearance should be planned well to provide patient satisfaction.

#### SP269 THREE-DIMENSIONAL PROCRUSTES ANALYSIS OF SEXUAL DIMORPHISM IN THE MANDIBLE FOR DIAGNOSIS OF FACIAL ASYMMETRY†††

Hoi-Jeong Lim<sup>1</sup>, Dongsoo Har<sup>2</sup>, Alix Har<sup>3</sup>, <sup>1</sup>Chonnam National University, Gwangju and <sup>2</sup>KAIST, Daejeon, Korea, South and <sup>3</sup>University of Illinois at Urbana-Champaign, Illinois, USA

**AIMS:** Facial asymmetry has long been a critical factor for evaluation of attractiveness and expressions. Diagnostic evaluation using three-dimensional (3D) computed tomographic images has progressed and the need for 3D craniofacial analysis has increased in the dental field. The purpose of this study was to verify the existence of sexual dimorphism between normal occlusion individuals and those with facial asymmetry.

**MATERIALS AND METHOD:** The samples used were derived from a total of 30 patients with apparent facial asymmetry and 30 normal occlusion individuals without facial asymmetry as the controls. Sixteen mandibular landmarks were identified and digitized. To

ascertain whether morphological differences existed between female and male mandibular forms, generalized Procrustes analysis was employed to obtain Procrustes estimate of the mean shape of each group. Following this, Mahalanobis-distance multivariate permutation test was employed to compare facial morphologies in small samples.

**RESULTS:** No significant differences between males and females were observed after Procrustes superimposition in either the normal or asymmetry groups. However before Procrustes superimposition, the size of the male facial form was shown to be larger than that of the female facial form. Mandibular geometries of normal occlusion individuals and patients with facial asymmetry were significantly different, revealing that the greatest difference in morphology arose in the condylar neck length.

**CONCLUSION:** The morphology of the mandible differs in patients with apparent facial asymmetry and normal occlusion individuals ( $P < 0.05$ ).

SP270 THE ASSOCIATION OF UNILATERAL MASTICATION WITH FACIAL ASYMMETRY  
Hoi-Jeong Lim<sup>1</sup>, Alix Har<sup>2</sup>, <sup>1</sup>Chonnam National University, Gwangju, Korea, South and  
<sup>2</sup>University of Illinois at Urbana-Champaign, Illinois, USA

**AIMS:** Unilateral mastication might result in morphological and functional dysfunctions of the craniofacial structure, including jawbone growth, occlusion, and the whole facia; form. This study examined whether or not facial asymmetry is associated with the unilateral mastication habit.

**SUBJECTS AND METHOD:** A questionnaire was given to orthodontic patients who visited a university hospital, which was designed to determine mastication habit patterns. Patients were classified as unilateral and bilateral mastication groups. Forty-eight individuals with a unilateral mastication habit and the same number of bilateral mastication individuals were enrolled in this study. Lateral and frontal cephalograms were taken and traced. The gonial angle and lateral ramal inclination were defined on the lateral cephalograms, and ramal height and frontal ramal inclination were measured using the frontal cephalograms. All measurements were defined as being either on the right or left sides and then compared between the sides using paired *t*-tests.

**RESULTS:** In the unilateral mastication group, ramus height on the mastication side was significantly greater than that on the non-mastication side ( $P < 0.001$ ). Conversely, subsequent comparisons between the right and left sides in the bilateral mastication group showed that there were no significant differences in mandibular size and shape between the sides.

**CONCLUSION:** These results suggest that facial asymmetry can be associated with a unilateral mastication habit.

SP271 EXPRESSION OF EPH-EPHRIN SIGNALLING IN OSTEOCYTES UNDER MECHANICAL LOADING

Chongshan Liao<sup>1</sup>, Chengfei Zhang<sup>1</sup>, Lijian Jin<sup>1</sup>, Koichi Matsuo<sup>2</sup>, Yanqi Yang<sup>1</sup>, <sup>1</sup>University of Hong Kong, Hong Kong and <sup>2</sup>Keio University, Tokyo, Japan

**AIMS:** To investigate the effect of mechanical loading on ephrinB2-EphB4 and ephrinA2-EphA2 signalling pathways in the osteocyte-like MLO-Y4 cell line.

**MATERIALS AND METHOD:** MLO-Y4 cells were seeded on collagen-coated plates and loaded with a force of 2000  $\mu$  strain for 1 hour, while the cells treated with no force loading served as the control. The cells were collected and analysed by real-time polymerase chain reaction to assess the expression of EphB4, ephrinB2, EphA2, and ephrinA2. All data were expressed as the mean standard deviations from three independent experiments. *t*-tests were used for two-sample comparisons. Significant differences were indicated as  $P < 0.05$ .

**RESULTS:** Both ephrinB2-EphB4 and ephrinA2-EphA2 signalling pathways were altered by mechanical stress stimulation. The mRNA expression level of EphB4 in osteocytes was significantly increased after 1 hour of mechanical loading ( $P < 0.05$ ), and ephrinA2 was also up-regulated under mechanical stress stimulation ( $P < 0.05$ ).

**CONCLUSION:** Mechanical stress alters Eph-ephrin signalling in osteocytes, with both ephrinB2-EphB4 and ephrinA2-EphA2 signalling pathways regulated, which indicates a dynamic balance between bone formation and bone resorption.

## SP272 CHANGES IN DENTAL ARCH FORM IN THE EARLY PERIOD AFTER TREATMENT WITH BEGG AND EDGEWISE MULTIBRACKET APPLIANCES

Natsuki Sano, Akishige Kato, Takashi Kameda, Yukari Terashima, Kazuto Terada, Department of Orthodontics, The Nippon Dental University School of Life Dentistry at Niigata, Japan

**AIMS:** Dental arch forms change during retention and post-retention. Long-term changes of dental arch form could be caused not only by treatment itself but also by other factors, i.e. oral function, growth and habits. For comparison of dental arch form changes after treatment with different multibracket appliances, these changes in the early post-treatment periods were studied.

**MATERIALS AND METHOD:** Multivariate methods were used to investigate dental arch changes on study models at three time points; before treatment (T1), post-treatment (T2), and post-retention (T3, >1.5 years after treatment). These models were obtained from 31 adults treated with multibracket appliances [16 with the Begg technique (group B) and 15 with the standard edgewise technique (group E)] with premolar extractions. The analyses were carried out on the mandibular dental arches and the incisor occlusion.

**RESULTS:** Correlations were observed in the intercanine width minus the intercanine lingual and intercanine lingual (group B), and the intermolar lingual (group E) between T1 and T2. Principal component analyses were calculated to clarify the dental arch changes from T2 to T3. The large and second main component loadings of each component score of all measurement items in both groups was plotted on the X-Y plane. At T2, the irregularity index, intercanine width, intermolar width, and overjet were sampled in group B, and irregularity index, intercanine width, intermolar width, irregularity index, intercanine width, and inside arch length in group E. Multiple regression analyses revealed that the irregularity index was related to intermolar width in group B, and to intercanine width and inside arch length in group E.

**CONCLUSION:** Different dental arch changes in the early post-treatment period might be caused by the treatment mechanics - derived different tooth movement of the canines and first molars.

## SP273 CHANGES OF ELECTROMYOGRAPHIC SWALLOWING PATTERN IN FUNCTIONAL TREATMENT OF PATIENTS WITH CLASS II MALOCCLUSION\*\*\*

Ahmet Ertan Soğancı<sup>1</sup>, Yaşar Bedii Göyenci<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Necmettin Erbakan University Faculty of Dentistry, Konya and <sup>2</sup>Private Practice, Balıkesir, Turkey

**AIMS:** To investigate the changes in the electromyographic (EMG) swallowing pattern of patients with a Class II malocclusion using an EMG device during functional treatment with an activator appliance.

**SUBJECTS AND METHOD:** Twenty six subjects (16 girls, 10 boys, mean age; 12.1 years) with a Class II malocclusion in the pubertal peak were selected and an activator appliance was used for functional treatment. An EMG device and bipolar surface electrodes were used to determine the activity values of the right and left anterior temporal, masseter and anterior digastric muscles during swallowing. Measurements were performed using special software. The EMG records were noted at the start of the treatment (T1) and 1 week (T2), 1 month (T3), 3 months (T4) and 6 months (T5) after activator insertion.

**RESULTS:** There was a significant decrease ( $P < 0.05$ ), in the activity values of right and left anterior temporal muscles at T2 and a significant increase ( $P < 0.05$ ) in the activity values of right anterior temporal muscles at T5. No significant changes were observed in the activity values of right and left masseter muscles during T1-T5. A significant decrease ( $P < 0.05$ ) was noted in the activity of left anterior digastric muscles at T2 and the activity values of the right and left anterior digastric muscles showed progressive and significant decreases ( $P < 0.01$ ;  $P < 0.001$ ) at T3, T4 and T5 during swallowing. The decreased EMG activity of the anterior digastric muscles can be attributed to the reduction of overjet as a result of functional treatment of the patients with Class II malocclusions.

**CONCLUSION:** High EMG activity values of anterior digastric muscles at the beginning of functional treatment, showed progressive and significant decreases. An abnormal and unwanted EMG swallow pattern was changed to normal.

#### SP274 EVALUATION OF APICAL ROOT RESORPTION IN ORTHODONTIC PATIENTS WITH MAXILLARY ANTERIOR INTRUSION USING UTILITY ARCHES AND MINISCREWS – A CLINICAL TRIAL

Sunil Muddaiah Kanjithanda, Sanju Somaiah, Balakrishna Shetty Shetty, Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, India

**AIMS:** To evaluate the amount of root resorption in orthodontic patients with maxillary anterior intrusion using utility arches and miniscrews, and also to compare the efficacy of mini-implants over utility arches in reducing overbite.

**SUBJECTS AND METHOD:** Twenty patients divided into two groups. Group A consisted of 10 patients with titanium miniscrews of 1.3 mm diameter and 8 mm length and group B 10 patients with a utility arch made of 0.017 × 0.25 inch TMA. The miniscrews were placed below the anterior nasal spine region with a force of 40 g using nickel titanium closed coil springs. Standardized radiographs were recorded using the radiovisiography technique. Overbite measurements were made and radiographs were recorded before mini-implant and utility arch placement (T1) and at the end of 3 months (T2). The pre-and post-radiographic images were measured from the incisal tip to the apical tip with the help of intrascan DC software. Thus from the difference (T1- T2) the amount of resorption as a result of intrusion mechanics was calculated. Overbite depth reduction was evaluated by clinically comparing the difference of overbite between T1 and T2.

**RESULTS:** 1. The central and lateral incisors were intruded in both groups. 2. Resorption was seen in both groups. 3. The amount of resorption was greater in group A than in group B. 4. Mini-implants were more efficient in reducing the overbite when compared to the utility arches.

**CONCLUSION:** Intrusion with miniscrews resulted in more apical root resorption than utility arches. Miniscrews were more efficient in decreasing the overbite.

#### SP275 PLASTIC DEFORMATION OF FIXED RETAINERS AFTER *IN-VITRO* LOADING

Iosif Sifakakis<sup>1</sup>, Theodore Eliades<sup>2</sup>, Christoph Bourauel<sup>3</sup>, <sup>1</sup>Department of Orthodontics, School of Dentistry, University of Athens, Greece, <sup>2</sup>Department of Orthodontics and Paediatric Dentistry, Center of Dental Medicine, University of Zurich, Switzerland and <sup>3</sup>C+M Endowed Chair of Oral Technology, School of Dentistry, University of Bonn, Germany

**AIMS:** To compare four common flexible archwires used for fixed canine-to-canine retention regarding the maximum and residual intrusive forces and labiolingual moments generated on a canine during the intrusive *in-vitro* loading of the rest of the anterior teeth.

**MATERIALS AND METHOD:** Fifteen retainers (canine-to-canine) were constructed from each of the following wires: Ortho-FlexTech gold chain (Reliance), Wildcat 0.0175 inch and 0.0215 inch three-strand twist-flex steel wire (GAC) and Tru-Chrome® seven-strand twisted 0.027 inch steel wire (RMO). The retainers were bonded on the anterior teeth of an acrylic resin model, and the model was installed in the Orthodontic Measurement and Simulation System. The maximum intrusive forces and labiolingual moments on the canine were recorded during 15 N loading of the rest of the anterior teeth as well as the residual forces and moments at the same tooth after unloading. Between types of wire differences were assessed through permutation based (1,000 replications) versions of Kruskal-Wallis and Mann-Whitney tests. *P*-values for the pairwise comparisons by type of group were adjusted for multiple comparisons (Bonferroni correction).

**RESULTS:** During maximum loading, the gold chain exerted the lowest and the 0.0215 inch twisted archwire the highest force and moment magnitude. Residual forces and moments were exerted on the canine after unloading in all archwires. The lowest magnitude was measured in cases with the gold chain and the highest in cases of the dead-soft twisted 0.027 inch archwire.

**CONCLUSION:** Archwires with a vertical dimension of 0.019 inches in the 0.022 inch slot system generated lower moments in comparison with those with a vertical dimension of 0.018 inches in the 0.018 inch slot system.

This work was supported by research grant from the German Academic Exchange Service (DAAD).

#### SP276 TORQUE EFFICIENCY OF SQUARE VERSUS RECTANGULAR ARCHWIRES IN 0.018 AND 0.022 INCH CONVENTIONAL BRACKETS

Iosif Sifakakis<sup>1</sup>, Ioannis Doulis<sup>2</sup>, Theodore Eliades<sup>3</sup>, Christoph Bourauel<sup>4</sup>, Departments of Orthodontics, <sup>1</sup>School of Dentistry, University of Athens and <sup>2</sup>Hellenic Air Force General Hospital, Athens, Greece, <sup>3</sup>Department of Orthodontics and Paediatric Dentistry, Center of Dental Medicine, University of Zurich, Switzerland and <sup>4</sup>C+M Endowed Chair of Oral Technology, School of Dentistry, University of Bonn, Germany

**AIMS:** To compare the moments generated during the final stages of orthodontic treatment from square and rectangular stainless steel archwires inserted in 0.018 and 0.022 inch brackets.

**MATERIALS AND METHOD:** The Orthodontic Measurement and Simulation System was used for the evaluation of the moment generated on a central incisor with the following archwire types: 0.018 × 0.018 inch, 0.018 × 0.022 inch and 0.018 × 0.025 inch in 0.018 inch brackets and 0.019 × 0.019 inch, 0.019 × 0.025 inch and 0.019 × 0.026 inch in 0.022 inch brackets. Ten specimens of each archwire type were evaluated. The wires were ligated with elastomerics into the brackets and each measurement was repeated once after re-ligation. A 15 degree buccal root torque was gradually applied to the right central incisor bracket. After each activation the bracket returned to its initial position and the moments in the sagittal plane were recorded during these movements. Ordinary least squares regression models were fitted and moment served as the dependent variable of the model, while the different types of wires served as explanatory variables.

**RESULTS:** The mean maximum moments generated in the 0.018 inch brackets were 18.19, 22.93 and 30.60 Nmm for the 0.018 × 0.018, 0.018 × 0.022 and 0.018 × 0.025 inch archwires, respectively. The moments recorded in the 0.022 inch brackets were 10.78, 15.66 and 16.51 Nmm for the 0.019 × 0.019, 0.019 × 0.025 and 0.019 × 0.026 inch archwires, respectively. The recorded differences of maximum moments between the archwires with different cross-sections were statistically significant at both slot dimensions.

**CONCLUSION:** The archwires with a vertical dimension of 0.019 inches in the 0.022 inch slot system generated lower moments in comparison with those exerted by archwires with a vertical dimension of 0.018 inches in the 0.018 inch slot system.

This work was supported by a research grant from the German Academic Exchange Service (DAAD).

#### SP277 UPPER AIRWAY DIMENSIONS IN CHILDREN TREATED WITH EARLY AND LATER TIMED CERVICAL HEADGEAR – A RANDOMIZED CLINICAL TRIAL

Johanna Julku<sup>1</sup>, Kirsi Pirilä-Parkkinen<sup>1</sup>, Pertti Pirttiniemi<sup>2</sup>, <sup>1</sup>Department of Oral and Maxillofacial Department, Oulu University Hospital and <sup>2</sup>Institute of Dentistry, University of Oulu, Finland

**AIMS:** To evaluate craniofacial structures and pharyngeal airway dimensions in children with a Class II occlusion treated with cervical headgear and randomized into early and late treatment.

**SUBJECTS AND METHOD:** Sixty seven children (28 girls, 39 boys) with a Class II occlusion. The children were randomly divided into two groups. In the first group headgear treatment was started immediately or after eruption of the first maxillary molars (mean age 7.3 years, SD 0.53). In the second group active headgear treatment was started later (mean age 9.5 years, SD 0.56). The active headgear treatment was continued in both groups until a normal Class I occlusion on the first molars was achieved. Lateral cephalometric radiographs were taken of both groups at the beginning of follow-up (T0) and at the

beginning (T1) and end (T2) of treatment (mean age 11.5 years, SD 0.57) of the second group. Conventional cephalometric landmarks were used for skeletal structures. The upper airway variables were modified from the analysis of Linder-Aronson (1970) and Solow *et al.* (1996). The cephalometric values were compared between the early and later treatment groups. An independent samples *t*-test was used to compare the means of the groups. The difference between time points was calculated and compared with an independent samples *t*-test. For those parameters that did not follow the normality of the sample, the Mann-Whitney *U*-test was used.

**RESULTS:** SNA and SNB angles were reduced in the early treatment boys. In the upper airway dimensions the largest difference between the groups at T2 was seen at the oropharynx area ( $P = 0.022$ ), the linear distance being larger in the late treatment group.

**CONCLUSION:** There were only minor changes in upper airway dimensions at T2-T0, and the most significant changes were seen in skeletal variables.

#### SP278 COMPARISON OF SEMI-RAPID AND RAPID EXPANSION WITH A TOOTH- AND BONE-BORNE APPLIANCE IN THE TRANSVERSE DIMENSION

Melike Busra Ducan<sup>1</sup>, Sabri Ilhan Ramoglu<sup>2</sup>, Departments of Orthodontics, <sup>1</sup>Biruni University, Istanbul and <sup>2</sup>Bezmialem Vakif University, Istanbul, Turkey

**AIMS:** To compare the effects of semi-rapid and rapid expansion protocols in the transverse dimension with the application of a tooth- and bone-bore appliance.

**SUBJECTS AND METHOD:** Thirty seven bilaterally posterior crossbite patients divided into two groups. The semi-rapid expansion group consisted of 19 patients with a mean age of  $13.26 \pm 1.36$  years. The rapid expansion group comprised 18 patients with a mean age of  $13.22 \pm 1.39$  years. The mean treatment time was  $60.95 \pm 23.68$  days for the semi-rapid expansion group and  $22.27 \pm 4.41$  days for the rapid expansion group. The patients were instructed to activate the screw  $2\frac{1}{4}$  turns per day for the first week followed by  $1\frac{1}{4}$  turns every other day for the semi-rapid expansion group and  $2\frac{1}{4}$  turns per day throughout treatment for the rapid maxillary expansion group. Dental casts and frontal cephalometric radiographs were obtained at the beginning of treatment and at the end of expansion period. The maxillary base and nasal cavity width, bucco-lingual inclination of the maxillary molars and maxillary intermolar width were measured. Intra-group changes were evaluated with paired and independent *t*-tests and the Mann-Whitney *U* test was used to compare inter-group changes. *P* values less than 0.05 were considered statistically significant.

**RESULTS:** According to statistical analysis; maxillary intermolar, maxillary base and nasal cavity widths and maxillary molar bucco-lingual inclinations were increased significantly. However no statistically significant differences were found between the groups.

**CONCLUSION:** Rapid and semi-rapid maxillary expansion protocols have similar dental and skeletal effects in the transverse dimension with the use of a tooth- and bone-borne appliances at the end of the expansion period.

#### SP279 EVALUATION OF SHEAR BOND STRENGTH OF A LOW VISCOSITY ADHESIVE

Onur Özcan, Barış Öztürk, Samet Çelik, Tamer Türk, Department of Orthodontics, Ondokuz Mayıs University/Dentistry Faculty, Samsun, Turkey

**AIMS:** To evaluate shear bond strengths (SBS) of a low viscosity adhesive.

**MATERIALS AND METHOD:** Sixty human premolar teeth were included in this study. The teeth were stored in 0.1 per cent thymol after extraction to avoid bacterial growth. Before bonding, the teeth were cleaned with fluoride-free pumice. All teeth were randomly divided into two groups of 30 specimens. The teeth were etched with 37 per cent phosphoric acid for 30 seconds, washed for 20 seconds, and dried for 20 seconds for both groups. After etching, a thin uniform coat of primer (Transbond XT Primer; 3M Unitek) was applied. In group 1 Transbond LR (3M Unitek) and in group 2 Transbond Supreme LV (3M Unitek) light cure adhesives were applied to the mesial or distal side of the buccal surface. To standardize the bonding area, cylindrical plastics blocks with a diameter of 3.2 mm were used. The adhesive resins were polymerized for a total of 10 seconds. The samples were stored in 37°C water for 24 hours and then thermocycled 1000 times from 5°C to 55°C. After thermocycling each tooth was embedded in a plaster cylindrical block. A jig was used to align the mesial or distal

side of the buccal surface parallel to the cylinder's base. The shear bond test was performed with a universal testing device at a crosshead speed of 1 mm/minute. The bond strengths were calculated in megapascals (MPa).

**RESULTS:** Group 2 showed a higher SBS value ( $41.08 \pm 7.5$  MPa) than group 1 ( $36.40 \pm 8.97$  MPa). However, no significant difference was observed between the groups. No enamel damage was observed.

**CONCLUSION:** Low viscosity light cure adhesive (Transbond Supreme LV) may be suitable for bonding of lingual retainers. Nevertheless, this adhesive requires further laboratory testing with lingual retainer wires.

#### SP280 ORTHODONTIC CONSIDERATIONS IN BILATERAL MANDIBULAR DISTRACTION OSTEOGENESIS OF SEVERE MANDIBULAR DEFICIENCY CASES†††

Azita Tehranchi<sup>1</sup>, Sepideh Soheilifar<sup>2</sup>, Parsa Behnia<sup>3</sup>, Hossein Behnia<sup>4</sup>, <sup>1</sup>Dental Research Center, Research Institute of Dental Sciences, <sup>2</sup>Orthodontic Department, <sup>3</sup>Dental School and <sup>4</sup>Dentofacial Deformity Research Center, Research Institute of Dental Sciences, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran

**AIMS:** To evaluate aesthetic and functional changes in patients undergoing bilateral mandibular distraction osteogenesis (BMDO).

**SUBJECTS AND METHOD:** A 'before-after' type of study was conducted. Patients who were chosen for BMDO were all had bilateral condylar ankylosis, severe mandibular retrognathia and obstructive sleep apnoea. Cephalometric variables were classified into skeletal, dental, soft tissue and airway parameters. Pre- (T1), post- (T2) treatment and follow-up (T3) cephalograms were taken and data was analyzed by a paired *t*-test.

**RESULTS:** Seven patients [3 females with a mean age of 17.6 years (8 to 31 years) and 4 males with a mean age of 16.2 years (6 to 23 years)] met the inclusion criteria. BMDO caused an increase in SNB ( $10.8^\circ$ ,  $P < 0.001$ ), mandibular length (19.54 mm,  $P < 0.002$ ), lower face height (4.3 mm,  $P < 0.012$ ) and interincisal angle ( $23.73^\circ$ ,  $P < 0.009$ ) and a decrease in ANB ( $9.43^\circ$ ,  $P < 0.003$ ), Wits (15.88 mm,  $P < 0.005$ ), IMPA ( $20.54^\circ$ ,  $P < 0.028$ ) and overjet (9.46 mm,  $P < 0.003$ ). A reduction in the distance between upper and lower lip to E-line (7.08 mm,  $P < 0.001$ ; 4.01 mm,  $P < 0.008$ , respectively) led to changes in the soft tissue profile. Airway space analysis revealed an increase in nasopharyngeal space (Nph2; 4.94 mm,  $P < 0.004$ ), oropharyngeal space (Oph2; 6.84 mm,  $P < 0.022$ ) and posterior airway space (PAS; 10.46 mm,  $P < 0.018$ ). Of the available cases the occlusion remained stable during the follow-up period. Cranio-vertebral angle increased insignificantly between T1-T2, T2-T3 and T1-T3.

**CONCLUSION:** Correction of maxillomandibular discrepancy, increased lower anterior face height and decreased lip prominence relative to nose and chin leading to an aesthetic improvement. Achieving appropriate occlusion and increased oropharyngeal space were functional benefits of BMDO. Head orientation relative to vertebral bone did not change significantly.

#### SP281 TOMOGRAPHIC EVALUATION OF PROSPECTIVE CHANGES IN BUCCAL ALVEOLAR BORDER HEIGHT AFTER LOWER ARCH EXPANSION AND INCISOR PROCLINATION

Flavia Artese, Flavio Carvalho, José Augusto Miguel, Department of Orthodontics, Rio de Janeiro State University, Brazil

**AIMS:** To evaluate buccal alveolar border (AB) height changes of lower incisors and canines in patients treated with orthodontic expansion and proclination, and to correlate these modifications with: (a) the degree of incisor proclination (IMPA); (b) changes in lower intercanine width (ICW) and (c) gingival biotype (GB).

**SUBJECTS AND METHOD:** Fifteen adult patients ( $27.7 \pm 11.3$  years) with a lower arch discrepancy greater than 3 mm and a moderate or pronounced curve of Spee comprised the experimental group. The control group ( $n = 7$ ) consisted of patients ( $19.4 \pm 2.0$  years) with no lower arch discrepancy. These patients had their dental arches completely aligned and levelled up to a 0.020 inch stainless steel archwire. Mandibular cone-beam computed tomographs, with a field of view of 6 cm and 0.25 mm voxels, were the only radiographic

images taken before treatment and after levelling and alignment. AB heights of the lower incisors and canines were digitally measured from the incisal border to the most apical buccal alveolar contour on three-dimensional reconstructions. AB heights were compared between treatment times and between groups, by paired and independent Student's *t*-test, respectively. Changes in AB height were correlated with the degree of IMPA and ICW using the Pearson correlation test. Association between AB and GB was evaluated with the chi-squared test.

**RESULTS:** Lower canines and incisors in both groups presented buccal alveolar bone loss after levelling and alignment, but only teeth #43, #33 and #32 in the experimental group presented a significant decrease in AB height (mean final-initial values: 2.88 mm, 2.66 mm and 2.66 mm respectively,  $P < 0.001$ ). No significant differences were found between initial and final AB measurements for all teeth in the control group. When AB was compared between groups, only the lower canines presented significant differences ( $P < 0.04$ ), with a 21 per cent buccal alveolar bone loss in the experimental group. No correlation was found between changes in AB and IMPA, ICW and GB.

**CONCLUSION:** Alignment and levelling with continuous archwires increases lower incisor inclination and ICW, and this type of arch expansion seems to promote greater buccal alveolar bone loss on lower canines than on lower incisors.

### SP282 PERCEPTION OF ASYMMETRY OF THE LOWER FACIAL THIRD AND OF THE CHIN IN DIGITALLY MANIPULATED PHOTOGRAPHS

Flavia Artese, Danilo Martins, José Augusto Miguel, Department of Orthodontics, Rio de Janeiro State University, Brazil

**AIMS:** To analyze the perception of asymmetry in the lower facial third and chin by three different groups of raters and to determine if there are differences between their assessments.

**MATERIALS AND METHOD:** A standard frontal facial photograph of a clinically symmetrical adult patient was used. Sixteen new images were obtained from the original photograph by digital manipulations. Rotating the image on point subnasale made the lower facial third asymmetric by 1 mm increments, both to the right and left. The same procedure was repeated for the chin with 1 mm linear displacements of the lowest point of the lower lip vermilion and gnathion. These manipulations were subdivided into two groups: eight images with chin deviations of 1 to 4 mm for the right and left sides, and eight images with bimaxillary deviations of 1 to 4 mm for both sides. These images and the original photograph were randomly and individually presented to the groups of raters (30 orthodontists, 32 oral and maxillo-facial surgeons, and 30 laymen) and a 0-100 mm visual analogue scale was used to assess the degree of asymmetry perception, with 100 denoting the greatest asymmetry. Scores for each image were compared between groups of raters by ANOVA and a Tukey *post-hoc* test.

**RESULTS:** The highest scores were given to the 4 mm bimaxillary deviation to the right by all raters (mean scores: 83.7, orthodontists; 86.8, surgeons; 74.6, laymen). For the chin manipulations the highest scores were also given to the 4 mm deviation to the right (mean scores: 85.1, orthodontists; 88.5, surgeons; 62.3, laymen). Scores increased in images with 2 mm of asymmetry or more and were in general higher for deviations to the right than to the left. There were no significant differences in scores between orthodontists and surgeons for all images, but laymen gave significantly lower scores than orthodontists and surgeons for asymmetries of 2 mm or more ( $P < 0.05$ ).

**CONCLUSION:** Lower facial third and chin asymmetries of 2 mm or more are clearly perceived by laymen and professionals and there seems to be a greater perception of asymmetries to the right side. Orthodontists and surgeons have a greater ability to distinguish asymmetries than laymen.

### SP283 A COMPARISON OF PHOTOGRAPHIC AND CEPHALOMETRIC MEASUREMENTS IN THE EVALUATION OF THE SOFT TISSUE PROFILE

Alev Yılmaz, Yonca Sungur, Begüm Tunasoylu, Mine Geçgelen Cesur, Törün Özer, Department of Orthodontics, Adnan Menderes University, Faculty of Dentistry, Aydın, Turkey

**AIMS:** To investigate the relationship between soft tissue measurements obtained from cephalometric radiographs and analogous measurements from standardized facial profile photographs, and to check the reliability of using photographic measurements for evaluating the soft tissue profile.

**MATERIALS AND METHOD:** The pre-treatment lateral cephalometric radiographs and standardized facial profile photographs of 120 subjects. All subjects had completed their growth and development stages according to the cervical vertebral maturation method. Cephalometric radiographs and profile photographs were taken in the natural head position (NHP), with maximum intercuspation and the lips at rest. The subjects were divided into three groups of 40 patients, as Class I, II and III according to their ANB angles. Facial length, projections to TVL, intra-mandibular and inter-jaw relationships and full facial balance parameters of soft tissue analysis (Arnett *et al.*) were measured by the same investigator. Two weeks later the profile photographs of 40 randomly selected subjects were traced and measured again. Intraclass correlation coefficients (ICC) were used to determine the reliability of the repeated tracings. Pearson's correlation coefficient was used to estimate the correlations between the photographic and cephalometric variables.

**RESULTS:** High ICC values were obtained for all variables. The reliability of the photographic technique was satisfactory. Highly significant correlations ( $P \leq 0.001$ ) were found for all variables in all groups, except interlabial gap ( $P > 0.05$ ). The highest coefficients were found between cephalometric and radiographic measurements of the variables glabella-pogonion ( $r = 0.987$ ) and glabella-TVL ( $r = 0.977$ ) in group I which included Class I subjects. The lowest coefficients were obtained for point A-TVL ( $r = 0.563$ ) in group II and nasal projection-TVL ( $r = 0.591$ ) in group I.

**CONCLUSION:** Highly significant correlations between analogous photographic and cephalometric soft tissue measurements were found. The photographic method can be considered as a repeatable, low-cost, and non-invasive diagnostic alternative.

#### SP284 PREDICTORS FOR SOFT TISSUE PROFILE RESULTS AFTER CLASS II TWIN-BLOCK TREATMENT

Seo-Woo Park<sup>1</sup>, Ji-Eun Kim<sup>2</sup>, Su-Jung Mah<sup>1</sup>, Ji-Young Kim<sup>2</sup>, Yoon-Goo Kang<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Kyung Hee University Hospital at Gangdong, Seoul and <sup>2</sup>Face Design Dental Clinic, Seoul, Korea, South

**AIMS:** The Class II Twin-Block (TB) is one of the appliances widely used for jaw growth modification in growing Class II patients. The purpose of this study was to develop cephalometric factors to predict soft tissue profile results that may or not be favourable after Class II TB appliance treatment.

**MATERIALS AND METHOD:** Pre- and post-treatment lateral cephalograms of 45 patients treated with a Class II TB. Profile silhouettes were drawn from the cephalograms and evaluated by three orthodontists to determine the extent of improvement after Class II TB treatment. According to evaluation, samples were divided into two groups: favourable (upper 30% score,  $n = 14$ ) and unfavourable (lower 30% score,  $n = 14$ ). Skeletal and soft tissue measurements were performed on the cephalograms and intergroup comparison was undertaken. Treatment changes were also compared between the groups.

**RESULTS:** Independent *t*-tests revealed that the favourable group had a smaller IMPA, lower incisor to pogonion distance, ANB, SN to maxillary plane angle, SN to mandibular plane angle, gonial angle, symphysis inclination and larger lower incisor inclination to the occlusal plane before treatment compared to the unfavourable group. The favourable group showed larger treatment changes in gonial angle, soft tissue point B projection and soft tissue pogonion projection.

**CONCLUSION:** Class II patients with a lower divergent skeletal pattern and less protruded lower incisors, would have a better profile result after Class II TB treatment. A poorer profile improvement result may occur in patients with high divergency with protruded lower incisors after Class II TB treatment which may require further orthodontic extraction treatment.

#### SP285 ANALYSIS OF MIDPALATAL MINISCREW ASSISTED UPPER MOLAR DISTALIZATION PATTERN

Seo-Woo Park<sup>1</sup>, Ji-Eun Kim<sup>1</sup>, Su-Jung Mah<sup>1</sup>, Ji-Young Kim<sup>2</sup>, Yoon-Goo Kang<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Kyung Hee University Hospital at Gangdong, Seoul and <sup>2</sup>Face Design Dental Clinic, Seoul, Korea, South

AIMS: To compare the patterns of tooth movement using two different types of upper molar distalization appliances with midpalatal miniscrews.

SUBJECTS AND METHOD: Fourteen patients, treated successfully with maxillary molar distalization using midpalatal screws, seven subjects were treated with a lingual arch type appliance and the others with a pendulum arm type appliance. Lateral cephalographs were used to measure the amount of distalization, vertical change and angulation change of the upper first molar between pre- and post-treatment.

RESULTS: With the lingual arch type, molar distalization with bodily movement was observed and with pendulum arm type, molar distalization with distal tipping and intrusion.

CONCLUSION: The patterns of tooth movement were different according to appliance design when lingual arch or pendulum arm types with midpalatal miniscrews were used for upper molar distalization. It is recommended to select the correct appliance type according to the desired tooth movement.

#### SP286 ACCELERATING ORTHODONTIC TOOTH MOVEMENT. A COMPARATIVE STUDY OF THE EFFECTIVENESS OF DIFFERENT TECHNIQUES

Rafael Fernandez Sabater, Maria Florez Gil, Carol Andres Castello, Universidad Europea de Valencia, Spain

AIMS: To compare the effectiveness of different techniques used to accelerate orthodontic tooth movement.

MATERIALS AND METHOD: A PubMed literature review search was carried out. The articles selected were related to acceleration of tooth movement. The keywords used in the search were: 'dentoalveolar distraction in orthodontics', 'low level laser therapy', 'corticotomy', 'electrical current', and 'pulse electromagnetic fields'. The inclusion criteria were to accept articles published within the last 3 years in English. A total of 18 articles were found, of which two were excluded leaving 16 articles for the purpose of this study.

RESULTS: The articles reported that laser therapy is unable to accelerate tooth movement, whereas corticotomy is a safe and an effective technique. However, the effectiveness of electric currents and electromagnetic fields could not be determined. Dentoalveolar distraction is a promising technique, although it lacks scientific evidence.

CONCLUSION: The reviewed articles conclude that corticotomy is a safe and capable technique to accelerate tooth movement, and dentoalveolar distraction is a promising technique despite little available scientific support. More studies would need to be conducted on other techniques in order to determine their effectiveness.

#### SP287 THE EFFECT OF PRE-ORTHODONTIC FORCE APPLICATION ON PERIODONTAL TISSUE REGENERATION DURING REIMPLANTATION

Jin-Hyoung Cho<sup>1</sup>, Wang-Sik Kim<sup>2</sup>, Ki-Heon Lee<sup>3</sup>, Kyung-Min Lee<sup>1</sup>, Hyeon-Shik Hwang<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Chonnam National University, Gwangju, <sup>2</sup>GoodDoctors More Dental Clinic, Bucheon and <sup>3</sup>Lovely Line Orthodontic Clinic, Gwangju, Korea, South

AIMS: Transplantation of a tooth has been a major alternative approach to replace missing or hopeless teeth. It is known that the periodontal ligament (PDL) acts as a critical part for healing in transplantation. The purpose of this study was to investigate the effect of the application of orthodontic forces to the donor teeth on periodontal healing after transplantation.

MATERIALS AND METHOD: Reimplantation of both maxillary first molars after application of orthodontic force for 7 days to the left maxillary first molar was carried out in sixty 7-week-old Sprague-Dawley rats. Resin-wire fixation was performed for retention. After 1, 2, 3, and 4 weeks from replantation, a bone block with a maxillary first molar was taken for analysis. Haematoxylin and eosin staining was conducted for histologic analysis, and polymerase chain reaction (PCR) and real-time PCR was performed for 10 mRNA related bone remodelling and PDL regeneration.

**RESULTS:** The application of orthodontic force for 7 days prior to replantation increased the velocity of new attachment of the PDL and activated many chemokines (CXCL2, CCL, MMP, IL-24, RANKL, OPG, Amelx, SOX, Runx2), especially at 1 and 2 weeks.

**CONCLUSION:** It is assumed that the activated PDL cells could be retained in the donor teeth after pre-application of orthodontic force, and these could help periodontal healing of transplanted teeth.

#### SP288 EFFECTS OF RAPID MAXILLARY EXPANSION IN CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA

Ángeles Ramada Calaforra, Nerea Chulia Beitia, Sonia Presencia Pascual, Beatriz Tarazona Álvarez, Ana María Tejero Martínez, European University of Valencia, Spain

**AIMS:** To conduct a comprehensive literature review of the last 5 years on the effects of rapid maxillary expansion (RME) in children with obstructive sleep apnoea (OSA).

**MATERIALS AND METHOD:** A comprehensive literature review was performed in PubMed, using a combination of the keywords 'rapid maxillary expansion', 'rapid palatal expansion', 'maxillary disjunction' and 'childhood obstructive sleep apnoea'. All articles published without any language or time restriction were retrieved. Inclusion criteria: articles written in English and Spanish published in the last 5 years addressing methodologies or results in relation to the aim of this study. Articles were selected by means of a peer review conducted in two consecutive rounds, firstly based on the title and secondly based on the abstract. The full text of all selected articles was analyzed.

**RESULTS:** A total of 1395 articles were retrieved without restrictions. After applying the language and time restrictions, 78 articles were selected for peer review (titles and abstracts), and subsequently 15 articles were selected for full text analysis. Randomized controlled trials with a control group were not found to assess the effectiveness of the RME. The sample size of six of the selected studies was rather small. All articles analyzed in full text reported that RME increases the nasal and oropharyngeal volumetric space, restoring nasal airflow with the disappearance of obstructive sleep disorders. Five of the selected articles reported that in cases of adenotonsillar hypertrophy, the treatment of choice is adenotonsillectomy, although it is advisable to use RME as a post-operative therapy due to the frequent association of respiratory symptoms in the presence of facial abnormalities.

**CONCLUSION:** 1) Although RME appeared to be a promising alternative treatment in childhood OSA, no randomized controlled trials with a control group were found. 2) A stronger study design is needed to assess the effectiveness of RME in children with OSA. 3) Further research is needed to identify patients most likely to benefit from RME and to clarify the ideal time to initiate therapy.

#### SP289 COMPREHENSIVE ANALYSIS OF THE MOLECULAR MECHANISM IN PRIMARY FAILURE OF ERUPTION

Kumi Sumiyoshi, Takeshi Yanagita, Masahiro Nakamura, Noriaki Kawanabe, Hiroshi Kamioka, Department of Orthodontics, Okayama University Hospital, Okayama city, Japan

**AIMS:** Primary failure of eruption (PFE) is a non-syndromic disease with complete or partial disorder of tooth eruption. The gene mutation of parathyroid hormone receptor 1 (PTH1R) has been reported to be associated with PFE for familial cases. However, the detailed molecular mechanism of PFE has not been fully clarified. In this study, genes that were related with the developmental mechanism of PFE, focusing on periodontal ligament (PDL) tissue were analysed.

**MATERIALS AND METHOD:** Human PDL cells were isolated from the extracted tooth affected with PFE. A normally erupting tooth extracted for orthodontic treatment was provided from same patient as a control. Total RNA was extracted from cells cultured in medium after collagenase treatment. Comprehensive and pathway quantification of related genes was carried out by microarray analysis.

**RESULTS:** From the pathway analysis, some genes concerning bone remodelling and inflammation were identified as statistically having a difference of five times. The inflammatory cytokines were increased in the PDL of PFE, whereas the genes concerning bone remodelling were decreased.

**CONCLUSION:** Disorders of bone remodelling have been considered to be the main cause in preventing tooth eruption, however the change in gene expression level also occurred in the surrounding PDL tissue. Therefore, the interaction mechanism between the PDL and surrounding bone tissue may have an important role in the developmental mechanism of PFE in addition to the normal tooth erupting mechanism.

#### SP290 EFFECT OF ORTHOGNATHIC SURGERY ON CONDYLAR HEAD REMODELLING: EVALUATION WITH CONE-BEAM COMPUTED TOMOGRAPHY GENERATED CEPHALOGRAMS

Min-Hee Oh<sup>1</sup>, Hwang-sog Ryu<sup>2</sup>, Kyung-Min Lee<sup>1</sup>, Jin-Hyoung Cho<sup>1</sup>, Hyeon-Shik Hwang<sup>1</sup>,  
<sup>1</sup>Department of Orthodontics, Chonnam National University, Gwangju and <sup>2</sup>Well Dental Clinic, Mokpo, Korea, South

**AIMS:** To use cone-beam computed tomography (CBCT) generated cephalograms to investigate the effect of orthognathic surgery on condylar head remodelling.

**MATERIALS AND METHOD:** One investigator evaluated the CBCT data of 30 subjects who had undergone mandibular setback surgery. Condylar displacement was measured before and immediately after surgery and condylar head remodelling 6 months after surgery. Changes of condylar head remodelling were correlated with condylar displacement.

**RESULTS:** Immediately after surgery, condylar displacement occurred predominantly in the lateral, posterior, and downward directions. Regarding rotation, it predominantly showed inward rotation. Six months post-surgery, the condyles presented distinct resorption/deposition according to the surfaces, and bone remodelling occurred according to condylar displacement. Condylar head remodelling significantly correlated with the direction of condylar displacement.

**CONCLUSION:** Significant bone remodelling occurs on the condylar head after orthognathic surgery, and resorption/deposition and its amount is determined by condylar displacement during surgery.

#### SP291 VARIATIONS INDUCED IN AIRWAY SPACE BY TWO MOLAR DISTALIZATION DEVICES

Ruggero Turlà<sup>1,2</sup>, Francesco Pachi<sup>2</sup>, <sup>1</sup>Department of Orthodontics, <sup>2</sup>Tor Vergata University, Rome, Italy

**AIMS:** To evaluate the changes in airway space of two molar distalization devices: Hilgers pendulum and cervical pull headgear.

**SUBJECTS AND METHOD:** Forty Class II malocclusion subjects, due to maxillary protrusion. To obtain molar distalization, 20 subjects were treated with cervical pull headgear (group 1) and 20 with the pendulum (group 2). For all patients lateral cephalograms were obtained at the beginning (T0) and end (T1) of distalization. Airway space and soft tissue values evaluated on the cephalograms were: length and thickness of the soft palate (Pns-U; SPT), upper airway space (Phw1-SPT), lower airway space (Phw2-Tp), and length (VT) and vertical position of the tongue with respect to the Frankfort plane (HperPH), horizontal and vertical distance between C3 and hyoid bone (AH-C3hor; AH-C3ver) and the distance between hyoid bone and the Frankfort plane (AH-PH). Statistical analysis was carried out using the Student's *t*-test.

**RESULTS:** In group 1 there was a significant reduction of nasopharyngeal ( $P \leq 0.05$ ) and oropharyngeal ( $P \leq 0.05$ ) airway space. An increase of lingual length ( $P \leq 0.01$ ) was evident. The tongue maintained a lower position (T0: 26.13 - T1: 30.37;  $P \leq 0.01$ ); the hyoid bone increased its distance from C3 ( $P \leq 0.05$ ) and from the Frankfort plane ( $P \leq 0.01$ ).

**CONCLUSION:** Cervical pull headgear induces a significant reduction of upper and lower airway space when compared with Hilgers pendulum.

#### SP292 QUALITATIVE AND QUANTITATIVE ASSESSMENT OF BISPHENOL-A IN RINSING SOLUTIONS OF ORTHODONTIC PATIENTS ASSOCIATED WITH BONDING OF BRACKETS

Dimitrios Kloukos<sup>1</sup>, Iosif Sifakakis<sup>2</sup>, Ioannis Doulis<sup>3</sup>, George Eliades<sup>4</sup>, Theodore Eliades<sup>5</sup>,  
<sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics, Faculty of Medicine, University of

Bern, Switzerland, Departments of <sup>2</sup>Orthodontics and <sup>4</sup>Biomaterials, School of Dentistry, University of Athens, Greece, <sup>3</sup>Department of Orthodontics, 251 Hellenic Air Force VA Hospital, Athens, Greece and <sup>5</sup>Department of Orthodontics and Paediatric Dentistry, University of Zurich, Switzerland

**AIMS:** To assess and quantify the amount of Bisphenol-A (BPA) leached in the oral cavity from adhesives used to bond fixed orthodontic appliances.

**SUBJECTS AND METHOD:** Twenty healthy volunteers were recruited after obtaining informed consent. All patients received fixed orthodontic appliances in the upper and lower arches, namely from first molar to first molar on the contralateral side (24 brackets). All bonding procedures were performed by one orthodontist in order to approximately standardize the amount of resin composite used to bond the orthodontic brackets. The saliva samples of the patients were stored in glass tubes containing either 25 mL de-ionized water or 20 mL de-ionized water and 5 mL absolute alcohol (99% v/v) to induce accelerated ageing. To evaluate the levels of BPA, saliva was collected before, immediately after placing the fixed appliances and after washing out the oral cavity, i.e. three samples per patient were collected. Analytical determination was performed using gas chromatography. The molecular composition of the eluents was investigated by micro-attenuated reflection Fourier transform infrared spectroscopy (micro-ATR FTIR).

**RESULTS:** A substantial increase of 98.15 ng/L ( $P < 0.001$ , 95% CI = 59.57-136.73) from pre-bonding to first post-bonding analysis, followed by a substantial decrease of 82.80 ng/L ( $P < 0.001$ , 95% CI = 48.05-117) between first post-bonding and second post-bonding analysis were observed for the complete set of the solutions tested. At the second post-bonding analysis the BPA concentration levels were equal or below their initial pre-bonding values. However this difference was not statistically significant, meaning that BPA levels practically returned to their initial values ( $P = 0.48$ ) after washing out the mouth. ATR-FTIR spectra obtained from the samples exhibited evidence of aromatic components in all specimens.

**CONCLUSION:** A notable pattern of increase of BPA levels, followed by a decrease that reached the initial values was observed throughout all samples tested. The amount of BPA released from resin composites used while bonding orthodontic appliances should not be overlooked.

## SP293 RELATIONSHIP BETWEEN ORTHODONTIC TREATMENT AND ROOT RESORPTION: RISK FACTORS. A LITERATURE REVIEW

Ana Mateu, Carla Barber, Juan Manuel Maciá, Barbara Martos, European University of Valencia, Spain

**AIMS:** To evaluate the effect of orthodontic treatment on root resorption. A further objective was to compare the amount of root resorption among different types of orthodontic treatments.

**MATERIALS AND METHOD:** The literature published in PubMed from 1995 to 2014 was reviewed, in addition to well-known reports that were not classified under this database. The keywords used were: 'root resorption in orthodontic treatment' and 'inflammatory root resorption'.

**RESULTS:** The search strategy yielded 145 articles. Following the application of inclusion and exclusion criteria, 28 articles qualified for the final review. The following results were observed: Arc types used during treatment, different orthodontic forces, and different treatment systems, different types of orthodontic movements, different types and degrees of root resorption related to orthodontic treatments as well as different treatment plans. However there were factors that did not influence root resorption such as bracket type, since no significant differences between the use of conventional and self-ligating brackets were found.

**CONCLUSION:** Iatrogenic root resorption is common during orthodontic treatment and can compromise the treatment success with multifactorial aetiologies. There is no consensus in the literature regarding the causes of this condition. Knowing the most harmful risk factors for periodontal health, can help establish criteria for treatment thus avoiding, where possible, severe root resorption.

#### SP294 EFFECT OF PULSING MODE OF LIGHT EMITTING DIODES ON ATDC5 CHONDROGENIC CELLS

Nattapong Khamcha<sup>1</sup>, Sirinthip Choonate<sup>2</sup>, Anak Khantachawana<sup>3</sup>, Dutmanee Seriwatanachai<sup>2</sup>, Peerapong Santiwong<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Oral Biology,, Mahidol University, Bangkok and <sup>3</sup>Department of Mechanical Engineering, King Mongkut's University of Technology Thonburi, Bangkok, Thailand

**AIMS:** To determine the effect of pulsed-operating light emitting diodes (LEDs) at 830 nm wavelength on ATDC5 chondrogenic cells.

**MATERIALS AND METHOD:** ATDC5 chondrogenic cells were cultured in DMEM/F12 medium and irradiated with LEDs with a 830 nm wavelength in two different pulsing modes, 1 and 500-Hz for 20 minutes with two time intervals. The total energy density was 3.5 J/cm<sup>2</sup>. Temperature alteration of culture media in each well was evaluated prior to biological analyses. After complete irradiation, cells were returned to the cultured medium. After 16 hours, cell viability was evaluated by the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) test.

**RESULTS:** During irradiation at a wavelength of 830 nm for 20 minutes, there was no alteration of temperature between the irradiated and control group, 25.0-26.4°C and 26.2-26.7°C, respectively. Chondrogenic cell viability was not altered by 1 or 500 Hz pulsed LEDs.

**CONCLUSION:** Exposing ATDC5 chondrogenic cell to 1 and 500 Hz pulsed LEDs did not cause an inhibitory effect on chondrogenic cells numbers despite the alteration of temperature environment during irradiation.

#### SP295 THE RELATIONSHIP BETWEEN THE SOFT PALATE AND MANDIBLE IN PRESCHOOL CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA

Shigeto Kawashima<sup>1</sup>, Mitsuyoshi Suzuki<sup>2</sup>, <sup>1</sup>Isdorly Orthodontic Office, Tokyo and <sup>2</sup>Department of Pediatrics, Juntendo University Graduate School of Medicine, Tokyo, Japan

**AIMS:** To evaluate the relationships between the soft palate and the mandible in preschool children with obstructive sleep apnoea (OSA) by retrospective research.

**SUBJECTS AND METHOD:** Sixteen preschool children (mean: 4.6 S.D.: 0.8 years) with OSA were monitored at home during nocturnal sleep for three nights by their parents, who were instructed in the use of portable polysomnography. Finally, all OSA children were diagnosed by a paediatric otorhinolaryngologist. The control subjects included 35 preschool children (mean: 4.7 S.D.: 0.7 years) without OSA. The sample and control cephalometric radiographs were obtained for previous research. The difference between OSA and control children was calculated with the Mann-Whitney *U* test. In addition, the relationship between the soft palate and mandible was investigated using Pearson's product moment correlation coefficient.

**RESULTS:** Compared with the control group, OSA children had both a longer and thicker soft palate. In addition, there was a significant correlation between soft palatal length and facial depth, and soft palatal thickness and facial axis in the OSA group. However, there was no significant correlation between the soft palate and mandible in the control children.

**CONCLUSION:** The lack of a normal soft palatal length and thickness in preschool children with OSA may be related to abnormal growth of the mandible. Therefore, it may be necessary to surgically control the feature of the soft palate in the clinical management of preschool children with OSA.

#### SP296 EFFECT OF SLEEP SPLINT THERAPY WITH A FUNCTIONAL APPLIANCE IN OBSTRUCTIVE SLEEP APNOEA

Shigeto Kawashima<sup>1</sup>, Mitsuyoshi Suzuki<sup>2</sup>, <sup>1</sup>Isdorly Orthodontic Office, Tokyo and <sup>2</sup>Department of Pediatrics, Juntendo University Graduate School of Medicine, Tokyo, Japan

**AIMS:** To evaluate the polysomnographic values of patients with obstructive sleep apnoea (OSA).

**SUBJECTS AND METHOD:** Ten adult patients (age range; 45-70 years, mean; 58 years) underwent nocturnal polysomnography. Their clinical symptoms were a decreased number of snoring and sleep apnoea episodes both with (S2) and without (S3) a sleep splint after approximately six months. Evaluation of the apnoea-hypopnea index (AHI), mean SpO<sub>2</sub> and lowest SpO<sub>2</sub> consisted of three polysomnographic values. First, these initial polysomnographic values were evaluated at S1, then the effectiveness of the sleep splint on these polysomnographic values were evaluated at S2 and S3 after its use for at least six months.

**RESULTS:** There were differences in polysomnographic values at S1, S2 and S3 for the following values; AHI, mean SpO<sub>2</sub> and lowest SpO<sub>2</sub>. These variables were selected for comparison using the Friedman test among S1, S2 and S3. Compared with polysomnographic values at S1, the values at S2 and S3 revealed a decreased AHI and an increased mean and lowest SpO<sub>2</sub>. There were no differences in AHI, mean SpO<sub>2</sub> and lowest SpO<sub>2</sub> between S2 and S3.

**CONCLUSION:** AHI was not found to be lower; mean SpO<sub>2</sub> and lowest SpO<sub>2</sub> were not raised in patients wearing a sleep splint rather than no appliance. The present findings show that sleep splint therapy may be associated with a change in oral function after at least six months.

#### SP297 HARDNESS OF FOOD INFLUENCES THE CHARACTERISTICS OF MASSETER MUSCLE SUBSEQUENT TO MYH GENE EXPRESSION

Kana Kono, Takeshi Yanagita, Hiroshi Kamioka, Takashi Yamashiro, Department of Orthodontics and Dentofacial Orthopedics, Graduate School of Dentistry, Osaka University, Japan

**AIMS:** The increasing number of malocclusions in modern Japanese society is commonly attributed to changes in dietary habits, albeit there is no strong evidence. How an acquired factor such as a dietary habit changes skeletal shape has not been shown. The purpose of this study was to clarify the molecular mechanism to acquired morphological change of the mandible.

**MATERIALS AND METHOD:** Fourteen mice were randomly divided into two groups. One group was fed a solid diet and the other a powdery diet with the same nutritional values. Microcomputed tomographs (CT) were taken of the heads of the mice and three-dimensional (3D) reconstruction of the CT data was performed using 3D analysis software. The cephalometric analysis method was used for morphological comparison between the sample. The masseter muscular fibre properties were observed by NADH-Tr staining to assess changes. Additionally total RNA was collected from the masseter muscle of each specimen and the expression of MYH genes was compared using the real time polymerase chain reaction method.

**RESULTS:** The length of the mandibular ramus became shorter and the alveolar bone longer in the powdery group compared with the solid group. These characteristics accorded with a tendency to a skeletal open bite with a high mandibular plane angle. NADH-Tr staining showed that the ratios of the fast muscle fibres increased in the powdery group. Additionally MYH4 gene expression was increased in the masseter muscles of the powdery group, while MYH1 and MYH2 gene expressions were decreased.

**CONCLUSION:** The characteristics of mandibular shape in the powdery group demonstrated a skeletal open bite with a high mandibular plane angle, similar to a malocclusion patient. This may partly explain the relationship between postnatal surrounding factors and the origin of malocclusion via mandibular growth.

#### SP298 DENTAL ARCH EFFECTS AFTER EARLY OR LATE CERVICAL HEADGEAR TREATMENT – A RANDOMIZED CLINICAL TRIAL

Johanna Julku<sup>1</sup>, Matti Hannula<sup>2</sup>, Pertti Pirttiniemi<sup>2</sup>, <sup>1</sup>Oral and Maxillofacial Department, Oulu University Hospital and <sup>2</sup>Institute of Dentistry, University of Oulu, Finland

**AIMS:** To compare the effects of cervical headgear treatment on dental arch dimensions in children with a Class II occlusion after early or late headgear treatment.

**SUBJECTS AND METHOD:** Sixty seven children (39 boys, 28 girls). The children, who had a Class II malocclusion, were randomly divided into two groups. Headgear treatment was started at the age of 7.2 years (SD 0.58) in the early group and at 9.5 years of age (SD 0.57) in the late group. Headgear treatment was continued in both groups until a Class I tendency was achieved. Dental casts were taken at the beginning of follow-up, at the age of 9.5 years (SD 0.57) and at the end of headgear treatment (mean age 11.5 years, SD 0.70). Dental casts were scanned into three-dimensional models (3Shape, R700 Scanner, Denmark) and measured with an analyzing program (3Shape, Ortho Analyzer 2012). The measurements were compared between the two groups. The independent samples *t*-test was used to compare the means of the groups and the Mann-Whitney *U*-test for those differences which did not follow the normality of the sample.

**RESULTS:** There were highly significant differences between groups in boys at the end of treatment. The distance between the first molars was 1.96 mm larger in the upper dental arch ( $P = 0.031$ ) and 2.83 mm longer in the lower dental arch ( $P = 0.003$ ). The distance between the first molars and canines was bilaterally longer in the lower dental arch in the early group. With girls there were no significant differences between the groups.

**CONCLUSION:** Early headgear treatment has significant benefits on dental arch dimensions in boys compared to late headgear treatment. The dental arches were significantly wider in both jaws. There were also significant positive sagittal effects in the lower dental arch in boys treated with early timed headgear.

#### SP299 EFFECT OF DRUG-LOADED TITANIUM DIOXIDE NANOTUBE ARRAYS ON OSSEOINTEGRATION OF ORTHODONTIC MINISCREWS. AN *IN VIVO* STUDY

Insan Jang<sup>1</sup>, Dong-Soon Choi<sup>1</sup>, Bong-Kuen Cha<sup>1</sup>, Jae-Kwan Lee<sup>2</sup> Won-Youl Choi<sup>3</sup>,  
Departments of <sup>1</sup>Orthodontics, <sup>2</sup>Periodontics and <sup>3</sup>Metal and Materials Engineering,  
Gangneung-Wonju National University, Gangneung city, Korea, South

**AIMS:** To evaluate osseointegration on the surface of miniscrews with titanium dioxide (TiO<sub>2</sub>) nanotube arrays containing recombinant human bone morphogenetic protein-2 (rhBMP-2) or antibiotics.

**MATERIALS AND METHOD:** Highly ordered TiO<sub>2</sub> nanotube arrays were grown on the surface of orthodontic miniscrews. Ethylene glycol based electrolyte was used in the anodic oxidation process. Two-step anodic oxidation was conducted to obtain clean and open windows in TiO<sub>2</sub> nanotube arrays. The diameter and length of TiO<sub>2</sub> nanotube arrays were ~70 nm and ~5 μm, respectively. In TiO<sub>2</sub> nanotube arrays of 12 miniscrews, rhBMP-2 or ibuprofen were loaded. These 12 miniscrews with drug-loaded TiO<sub>2</sub> nanotube arrays, six miniscrews with no drug-loaded TiO<sub>2</sub> nanotube arrays, and six conventional miniscrews as control were implanted on the tibia of New Zealand white rabbits. Histological osseointegration was assessed after 8 weeks by bone-to-implant contact (BIC) ratio.

**RESULTS:** Miniscrews with ibuprofen-loaded TiO<sub>2</sub> nanotube arrays showed higher BIC ratio (66.6% on average), than those of other miniscrews. The mean BIC of miniscrews with no drug-loaded TiO<sub>2</sub> nanotube arrays was 54.7 per cent, and that of conventional miniscrews 44.3 per cent. However, loading rhBMP-2 in TiO<sub>2</sub> nanotube arrays did not show significant differences in BIC from other groups.

**CONCLUSION:** TiO<sub>2</sub> nanotube arrays on the surface of miniscrews were useful as a carrier of drugs, and loading antibiotics in TiO<sub>2</sub> nanotube arrays improved osseointegration of miniscrews *in vivo*.

#### SP300 ARCH WIDENING IS REVERSELY CORRELATED WITH TEMPORAL BONE GROWTH AFTER 2 YEARS OF BIMLER-A-TYPE-TREATMENT\*\*\*

Barbara Bimler, Vera Lepperhof, Bimler Laboratorien KG, Köln, Germany

**AIMS:** Assessment of a possible relationship between growth of the temporal bone, as expressed in the distance between the tuber vertical and the temporomandibular joint (TMJ), and the increase in the distance 14-24 after 2 years of treatment with a Bimler A-type appliance.

**SUBJECTS AND METHOD:** Thirty seven Class II patients (20 females, 17 males) aged 7 or 8 years at the beginning of treatment. Lateral headplates were evaluated using the Bimler

Cephalometric Analysis, and the distance measured between the tuber vertical and the TMJ (T-TM distance). The maxillary inter-premolar distance was measured using the pont-points with a three-dimensional calliper. Changes of each value after two years were determined. The values were distributed into two groups according to the intensity of increase in 14-24 distances. The averages for each group were calculated and a two-tailed unpaired *t*-test was performed between the high and low groups of the difference in the T-TM distance in relation to the change in the 14-24 distance.

**RESULTS:** The 14-24 distance average change in the low value group was  $2.5 \pm 1.25$  mm and the corresponding T-TM distance average change was  $1.89 \pm 1.71$  mm. For the high 14-24 distance group, the average change after 2 years was  $5.86 \pm 0.95$  mm with an average T-TM distance increase of  $0.61 \pm 0.87$  mm. Statistical analysis revealed a significant correlation of a higher increase in the T-TM distance with a lesser increase in the 14-24 distance after 2 years.

**CONCLUSION:** 14-24 arch widening by Bimler-A-type treatment is inversely correlated with sagittal growth of the temporal bone. This could indicate that sagittally shorter skulls allow for wider dental arches under patient-controlled functional treatment with a free-floating appliance, and *vice versa*.

### SP301 THE EFFECT OF SELF-PERCEIVED DENTAL AESTHETICS TO SOCIAL APPEARANCE, ANXIETY AND BODY SATISFACTION

Cahide Aglarci, Asli Baysal<sup>2</sup>, Ferhan Dikmen<sup>1</sup>, Kadir Demirci<sup>3</sup>, Departments of Orthodontics, Faculties of Dentistry. <sup>1</sup>Sifa University, İzmir and <sup>2</sup>Katip Celebi University, İzmir and <sup>3</sup>Department of Psychiatry, Faculty of Medicine, Suleyman Demirel University, Isparta, Turkey

**AIMS:** To investigate the relationship between self-perceived dental aesthetics, social appearance, anxiety and body satisfaction.

**SUBJECTS AND METHOD:** One hundred and fifty students [77 males (51.3%), 73 females (48.7%)] randomly selected from the university campus (age range: 17-30 years, mean age:  $20.8 \pm 1.96$  years) who had no previous orthodontic treatment. The participants were asked to fill in a questionnaire to assess the awareness of malocclusion, satisfaction with dental appearance and orthodontic treatment need. Self-perceived dental aesthetics were assessed by the Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN-AC). The psychological variables were evaluated with the Social Appearance Anxiety Scale (SAAS) and Body-Cathexis Scale (BCS). The data was analysed using the Chi-square test, Mann-Whitney *U* test and Spearman correlation at a significance level of  $P < 0.05$ .

**RESULTS:** Forty-two (28%) participants stated that they needed orthodontic treatment. Orthodontic treatment need was found to be greater in females compared to males ( $P = 0.03$ ). A statistically significant relationship was found between orthodontic treatment need and IOTN-AC ( $P = 0.44$ ). Awareness of malocclusion and satisfaction with dental appearance were found to be correlated with BCS ( $P < 0.01$ ). High correlations were found between IOTN-AC and awareness of malocclusion ( $P < 0.001$ ). There was a significant correlation between SAAS and BCS ( $r = 0.378$ ,  $P < 0.001$ ). However no statistically significant relationship was found between IOTN-AC and orthodontic treatment need with psychological scales ( $P > 0.05$ ).

**CONCLUSION:** Awareness of malocclusion and satisfaction with dental appearance has an effect on BCS. However SAAS and BCS evaluate the whole body appearance. Psychological tests specifically designed for evaluating perception of facial appearance should be used in further orthodontic studies.

### SP302 NEURAL TUBE DEFECTS AND NON-SYNDROMIC DENTAL AGENESIS: A RETROSPECTIVE STUDY\*\*\*

Alessandra Putrino, Maria Rosaria Abed, Stefania Migliaccio, Ersilia Barbato, Gabriella Galluccio, Department of Odontostomatological and Maxillo-Facial Sciences, University 'Sapienza', Rome, Italy

**AIMS:** Complex genetic and molecular processes lead to the development of teeth and other facial structures during embryogenesis. Neural tube defects may increase the risk of

abnormal development of these structures, including dental agenesis in non-syndromic patients. The association between the presence of congenital agenesis and atlantooccipital ligament (AOL) calcification as a possible link was investigated.

**MATERIALS AND METHOD:** AOL calcification was assessed on lateral cephalograms of 40 non-syndromic patients (12-25 years old) with dental agenesis according to the inclusion criteria. The results were compared with a control group (non-syndromic patients, without congenitally missing teeth) using the *t*-test.

**RESULTS:** The group with dental agenesis showed a relevant degree of AOL calcification in 26 per cent of cases whereas in the control group the same anomaly was found in 15 per cent; the difference was statistically different ( $P = 0.2$ ).

**CONCLUSION:** There is a possible association between dental agenesis in non-syndromic patients and neuro crestal cell defects.

### SP303 SYSTEMATIC REVIEW OF SYSTEMATIC REVIEWS ON THE EFFECTS OF PALATAL EXPANSION ON THE UPPER AIRWAYS

Rosaria Bucci, Vincenzo D'Antò, Francesca D'Apolito, Roberto Rongo, Ambrosina Michelotti, Department of Neuroscience, Reproductive Sciences and Oral Sciences - School of Orthodontics and Temporomandibular Disorders, University of Naples Federico II, Italy

**AIMS:** To assess the quality and to summarize the results of systematic reviews (SRs) and meta-analysis (MAs) on the effects of palatal expansion techniques on the upper airways.

**MATERIALS AND METHOD:** A systematic literature search was independently conducted by two operators using Medline (via PubMed), Latin American and Caribbean Health Sciences (LILACS), Scientific Electronic Library Online (SciELO), the Cochrane Library, Web of Knowledge (WOK) and Scopus, up to October 2014. A further hand-search of orthodontic journals and reference lists was performed. No restrictions were set for language. SRs and MAs focusing on the effects of palatal expansion on the upper airways were included. For each paper the methodological quality was assessed using the Assessment of Multiple Systematic Reviews (AMSTAR). The design of the studies included in each SR was assessed with the Level of Research Design (LRD) scoring.

**RESULTS:** Five studies fulfilled the inclusion criteria. One study evaluated both rapid maxillary expansion (RME) and slow maxillary expansion (SME), while four assessed only RME. The average AMSTAR score was 8.2 (range 7 to 9). One study was LRD II-III, one LRD II, two LRD III, and one LRD II-IV. Posteroanterior radiographs, lateral radiographs, cone-beam computed tomography, rhinomanometry, and acoustic rhinometry were adopted. An increase in nasal cavity width was reported between 1.2 and 2.73 mm. An increase in nasal cavity volumes and minimum cross-sectional area were also reported.

**CONCLUSION:** The quality of the included SRs and MAs was high. RME seems to be an effective procedure to increase nasopharyngeal airway dimensions, but more research is needed to assess the clinical relevance of the enhancement of breathing ability. Hence, at this stage, if the main purpose is to improve nasal breathing, palatal expansion is recommended when an orthodontic indication is present and must be part of an interdisciplinary approach.

### SP304 DENTAL EVALUATION OF PATIENTS REQUIRING ORTHODONTIC TREATMENT: A PANORAMIC RADIOGRAPHIC STUDY

Eren Isman<sup>1</sup>, Merve Goymen<sup>1</sup>, Fatih Mehmet Zopçuk<sup>1</sup>, Aytac Agca<sup>4</sup>, Tolga Topcuoglu<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Gaziantep University and <sup>2</sup>Private Practice, Gaziantep, Turkey

**AIMS:** To evaluate dental characteristic of patients referred with panoramic radiographs.

**SUBJECTS AND METHOD:** Four hundred and forty five patients (218 males, 227 females) with a mean age of  $11.8 \pm 1.5$  years referred between 2010-2014. The panoramic radiographs were analysed. The patients were evaluated according to congenital missing, supernumerary, caries, deep caries, secondary caries, periapical lesion, root treatment, filling teeth and eruption disorders.

**RESULTS:** Sixteen patients (3.53%) had caries, 12 (2.65%) fillings, eight (1.77%) eruption disorders, seven (1.54%) congenitally missing teeth, six (1.32%) secondary caries, five

(1.10%) supernumerary teeth, five (1.10%) caries, four (0.88%) periapical lesions and three (0.66%) root treatment.

**CONCLUSION:** Prior to orthodontic treatment, patients should be carefully examined because of the relatively high risk of tooth decay, filled teeth and eruption disorders.

### SP305 COMPARISON OF TREATMENT EFFECTS OF THE MODIFIED PALATAL ANCHORAGE PLATE AND HEADGEAR IN ADULTS

Seong Ho Han<sup>1</sup>, Mohamed Bayome<sup>2</sup>, Yoon-Ah Kook<sup>2</sup>, Chong-Ook Park<sup>2</sup>, Ju Yeon Nam<sup>1</sup>, Department of Dentistry, Division of Orthodontics, The Catholic University of Korea, <sup>1</sup>St. Vincent's Hospital, Suwon and <sup>2</sup>St. Mary's Hospital, Seoul, Korea, South

**AIMS:** To evaluate skeletal and dental treatment effects of the modified palatal anchorage plate (MPAP) and headgear (HG) in distalization of maxillary molars in adults.

**MATERIALS AND METHOD:** Lateral cephalographs of 40 skeletally mature patients treated with either MPAP (mean age:  $24.6 \pm 7.7$  years; 5 males, 14 females) or HG (mean age:  $23.0 \pm 7$  years; 6 males, 15 females) for correction of a dental Class II malocclusion. The non-extraction treatment plan included fixed appliance therapy combined with distalization of the maxillary molars by MPAP or HG. Pre- (T1) and post- (T2) treatment cephalographs were analyzed for 31 cephalometric variables with multivariate analysis of covariates.

**RESULTS:** No significant difference was found in treatment duration between the MPAP and HG groups ( $19 \pm 2.2$  months and  $21 \pm 2.2$  months;  $P = 0.86$ ). Both groups showed a reduction in SNA angle (MPAP =  $-1.0 \pm 1.7^\circ$ ; HG =  $-0.72 \pm 2.2^\circ$ ;  $P = 0.83$ ). ANB angle was either marginally reduced ( $-0.24 \pm 2.19^\circ$  in HG) or did not change ( $0.0 \pm 1.10^\circ$  MPAP) after treatment. A significant amount of distalization of the maxillary first molar was observed in both groups ( $3.48 \pm 2.88$  mm in MPAP and  $1.48 \pm 2.34$  mm in HG). The HG group showed greater reduction in overjet ( $-3.7 \pm 2.7^\circ$ ) than the MPAP group ( $-0.82 \pm 1.67^\circ$ ) but the difference did not reach statistical significance. ( $P = 0.38$ )

**CONCLUSION:** Both MPAP and HG appliances were effective in distalization of the maxillary molars and reduction of overjet with similar treatment results. Therefore, MPAP may be considered as a viable alternative among non-compliant dental Class II adult patients.

### SP306 CORRELATIONS BETWEEN CEPHALOMETRIC AND PHOTOGRAPHIC MEASUREMENTS

Mine Gecgelen Cesur, Gozde Beygirici, Mert Ogrenim, Yazgı Ay, Torun Ozer, Department of Orthodontics, Adnan Menderes University Faculty of Dentistry, Aydin, Turkey

**AIMS:** To compare craniofacial measurements from cephalometric radiographs with analogous measurements from facial photographs.

**MATERIALS AND METHOD:** Standardized cephalometric radiographs and photographs of skeletal Class I (n = 54), Class II (n = 49) and Class III (n = 44) post-pubertal Turkish subjects. Fourteen facial landmarks were identified on photographs and cephalograms. Eight angular and 11 linear measurements were created from these landmarks. Pearson correlation coefficient was used to estimate the correlations between the photographic and cephalometric variables.

**RESULTS:** The correlations between the photographic and cephalometric measurements of all of the subjects (Class I, II and III) were high. The highest correlations were found for Class I subjects ( $P < 0.001$ ), followed by Class II ( $P < 0.01$ ) and Class III ( $P < 0.05$ ). The measurements of superior sulcus depth in Class I subjects and ANB angle in Class III subjects was not correlated between the photographic and cephalometric variables ( $P > 0.05$ ).

**CONCLUSION:** Linear and angular measurements from facial photographs were found useful for characterizing craniofacial morphology.

### SP307 COMPUTED TOMOGRAPHIC ANALYSIS OF SOFT TISSUE THICKNESS IN PATIENTS TREATED WITH DIFFERENT PERIODONTALLY ACCELERATED OSTEOGENIC ORTHODONTIC MODALITIES

Abdullah Ekizer, Zeynep Burçin Gönen, Özge Altınpulluk, Tancan Uysal, Department of Orthodontics, Erciyes University Faculty of Dentistry, Kayseri, Turkey

**AIMS:** To compare soft tissue thickness values of the lower anterior face among patients treated with different periodontally accelerated osteogenic orthodontics (PAOO) modalities using cone-beam computed tomographs (CBCT).

**MATERIALS AND METHOD:** Initial and post-treatment CBCT of 23 patients (mean age  $15.5 \pm 2.7$  years) treated with PAOO for a Class I malocclusion with anterior crowding. The patients were divided into three groups according to the corticotomy treatment: group 1, eight patients treated with PAOO; group 2, nine patients treated with a bone graft after corticotomy for PAOO; group 3, six patients treated using platelet rich fibrin after corticotomy for PAOO. Six measurements were carried out on the pre- and post-treatment CBCT in SimPlant Pro 2011. A paired samples *t*-test was performed to assess pre- and post-treatment soft tissue thickness differences in each group. Multiple comparison of the soft tissue thickness measurements of the lower anterior face among the groups were analyzed with one-way analysis of variance and Tukey tests.

**RESULTS:** Paired samples *t*-tests indicated significant increases at subnasale ( $P < 0.05$ ) in group 1, statistically significant decreases at labrale inferius ( $P < 0.05$ ), labiamentale ( $P < 0.01$ ), and pogonion ( $P < 0.05$ ) in group 2; and significant decreases at labrale inferius ( $P < 0.05$ ), and pogonion ( $P < 0.05$ ) in group 3. The thickness values at the labiamentale were significantly higher in group 1 ( $9.43 \pm 1.65$  mm) compared with group 2 ( $8.8 \pm 1.12$  mm;  $P < 0.05$ ), and significantly smaller in group 1 compared with group 3 ( $10.45 \pm 0.71$ ;  $P < 0.05$ ).

**CONCLUSION:** After PAOO treatment patients had thicker soft tissue thickness at subnasale; using bone graft after corticotomy for PAOO resulted in a thinner thickness at labrale inferius, labiamentale, and pogonion; using platelet rich fibrin after corticotomy for PAOO caused a thinner thickness at the labrale inferius, and pogonion. Among the different graft modalities after corticotomy for PAOO only soft tissue thickness at labiamentale is affected.

#### SP308 THE EFFECT OF PRE- AND POS-NATAL HYPOTHYROIDISM ON THE CRANIOFACIAL STRUCTURE IN RATS

Mine Gecgelen Cesur<sup>1</sup>, Gokhan Cesur<sup>2</sup>, Mert Ogrenim<sup>1</sup>, Afra Alkan<sup>3</sup>, <sup>1</sup>Department of Orthodontics, Faculty of Dentistry and <sup>2</sup>Department of Physiology, Faculty of Medicine, Adnan Menderes University Aydın and <sup>3</sup>Department of Biostatistics, Faculty of Medicine, Yıldırım Beyazıt University Ankara, Turkey

**AIMS:** To investigate the effect of experimental methimazole-induced pre- and post-natal hypothyroidism on the craniofacial structure in rats.

**MATERIALS AND METHOD:** In this prospective study, female Wistar albino rats were mated with males for fertilization. The pregnant rats were divided into three groups: group 1 [methimazole (MMI) induced prenatal hypothyroidism group], rats were given MMI-water during and after pregnancy; the pups were fed with breast milk. In group 2 (MMI-induced postnatal hypothyroidism group), the mother rats were given MMI-water after pregnancy; the pups were fed with breast milk. After the breastfeeding period, group 1 and 2 rat pups received the same water as their lactating mothers. Group 3 (control group), pregnant rats and rat pups were given normal tap water. When the pups were 90 days of age, lateral cephalometric and posteroanterior (PA) films were taken under anaesthesia. Linear and angular measurements were measured using a cephalometric analysis program. All statistical analyses were conducted using SPSS version 21.0.

**RESULTS:** PA radiographs revealed that palatal, cranial, bizygomatic arch and bigonial widths were significantly shorter in groups 1 and 2 than in the control group and these differences were statistically significant for both groups ( $P < 0.001$ ). Male rats showed longer bizygomatic arch widths in the control group and cranial widths in the pre- and postnatal groups than female rats ( $P < 0.001$ ). Cephalometric radiographs showed statistically significant differences between the three groups for nearly all linear and angular measurement ( $P < 0.001$ ). Co-Gn and E-Pg/S-Gn measurements were not significant between groups 1 and 2 when the gender factor was ignored ( $P > 0.05$ ).

CONCLUSION: Sagittal and transverse measurements on radiographs showed that pre- and postnatal hypothyroidism influenced craniofacial structures.

#### SP309 SLOW VERSUS FAST ORTHODONTIC TOOTH MOVEMENT IN HUMANS

Alexander Dudic, Catherine Giannopoulou, Stavros Kiliaridis, University of Geneva, Switzerland

AIMS: To investigate the variation of orthodontically-induced tooth movement between and within humans and its association to factors, such as age and location in the mandible or maxilla.

SUBJECTS AND METHOD: In standardized experimental orthodontic tooth movement in 11 subjects, two premolars of each subject were moved buccally during 8 weeks with application of a force of 1 N. No functional or localized obstacle impeded the displacement. Plaster models before and after tooth movement were digitized and superimposed, to evaluate the amount of tooth movement. Multiple linear regression analysis was performed to determine correlations between tooth displacement, age and tooth location.

RESULTS: The mean displacement of the teeth was  $2.7 \pm 1.4$  mm. The range of tooth movement varied substantially between individuals (0.6-5.8 mm). The displacement of the teeth within the same individual was highly correlated ( $R^2 = 0.782$ ,  $P < 0.001$ ). Younger subjects showed greater tooth velocity than older individuals. Tooth movement was greater in the maxilla than in the mandible.

CONCLUSION: The wide range of tooth displacement revealed slow and fast movers in the sample. Furthermore, the amount of tooth movement was influenced by age and the location of the teeth.

#### SP310 ASTHMA AND ALLERGIC RHINITIS AS A RISK FACTOR FOR MALOCCLUSION IN THE MIXED DENTITION

Katarzyna Olszewska, Izabella Dunin-Wilczyńska, Department of Jaw Orthopaedics, Medical University in Lublin, Poland

AIMS: Altered mechanics of breathing as a consequence of allergy may influence the development of craniofacial structures and has been considered as a risk factor for development of malocclusion. The aim of the study was to investigate the prevalence of malocclusion in children with asthma (AS) and/or allergic rhinitis (AR) compared to healthy controls.

SUBJECTS AND METHOD: Eighty two children in the age range of 6 to 12 years were enrolled in the research. The study group comprised 42 children (25 boys, 17 girls, mean age  $10.18 \pm 2.45$ ), including 12 children with AS, 20 with AS/AR and 10 with AR. The control group included 40 children (22 boys, 18 girls, mean age:  $10.56 \pm 2.12$ ) with no respiratory system pathologies. For orthodontic assessment intra- and extraoral examination were performed. The data was analyzed using Statistica 10 for Windows Software (StatSoft Inc., Tulsa, USA). The differences between groups were tested with a *t*-test for independent samples, Chi-square test and non-parametric Mann-Whitney *U* test.

RESULTS: The highest prevalence of malocclusion was observed in children treated for AS and AR, which was threefold greater than in the control group. The study group exhibited a significantly higher frequency of dental crowding, posterior crossbite, anterior open bite and increased overjet in comparison with the controls ( $P < 0.05$ ). No significant difference was found in midline symmetry between the groups. Incompetent lip posture and increased lower anterior face height were more frequent in the study group compared to the control group ( $P < 0.05$ ). A statistically significant association was found between AR and increased overjet, dental crowding, posterior crossbite and lip incompetence ( $P < 0.05$ ).

CONCLUSION: AS and AR, as a common cause of airway obstruction, must be considered a possible risk factor in the development of malocclusion. Early orthodontic examination of children with AS or AR would allow for interceptive treatment of a developing malocclusion.

#### SP311 RELATIONSHIP BETWEEN BODY MASS INDEX PERCENTILE AND DENTITION DEVELOPMENT IN CHILDREN AND ADOLESCENTS

**AIMS:** There is strong evidence that weight is an important regulator of the tempo of childhood growth and development and may affect skeletal maturation and the onset of puberty. The objective of the study was to determine if there is a correlation between body mass index (BMI) percentile and dental development in children and adolescents.

**MATERIALS AND METHOD:** A retrospective analysis of the pre-treatment medical records of orthodontic patients was performed. In total, 200 patients ranging in age from 6 to 16 years (mean: 10.44 years) were selected for analysis. BMI score, age and gender were used to obtain the BMI percentile value for each subject in accordance with the International Obesity Task Force cut-offs. Dental development was assessed using a method introduced by Demirjian *et al.* The data was analyzed using Statistica 10 for Windows Software (StatSoft Inc., Tulsa, USA). A linear regression model was used to assess the effect of BMI percentile on dental maturity. The relationships between variables were tested using Spearman's rank correlation coefficient.

**RESULTS:** Forty one patients were underweight, 92 normal weight, 44 overweight and 23 obese. No significant difference in the chronological age among groups was noted, but the groups were significantly different with respect to dental age ( $P < 0.05$ ). A strong positive correlation between BMI percentile and dental age was found ( $P < 0.05$ ). Dental age increased incrementally with the increases in BMI percentile.

**CONCLUSION:** The findings revealed accelerated dental development in the high BMI individuals in comparison with their normal-weight peers. Weight is important data that orthodontists should carefully consider in the context of orthodontic treatment timing.

#### SP312 TOOTH-BORNE PALATAL EXPANSION AND CHANGES IN THE SUBGINGIVAL MICROBIOME: A CASE CONTROL STUDY

Elisabeth Santigli<sup>1</sup>, Gernot Wimmer<sup>2</sup>, Martin Grube<sup>3</sup>, Barbara Klug<sup>1</sup>, Department<sup>1</sup> of <sup>1</sup>Orthodontics and Maxillofacial Orthopaedics and <sup>2</sup>Prosthodontics, Restorative Dentistry, Periodontology and Implantology, Medical University of Graz and <sup>3</sup>Institute of Plant Sciences, University of Graz, Austria

**AIMS:** Orthodontic appliances are suspected to shift the oral biofilm composition. Next generation sequencing studies shed new light on the onset of periodontal disease. The aim of this study was to assess the influence of tooth-borne palatal expanders on the subgingival microbiome.

**SUBJECTS AND METHOD:** The microbiome of children treated with tooth-borne palatal expanders in the late mixed dentition was compared to an untreated control group (CA, n = 16; controls, n = 16). Subgingival biofilm was sampled at three time points: baseline (T1), 3 weeks after a standardized oral hygiene programme (T2), and four months later (T3), the day of appliance removal for cases. Pooled paper point sampling was performed and bacterial DNA was analyzed with 454-pyrosequencing targeting the V1-V3 hypervariable regions of the 16S rRNA gene. Pyrosequencing data was processed with QIIME 1.8.0. Statistical data analysis was performed with R 3.1.2.

**RESULTS:** Rarefaction curves showed a loss of bacterial diversity at T3. A significant decrease in diversity was confirmed by Richness ( $P = 0.05$ ) and Shannon ( $P = 0.01$ ) indices. In PCoA a bacterial species clustering for CA was found at T3 while the control group samples were evenly distributed. Relative abundances differed on genus level in Fusobacteria ( $P = 0.022$ ), Leptotrichia ( $P = 0.001$ ), Veillonella ( $P = 0.002$ ) and Capnocytophaga ( $P = 0.042$ ) species.

**CONCLUSION:** Wearing palatal expanders for 4 months leads to a loss of diversity in the subgingival microbiome of children. As this is a marker for later onset of disease, long-term studies are suggested to monitor further microbiome behaviour after appliance removal.

#### SP313 ACCURACY OF PHOTOGRAPHIC AND MODEL SCREENING FOR ORTHODONTIC TREATMENT NEED IN CHILDREN BY MEANS OF THE INDEX OF ORTHODONTIC TREATMENT NEED

Elisabeth Santigli, Claudia Poelzl, Division of Orthodontics and Maxillofacial Orthopedics, Dept. of Dentistry and Maxillofacial Surgery, Medical University Graz, Austria

**AIMS:** Screening for orthodontic treatment need is gaining increasing importance for a resource-saving health policy. The Index of Orthodontic Treatment Need (IOTN) is the most applied screening procedure. The aim of this study was to compare the accuracy of the IOTN when applied to intraoral photographs with model screening.

**MATERIALS AND METHOD:** Pre-treatment records of 530 children aged between 8 and 18 were judged for orthodontic treatment need. The IOTN was applied to the intraoral photographs taken at the patient's first consultation. When orthodontic treatment was started, the IOTN was again applied to the model casts. Finally all records, including the panoramic radiograph, were judged to determine the gold standard for orthodontic treatment need according to the IOTN.

**RESULTS:** Applying the IOTN to the photographs, the assessments for grades 4 and 5 was 56 and 10 per cent, respectively/ Applying the IOTN to model casts, the findings were 58 per cent for grade 4 and 11 per cent for grade 5. Summarizing grades 4 and 5 for orthodontic treatment need resulted in 70 per cent measured on photographs and in 71 per cent measured on model casts. Comparing model screening with the gold standard revealed excellent agreement (Kappa 0.9,  $P < 0.001$ ) and an accuracy with a sensitivity of 0.90 and a specificity of 1.00. Comparing photographs with the gold standard revealed poor agreement (Kappa 0.4,  $P < 0.001$ ) and an accuracy with a sensitivity of 0.80 and a specificity of 0.69.

**CONCLUSION:** Although not accurate, IOTN photographic screening can serve as an estimator for population based treatment need. The bias due to false positives and false negatives was equal. On an individual basis, only model screening is appropriate to determine treatment necessity for the majority of patients. Patients with missing or impacted teeth will benefit from a panoramic radiograph.

#### SP314 THE EFFECTS OF THE FORSUS FATIGUE RESISTANT DEVICE ON MANDIBULAR ASYMMETRY AND THE COMPONENTS OF THE TEMPOROMANDIBULAR JOINT

Elif Ergin, Merve Fidanboy, Zehra Ileri, Zeliha Muge Baka, Mehmet Akin, Department of Orthodontics, Selcuk University Faculty of Dentistry, Konya, Turkey

**AIMS:** To investigate the effects of the Forsus Fatigue Resistant Device (FFRD) on mandibular asymmetry and the components of the temporomandibular joint (TMJ).

**SUBJECTS AND METHOD:** Twenty six patients (19 females, 7 males) with a Class II malocclusion treated with the FFRD. Each patient wore Forsus springs bilaterally for Class II correction. Panoramic radiographs were taken in the standard head position and with a standard panoramic X-ray device. Then, Quick Ceph® studio software was used for measurements on initial and final radiographs. For both sides, ramal, condylar and condylar plus ramal heights, anterior and superior joint spaces, gonial to gonial distances, ramus widths, bicondylar width, bicoronoidal width, the distances between condylar and coronoid processes, and the angle of articulare eminence slope (E angle) were measured. Mandibular asymmetry indices were calculated according to Habets *et al.* Wilcoxon signed rank test was used to determine the changes between pre- (T1) and post (T2) -treatment.

**RESULTS:** The right E angle, ramal and condylar plus ramal heights on the left side, bicondylar width and bicoronoidal width were significantly increased ( $P < 0.05$ ), whereas ramal width on the right side and E angle on the left side were significantly decreased ( $P < 0.05$ ) after treatment. Asymmetry indices were similar at T1 and T2.

**CONCLUSION:** Orthodontic treatment with the FFRD caused some changes in the slope of articulare eminence, ramal and condylar plus ramal heights. Further investigations using magnetic resonance imaging or computed tomography are required to evaluate the effects of treatment with the FFRD on the TMJ.

#### SP315 RELATIONSHIP BETWEEN SOFT AND HARD TISSUE CHANGES AFTER MANDIBULAR SETBACK SURGERY: A SYSTEMATIC REVIEW AND META-ANALYSIS

Eleftherios Kaklamanos, Olga-Elpis Kolokitha, Zoi Triantopoulou, Department of Orthodontics, Aristotle University of Thessaloniki, Greece

**AIMS:** To systematically investigate the available literature regarding the relationship between soft and hard tissue changes after mandibular setback surgery that could be used as an aid in cephalometric prediction.

**MATERIALS AND METHOD:** A systematic appropriate electronic database search was performed to identify articles of any type that had investigated the relationship between soft and hard tissue changes in patients of any age having undergone any type of mandibular setback surgery, in the time interval before surgery to a follow-up examination exceeding 12 months. The terms 'mandibular' and 'setback' were used for searches. No restrictions were applied on publication year or language of the retrieved citations. Using specific selection criteria, the final eligible studies were identified and the risk of bias was assessed following the Cochrane Collaboration guidelines. The included studies were divided into two categories: (1) studies presenting ratios between soft and hard tissue changes and (2) those presenting correlations between soft and hard tissue changes. The random effects method for meta-analysis was used to combine the ratios and correlations across studies.

**RESULTS:** Of the 405 initially identified articles only five fulfilled the selection criteria for inclusion in the systematic review and the subsequent meta-analysis. Two studies presented ratios between soft and hard tissue changes. The ratios between BS/BH and LI/li changes were found to be around 1 and the ratio for PogS/PogH changes around 0.90. In all cases the observed inconsistency was not considerable. Four studies presented correlations between soft and hard tissue changes. The correlation coefficients between soft and hard cephalometric points were generally large, with the exception of the correlation between LS and PogH. However, the inconsistency in quantitative data synthesis ranged from none to very large. Risk of bias assessment identified various drawbacks in the included studies.

**CONCLUSION:** The present systematic review and meta-analysis showed that evidence-based conclusions on the relationship between soft and hard tissue changes after mandibular setback surgery are difficult to draw. More studies of high quality are needed in order to produce results robust enough to be used for clinical aid during prediction.

#### SP316 WHAT ARE THE DIFFERENCES BETWEEN TREATMENT OUTCOMES USING CONVENTIONAL BRACKET SYSTEMS WITH EXTRACTION AND NON-EXTRACTION SELF LIGATING SYSTEMS?\*\*\*

Mehmet Nezir Karaca, Mehmet Ali Yavan, Oral Sokucu, Merve Nur Eglenen, Eren Isman, Department of Orthodontics, Gaziantep University Dentistry Faculty, Turkey

**AIMS:** To retrospectively compare extraction (MBT bracket system) and non-extraction (Damon 3MX bracket system) treatment methods using cephalometric and dental cast measurements in Class I patients with dental crowding.

**MATERIALS AND METHOD:** Archived pre- and post-treatment cephalometric radiographs and dental casts of patients. The inclusion criteria for both groups was a dental Class I relationship with crowding over 5 mm and the exclusion criteria was patients with any systemic disorders, high angle pattern and tendency to an open bite. The Damon 3MX group consisted of 22 patients with a mean age 18.0 years. The conventional group comprised of 23 subjects with a mean age of 17.9 years. The pre- (T0) and post- (T1) treatment cephalometric and dental records were evaluated and compared between the two groups. The Wilcoxon test was used to evaluate the values of each group and the differences between groups was determined by Mann-Whitney *U* test.

**RESULTS:** T1 records revealed that both methods were successful in correcting the anterior crowding. Cephalometric data showed that the upper and lower incisors were protruded and proclined significantly in the Damon group; controversially significant retrusion and retroclination of the incisor teeth was observed for the conventional method from T0 to T1. However, the Damon 3MX method caused expansion in all transverse dimension parameters in both jaws. There were significant decreases in molar width with the conventional method. Due to significant protrusion of the upper and lower lips, nasolabial angle and the thickness of the upper lip were statistically decreased in the Damon 3MX group. The changes for mentolabial angle and lower lip thickness were not significant. Despite, the conventional groups' upper and lower lips being significantly retruded, no

significant changes were demonstrated for nasolabial and mentolabial angles and the thickness of the upper and lower lips.

**CONCLUSION:** Both methods showed acceptable results at the end of treatment. The outcomes on the position of the incisor teeth, transverse dimensions of the dental arches and the appearance of the lips showed differences between the two methods. These points must be taken into consideration if patients have critical values for these parameters.

### SP317 MESIODISTAL WIDTH OF THE UPPER CENTRAL INCISORS – AN EARLY INDICATOR FOR FUTURE EXTRACTION NEED?

Marion Hahn<sup>1</sup>, Severin Hahn<sup>1</sup>, Josefin Hahn<sup>2</sup>, Charlotte Hahn<sup>2</sup>, Werner Hahn<sup>1</sup>, <sup>1</sup>Dres. Hahn, Orthodontic Practice, Hamburg and <sup>2</sup>Medical School, Asklepios Campus, Hamburg, Germany

**AIMS:** One main indicator for orthodontic extractions is based on the discrepancy between tooth and jaw relationships. The aim of this study was to find early indicators for future overcrowding and lack of space, causing the need for tooth removal. Special attention was paid to the mesiodistal width of the upper central incisors.

**MATERIALS AND METHOD:** The mesiodistal widths of the central incisors on the initial casts of 39 patients (22 females, 17 males) with four premolar extractions was measured using a digital calliper and compared to those of a non-extraction control group consisting of 42 patients (20 females, 22 males). Treatments were planned, lead and finished by two orthodontists with more than five years experience. Both patient groups were treated with the same bracket type/design and archwire system. All patients were of Caucasian descent.

**RESULTS:** In the extraction group the maxillary central incisors showed a mesiodistal width of 8.6-9.1 mm in 34 per cent of the cases. Thirty one per cent showed a width of 9.1-9.6 mm, while 23 per cent showed 9.6-10.1 mm. Larger than 10.1 mm was found in three patients. Only one subject had an incisor smaller than 8.6 mm. In the non-extraction control group a mesiodistal width of the maxillary incisors from 8.6 to 9.1 mm was found in half of the patients. The other 50 per cent of the control group had a mesiodistal width between 9.1 and 9.6 mm. No patient in the control group had maxillary incisor teeth measuring more than 9.6 mm.

**CONCLUSION:** The evaluation confirms the clinical observation that the need for future extraction therapy can be assessed in early orthodontic evaluation soon after eruption of the maxillary central incisors. The need for future orthodontic extractions is to be expected for patients with maxillary incisors having a mesiodistal width exceeding 9.6 mm. This retrospective cohort study reveals that patients with a mesiodistal width of the maxillary incisors measuring 9.7 mm or more underwent extraction therapy. Nevertheless other treatment approaches are considerable including compromises and/or compensation.

### SP318 DETERMINATION OF IDEAL CEPHALOMETRIC VARIABLES IN A JUVENILE PORTUGUESE POPULATION

Ana Sofia Bento, Sofia Pereira, Ana Luisa Maló, Francisco Vale, Department of Orthodontics, Faculty of Medicine of University of Coimbra, Portugal

**AIMS:** (1) To establish cephalometric variables in a lateral view, which are considered ideal for skeletal and soft tissue parameters of a young Portuguese Caucasian population; (2) To study eventual sexual dimorphism; (3) To assess statistical differences for the cephalometric values among girls before and after the growth peak.

**SUBJECTS AND METHOD:** An initial sample of 324 individuals was analyzed, of which only 90 (46 females, 44 males) met the inclusion criteria: chronological age between 8 and 14 years; no previous orthodontic treatment and an ANB angle between 0 and 4.3 degrees. Cephalometric analyses were performed using the direct digital method, with Dolphin Imaging Software™ 32. In order to determine cephalometric variables for each gender, descriptive statistical analysis was performed using IBM® SPSS Statistics™. The Student's *t*-test was used to study sexual dimorphism and to find differences between females before and after the growth peak.

**RESULTS:** Sexual dimorphism was found for several angular variables: SNA, NL-NSL, ML-NSL, Me-tGo-Ar and naso-labial. The male population showed higher values, except for

naso-labial and SNA angles. Among females, after the growth peak, an increase in the value of angles NSBa and Me-tGo-Ar and in the facial index was found.

CONCLUSION: This investigation allowed determination of the cephalometric variables of the skeletal and soft tissue parameters, due to the homogeneous nature of the population under study. The female population presented a more convex face compared to the male population of the same age, who in turn presented a larger facial height.

#### SP319 ASSOCIATION BETWEEN THIRD MOLAR AGENESIS AND CRANIOFACIAL STRUCTURE DEVELOPMENT

Jara Ramiro-Verdugo, Elena de Vicente-Corominas, Jose María Montiel-Company, José Luís Gandía-Franco, Carlos Bellot-Arcís, Department of Orthodontics, University of Valencia, Spain

AIMS: To study the relationship between third molar agenesis, including the number of teeth with agenesis and the craniofacial growth structure.

MATERIALS AND METHOD: A review was made of 305 clinical histories of treated patients which included radiographic records of optimal quality. Of these, 40 subjects who presented agenesis of at least one third molar were included in the study group. A control group was formed of 40 individuals who had all four third molars present. For both groups, a further criterion for inclusion was cone beam computed tomographic radiographic records. The cephalometric analysis was performed with NemoCeph® 3D version 11.3.1.38 software.

RESULTS: The only significant differences between the two groups was in total gonial angle and upper gonial angle ( $P \leq 0.05$ ), which were both smaller in the study group.

CONCLUSION: Third molar agenesis is associated with a reduction in Jarabak's total and upper gonial angles, characteristic of patients with a more horizontal or brachyfacial skeletal pattern.

#### SP320 CHARACTERISTIC FEATURES OF TOOTH TRANSPOSITIONS AND ASSOCIATED DENTAL ANOMALIES

Huseyin Alkis, Hakan Turkkahraman, Filiz Aydogan, Oguzhan Akkaya, Department of Orthodontics, Suleyman Demirel University, Isparta, Turkey

AIMS: Tooth transposition occurs when adjacent teeth switch positions. The aetiology of transposition is still obscure. Transposition of tooth buds at anlage stage, migration of a tooth during eruption, heredity, and trauma have been proposed as possible aetiological factors. The aim of this study was to evaluate the characteristics of transpositions and associated dental anomalies.

MATERIALS AND METHOD: The records of 72 individuals with tooth transpositions (41 females, 31 males) were studied. Types and sides of tooth transposition were examined. Associated peg-shaped maxillary lateral incisors, missing, impacted, supernumerary, retained teeth and dilaceration of teeth were ascertained from both the panoramic radiographs and clinical records. Histories of the patients were also recorded.

RESULTS: Eighty transpositions were found in 72 patients in the maxillary and mandibular arches. Females were affected more than males (31 males, 41 females) Transpositions were more common in the maxilla than in the mandible (58 of 80). The most frequently seen transposition was maxillary canine-first premolar (35 of 80). Unilateral transposition accounted for 89 per cent of cases and 82 per cent of cases had complete transpositions. Thirty six subjects (45%) had right sided transpositions. Peg-shaped maxillary lateral incisors were judged to be present in 15 per cent of subjects, and 36 per cent had retained primary teeth.

CONCLUSION: Dental transposition represents a multifactorial condition. Genetics and environmental factors seem to be involved in the aetiology of transposition and other dental anomalies.

#### SP321 COULD WE ACHIEVE BETTER SHEAR BOND STRENGTH WITH A NOVEL LASER\*\*\*

Emire Aybuke Erdur, Faruk Ayhan Basciftci, Department of Orthodontics, Selcuk University, Faculty of Dentistry, Konya, Turkey

**AIMS:** Due to increasing demand for orthodontic treatment in adults, orthodontists are still debating the preparation of porcelain surfaces for bonding. The aim of the present study was to evaluate the effect of Ti:Sapphire femtosecond (fs) laser (Integra-C-3.5, Quantronix, New York, USA) on shear bond strength (SBS) of orthodontic brackets bonded to two porcelain surfaces (feldspathic and IPS Empress e-Max; Ivoclar-Vivadent, Schaan, Lichtenstein) and compare it with other two lasers (Er:YAG, Nd:YAG, Fotona, Slovenia) and conventional techniques [sandblasting (50 µm), hydrofluoric (HF) acid].

**MATERIALS AND METHOD:** A total of 150 ceramic discs were fabricated and divided into two porcelain groups. In each group, five subgroups were either prepared by Ti:Sapphire fs laser, Nd:YAG laser, Er:YAG laser, sandblasting or HF acid. Mandibular incisor brackets were bonded with a light-cured adhesive (Transbond XT, 3M Unitek, USA). The samples were stored in distilled water for 24 hours at 37°C and then thermocycled (Thermal Cycler Tester, Dental Teknik, Konya, Turkey). An extra sample was prepared and examined with a scanning electron microscope (SEM). SBS testing was performed, and the failure types were classified with the adhesive remnant index. ANOVA and Tukey tests were used to compare the SBS in the five groups ( $P < 0.05$ ).

**RESULTS:** Feldspathic and IPS Empress e-Max porcelains showed similar SBS values. Ti:Sapphire fs laser ( $16.76 \pm 1.37$  MPa) showed the highest mean bond strength which was followed by sandblasting ( $12.79 \pm 1.42$  MPa) and HF acid ( $11.28 \pm 1.26$  MPa). Er:YAG laser ( $5.43 \pm 1.21$  MPa) and Nd:YAG laser ( $5.36 \pm 1.04$  MPa) groups were similar and demonstrated the lowest SBS values. The results of SEM analysis confirmed that the conditioning pattern with the Ti:Sapphire fs laser had uniformly more porosity when compared with other surfaces.

**CONCLUSION:** Within the limitations of this *in vitro* study, Ti: Sapphire fs laser treated surfaces demonstrated the highest SBS values and therefore, could be used for pre-treatment of ceramic surfaces as an alternative to conventional techniques.

#### SP322 COMPARISON OF PROPHYLACTIC METHODS USED TO PREVENT WHITE SPOT LESIONS IN THE FIRST MONTH OF ORTHODONTIC TREATMENT: A PILOT STUDY

Yasemin Alpagan Ozkaynak, Huseyin Alkis, Ugur Burak Temel, Suleyman Demirel University, Faculty of Dentistry, Isparta, Turkey

**AIMS:** To test the efficacy of fluoride varnish, casein varnish and, bonding agent with fluoride to prevent enamel demineralization [white spot lesions (WSL)] in the first month of orthodontic treatment with fixed appliances.

**SUBJECTS AND METHOD:** Thirty three patients with good oral hygiene (17 girls, 16 boys) who had plaque, gingival and Diagnodent indices scores of 0 were included in the split mouth design pilot study. Casein varnish (MI Varnish with Recaldent™, GC, USA), fluoride varnish (ProSeal™, Reliance Orthodontic Products, Itasca, Illinois, USA), bonding agent with fluoride (Quick Cure, Reliance Orthodontic Products) and a control bonding agent (Transbond™ XT, 3M Unitek, Puchheim, Germany) were applied to each patient randomly. The effectiveness of these agents was assessed using a diode laser fluorescent device (DiagnoDent, KaVo, Biberach, Germany) in the first month of treatment. Oral hygiene changes occurring during treatment were evaluated using plaque and gingival index scores. DiagnoDent index scores were measured by Kruskal-Wallis test. Gender differences were performed by Mann Whitney *U* test. Plaque and gingival index score changes were evaluated with the signed rank test.

**RESULTS:** All DiagnoDent scores were between 0-9.25. No statistically significant differences were noted in the distribution of WSL among different types of teeth. When the gender effect on WSL development was evaluated, there were statistically significant differences. Males had higher DiagnoDent index scores than females. Plaque and gingival index scores increased when compared to the beginning of treatment, which was statistically significant.

**CONCLUSION:** It is not effective to evaluate prophylactic methods during orthodontic treatment just for one month. Long-term results are required for effective evaluation.

### SP324 COMPARISON OF TOOTH SIZE BETWEEN EXTRACTED AND NON-EXTRACTED SUBJECTS†††

Nesime Özdemir, Hülya Yardımçı, Murat Çelikkelen, Ahmet Kemal Kocacık, Ali Altuğ Bıçakçı, Department of Orthodontics, Gaziosmanpaşa University, Faculty of Dentistry, Tokat, Turkey

**AIMS:** To investigate possible differences in terms of tooth size between extracted and non-extracted patients.

**MATERIALS AND METHOD:** Eighty two dental casts (41 extracted, 41 non-extracted) of patients referred for orthodontic treatment. The sum of the mesiodistal dimensions of 10 teeth between the upper and lower first molars were digitally measured.

**RESULTS:** No significant correlation was observed in terms of mesiodistal tooth size between the extraction and non-extraction cases either in males or females ( $P > 0.05$ ).

**CONCLUSION:** Tooth size is not a determinant factor for an extraction decision.

### SP325 DOES EXPANSION OF VERTICAL SYMPHYSEAL OSTEOTOMY GAPS WITH LINGUALLY PLACED SCREWS AFFECT THE POSITION OF THE FIRST MOLARS IN THE FRONTAL PLANE?

Alfred Peter Muchitsch<sup>1</sup>, Brigitte Wendl<sup>1</sup>, Heinz Winsauer<sup>2</sup>, Margit Pichelmayer<sup>1</sup>, Markus Muchitsch<sup>3</sup>, <sup>1</sup>Department of Orthodontics, University Dental School Graz, <sup>2</sup>Private Practice, Bregenz and <sup>3</sup>Graz University of Technology, Austria

**AIMS:** To determine, whether and to what extent median symphyseal distraction with bonded and screw fixed full coverage splint appliances employing hinged expansion screws causes transversal and inclination changes of the lower first molars.

**SUBJECTS AND METHOD:** Seventeen patients (12 females; average age 16 years 3 months) with transverse space deficits and severe dental crowding. Mandibular casts before and after 6 weeks of median distraction were created, scanned and matched via their coordinate systems. Perpendiculars were drawn at the geometric centres between the cusp tips of teeth 36 and 46 and projected against the frontal plane. The intersection angles yielded single tooth and total inclination values for both molars, and the difference between the intermolar distances provided the amount of transverse expansion.

**RESULTS:** Comparing a series of three measurements, an intraclass correlation coefficient (ICC) of  $>0.99$  was achieved. After distraction, the total inclination values between teeth 36 and 46 changed by  $+ 2.93 + 9.14$  degrees. The corresponding single tooth inclination changed by  $+ 0.68 + 6.32$  degrees and  $2.25 + 4.33$  degrees, respectively. Both molars underwent similar degrees of buccal or lingual tipping. Compared to a mean expansion of  $+ 6.9 + 1.83$  mm at the distraction screw, a distance increase of only  $+ 3.77 + 1.27$  mm along the transversal connecting teeth 36 and 46 was recorded. Pearson's correlation coefficient was 0.336 between total tipping and intermolar expansion ( $P = 0.187$ ) and 0.426 between total tipping and patient age ( $P = 0.088$ ).

**CONCLUSION:** At the expansion screws the amount of expansion was about twice as much as between the first molars. This V-shaped expansion pattern was due to the hinged connections between each expansion screw and the splints. The buccal and lingual tipping of molars measured may be due to varying heights of the posterior alveolar ridge during the mixed dentition or to anatomy-related differences in the expansion screw position. A mainly parallel opening of the distraction gap in the vertical plane was observed in all cases.

### SP326 ANOMALY IMPROVEMENT GRADES OF PATIENTS WITH COMPLETED ORTHODONTIC TREATMENT ACCORDING TO THE INDEX OF COMPLEXITY, OUTCOME, AND NEED

Zeynep Seyman, Yasin Erdem Akgul, Rabia Merve Celik Karatas, Abdullah Demir, Faruk Izzet Ucar, Department of Orthodontics, Selcuk University/Faculty of Dentistry, Konya, Turkey

**AIMS:** To evaluate the anomaly improvement grades of orthodontic treatment results according to the Index of Complexity, Outcome and Need (ICON).

**MATERIALS AND METHOD:** Pre- and post-treatment archived orthodontic models and cephalometric radiographs of 194 subjects divided into two main groups (99 Class I and 95 normodivergent). The first group (skeletal Class I cases) was classified according to the vertical growth pattern (57 normodivergent, 12 low angle, 30 high angle) and the second group (normodivergent cases) according to skeletal classification (57 Class I, 28 Class II, 10 Class III). The pre- and post-treatment models were carefully examined and occlusal features were scored using the ICON.

**RESULTS:** Statistical analysis indicated that all cases had successful improvement grades according to the ICON ( $P < 0.05$ ). However, the improvement grades in each of the main groups showed similar results ( $P > 0.05$ ).

**CONCLUSION:** The treatment results in this university clinic showed improvement grades according to the ICON. Thus better treatment outcomes can be achieved in following cases after using ICON.

### SP327 GENERAL DENTAL PRACTITIONERS' ATTITUDES TOWARDS ORTHODONTIC RETAINERS: A REGIONAL QUESTIONNAIRE

Mohamed-Saeed Seedat<sup>1</sup>, Aman Ulhaq<sup>2</sup>, David Tewson<sup>1</sup>, <sup>1</sup>Department of Oral Health, Norfolk & Norwich University Hospital, Norwich and <sup>2</sup>Department of Orthodontic, Edinburgh Dental Institute, U.K.

**AIMS:** Patients are reviewed for one year following the cessation of active orthodontic treatment. It is customary for general dental practitioners (GDPs) to then continue the management of orthodontic retention. The aim of this audit was to assess the GDPs' level of awareness and experience of managing orthodontic retainers. Information on the provision of replacement retainers was also sought.

**MATERIALS AND METHOD:** The gold standard was that 100 per cent of GDPs should be aware of commonly used retainers, be able to supervise wear and provide any necessary replacements. National Health Service (NHS) GDPs in the Norfolk and Cambridgeshire counties were identified from the Trust database. Postal questionnaires were sent out in October 2013 to 525 NHS GDPs working in the region. Non-responders were sent a reminder letter in November 2013.

**RESULTS:** The response rate was 49 per cent (259 GDPs). Forty eight per cent of GDPs were trained in the United Kingdom. Awareness of vacuum-formed, Hawley and bonded retainers was 92, 80 and 94 per cent, respectively. Regarding vacuum-formed retainers, 62 per cent were comfortable prescribing, 70 per cent were able to fit and 70 per cent were willing to review. For Hawley and fixed-bonded retainers the percentages were 36, 43 and 49 and 39, 39 and 54, respectively. Seventy three per cent of GDPs reported they had insufficient training to monitor the retention phase and 70 per cent felt management was the responsibility of the orthodontist. Replacement of removable retainers was provided by 34 per cent of GDPs, whereas only 20 per cent provided replacement of bonded retainers. When charging privately for replacement retainers, the amount of fees varied widely between GDPs.

**CONCLUSION:** The majority of GDPs reported insufficient undergraduate orthodontic training and felt retainer supervision should lie with the treating orthodontist. The need to further educate GDPs and to improve communication with GDPs was highlighted. A regional educational seminar is being proposed to address this. Orthodontic discharge letters to the GDP should include information on the type of retainer provided and its design. Patients need to be made aware of the financial implications of replacing lost or damaged retainers.

### SP328 LONGITUDINAL ASSESSMENT OF TRANSVERSE CHANGES IN CLASS II MALOCCLUSIONS INDUCED BY TWO-PHASE TREATMENT

Ary Santos-Pinto<sup>1</sup>, Lourdes Santos-Pinto<sup>2</sup>, Renata Cássia Gonçalves<sup>3</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Pediatric Dentistry, Araraquara School of Dentistry/São Paulo State University, Araraquara/SP and <sup>3</sup>Orthodontics, Private Practice, Araraquara, Brazil

**AIMS:** To longitudinally evaluate transverse changes in dentoskeletal structures in children induced by two-phase Class II malocclusion treatment using postero-anterior cephalometric analysis.

**MATERIALS AND METHOD:** Longitudinal data were collected from 64 children with a Class II division 1 malocclusion who were assigned to two groups each containing 17 girls and 15 boys: The initial mean age of the treated group was 8.8 years and of control group 9 years. The Klammt open activator was used in the orthopaedic phase (two years) followed by an orthodontic phase (three years) using fixed orthodontic appliances in the treated group. Children in the control group did not receive any treatment and were followed for five years. The Mann-Whitney non-parametric test was used to evaluate changes in dentoskeletal structures induced by treatment in each gender.

**RESULTS:** Two-phase treatment increased maxillary and mandibular width and upper intermolar distances in both phases in both genders. Lower intermolar width did not increase in girls but increased in boys during the entire orthopaedic phase as well as the last period of the orthodontic phase. The upper dental arches were wider than the lower dental arches, improving the shape of the maxilla. Two-phase treatment changed the natural inclination of the upper molars but did not affect the natural inclination of the lower molars in either gender. Natural growth promoted lingual inclination of the upper molars in girls and labial inclination in boys, whereas the lower molars had a lingual inclination at the beginning of treatment and a labial inclination at the end of treatment in both genders.

**CONCLUSION:** Two-phase Class II malocclusion treatment increased maxillary and mandibular widths with more transverse changes in boys than in girls.

### SP329 CLINICAL AND MICROBIOLOGICAL ASSESSMENT OF PERIODONTAL STATUS IN PATIENTS USING FIXED VERSUS REMOVABLE ORTHODONTIC APPLIANCES

Agnieszka Osmólska-Bogucka, Małgorzata Zadurska, Department of Orthodontics, Medical University of Warsaw, Poland

**AIMS:** To compare the periodontal and microbiological status of orthodontic patients treated with fixed versus removable appliances.

**SUBJECTS AND METHOD:** One hundred and two orthodontic patients (9-14 years of age), treated with fixed (30 patients, group B) and removable appliances (42 patients, group C). The mean age of patients was 12.2 in group B and 12.1 in group C. The control, group A, comprised 30 patients (mean age: 11.7, range: 9 to 14 years) before the beginning of orthodontic treatment. Measurements of plaque index (PI), bleeding on probing (BOP) and pocket depth (PD) were performed. The microbiological examination used standard diagnostic tests. Patients who underwent diagnostic testing were selected from study groups B and C. The material was collected from a pocket depth exceeding 4 mm (14 samples from each group). With real-time polymerase chain reaction, quantitative and qualitative analysis of nine periopathogens was performed: *Aggregatibacter actinomycetemcomitans*, *Parvimonas micra*, *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Treponema denticola*, *Tannerella forsythia*, *Prevotella intermedia*, *Eubacterium nodatum*, and *Capnocytophaga gingivalis*.

**RESULTS:** No statistically significant difference was found in PI among groups A, B, and C. A statistically significant difference was observed in the value of BOP as well as the mean depth of PD between groups B and C. There was a difference with respect to the composition of subgingival microflora between patients using fixed and removable orthodontic appliances. *Tannerella forsythia* was identified significantly more frequently in patients treated with fixed appliances than in those who used removable orthodontic appliances.

**CONCLUSION:** Injuries to the oral mucosa of patients using fixed orthodontic appliances may create a favourable ecological niche for growth of *Tannerella forsythia*. Patients using fixed appliances may be at higher risk for periodontal breakdown, which should be monitored during treatment.

### SP330 THE EFFECTS OF A MAXILLARY EXPANSION APPLIANCE ANCHORED ON PRIMARY TEETH IN THE MIXED DENTITION PATIENTS

Yagmur Lena, Gökhan Önçağ, Department of Orthodontics, Ege University Dentistry Faculty, Izmir, Turkey

**AIMS:** To evaluate the efficacy of the Haas appliance anchored on the primary molars and canines in the mixed dentition, for inducing spontaneous correction of a permanent molar crossbite, without force and without involvement of the permanent teeth.

**SUBJECTS AND METHOD:** The rapid maxillary expansion (RME) appliance was cemented on the maxillary primary second molars and canines of 13 (5 females, 8 males) patients with unilateral or bilateral crossbites. The age range of the group at the beginning of treatment was 6-9 years. After an activation period of 20-25 days (once a day) for expansion, the appliance was stabilized and kept in place as retention for 18 months. Expansion was carried out until the posterior crossbite on permanent molars self-corrected and adequate space for upper lateral incisor eruption was achieved. No direct forces were applied on the permanent teeth. Digital models and posteroanterior cephalometric radiographs were obtained before insertion of the appliance (T1), after expansion (T2) and at debanding (T3). Measurements of intercanine and intermolar width were recorded. The means and standard deviations were calculated for the pre- and post-expansion measurements by one sample *t*-test.

**RESULTS:** In all subjects, intermolar width increased during the active phase, and transverse overcorrection was obtained on primary maxillary molars. The posterior crossbite of the permanent molars self-corrected in all patients during the active phase. The correction was stable. The first permanent molars also moved spontaneously in the following months and adjusted within a stable occlusion. The mean maxillary permanent intermolar width was 41.3 mm at T1, 45.6 mm at T2, and 45.8 mm at T3.

**CONCLUSION:** Early treatment of a posterior crossbite with RME resulted in spontaneous correction of the permanent teeth. The Haas appliance in the early mixed dentition is effective in producing favourable stable changes with the prevention of adverse effects on the permanent molars.

#### SP331 ACCURACY OF CLEAR ALIGNERS. A SYSTEMATIC REVIEW

Ioannis Doulis<sup>1</sup>, Ilektra Toulia<sup>1</sup>, Sofia Mousoulea<sup>1</sup>, Georgios Kouvelis<sup>1</sup>, Dimitrios Kloukos<sup>1,2</sup>,  
<sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics, 251 Hellenic Air Force V.A. General Hospital, Athens, Greece and <sup>2</sup>Department of Orthodontics and Dentofacial Orthopedics, University of Bern, Switzerland

**AIMS:** To systematically search the literature and assess the accuracy of Invisalign therapy applied in orthodontic patients.

**MATERIALS AND METHOD:** Electronic database searches of published and unpublished literature were performed. The following electronic databases were searched: Medline (via Ovid and PubMed), Embase, the Cochrane Oral Health Group's Trials Register and Central. Unpublished literature was searched on ClinicalTrials.gov, the National Research Register, and Pro-Quest Dissertation Abstracts and Thesis database. The reference lists of all eligible studies were hand-searched for additional studies. Two review authors performed data extraction independently and in duplicate using individualised data collection forms. Potential disagreements were resolved by discussion.

**RESULTS:** From the 120 articles identified by the search, after application of the specific inclusion and exclusion criteria and removal of duplicates, 20 papers were considered eligible for further screening. Among them six studies qualified for the final review analysis. No randomised clinical trial was identified. All studies were assessed for their quality and graded eventually from low to moderate level of evidence. Common results across the included studies was that Invisalign therapy successfully treated some types of malocclusions, but was not adequately accurate in others. The most frequent finding was the weakness in the alignment of upper canines.

**CONCLUSION:** Invisalign therapy is accurate in cases that fall within certain bounds, but does not have predictable results if the malocclusion is extreme or refers to the vertical or anteroposterior plane.

#### SP332 THE EFFECTIVENESS OF BITE-WAFERS AND CHEWING GUM AS A MEANS OF PAIN RELIEF, AFTER INITIAL BONDING IN ORTHODONTIC PATIENTS. A SYSTEMATIC REVIEW

Ioannis Doulis<sup>1</sup>, Georgios Kouvelis<sup>1</sup>, Konstantinos Dritsas<sup>1</sup>, Sofia Mousoulea<sup>4</sup>, Dimitrios Kloukos<sup>1,2</sup>, <sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics, 251 Hellenic Air Force V.A. General Hospital, Athens, Greece and <sup>2</sup>Department of Orthodontics and Dentofacial Orthopedics, University of Bern, Switzerland

**AIMS:** To evaluate, in a systematic review, the effectiveness of bite-wafers or chewing gum in relieving orthodontic pain following initial bonding and archwire placement in orthodontic patients.

**MATERIALS AND METHOD:** Published literature was searched at the following electronic databases with no language or publication date restrictions: Medline (via Ovid and PubMed), Embase (via Ovid), the Cochrane Oral Health Group's Trials Register and Central. Unpublished literature was searched on ClinicalTrials.gov, the National Research Register, and Pro-Quest Dissertation Abstracts and Thesis database. Additional studies were searched in the reference lists of all eligible studies. Two review authors performed data extraction independently and in duplicate using standardized data collection forms. Disagreements were resolved by discussion or the involvement of an arbiter.

**RESULTS:** From the 51 identified studies, after application of the pre-specified inclusion and exclusion criteria, four were considered eligible for inclusion in this systematic review, all of which were randomized clinical trials. Quality assessment revealed that the included studies ranged from unclear to high risk of bias. The studies varied in the population studied, the controls and the types of outcome measures. Clinical heterogeneity did not allow quantitative synthesis of the results. The common result among studies was that the use of bite-wafers or chewing gum is a non-pharmacologic option for pain management after orthodontic procedures that is at least as effective as other analgesics.

**CONCLUSION:** Bite-wafers or chewing gum as means of pain relief are effective for pain reduction in orthodontic patients and can be recommended as suitable substitutes for pharmacological intervention. Nevertheless, more and well-conducted randomized clinical trial with standardized methodology should be undertaken in order to establish their clinical usefulness.

### SP333 INCREASING THE SPEED OF TOOTH MOVEMENT: A LITERATURE REVIEW ON PUBLICATION TENDENCIES

Maria Cadenas de Llano Perula<sup>1</sup>, Alejandro Iglesias-Linares<sup>2</sup>, Enrique Solano-Reina<sup>1</sup>, <sup>1</sup>Department of Stomatology, University of Sevilla and <sup>2</sup>Department of Orthodontics, Complutense University of Madrid, Spain

**AIMS:** To review the tendencies of publications, throughout the years, focused on accelerating orthodontic tooth movement (OTM).

**MATERIALS AND METHOD:** An electronic search was performed in PubMed with the following MeSH Terms: 'Tooth Movement AND Orthodontics AND Time factors' in a cross-search with 'Tooth movement AND orthodontics AND (acceleration OR increase). No time limits were set, any article type whose main topic was the acceleration of OTM comparing standard movement with that achieved with a different technique and resulting in an increase of OTM was included. Exclusion criteria were: papers focusing on inhibition or decrease of OTM, relapse and/or root resorption, no difference between groups or acceleration purposes not met, as well as other articles not matching the purposes of this review.

**RESULTS:** One hundred and nine articles were included. Non-biologically based techniques accounted for 27.25 per cent of the articles (25/109). They could be divided into three main procedures: improvement of the basic mechanics of orthodontics (7/109), decrease of friction and/or improvement of materials and changes in the magnitude (11/109), direction or application of the orthodontic force (7/109). Biologically based techniques were used in 72.75 per cent of the articles (84/109) and six different procedures could be identified: the use of magnets or magnetic fields (7/109), low-level laser therapy (9/109), chemical or pharmaceutical methods (32/109), surgical techniques (31/109), gene therapy (3/109) and vibration/electric currents (2/109).

**CONCLUSION:** Reducing treatment time is a topic of interest within the orthodontic community. A publication trend can be observed in the orthodontic literature from the 1980s to date on research related to methods to enhance OTM, especially those with a biological

base, and particularly surgical techniques and administration of pharmacological substances. There is a need for international consensus when it comes to protocols and experimental designs that allow comparisons between studies to be safely made. High quality reports are needed in order to rationalise knowledge in the area for the future, real clinical applicability of these advancements.

#### SP334 THE CRANIOFACIAL PATTERN AND ITS INFLUENCE ON FRICTION: A SCANNING ELECTRON MICROSCOPY STUDY

Maria Cadenas de Llano Perula<sup>1</sup>, Alejandro Iglesias-Linares<sup>2</sup>, Enrique Solano-Reina<sup>1</sup>,  
<sup>1</sup>Department of Stomatology, University of Sevilla and <sup>2</sup>Department of Orthodontics, Complutense University of Madrid, Spain

**AIMS:** To investigate, by confocal (CLM) and scanning electron microscopy (SEM), the changes of roughness on the sliding surface of both archwires and brackets, making a comparison with the clinical data gathered from dolichofacial and brachyfacial patients after sliding mechanics.

**SUBJECTS AND METHOD:** Thirty five subjects were included and classified according to their facial pattern. Only dolichofacial and brachyfacial patients were included, in order to avoid non-well defined muscular patterns that might bias differences among biotypes. Bilateral sliding mechanics were applied for individual retraction of the upper left and right canines with an elastic chain. Distance and clinical sliding time were recorded. The rate of tooth movement was obtained by a function of the distance and the required time. Analysis of the surfaces was then performed by CLM and SEM. The following roughness parameters were measured for 10 regions of interest for each of the samples: roughness average, root mean square roughness, roughness peak, surface skewness. The obtained values were then compared statistically using Mann-Whitney, Wilcoxon and Pearson tests.

**RESULTS:** The mean treatment time in both groups was significantly different ( $P < 0.05$ ). Sliding time of the canine took an average of  $21.48 \pm 4.88$  weeks. Statistically significant differences ( $P < 0.001$ ) were found between both groups regarding sliding time of the canines ( $17.83 \pm 2.36$  weeks in dolichofacial versus  $25.35 \pm 3.71$  weeks in brachyfacial). Roughness, both at the beginning ( $273.24 \pm 35.79$  and  $655.17 \pm 119.77$ ) and after 4 mm of sliding ( $208.67 \pm 26.01$  and  $439.26 \pm 77.71$ ) was higher in brachyfacial subjects. A strong relationship was also found in both groups (0.688 for brachyfacial and 0.472 for dolichofacial) between final roughness and the sliding time of the canine, therefore, the higher the roughness, the longer it takes to perform sliding ( $P < 0.001$ ) for brachyfacial and for dolichofacial ( $P < 0.05$ ) types. However, there does not appear to be statistically significant differences between groups regarding total orthodontic treatment time.

**CONCLUSION:** The craniofacial pattern is suggested to be a new factor to account for during treatment, because of the influence that muscular and chewing forces may have over roughness and overall friction in sliding mechanics and therefore over treatment time.

#### SP335 PHARYNGEAL DIMENSIONS DURING VOWEL PRODUCTION IN PATIENTS WITH MANDIBULAR RETROGNATHIA UNDERGOING ORTHOGNATHIC SURGERY

Naoko Niikuni<sup>1</sup>, Jean-Marc Luukinen<sup>1</sup>, Daniel Aalto<sup>2</sup>, Päivi Jääsaari<sup>1</sup>, Risto-Pekka Happonen<sup>1</sup>, <sup>1</sup>Department of Oral and Maxillofacial Surgery, University of Turku, <sup>2</sup>Institute of Behavioural Science, University of Helsinki and <sup>3</sup>Department of Oral and Maxillofacial Diseases, Turku University Hospital, Finland

**AIMS:** The pharynx is involved in breathing, swallowing, and speech. Orthodontic treatment, especially orthognathic surgery, may affect these functions. Traditional morphological analysis of the pharyngeal area is based on cephalograms where bony structures can be identified. However, soft tissues and pharyngeal volume are not well captured and the instructions usually do not specify well the position of the tongue. The high front vowel /i/ has stable, bilateral tongue contact to the hard palate and characteristically large pharyngeal volume. Here an alternative is proposed for measuring pharyngeal dimensions in three dimensions using magnetic resonance imaging (MRI) during sustained production of vowel /i/.

**SUBJECTS AND METHOD:** Eight patients with mandibular retrognathia (4 males) undergoing orthognathic treatment and two control subjects (1 male) produced a large set of sustained vowels and the anatomy was imaged using structural MRI (isotropic 1.8 mm voxel size; 8 second acquisition time). In this research one sustained production of vowel /i/ from each patient and control was used. The distance of the tongue to the back of the pharynx and the cross-sectional area of the air column was measured in the axial plane which contains the posterior inferior tip of the second cervical vertebra (C2) and which is parallel to the nasal floor. The distance and area were normalized using the distance between C2 and C4 as the anatomical scalar. Wilcoxon's signed rank test was used to compare the orthognathic and control groups.

**RESULTS:** The normalized pharyngeal width ( $W = 10$ ,  $P = 0.7$ ) and area ( $W = 14$ ,  $P = 0.18$ ) were not significantly different between the control and patient group.

**CONCLUSION:** The articulation of high front vowel /i/ was produced with a grooved tongue and bilateral palatal contact in every patient and control. MRI offers a way to study vowel articulation directly in orthognathic patients, complementing acoustic analyses.

### SP336 RELATIONSHIP BETWEEN PERCEPTION OF MALOCCLUSION AND THE PSYCHOLOGICAL IMPACT OF DENTAL AESTHETICS IN UNIVERSITY STUDENTS

Veronica Garcia-Sanz, Carlos Bellot-Arcís, José María Montiel-Company, Vanessa Paredes-Gallardo, José Luis Gandía-Franco, University of Valencia, Spain

**AIMS:** To establish the relationship between perceived smile aesthetics and perceived psychological impact as measured by the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ), and students' perception of it using the Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN-AC) and a visual analogue scale (VAS).

**SUBJECTS AND METHOD:** A cross-sectional study was conducted of 447 college students in Spain and Portugal (average age 20.4 years, 33.1% males, 66.9% females). The online self-completed surveys used the PIDAQ to assess the self-reported psychological impact of the students' dental aesthetics and IOTN-AC and an *ad hoc* 100 mm VAS for their perception of their dental aesthetics.

**RESULTS:** PIDAQ was linearly correlated with IOTN AC and VAS. Pearson's coefficient was 0.55 for PIDAQ and IOTN-AC (CI 95% 0.48-0.61) and  $-0.72$  for PIDAQ and VAS (CI 95%  $-0.66$  -  $-0.76$ ). VAS and IOTN-AC were predictive variables in a linear regression model of the total PIDAQ score. The VAS diagnosed individuals whose dental aesthetics had a self-perceived psychological impact more precisely than the IOTN-AC.

**CONCLUSION:** In adult patients, there was a significant linear relationship between perceived smile aesthetics and self-perceived psychological impact.

### SP337 DOES PONT'S INDEX APPLY TO A SERBIAN POPULATION?

Gordana Filipovic, Julija Radojicic, Predrag Janosevic, Mirjana Janosevic, Faculty of Medicine, University of Nis, Serbia

**AIMS:** To assess the applicability of Pont's Index to a Serbian population and to compare the results with those obtained from studies of different ethnic subjects.

**MATERIALS AND METHOD:** Dental casts of 200 Serbian subjects (100 males, 100 females) with an age range of 13 to 16 years. All subjects had a normal Class I occlusion, with no history of orthodontic treatment. Measurements were taken using a digital calliper with a precision of 0.01 mm. The mesiodistal widths of the maxillary permanent incisors, as well as interpremolar and intermolar maxillary arch widths, were measured. A Student's *t*-test was used to compare Pont's Index ratios between this and Pont study and between genders. Pearson's correlation coefficient between measured arch width values according to Pont's formulae was used.

**RESULTS:** Although correlation coefficients determined between the measured arch width values and the corresponding values calculated according to Pont's Index were high in all cases for males and females, with *r* values ranging from 0.33 to 0.49, between these two values there was a statistically significant difference in the maximum level of statistical significance of  $P < 0.001$ .

CONCLUSION: Pont's Index was not applicable to the Serbian population and a specific standard for the Serbian population might be needed.

#### SP338 TWIN-BLOCK VERSUS FRÄNKEL II FOR CORRECTION OF CLASS II DIVISION 1 MALOCCLUSION: A RANDOMISED CLINICAL TRIAL

Ciara Campbell<sup>1</sup>, Niamh Kelly<sup>1</sup>, Michael Cronin<sup>2</sup>, Marie Cooke<sup>3</sup>, Declan Millett<sup>1</sup>, <sup>1</sup>Dental School, University College Cork, <sup>2</sup>Western Gateway, University College Cork and <sup>3</sup>St Finbarr's Hospital, HSE South, Cork, Ireland

AIMS: To investigate in a single centre prospective randomised clinical trial on the Oral Health Related Quality of Life (OHRQoL), psychosocial impact and perception of treatment with a modified Clark Twin-Block (MCTB) or a Fränkel II appliance in the management of a Class II division 1 malocclusion in growing children.

SUBJECTS AND METHOD: Sixty patients were randomised to either a MCTB or a Fränkel II functional appliance. Each patient completed four pre- and post-treatment questionnaires [Piers-Harris 2 Children's Self-Concept Scale; Oral Aesthetic Subjective Impact Scale (OASIS); Child Oral Health Questionnaire (COHQ) and Standard Continuum of Aesthetic Need (SCAN)]. Their accompanying parent completed one pre- and post-treatment questionnaire (SCAN). Post-treatment scores for each questionnaire were compared between the two treatment groups using a general linear model. Treatment and gender were included as fixed factors for each questionnaire and age, pre-treatment overjet, Peer Assessment Rating and questionnaire scores were included as covariates.

RESULTS: Twenty two patients completed treatment with a MCTB (12 females; 10 males) with a mean age of  $13.4 \pm 0.8$  years. Twenty patients completed treatment with a Fränkel II (13 females; 7 males) with a mean age of  $12.7 \pm 1.2$  years. Thirty six patients completed the COHQ and Piers-Harris 2 with 40 patients completing the SCAN and OASIS. There were no significant differences in any of the questionnaires between appliances for patients or parents. For patients, post-treatment there were statistically significant differences for: COHQ with males having better OHRQoL ( $P = 0.0107$ ); for Piers-Harris 2 older patients had lower scores ( $P = 0.0158$ ); for SCAN older patients had lower scores ( $P = 0.0460$ ) and OASIS older patients had higher scores ( $P = 0.0284$ ). Males had lower scores ( $P = 0.0319$ ). For parents post-treatment there were statistically significant differences for SCAN with parents of older children having lower scores ( $P = 0.0334$ ).

CONCLUSION: There were no differences between the MCTB and Fränkel II with regard to OHRQoL, psychosocial impact and perception of treatment.

#### SP339 RELIABILITY OF THE INDEX OF ORTHODONTIC TREATMENT NEED, PEER ASSESSMENT RATING INDEX AND INDEX OF COMPLEXITY OUTCOME AND NEED OCCLUSAL INDICES SCORED ON PLASTER AND DIGITAL MODELS.

Athina Chatzigianni<sup>1</sup>, Sossani Sidiropoulou<sup>1</sup>, Athanasios E. Athanasiou<sup>2</sup>, Departments of Orthodontics, <sup>1</sup>Dental School, Aristotle University of Thessaloniki, Greece and <sup>2</sup>Dubai College of Dental Medicine, United Arab Emirates

AIMS: The severity of malocclusion and orthodontic treatment priority has been evaluated until now with the use of plaster dental casts. In recent years, computer-based dental models have been introduced as an alternative to plaster models. The aim of this study was to estimate the diagnostic accuracy of three occlusal indices: a) Index of Orthodontic Treatment Need (IOTN), b) Peer Assessment Rating (PAR) Index and c) Index of Complexity Outcome and Need (ICON) scored on plaster models and digital models.

MATERIALS AND METHOD: Thirty five plaster dental casts and their digital counterparts. Impressions were taken from an equal number of orthodontic patients to obtain the plaster casts, which were further scanned using a three-dimensional scanner to create the digital dental models. Measurements and scoring on plaster models were made by hand using specific rulers, whereas those on digital models were conducted with the use of sophisticated software (OrthoAnalyzer). Kappa ( $\kappa$ ) statistics and paired *t*-tests were performed to examine the agreement between the component, total and weighted scores.

RESULTS: Intra-examiner agreement for IOTN scores of the plaster and digital models was found for the Dental Health Component grade to be  $\kappa = 0.77$  ( $P < 0.001$ ) and for Aesthetic

Component (AC)  $\kappa = 0.708$  ( $P < 0.001$ ), indicating substantial agreement for plaster and digital models for both components. The weighted total PAR score also showed good correlation between the two groups ( $r = 0.898$ ,  $P < 0.001$ ). However, a slight overestimation of PAR scores on digital models was observed. The ICON components (AC, crowding/spacing, crossbite, overbite and sagittal buccal occlusion) were statistically significantly correlated ( $P < 0.001$ ). Total ICON score also showed a statistically significant correlation between plaster and digital models (ICC = 0.897,  $r = 0.821$ ,  $P < 0.001$ ).

**CONCLUSION:** Despite some over- or underestimations observed, the IOTN, PAR and ICON scores showed a substantial agreement between plaster casts and digital models. The results of this study support the validity and reliability of occlusal indices applied on digital models.

#### SP340 EVALUATION OF THE EFFECT OF A FUNCTIONAL MANDIBULAR ADVANCER IN CLASS II TREATMENT USING TWO DIFFERENT ACTIVATION METHODS: A PILOT STUDY

Aylin Pasaoglu, Isil Aras, Aynur Aras, Department of Orthodontics, Ege University, Izmir, Turkey

**AIMS:** To evaluate skeletal and dental effects during treatment of Class II malocclusions in adolescents using a rigid functional mandibular advancer (FMA) with two different activation methods.

**SUBJECTS AND METHOD:** Sixteen patients; 11-14 years of age with a Class II malocclusion. All had mandibular deficiency with normal maxillary development. Two groups were created by way of activation. Group 1 (G1; 8 patients) underwent full activation and group 2 (G2; 8 patients) step-by-step activation. The FMA was used for 8 months. The course of treatment was documented cephalometrically. Initial and final data were evaluated. Independent *t*-tests were used to evaluate differences between the two groups.

**RESULTS:** No statistically significant differences were found between the values for boys and girls. There were no significant differences for SNB, ANB, Wits, overjet, (UP6-PTV) - LO6-PTV), (UP1-PTV) - (N-ANS on FH), (UP6-PTV) - (N-ANS on FH), (LO6-PTV) - (N-Pog on FH) values for the two different activation methods. There was a statistically significant difference in LO1-PTV - N-Pog on FH and IMPA values between G1 and G2 ( $P < 0.01$ ).

**CONCLUSION:** Step-by-step activation of the FMA appliance had less proclination effect on the lower incisors.

#### SP341 INTERRELATIONSHIP BETWEEN MALOCCLUSIONS AND SUPPORTING PERIODONTAL TISSUES AMONG ADULT PATIENTS UNDERGOING ORTHODONTIC TREATMENT

Miroslava Dinkova, Department of Orthodontics, Medical University of Sofia, Faculty of Dental Medicine, Bulgaria

**AIMS:** To establish the interrelationship between malocclusion and supporting periodontal tissues in adult patients undergoing orthodontic treatment.

**SUBJECTS AND METHOD:** Two hundred and fifty adult orthodontic patients (21-55 years of age). Impressions, intra- and extraoral photographic documentation, panoramic and lateral cephalometric radiographs and full periodontal status were taken of every patient before and after orthodontic treatment. Clinical crown height was measured on plaster casts before and after orthodontic treatment as well as the bone level on panoramic radiographs using digital callipers with an accuracy of 0.01 mm. For every patient a full orthodontic analysis was made and all existing malocclusions were registered. The patients were categorized into four groups according to the health of the supporting periodontal tissues: group 1, healthy periodontal tissues; group 2, gingivitis; group 3, early periodontal disease and group 4, advanced periodontal disease. The statistical package, SPSS PC plus (version 4.0.1) was used for data processing and statistical analysis. A probability at the 5 per cent level or less ( $P < 0.05$ ) was considered statistically significant.

**RESULTS:** Statistical analyses showed an interrelationship between the severe crowding malocclusion and patients in groups 2 and 3. Pathological abrasion and tilting in the anterior

segment were significantly correlated in group 4. There was no statistically significant ( $P > 0.05$ ) correlation between the other groups and the established malocclusions.

**CONCLUSION:** Orthodontic treatment in adult patients with periodontal disease is possible and even useful if it is conducted during periodontal maintenance therapy before, during and after orthodontic treatment.

### SP342 TREATMENT MODALITIES OF DIFFERENT TYPES OF MANDIBULAR PROGNATHISM

Tatjana Cutovic<sup>1</sup>, Julija Radojicic<sup>2</sup>, Paulina Pandjaitan Donfrid<sup>1</sup>, <sup>1</sup>Military Medical Academy, Belgrade and <sup>2</sup>University of Nis, Faculty of Medicine, Serbia

**AIMS:** There are two basic morphological types of patients with mandibular prognathism (MP): divergent and convergent. The main cephalometric features of the divergent type are: divergent palatal, occlusal and mandibular planes, increased gonial angle and an open bite. The convergent type has almost parallel palatal, occlusal and mandibular planes, gonial angle near normal value and the bite is either incisal or even deep. The aim of this study was to determine the significance and difference in craniofacial features of these two types of MP. in order to find the correct treatment modality for each of them.

**MATERIALS AND METHOD:** Profile radiographs of 90 patients with MP were analyzed. The patients, all male, 18 to 30 years of age, without previous orthodontic treatment, were divided into three groups, according to their dental and skeletal jaw relationships: divergent MP, convergent MP and control. Seven cephalometric parameters were measured and analyzed.

**RESULTS:** When planning orthodontic treatment for divergent MP patients, besides the basic rules, the following should be taken into consideration: present prominent posterior maxillary dentoalveolar hyperplasia, increased mandibular plane angle, increased gonial angle, increased angle of basic jaw planes, increased total anterior and lower anterior face height, condyle and ramus positioned backwards and downwards.

**CONCLUSION:** In order for treatment to be successful, accurate evaluation of the severity of the malocclusion, localization of the problem and understanding the biological potential is necessary. This study is scientific confirmation of clinical experience that gives general but not strict rules. In divergent MP patients, due to vertical disharmony bimaxillary orthognathic surgery is recommended, since isolated sagittal split ramus osteotomy would result in relapse. In convergent MP, if the sagittal component is not too prominent, an isolated sagittal split ramus osteotomy with repositioning of mandible can be taken into consideration.

### SP343 ASSOCIATION BETWEEN POSTERIOR CROSSBITE AND SKELETAL AND MUSCLE ASYMMETRY: A SYSTEMATIC REVIEW

Giorgio Iodice<sup>1</sup>, Gianluca Danzi<sup>2</sup>, Roberta Cimino<sup>3</sup>, Ambrosina Michelotti<sup>3</sup>, Roberto Martina<sup>3</sup>, Department of Dental and Maxillo-Facial Sciences, Section of Orthodontics and Gnathology, University of Naples Federico II, <sup>1</sup>Caserta, <sup>2</sup>Aversa and <sup>3</sup>Naples, Italy

**AIMS:** A posterior crossbite has often been associated with asymmetrical growth and function of the hard structures and muscles. Hence, a systematic review of the literature was carried out focusing on the association between posterior crossbite and morphological and/or functional asymmetries of the stomatognathic system.

**MATERIALS AND METHOD:** A literature survey was carried out through the Medline database covering the period from 1 January 1966 to 27 April 2014. The survey used the medical subject heading term: 'crossbite', which was crossed with the keywords 'masticatory cycle', 'chewing cycle', 'asymmetry', 'bite force', 'EMG', and 'muscle thickness'. The studies were selected on the basis of specific inclusion and exclusion criteria by three researchers. Afterwards, the researchers independently evaluated the scientific and methodological soundness of each study using a published quality score.

**RESULTS:** Screened among 2094 citations, 40 articles were selected and analyzed. The mean quality score was 6,6 (range from 4 to 8). Of the 15 articles specifically investigating the relationship between crossbite and skeletal asymmetry, nine reported a significant association while six did not find any significant association. Of the 10 articles investigating the relationship between crossbite and masticatory muscle electromyographic (EMG)

performance, all reported a significant association. Among four articles investigating the relationship between crossbite and bite force, three reported a significant association while one study did not find any significant association. Of the four articles investigating the relationship between crossbite and masticatory muscle thickness, two studies reported a significant association while two did not find any significant association. Of the seven articles that investigated the relationship between crossbite and an asymmetric chewing cycle, five reported a significant association while two studies did not find any significant association.

**CONCLUSION:** On the basis of the results of the selected studies, there is a higher percentage of agreement about the association between posterior crossbite and morphological and/or functional asymmetries of the stomatognathic system. However, there is a strong consensus about the positive association with EMG performance.

#### SP344 CORRELATION OF THE SECOND DIGIT TO THE FOURTH DIGIT RATIO AND CRANIOFACIAL SHAPE IN A NON-GROWING POPULATION

Anastasia Spanou, Kalliopy Valla, Demetrios Halazonetis, Department of Orthodontics, School of Dentistry, National and Kapodistrian University of Athens, Greece

**AIMS:** Digit ratio is related to prenatal testosterone concentrations and presents a sexually dimorphic pattern. The aim of this study was to evaluate, the correlation between the ratio of the second digit to the fourth digit length (2D:4D ratio) and the shape and size of the craniofacial complex in a non-growing sample

**MATERIALS AND METHOD:** Cephalometric and hand-wrist radiographs of 72 Caucasian (mostly Anglo-Saxon) subjects (34 females aged 17 years and 38 males aged 18 years) taken from the Burlington Growth Study Collection. For measurement of the craniofacial complex, curves were digitally traced to comprehensively describe the major anatomical structures and 132 skeletal landmarks (11 fixed and 121 sliding semi-landmarks) were automatically placed, covering the cranial vault, cranial base, nasomaxillary complex and mandible. The landmark configurations were superimposed using Procrustes superimposition after sliding by minimizing bending energy. Principal components (PCs) analysis was performed to extract the major shape patterns. Finger length was measured from the base of the proximal to the tip of the distal phalanx on digitized scanned left hand radiographs and 2D:4D ratio was computed.

**RESULTS:** The first four PCs described approximately 50 per cent of the total of shape variance. The first PC was related to the vertical dimension and contrasted between low and high angle patterns. The second PC differentiated between males and females, females presenting with a proportionately larger cranial vault, smaller face, higher facial divergency, and flatter cranial base. Sexual dimorphism of the craniofacial complex was found for both shape and size ( $P < 0.001$ ). Digit ratio was higher in females than males ( $0.941 \pm 0.021$  versus  $0.926 \pm 0.022$ ,  $P = 0.01$ ). There was no correlation between digit ratio and craniofacial complex shape in either of the two groups.

**CONCLUSION:** Sexual dimorphism was found in digit ratio and craniofacial shape and size but no correlation was detected between them. Digit ratio, a putative biomarker of prenatal androgen levels, did not substantiate the effect of foetal sex hormones on craniofacial growth and development.

#### SP345 IS CONE BEAM COMPUTED TOMOGRAPHY APPROPRIATE FOR MEASURING DENTAL CASTS?

Verónica García, Beatriz Tarazona, Natalia Zamora, Vanessa Paredes, José Luis Gandía, University of Valencia, Spain

**AIMS:** To compare the reliability and reproducibility of measuring mesiodistal tooth sizes, arch width and arch length using two different methods: a two-dimensional (2D) digital program and three-dimensional (3D) segmented cone beam computed tomography (CBCT).

**SUBJECTS AND METHOD:** Fifty patients were randomly selected. Plaster study models and a CBCT image were obtained. The CBCT used was the Picasso Master 3D® (Ewoo Technology, South Korea, 2005) with a voxel resolution of 0.1 mm and a field of view of  $0.4 \times 0.4 \times 0.4$  mm. The images were sent in Dicom format to the InVivo Dental Company to be segmented and to obtain 3D images of the models. Plaster study casts were made for the 50

patients and then digitised and measured using the 2D digital method. Tooth measurements were undertaken for each of the models.

**RESULTS:** There were significant differences between both methods. There were statistically significant differences for the upper right first premolar, upper left first molar, lower left first premolar, and lower right second premolar, also for lower intercanine distance and lower arch length. The differences, however, were less than 1 per cent.

**CONCLUSION:** CBCT digital models are as accurate and reliable as digital models obtained from plaster casts. The existing differences between both methods are clinically acceptable.

#### SP346 TREATMENT OF UNILATERAL CLEFT LIP AND PALATE NEWBORNS WITH THE NASOALVEOLAR MOULDING DEVICE. A DESCRIPTIVE STUDY ON STL DENTAL CASTS

Luis Miguel Floría<sup>1</sup>, Ana María Tejero<sup>1</sup>, María José Cimadevilla<sup>2</sup>, José Luis Gandía<sup>1</sup>,  
<sup>1</sup>Department of Estomatology, University of Valencia and <sup>2</sup>Cimadevilla Private Practice, Madrid, Spain

**AIMS:** To elucidate the various effects on maxillary growth of the nasoalveolar moulding (NAM) device in newborn patients with a unilateral cleft lip and palate (UCLP) prior to surgical lip and palate repair.

**MATERIALS AND METHOD:** Dental casts of 10 neonatal (2 weeks old) and pre-surgical (4 months old) patients were digitized using the iTero scanner. STL files were uploaded to the Orthocad 3.5 software. Reproducible three-dimensional landmarks were placed on each dental cast. Comparison of measurements between the neonatal and pre-surgical casts allowed evaluation of maxillary growth.

**RESULTS:** The width of the alveolar and palatal cleft gap was significantly narrowed and the cleft edges moved closer to each other.

**CONCLUSION:** NAM induces favourable changes in UCLP patients' growth.

#### SP347 PROPOSAL OF A NOVEL METHOD FOR LOWER INCISOR INTRUSION AND TORQUE CONTROL WITH THE i-TTЯ LINGUAL BRACKET SYSTEM: A THREE-DIMENSIONAL EVALUATION

Paola Lorusso, Matteo Beretta, Elia Kodjo Chardey, Alberto Caprioglio, Aldo Macchi, University of Insubria, Varese, Italy

**AIMS:** To evaluate dental movements using the i-TTЯ lingual bracket system, focussing on intrusion and torque control of the lower incisors.

**MATERIALS AND METHOD:** An extraoral typodont model was arranged to simulate a typical malocclusion with lower crowding and increased overbite (T0). Initial records, consisting of photos, cone beam computed tomographs (CBCT; Newton, Giano, Cefla S.C., Cefla Dental Group, Imola, BO, Italy; 90 KV, 10 mA, 18 s) and intraoral scans (3Shape Trios®, 3Shape A/S, Copenhagen K, Denmark) were collected. CBCT and intraoral scan models were matched to create a three-dimensional digital arch comprising dental crowns and roots. The same procedure was performed to monitor key steps of the i-TTЯ technique consisting of lower incisor intrusion (T1), alignment (T2) and torque control (T3). The resulting digital arches were registered, superimposed and compared by colour displacement maps in order to quantify dental movements.

**RESULTS:** By comparing T0 with T1, the lower incisors intruded 0.8 mm (range 0.3-1.00 mm) without clinically significant bodily translation towards the buccal plate (range 0.2-0.7 mm). The premolars, used as the anchorage unit, did not show any significant extrusion. After alignment, torque control was evaluated by comparing T2 with T3. Using the double arch torque control system, a sectional torque of 2 mm of a single lower incisor root apex toward lingual was obtained.

**CONCLUSION:** The i-TTЯ bracket system results in significant lower incisor intrusion with negligible undesired extrusion of posterior teeth and provides, if necessary, effective lower incisor torque control.

#### SP348 COMPARISON OF RAPID MAXILLARY EXPANSION IN GROWING AND NON-GROWING SUBJECTS

Gökmen Kurt<sup>1</sup>, Ayşe Tuba Demiralp<sup>2</sup>, Gökhan Türker<sup>3</sup>, Banu Kılıç<sup>4</sup>, Erdem Kılıç<sup>5</sup>, Departments of Orthodontics, Faculties of Dentistry, <sup>1</sup>Yeni Yuzyil University, İstanbul, <sup>2</sup>Ankara University and <sup>3</sup>Erciyes University, Kayseri, <sup>4</sup>Private Practice, Kayseri and <sup>5</sup>Department of Oral and Maxillofacial Surgery, Erciyes University, Faculty of Dentistry, Kayseri, Turkey

**AIMS:** To evaluate the dentoalveolar effects of rapid maxillary expansion (RME) in growing and non-growing patients

**SUBJECTS AND METHOD:** Fifty four patients indicated for RME due to maxillary skeletal constriction. The child RME group (C-RME) consisted of 18 subjects (12 males, 6 females) with a mean age of  $13.04 \pm 1.02$  years, the non-growing RME group (A-RME) comprised 18 patients (1 male, 17 females) with a mean age of  $16.41 \pm 0.83$  years, while 18 patients in the surgically assisted rapid maxillary expansion (SARME) group (2 males, 16 females) had a mean age of  $19.9 \pm 2.69$  years. All patients were in the Ru stage in the SARME and A-RME groups. A banded expansion device with a hyrax screw in the SARME group and a bonded full coverage acrylic appliance with hyrax screw for both RME groups were used. The retention period in all groups after expansion was 3 months. Twelve linear and two angular measurements were measured on the study casts. Intragroup differences were evaluated with a paired *t*-test and intergroup differences with one-way analysis of variance.

**RESULTS:** All groups exhibited significant increases in all dental and angular measurements after expansion. The most expansion between canines was found in the C-RME group ( $5.51 \pm 1.66$  mm), and the least in the SARME group ( $4.43 \pm 1.38$  mm). The SARME group showed the most transverse increase in both the first premolar ( $7.55 \pm 2.51$  mm) and first molar ( $7.55 \pm 1.91$ ) regions and the most tipping at the palatal vault ( $9.77 \pm 5.9^\circ$ ). At the mid-palatal level, A-RME ( $5.84 \pm 3.11$  mm) and C-RME ( $5.15 \pm 2.86$  mm) groups showed similar expansion, and the least difference was calculated in SARME patients ( $4.03 \pm 1.82$  mm). The mean tipping of the upper first molars was  $15.00 \pm 11.25$  degrees in the A-RME and  $9.95 \pm 4.85$  degrees in the C-RME groups.

**CONCLUSION:** Significant expansion was achieved in all study groups. The most molar tipping was found in the A-RME group, the greatest expansion was calculated in the anterior region after C-RME, and in the first molar area after SARME. The amount of expansion need is important for choosing surgical or non-surgical expansion procedures in non-growing patients.

#### SP349 THREE-DIMENSIONAL SOFT TISSUE EVALUATION AFTER RAPID MAXILLARY EXPANSION: A CONTROLLED CLINICAL TRIAL

Rosamaria Fastuca, Piero Antonio Zecca, Alessandra Campobasso, Aldo Macchi, Alberto Caprioglio, Department of Orthodontics, University of Insubria, Varese, Italy

**AIMS:** The evaluation of immediate soft tissue changes following rapid maxillary expansion (RME) in growing patients using a facial three-dimensional (3D) soft tissue scanner.

**SUBJECTS AND METHOD:** The final sample for this prospective study comprised a study group (21 Caucasian patients, mean age 7.6 years) who had undergone RME with a Haas type expander banded on the second primary upper molars and a control group (19 Caucasian patients, mean age 8.2 years) without a history of previous orthodontic treatment. The maxillary expansion was performed until dental overcorrection and the palatal expander was removed 7 months after insertion, at the end of the retention period. A facial scanner (Primesense Carmine 1.09, Subsidiary of Apple Inc., Israel, 2005) was employed for facial soft tissue acquisition before placing the appliance in the study group and after 7 months. Cephalometric analysis was developed employing 14 sagittal and 14 vertical angular measurements. The normal distribution of the data was confirmed by Shapiro-Wilk test. Means and standard deviations were computed for all variables, then a paired sample *t*-test was employed to test the differences between the timepoints within the same group and an independent *t*-test to determine differences between the groups at the same timepoint. A value of  $P < 0.05$  was set. All measurement error coefficients were found to be adequate for appropriate reproducibility of the study.

**RESULTS:** No significant differences were found between the two timepoints in the control group. The RME group showed significant changes for the upper lip which moved

downwards and backwards ( $-0.72 \pm 0.52^\circ$ ,  $P < 0.05$ ) and for the vertical and sagittal position of the mandible which significantly moved downwards and backwards ( $4.85 \pm 2.15^\circ$ ,  $P < 0.05$ ) in comparison within timepoints and with the control group.

**CONCLUSION:** RME treatment produced statistically and clinically significant changes in the facial soft tissues when compared to a control group. Further studies are needed to evaluate the long-term follow-up of the present results which evaluated the effects of RME on facial soft tissues immediately after treatment.

#### SP350 DENTAL ANOMALIES OF THE PRIMARY DENTITION IN PATIENTS WITH A CLEFT LIP AND PALATE: A CASE-CONTROL STUDY

Angela Galeotti<sup>1</sup>, Roberto Rongo<sup>2</sup>, Loretta Chianella<sup>1</sup>, Vincenzo D'Antò<sup>1</sup>, Roberto Uomo<sup>1</sup>,  
<sup>1</sup>Bambino Gesù Children Hospital, Roma and <sup>2</sup>University of Naples 'Federico II', Italy

**AIMS:** The occurrence of dental anomalies in children with a cleft lip and palate (CLP) appears to be significantly higher than in individuals without a cleft. Many studies have investigated anomalies in the permanent dentition, but limited data are available for the primary dentition. The purpose of this study is to describe the prevalence of tooth number anomalies in the primary dentition of children with CLP and to compare the obtained data to a control group of individuals without a cleft.

**MATERIALS AND METHOD:** Tooth agenesis and supernumerary teeth were identified from panoramic radiographs of 26 non-syndromic CLP subjects with a complete primary dentition and a Caucasian ethnic background, selected from the Bambino Gesù Children Hospital cleft database. A control group, without a CLP, was randomly selected from the orthodontic database of the same hospital. Children with previous extraction of any tooth for either pathologic or orthodontic reasons were excluded. Incidence of supernumerary teeth and tooth agenesis was assessed by two different operators independently. The data were statistically analysed by means of a non-parametric test.

**RESULTS:** A comparison between subjects with and without CLP showed a significant difference in the presence of tooth number anomalies of the primary dentition of the upper jaw. The number of supernumerary elements was significantly higher in the CLP group than in the control group ( $P = 0.006$ ); and even if not statistically significant, a clear trend of the presence of a supernumerary element in the cleft region was found (6 out of 7).

**CONCLUSION:** The incidence of tooth anomalies in CLP patients is significantly higher in the primary dentition as well as in the permanent dentition when compared to non-CLP subjects. The frequent occurrence of a supernumerary tooth on the same side as the cleft suggests a specific influence that should be investigated in order to better explain CLP aetiopathogenesis.

#### SP351 IS THERE ANY DIFFERENCE BETWEEN TOTAL AND PARTIAL ETCH PROCEDURES FOR WHITE SPOT LESIONS ?

Sabri İlhan Ramoğlu<sup>1</sup>, Ahmet Yağcı<sup>2</sup>, Kevser Kurt Demirsoy<sup>2</sup>, Dilara Ažeker<sup>2</sup>, Departments of Orthodontics, <sup>1</sup>Bezmialem University, Faculty of Dentistry, İstanbul, Turkey and <sup>2</sup>Erciyes University, Faculty of Dentistry, Kayseri, Turkey

**AIMS:** White spot lesions (WSL) are an important side-effect of orthodontic multibracket treatment. The purpose of this prospective study was to determine if there is any difference between etching procedures that involve total etching and partial etching techniques.

**SUBJECTS AND METHOD:** Twenty two patients (14 females, 8 males), who had a skeletal and dental Class I malocclusion with mild crowding treated non-extraction. All patients' dental arches were separated into four quadrants as lower, upper and right, left. Before applying the brackets, at the phase of acid etching, working quadrants were selected randomly. Different acid techniques were applied to these quadrants. The quadrants were separated as total and partial acid groups. i.e. the same acid technique was not allowed in the same jaw or on the same side. In the total etch group, all vestibular surfaces of the teeth up to the gingival area were etched, while in the partial etch group an area slightly wider than the bracket base was etched. Assessment was carried out on quantitative light induced fluorescence images obtained at the beginning (T0) and after 9 months (T1) of treatment. The presence of pre- and post-treatment WSL and their area sizes on the buccal surfaces of

the maxillary incisors, canines and premolars were calculated by QLF software. Differences were examined for significance by Wilcoxon signed rank test. A Student's *t*-test was used for intergroup comparisons.

**RESULTS:** In the total etch group, no significant difference of lesion area alteration was found in any of the evaluated teeth between T0 and T1 ( $P > 0.05$ ). In the partial etch group there was a significant difference between the upper canines  $\Delta Q$  measurements ( $P = 0.015$ ) and lesion area size ( $P = 0.005$ ) at T0 and T1. In intergroup evaluation there was no significant difference between the total and partial etch groups for T0 and T1 values ( $P > 0.05$ ).

**CONCLUSION:** There was no significant difference between etching techniques in terms of the formation of WSL. Both the total and partial etching procedures can be used as etching techniques.

#### SP352 ASSESSMENT OF CONDYLAR POSITION IN SUBJECTS WITH A CLASS I MALOCCLUSION WITH CONE-BEAM COMPUTED TOMOGRAPHY

Veronica Pie de Hierro<sup>1</sup>, Maria Jose Viñas<sup>2</sup>, <sup>1</sup>Department of Stomatology, UPV/EHU University, Lejona and <sup>2</sup>Department of Orthodontics, Complutense University, Madrid, Spain

**AIMS:** To assess the morphologic relationship of the condyle and fossa in subjects with a Class I malocclusion and normal function of the temporomandibular joint (TMJ).

**MATERIALS AND METHOD:** Cone beam computed tomographic (CBCT) scans of 17 young adult Caucasian (8 males, 9 females; mean age, 26 years) previously obtained for diagnosis and orthodontic treatment purposes, were randomly selected from the patients' database at a private diagnostic imaging centre. CBCT were acquired with Icat (Imaging Sciences International Inc., Hatfield, Pennsylvania, USA) The protocol was 13 cm field of view, 20 seconds. and a voxel size of 0.3. Distance measurements were performed with Nemoscan software (Nemotec. Madrid, Spain). Linear measurements of anterior (AS), superior (SS), and posterior (PS) space were made to evaluate the position of the condyle in the glenoid fossa using the Ikeda method. Statistical analyses were carried out with the Statistical Package for Social Sciences (SPSS. V. 17.0 Windows). Data were subjected to descriptive analysis for mean, range and standard deviation.

**RESULTS:** The mean AS, SS, and PS measurements were 1.92 mm (SD  $\pm 0.45$  mm), 3.03 mm (SD  $\pm 1.18$  mm) and 2.27 mm (SD  $\pm 0.58$  mm), respectively on the right and 2,07 mm (SD  $\pm 0.43$  mm), 3.37 mm (SD  $\pm 1.09$  mm) and 2.47 mm (SD  $\pm 0.53$  mm), respectively on the left side. The ratios PS/AS and SS/AS were 1.18 and 1.57, respectively, on the right and 1.19 and 1.62, respectively on the left TMJ.

**CONCLUSION:** A centric position of the condyle in the glenoid fossa is the most common position in subjects with a Class I malocclusion and normal TMJ function. The results show greater variability of measurements and higher values for the distances measured in comparison with previous reports performed on ideal and optimal function occlusions.

#### SP353 CORRELATION BETWEEN MAXILLARY SINUSITIS AND JUVENILE IDIOPATHIC ARTHRITIS: A CONE BEAM COMPUTED TOMOGRAPHIC STUDY

Paolo Cressoni, Ettore del Rosso, Rossano Soldo, Maria Leonardi, Umberto Garagiola, Biomedical Surgical and Dental Sciences Department, Maxillo-Facial and Odontostomatology Unit, Orthodontics and Gnathology Department, Fondazione Ca' Granda IRCCS Ospedale Maggiore Policlinico, University of Milan, Italy

**AIMS:** Juvenile idiopathic arthritis (JIA) is a chronic inflammatory disorder of probable autoimmune origin. The most important manifestation of this disease is chronic synovitis, synovial fluid pressure is produced in the joint often leading to pain. JIA begins before the age of 16 years. Maxillary sinusitis is an inflammatory process, acute or chronic, causing a marked thickening of the mucosa, with or without local pain. The aim of this study was to evaluate a possible correlation between JIA and maxillary sinusitis and to determine its prevalence.

**MATERIALS AND METHOD:** Two hundred cone beam computerized tomographs (CBCT) of which 100 patients had JIA and 100 were healthy. All patients were aged between 8 and 16 years. All CBCT were observed in the three planes of space, bringing attention to the

coronal and transverse sections. Pathological maxillary sinuses presenting with mucous cysts and those with mild thickening of the membrane of the maxillary sinus (within 2-3 mm) were not considered. Acute sinusitis that showed in the above sections, visible air-fluid level or complete obstruction (empyema) of the maxillary sinus were considered.

**RESULTS:** Analysis of CT slices showed involvement of the maxillary sinuses in a greater proportion of patients with JIA (24%) than in healthy subjects (11%). The difference between the two study groups was statistically significant ( $P < 0.01$ ;  $\chi^2 = 5.85$ ). Of the 24 patients with JIA, 50 per cent showed bilateral sinusitis and 50 per cent unilateral sinusitis. In healthy patients with sinusitis, however, the percentages varied (unilateral: 36.4%; bilateral 63.6%).

**CONCLUSION:** Only one of 11 healthy patients showed acute sinusitis, the remaining 10 had chronic sinusitis. Of the 24 patients with JIA, only two had acute sinusitis. In most cases analyzed, therefore, the sinusitis was chronic, especially in patients with JIA. In the light of these findings, it is possible to assume a correlation between JRA and sinusitis.

#### SP354 ENDOCHONDRAL OSSIFICATION OF THE SPHENO-OCCIPITAL SYNCHONDROSIS: JUVENILE IDIOPATHIC ARTHRITIS VERSUS HEALTHY PATIENTS

Paolo Cressoni, Rossano Soldo, Ettore del Rosso, Maria Leonardi, Umberto Garagiola, Biomedical Surgical and Dental Sciences Department, Maxillo-Facial and Odontostomatology Unit, Orthodontics and Gnathology Department, Fondazione Ca' Granda IRCCS Ospedale Maggiore Policlinico, University of Milan, Italy

**AIMS:** To evaluate, on cone beam computerized tomographs (CBCT), any discrepancy in the age range of complete ossification of the spheno-occipital suture, comparing a sample of patients with juvenile idiopathic arthritis (JIA+) with a sample of healthy patients (AIG-).

**MATERIALS AND METHOD:** One hundred and forty 140 CBCT of JIA+ patients between the ages of 4 and 25 years compared with a sample of 230 AIG- subjects aged between 5 and 25 years. The CBCTs of all patients had previously been evaluated because of the diagnosis of condylar disease (AIG+) or for cephalometric evaluation. The sections obtained were studied in three planes of space with dedicated software for three-dimensional (3D) volumetric reconstruction. The radiographic images were divided into two groups: the first in which there was complete spheno-occipital ossification, characterized by the absence of a radiolucent band separating the two bones considered and the second in which bone fusion was not observed.

**RESULTS:** Direct observation of the 3D images showed that: in AIG+ subjects no female presented complete spheno-occipital ossification before 10 years and no male patient before 11 years. Also no female subject had incomplete ossification after 15 years or any male after the age of 13 years.

**CONCLUSION:** With regard to females, comparable data was observed in the two samples analysed while in the male groups there were slight differences. Both JIA and its therapy do not significantly change the growth of the cranial base or the mean age ossification of the spheno-occipital suture.

#### SP355 OBJECTIVE WEAR-TIME REGISTRATION OF THE MODIFIED FRÄNKEL FUNCTION REGULATOR 3: MICROELECTRONIC EVALUATION

Tomaž Košorok, Maša Farkaš, Franc Marjan Farčnik, Orthos, Ljubljana, Slovenia

**AIMS:** To objectively evaluate the wear-time during orthopaedic treatment with the modified Fränkel function regulator 3.

**SUBJECTS/MATERIALS AND METHOD:** The wear-times of 20 patients (10 boys, 10 girls) undergoing orthopaedic treatment with the modified Fränkel function regulator 3 by Farčnik (2007) were measured, registered and analysed using the TheraMon microelectronic device (Gschladt, Hargelsberg, Austria) over a 6 month treatment period. Time-wear was registered every month and statistically evaluated. The values were compared with the recommended wear-time values.

**RESULTS:** The mean value wear-time for the 20 patients was 9.3 hours per day, compared with the prescribed 20 hours/day. The wear-time behaviour of the patients was mainly at night, with some days without wearing the appliance and some afternoon wearing periods. The highest measured wearing time was in a female patient with a mean value over 19

hours/day, and the lowest in a female patient with a mean value of 4.2 hours/day. The duration of daily wear-time was much shorter than at night. The difference was statistically significant.

**CONCLUSION:** Orthopaedic treatment with functional appliances demands strong cooperation regarding wear-time during the day to establish dynamic balance of the orofacial area. However, measured day time wear in these patients was lower than prescribed.

#### SP356 MINIMALLY INVASIVE DIAGNOSIS OF TEMPOROMANDIBULAR JOINT DISORDERS: ULTRASONOGRAPHY VERSUS MAGNETIC RESONANCE IMAGING

Umberto Garagiola, Paolo Cressoni, Ettore del Rosso, Rossano Soldo, Irene Borzani, Biomedical Surgical and Dental Sciences Department, Maxillo-Facial and Odontostomatology Unit, Orthodontics and Gnathology Department, Fondazione Ca' Granda IRCCS Ospedale Maggiore Policlinico, University of Milan, Italy

**AIMS:** To show the importance and reliability of ultrasonography (US) and magnetic resonance imaging (MRI) in the diagnosis of temporomandibular joint (TMJ) disorders in patients affected by orofacial pain and dysfunction with dentofacial and skeletal malocclusions.

**SUBJECTS AND METHOD:** Thirty patients assessed by US examination performed with a 11-18 MHz linear transducer. US offers specific advantages because it is non-invasive, does not require sedation or general anaesthesia (which facilitates follow-up examinations), is easily accessible and can be combined with clinical assessment (interactivity). Agitation of the patient is rarely a problem, as MRI and multiple locations can be assessed during a single session. Furthermore, modern high-frequency US transducers used by experienced examiners can provide unsurpassed resolution of the superficial musculoskeletal structures.

**RESULTS:** Morphological alterations and positions of mandibular condyles in the glenoid fossa, condylar synovitis, disc displacement and joint effusion were detected.

**CONCLUSION:** US is a non-invasive and inexpensive diagnostic procedure that can be suggested for evaluation of TMJ disorders, with particular accuracy in the detection of disc displacement and joint effusion. Limitations are especially related to the scarce accessibility of the medial part of the TMJ structures, and the need for trained and calibrated operators.

#### SP357 EFFECTS ON THE MID AND LOWER FACE SOFT TISSUES AFTER DOUBLE-JAW ORTHOGNATHIC SURGERY

Umberto Garagiola<sup>1</sup>, Leila Khamashta-Ledezma<sup>2</sup>, Gyorgy Szabò<sup>2,3</sup>, <sup>1</sup>Biomedical Surgical and Dental Sciences Department, Maxillo-Facial and Odontostomatology Unit, Orthodontics and Gnathology Department, Fondazione Cà Granda IRCCS Ospedale Maggiore Policlinico, University of Milan, Italy, <sup>2</sup>Eastman Dental Hospital and Croydon University Hospital, London, U.K. and <sup>3</sup>Department of Oral and Maxillofacial Surgery, Semmelweis University, Budapest, Hungary

**AIMS:** To cephalometrically assess the hard and soft tissue response of skeletal Class III patients treated by bimaxillary orthognathic surgery, and to evaluate the correlation between the two.

**SUBJECTS AND METHOD:** Forty-nine patients, 20 males and 29 females, aged 19 to 37 years, who had undergone two-jaw orthognathic surgery, with no additional surgical procedures on the midface or chin. Treatment planning for patients who require orthognathic surgery should include both hard and soft tissue cephalometric analysis. Although the hard tissue analysis will show the nature of the existing skeletal discrepancy, it is incomplete in providing information concerning the facial form and proportions of the patient.

**RESULTS:** After bimaxillary surgery there was a strong correlation in the horizontal and vertical direction between all selected landmarks of the lower lip and chin, but only between superior labial sulcus and point A in the upper lip in the horizontal direction ( $P > 0.1$ ).

**CONCLUSION:** The relationship between hard tissue surgery and its effect on the overlying soft tissue is extremely important in predicting the final facial profile and aesthetic changes. Patients may appear either more or less convex in their profiles than indicated by their hard tissues because of differences in soft tissue thickness, particularly at the junction of the nose and upper lip and in the region of the chin ( $P < 0.01$ ).

### SP358 INVESTIGATION OF CLEANING METHODS FOR REMOVABLE ORTHODONTIC APPLIANCES AMONG GREEK ORTHODONTISTS

Panagiotis Prevezanos<sup>1</sup>, Konstantina Syrrakou<sup>2</sup>, Faidra Xirouchaki<sup>3</sup>, Grigorios Polyzois<sup>4</sup>, Apostolos I. Tsolakis<sup>1</sup>, Department of <sup>1</sup>Orthodontics and <sup>4</sup>Removable Prosthodontics,, National and Kapodistrian University of Athens, Greece, <sup>2</sup>Department of General Dentistry, University of Rochester, USA and <sup>3</sup>Department of Orthodontics, Justus-Liebig-Universität Giessen, Germany

**AIMS:** Oral hygiene instructions that orthodontic patients receive throughout their treatment have three objectives: to avoid decalcification of the enamel, to have minimal inflammation of the gingiva and to preserve the characteristics of the appliances in order to function properly. The aim of the present study was to assess the means and methods being suggested by Greek orthodontists to their patients for daily cleaning of their removable devices.

**MATERIALS AND METHOD:** A questionnaire survey was conducted among a total of 265 Greek orthodontists who were members of the Greek Association for Orthodontic Study and Research. The clinicians were asked about the means and methods of daily cleaning they usually advised their patients for removable appliances. Furthermore, the questionnaire included questions related to possible complications of these devices and data about the use and type of applied devices.

**RESULTS:** From 265 Greek orthodontists, 136 completed the questionnaire and participated in this study. Almost all orthodontists reported that they used removable devices in their practice, either as active plates and functional appliances or as passive devices-retainers. The most suggested cleaning method was daily brushing with a toothbrush and the use of products for cleaning removable prostheses. The majority of orthodontists suggested more than one method and they advised their patients to wear their appliances more than 8 hours per day. They used removable orthodontic appliances for almost any age, with the group aged from 9-13 years being the most common. A significant percentage of clinicians had faced complications from the use of removable devices in the oral cavity. The most usual was trauma of the mucosa, mycosis and hyperplasia.

**CONCLUSION:** Greek orthodontists use removable orthodontic devices, active or passive, in their practice. Brushing with toothbrush and the use of cleaning products for removable prostheses are the most preferable methods for cleaning removable orthodontic appliances regardless of the orthodontic specialty programme they had graduated from.

### SP359 EFFECT OF OSTEO-MICROPERFORATION IN ORTHODONTIC EXPANSION OF THE MAXILLA

Miang Chneh Teo, Kanwipa Poorisat, Pornpan Hiranpradit, Christina Teixeira, Consortium of Translational Orthodontic Research, New York University College of Dentistry, USA

**AIMS:** To investigate the effects of micro-osteoperforations on dentoalveolar changes induced by maxillary expanders in non-growing rats.

**MATERIALS AND METHOD:** Eighty adult Sprague-Dawley rats divided into four groups: 1) Experimental group that received both an active expander and micro-osteoperforations, 2) Expansion group that received only an active expander, 3) Sham group that received an inactive expander, 4) Control group that did not receive any appliance. Groups that received active expanders (1 and 2) were exposed to 100 cN of tensile force across the mid-palatal suture using custom-designed and calibrated springs. Group 1, in addition to an active expander, received six small micro-osteoperforations on the buccal cortical plates between the first, second and third molars on both sides (3 microperforations per side). The activity of inflammatory markers (IL-1, CCL2), osteoclastic marker (RANKL) and bone formation marker (ALP) were measured at days 3, 14 and 28 after appliance activation. Samples collected after 28 and 56 days were used for microcomputed tomography ( $\mu$ CT), fluorescent microscopy and histology (haematoxylin and eosin and tartrate resistant acid phosphatase staining).

**RESULTS:** In comparison to other groups, the microperforation group showed a higher activity of inflammatory and osteoclastic markers, accompanied by a higher magnitude of osteopenia in the upper jaw at day 28. This resulted in an increase in translation, as

opposed to tilting of the teeth. At day 56, the micro-osteoperforation group also showed higher levels of bone formation.

**CONCLUSION:** Application of micro-osteoperforations can significantly accelerate and maximize the orthodontic effect of expansion and bone formation; and reduce tilting of teeth as a side effect to this procedure.

#### SP360 QUESTIONING THE VALIDITY OF CEPHALOMETRIC POINT A\*\*\*

Ahu Topkara, Erol Akin, Department of Orthodontics, Istanbul Aydin University, Turkey

**AIMS:** To evaluate the validity of point A as a cephalometric reference landmark for orthodontic treatment planning in certain cases.

**MATERIALS AND METHOD:** In this retrospective three-dimensional computed tomographic record-based study, three measurements were performed and analysed using Mimics software (10.0.1, Materialize, Leuven, Belgium) to determine the correlation between cephalometric point A used in traditional cephalometric analysis and the bony points just in front of the root apices of the upper central incisors [apical bone points (ABPs)]. The measurements were: 1. SN-A versus SN-ABPs (angular), 2. Nasion perpendicular to point A versus nasion perpendicular to ABPs (linear), 3. True vertical line passing through point A to ABPs (linear). Kruskal-Wallis and one-way analysis of variance were performed for evaluation of the data using SPSS statistical software (IBM Corp. Armonk, New York, USA).

**RESULTS:** A statistically significant difference was found between the dens and crestal bone point A as a routinely used traditional cephalometric landmark and ABPs.

**CONCLUSION:** Due to the anatomical crestal structure, using point A in cephalometric analysis is thought, in some cases, to mask the real maxillary deficiency. Attention must be paid in patients with a prominent anterior nasal spine below the crestal bone. Further research should be planned to determine the real effect of torque and inclination changes of the upper central incisors on dens and crestal cephalometric bone point A, with orthodontic treatment.

#### SP361 MAXILLARY SINUS VOLUME IN SKELETAL CLASS III VERSUS CLASS I\*\*\*

Ahu Topkara, Erol Akin, Department of Orthodontics, Istanbul Aydin University, Turkey

**AIMS:** To identify and compare the mean values of maxillary sinus volumes in healthy individuals without any craniofacial anomalies and in skeletal Class III orthognathic surgery patients.

**MATERIALS AND METHOD:** In this retrospective study three-dimensional computed tomographic records of skeletal Class I individuals (taken for various health problems) and skeletal Class III orthognathic surgery patients were evaluated. Maxillary sinus volumes were measured and analysed by Mimics software (10.0.1, Materialize, Leuven, Belgium). Kruskal-Wallis and one-way ANOVA analyses were performed for evaluation of the data using SPSS statistical software (IBM Corp., Armonk, New York, USA).

**RESULTS:** The sinus volume for one side was determined to be approximately 17000 mm<sup>3</sup> for Class I healthy individuals whereas this value was about 11000 mm<sup>3</sup> for skeletal Class III orthognathic surgery patients. The difference between the sinus volumes of the skeletal Class I and Class III individuals was statistically significant.

**CONCLUSION:** There is a statistically significant decrease in the mean maxillary sinus volumes in skeletal Class III orthognathic surgery patients. Further investigations should be undertaken to reveal the effect of decreased maxillary sinus volume on ventilation of the nasomaxillary complex.

#### SP362 MAXILLARY VERSUS MANDIBULAR MINISCREW INSERTION SITE PLACEMENT: A RANDOMIZED CLINICAL TRIAL ON PRIMARY STABILITY

Chiara Calzolari<sup>1</sup>, Marco Migliorati<sup>1</sup>, Leonardo Amorfini<sup>1</sup>, Fabio Gallo<sup>2</sup>, Armando Silvestrini Biavati<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Biostatistics, University of Genoa, Italy

**AIMS:** To compare torque insertion values of miniscrews inserted in the maxilla and in the mandible.

**MATERIALS AND METHOD:** Two different loading times were analyzed: immediate loading versus loading after one week. The study was designed as a randomized trial. The participants were 56 patients. Inclusion criteria were: complete dentition, need for fixed orthodontic treatment, no systemic disease, absence of the use of drugs altering bone metabolism. The patients who received miniscrews during the orthodontic treatment were blinded and divided in two groups. The final sample comprised 25 and 26 patients, respectively (2 drop-outs). In group 1 the miniscrews were loaded immediately after insertion, while group 2 they were loaded one week after. One type of miniscrew was used: ORTHOImplant, 1.8 mm diameter and 8-10 mm length. A total of 81 screws were placed (41 in the maxilla and 40 in the mandible) in 51 patients. The devices were loaded with constant loads, with nickel titanium coils. Maximum insertion torque (MIT) was measured twice: with a torque wrench at placement time (T1) and after one week (T2) applying a quarter of a turn to the screw; MIT was measured in Ncm. When miniscrews were removed the maximum removal torque (MRT) was recorded. Allocation of the patients to the two groups was determined by a randomization sequence generated by customized software. The clinical data was blindly statistically analysed for elaboration. In order to investigate the associations of MIT with treatment groups, miniscrew location and placement times, the analysis of variance test was used.

**RESULTS:** The mean MIT values were 12.90 (SD = 4.65) and 14.16 (SD = 5.69) for the maxillary and mandibular arch, respectively. There were statistically significant effects of miniscrew location and placement times on the MIT (*P*-values: 0.0028 and < 0.0001). With regard to the miniscrew location, a 1.48 significant increase (*P* = 0.0040) was observed when comparing the mean MIT in the mandibular arch with that in the maxillary arch.

**CONCLUSION:** The screws placed in the mandible showed significantly higher torque values.

### SP363 BIBLIOMETRIC ANALYSIS OF PUBLICATIONS IN TURKISH AND TWO DIFFERENT INTERNATIONAL ORTHODONTIC JOURNALS: AN ANALYSIS OF TWO 2-YEAR PERIODS

Beyza Tagrikulu, Eda Erorta, Muyesser Sarac, Department of Orthodontics, Istanbul University, Faculty of Dentistry, Turkey

**AIMS:** To analyze the types, origins and subjects of articles and authorship characteristics of three orthodontic journals.

**MATERIALS AND METHOD:** The sample comprised 1141 articles selected from three scientific journals, which were analyzed at two 2-year intervals over a 14-year period (1999-2000 and 2012-2013). The American Journal of Orthodontics and Dentofacial Orthopedics (AJODO), European Journal of Orthodontics (EJO) and Turkish Journal of Orthodontics (TJO) were assessed. Each journal's content was accessed through the web edition. From each article; article type, number of authors, number of affiliations, source of article (referring to the first author's affiliation), geographic origin and knowledge domains were recorded.

**RESULTS:** Assessment of the journals between the two periods showed that the number of publications increased in all journals but the increase was greatest in the EJO (72%). The percentages of multi-authored articles also increased. The most frequent article type in AJODO, EJO, and TJO was research (68, 94 and 76%, respectively) followed by case reports in the AJODO (28%) and TJO (15.8%) and reviews in the EJO (3.5%) in both time intervals. The topics most often investigated were dental materials in the AJODO (16%) and EJO (18%) but treatment devices in the TJO (26%) in 1999-2000. The most frequently investigated topic has become skeletal anchorage for the AJODO (12%) but it was still dental materials for the EJO (19%) in 2012-2013. In the AJODO and EJO most of the articles were from the United States (50%, 24.7%) and UK (25%, 9.6%) respectively, in both time intervals. Increases in articles from non-European Union countries, Asia, and other countries were found. Most of all studies derived from orthodontic departments.

**CONCLUSION:** The publications in 1999-2000 and in 2012-2013 were different both in terms of numbers and characteristics.

### SP364 QUANTIFICATION OF WEAR-TIME ADHERENCE OF REMOVABLE APPLIANCES IN YOUNG ORTHODONTIC PATIENTS IN RELATION TO THEIR BODY MASS INDEX: A PRELIMINARY STUDY

Timm Schott<sup>1</sup>, Björn Ludwig<sup>2</sup>, <sup>1</sup>University of Tübingen and <sup>2</sup>University of Homburg/Saar, Traben-Trarbach, Germany

**AIMS:** The relationship between an unhealthy body mass index (BMI) and adherence to orthodontic treatment with removable appliances has not previously been evaluated. The aim of this study was to quantify the association between BMI and wear-time of removable orthodontic appliances and to evaluate BMI changes during orthodontic treatment.

**SUBJECTS AND METHOD:** Fifty-three normal weight and 39 overweight/obese children and adolescents (7 to 15 years old) undergoing orthodontic treatment with removable appliances. BMI categories were determined using standardized age- and gender-specific BMI criteria using data measured at the beginning of therapy and once during orthodontic treatment. Wear-times of removable appliances were measured at 15 minute intervals over a period of five months using implanted microelectronic sensors. Median wear-time values were used in the analysis with the Mann Whitney *U*-test used to test statistical differences between groups.

**RESULTS:** The median wear-time of removable orthodontic appliances was 9.3 hours for normal weight patients and 9.2 hours for overweight/obese patients. No statistically significant ( $P > 0.05$ ) or clinically relevant differences in usage or adherence were detected between normal weight and overweight/obese patients. BMI did not influence wear-time or behaviour of removable orthodontic appliances by young patients. The majority of patients showed qualitative decreases in BMI during therapy.

**CONCLUSION:** Orthodontic treatment of young patients with removable devices does not require BMI-dependent changes in treatment strategy. However, the use of removable appliances during meal times raises the possibility of reducing food intake, and in this way the orthodontist may have an active role to play in weight reduction.

### SP365 STEREOGNOSTIC EXAMINATION TO COMPARE NEUROMOTOR TONGUE ABILITY

Sandra Osiewicz, Małgorzata Jurecka, Grzegorz Piątkowski, Elżbieta Pawłowska, Department of Orthodontics, University, Łódź, Poland

**AIMS:** To compare neuromotor abilities of the tongue in patients with a chronic infantile swallowing type and subjects with a correct swallowing type.

**SUBJECTS AND METHOD:** Two hundred and forty patients aged 5-13 years undergoing orthodontic treatment. Stereognostic examination was based on recognition of silicone shapes: a circle, a semi-circle, a triangle and a square. The procedure was designed to put the shapes in the patient's mouth three times. The first trial was without anaesthesia (10% Lidokain spray), the second trial was with the tip of the tongue anaesthetised and the third trial was with the front part of hard palate behind upper incisors anaesthetised. A chi square test was used.

**RESULTS:** Tongue dysfunction significantly influenced shape recognition. Gender did not determine shape recognition in either group. In the controls, age significantly influenced shape recognition; recognition increased with age. In patients with tongue dysfunction age was statistically unimportant with regards to shape recognition

**CONCLUSION:** Patients with tongue dysfunction have impaired gnostic sensation, which can significantly influence orthodontic treatment and speech therapy.

### SP366 A TONGUE FUNCTION CORRECTION APPLIANCE

Sandra Osiewicz, Katarzyna Kozłowska, Elżbieta Pawłowska, Department of Orthodontics, University, Łódź, Poland

**AIMS:** To describe available fixed and removable appliances used for tongue dysfunction treatment.

**SUBJECTS AND METHOD:** Thirty patients aged 4-10 years. The TPC appliance was created by connection of an upper Schwarz plate and Balters Bionator. It is characterized by

a modified tongue ridge which enables achievement of the correct tongue-rest position. The survey consisted of two parts: one completed by the child's parents and the other by the patient. Profile photographs of the subjects were used for assessment. To assess intra-oral movements, video recording was used.

**RESULTS:** The cribs are a documented tongue dysfunction treatment method, especially with anterior open bite and lateral open bite in the period of late primary, mixed and permanent dentition. Permanent fixation ensures that the therapeutic effect is not dependent on patient co-operation. It significantly increases the effectiveness of therapy and long-term stability results. The cribs located in removable appliances, despite the fact they require patient engagement, also bring positive results. Any discomfort with this type of appliance is temporary and this also creates an advantage of this method. In short period of time the change of tongue rest position 'retrusion' was observed. There were no negative effects according to the children's parents in connection to modified VAS index.

**CONCLUSION:** The TPC appliance can be successfully used in patients with AN abnormal swallowing pattern and inappropriate tongue rest position.

### SP367 RESPONSE OF THE MID-PALATAL SUTURE TO COMPRESSIVE STRESS

Jie Deng, Jonthan Beroukhim, Pardis Parizadeh, Fadwa Shembesh, CTOR, New York University College of Dentistry, New York City, USA

**AIMS:** Many orthopaedic treatments designed for the craniofacial skeleton directly or indirectly apply compressive stresses on one or several sutures in the skull. These treatments have been designed based on the assumption that application of compression forces can prevent sutural growth, but the cellular and molecular events that are stimulated in response to these appliances are not clear. The objective of this study was to investigate the cellular and molecular events in the sutures in response to compressive force.

**MATERIALS AND METHOD:** Eighty growing Sprague-Dawley rats (21 days old) were divided into two groups: 1) active constriction group that received constriction (100 cN compressive force) and 2) control group that did not receive any appliance. Compressive forces were applied to the suture using custom-designed calibrated springs. Samples were collected after 0, 1, 3, 7, 14, 28 and 56 days for microcomputed tomography ( $\mu$ CT), fluorescent and light microscopy (haematoxylin and eosin and tartrate acid phosphatase staining), RNA, protein and immunohistochemistry analyses. Comparisons between groups were assessed by analysis of variance. Pairwise multiple comparison analysis was performed with the Tukey *post hoc* test.

**RESULTS:** Animals that were exposed to compressive stresses demonstrated significant activation of inflammatory cytokines, RANKL and osteoclast activity at the suture early after force application. In these animals, osteopenia of the bone surrounding the suture was significant.  $\mu$ CT showed a decrease of intermolar width. In all groups, the bone resorption stage was followed by a bone formation stage due to decay of the force.

**CONCLUSION:** Application of compressive stresses to the mid-palatal suture stimulate an inflammatory response which is followed by activation of osteoclasts and further decrease in bone density around the suture. However, this is followed by a phase of bone formation. These changes were not limited to mid-palatal sutures and were observed in all surrounding sutures.

### SP368 'LONGITUDINAL STUDY OF FACIAL SOFT TISSUE PROFILE CHANGES IN ANATOLIAN TURKISH CHILDREN WITH A UNILATERAL AND BILATERAL CLEFT LIP AND PALATE

Sevde Sirikci, Asuman Deniz Gumru Celikel, Beyza Tagrikulu, Elif Fatma Erbay, Department of Orthodontics, Istanbul University, Turkey

**AIMS:** Longitudinal soft tissue changes of cleft lip and palate (CLP) patients have been generally focused to surgical processes and performed in unilateral CLP patients. The aim of this longitudinal study was to evaluate and compare facial soft tissue growth changes of unilateral and bilateral CLP patients from 4 to 9 years of age utilizing Arnett's soft tissue cephalometric analysis.

**MATERIALS AND METHOD:** Lateral cephalometric radiographs of 10 unilateral and 10 bilateral CLP children who received primary cleft surgery. Both groups included three girls and seven boys between 3 to 5 and 8 to 10 years of age. Lateral cephalograms were taken in the natural head position. All cephalograms were traced using Arnett's soft tissue cephalometric analysis in Nemotec Dental Studio software. The facial soft tissue growth changes of the unilateral and bilateral CLP groups were evaluated using Wilcoxon's signed-rank test and the differences between the groups were compared using the Mann Whitney *U*-test.

**RESULTS:** From 4 to 9 years of age upper incisor exposure and total face height increased significantly both in the unilateral and bilateral groups. While lower lip length increased significantly in the unilateral group; lower face height increased significantly in the bilateral group. The increase in nasolabial angle was significantly higher in the bilateral CLP group than in the unilateral CLP group at 9 years of age.

**CONCLUSION:** Current findings show that facial soft tissue profile changes can be different according to cleft type. For this reason cleft type should be considered during orthodontic treatment planning.

#### SP369 GENE THERAPY FOR CONDYLAR GROWTH

Dana Alyafi, Abdullah Almansour, Darren Huang, Cristina Teixeira, Consortium for Translational Orthodontic Research, New York, USA

**AIMS:** Gene therapy has been suggested for many medical treatments, but its potential application for skeletal treatment is still unclear. One of the main obstacles in this process is the mineralized matrix that can restrict direct access to the cells during gene delivery. Previously, it has been shown that transduction methods via tail injection in pregnant mice can successfully affect skeletogenesis. However, for minor deformities that occur during postnatal development, transduction methods can be considered excessive. In such cases, local application of target genes through transfection methods is more desirable. The aim of this study was to investigate the effects of local delivery of insulin-like growth factor-I (IGF-1) gene on mandibular condylar growth.

**MATERIALS AND METHOD:** Sixty four growing Sprague-Dawley rats (21 days old) were divided into four groups: control animals that received no treatment, IGF-1 animals that were transfected with carrier and IGF-I gene, GFP animals that were transfected with carrier and control plasmid, and sham animals that were injected with carrier only. Samples were collected after 0, 1, 2, 3, 7, 14, 28 and 56 days for fluorescent microscopy, histology, micro-computed tomographic ( $\mu$ CT) analysis, RNA and protein analyses. Different plasmid/carrier concentrations and different injection doses were tested to determine the optimal gene delivery system. Comparisons between groups were assessed by analysis of variance. Pairwise multiple comparison analysis was performed with the Tukey *post hoc* test.

**RESULTS:** Local delivery of the target gene to skeletal tissue using a non-viral carrier was successful and the dosage should be optimized based on the site of injection. Using this therapy method, IGF-I was successfully produced by local cells and could be tracked at least for two weeks after injection.  $\mu$ CT analysis, fluorescent microscopy, RNA and protein analyses revealed a significant increase in osteogenic activity that resulted in an increase in mandibular ramus length.

**CONCLUSION:** Localized gene therapy using non-viral carriers can effectively deliver the IGF-I gene to the treatment area and successfully increase growth of the mandible.

#### SP370 ACCELERATING TOOTH MOVEMENT WITH MICRO-OSTEOPERFORATIONS: CLINICAL TRIAL RESULTS AND CLINICAL APPLICATIONS

Mani Alikhani, Sean Seung Yoon, Chinapa Sangsuwon, Consortium for Translational Orthodontic Research, New York, USA

**AIMS:** To evaluate the effect of micro-osteoperforations on the rate of tooth movement and the expression of inflammatory markers, and to define possible case scenarios for its application in daily orthodontic practice.

**SUBJECTS AND METHOD:** Twenty adults with a Class II division 1 malocclusion divided into control and experimental groups. The control group did not receive micro-

osteoperforations while the experimental group received micro-osteoperforations on one side of the maxilla. Both maxillary canines were retracted, and movement was measured after 28 days. The activity of inflammatory markers was measured in gingival crevicular fluid (GFC) using an antibody-based protein assay. Pain and discomfort were monitored with a numeric rating scale. Comparisons between groups were assessed by analysis of variance. Pairwise multiple comparison analysis was performed with the Tukey *post hoc* test. In some experiments, paired and unpaired *t*-tests were used to compare the two groups.

**RESULTS:** Micro-osteoperforations significantly increased the rate of tooth movement by 2.3-fold; this was accompanied by a significant increase in the levels of inflammatory markers in GFC. The patients did not report significant pain or discomfort during or after the procedure, or any other complications.

**CONCLUSION:** Micro-osteoperforation is an effective, comfortable, and safe procedure to accelerate tooth movement and significantly reduce the duration of orthodontic treatment. This procedure can be easily incorporated into daily orthodontic practice, to address not only the need of patients who demand shorter treatment times, but also the need for increased bone response in numerous clinic scenarios where bone is deficient or teeth are required to move larger distances, expanding the envelope of treatment in non-surgical orthodontic cases.

### SP371 ORTHOPAEDIC EFFECT OF HIGH FREQUENCY ACCELERATION ON THE MANDIBULAR CONDYLE

Luz Maria Barrera Alviar, Thapanee Vongthongleur, Chaim Adler, Consortium for Translational Orthodontic Research, New York, USA

**AIMS:** To investigate the effect of high frequency acceleration (HFA) on chondrocyte activity in the growth plate of mandibular condyles.

**MATERIALS AND METHOD:** Forty five growing Sprague-Dawley rats (21 days of age) were divided into three groups: control (C), static load (static) and HFA. The HFA group received mechanical stimulation 5 minutes per day, on the lower right third molar at a very low magnitude of loading. The static group received an equivalent magnitude of static force, while the control group did not receive any treatment. Samples were collected at 0, 7, 28 and 56 days for histology, BrDu staining, RT-PCR analysis, micro computed tomography and fluorescent microscopy analysis. Comparisons between groups were assessed by analysis of variance. Pairwise multiple comparison analysis was performed with the Tukey *post hoc* test.

**RESULTS:** HFA increased the rate of chondrocyte proliferation. In addition, progression of chondrocytes through early chondrogenesis into the hypertrophic stage and finally replacement with bone was significantly faster in the HFA group resulting in an increased rate of endochondral bone formation. One possible mechanism through which HFA may affect condylar growth is the regulation of expression of key chondrogenic markers, such as Foxo3a and IHH, and their expression was higher in the condyles of the HFA group.

**CONCLUSION:** Chondrocytes, similar to osteoblasts, can respond to HFA by undergoing faster proliferation and differentiation and replacement by bone. Therefore, HFA could be used in conjunction with orthopaedic appliances to address craniofacial deformities and enhance mandibular growth.

### SP372 AN *IN VITRO* OPTICAL ANALYSIS OF THE BEHAVIOUR OF SEALANTS UNDER MECHANICAL PRESSURE, THERMAL BURDEN AND CHEMICAL EXPOSURE

Christina Erbe<sup>1</sup>, Florian Deckers<sup>2</sup>, Irene Schmidtman<sup>2</sup>, Heinrich Wehrbein<sup>1</sup>, <sup>1</sup>Department of Orthodontics and <sup>2</sup>Institute of Biometrics, Statistics & Epidemiology, University Medical Center Mainz, Germany

**AIMS:** Five frequently used sealants were tested to determine their resistance after mechanical pressure, thermal burden and chemical exposure *in vitro*. Optical analysis was carried out using a digital microscope.

**MATERIALS AND METHOD:** Sealants from two groups were applied in a standardized way to 180 bovine teeth with brackets bonded to them (n = 10 / sealer): Two fluoride varnishes, Protecto®CaF2 Nano One-Step Seal [PN] (BonaDent) and Fluor Protector [FP] (Ivoclar

Vivadent), and fluoride-composite filled sealants (with the acid etch technique): Pro Seal™ [PS] and Light Bond™ [LB] (Reliance Orthodontic Products), Clinpro™ XT Varnish [CP] (3M Espe) and a positive control group [CG] Tetric EvoFlow® (Ivoclar Vivadent). The effect of 1) mechanical pressure by simulating different time points (1 day, 1 and 6 weeks, 3 and 6 months) and electric cleaning protocol (2 minutes, 2 N), 2) thermal burden due to thermal stress (circulator DC10, Thermo Haake, 5-55°C, 5000 cycles), and 3) chemical exposure with a change in pH stress (Buskes-Sol., pH 5 and 7, 7d 22h Remin., 2h Demin., alternating from 11h-1h-11h-1h), were examined. Optical analysis was standardized with a grid incisal and apical to the brackets (n = 32 fields) using a digital microscope (VHX-1000, × 1000, Keyence). The variables were: 0 = 100 per cent material, 1 = sealer defective, 2 = 100 per cent loss of material. Statistical analysis was performed using SAS (9.3 2002-10 Cary, North Carolina, USA) with a generalized estimating equation using a Poisson regression model (*post-hoc*: Tukey-Kramer test).

RESULTS: 1) Compared to CG (score 0) the overall time points averaged relative score with a 95 per cent confidence interval showed the proportion of material loss to be expected are CP (1.2%), FP (21.5%), LB (22.2%) and especially PN (81%). PS alone showed no significant difference to the CG. 2) Compared to CG (0.00), the proportion of material loss to be expected are with CP (0.5%), PS (2%), FP (2.6%), LB (3.1%) and PN (39.9%). 3) Compared to the CG (0.00), the proportion of material loss to be expected are with FP (1.8%), PS (2.1%), LB (5.5%) and PN (39.6%). CP alone showed no significant difference to the CG.

CONCLUSION: Only PS and CP were provable in an optically relevant way in the test series and showed good resistance to mechanical pressure, thermal burden and chemical exposure. PN in particular showed significantly poorer outcomes. No statement is made in this study on the functional properties of the sealants.

#### SP373 ORTHODONTIC TREATMENT IN PATIENTS AFTER PERIODONTAL DISEASE - YES OR NO? - A SYSTEMATIC REVIEW

Christina Erbe, Sarah Heger, Adrian Kasaj, Heinrich Wehrbein, Department of Orthodontics, University Medical Center Mainz, Germany

AIMS: Severe functional and aesthetic impairments that arise in the course of periodontitis and, *inter alia*, manifest themselves in the form of attachment loss, bone depletion and pathologic tooth migration, require the use of interdisciplinary methods. For a long time orthodontics have been considered contraindicated in these cases. However, under certain conditions, promising therapeutic results can be achieved by forced orthodontic tooth movement. The objective of this systematic literature review was to demonstrate the effects of orthodontic measures on the reduced periodontium after periodontal treatment. Based on this evaluation the objective was to develop guidelines for the treatment of periodontitis patients.

MATERIALS AND METHOD: In addition to selected journals, which were searched by hand, mainly the electronic databases PubMed, Medline and DIMD were used as publication sources. In advance search keys were determined that were queried in a specific search mode. Articles were included in the publication period from 1990 to 2014. All articles passed through a unified multi-stage search pattern according to predetermined criteria.

RESULTS: After establishing inflammation-free conditions, orthodontic therapy was partially able to achieve a significant improvement in the key clinical parameters: the ST decreased by a mean of 4.84 mm, bone apposition of 2.55 mm was achieved and the CAL improved by 4.69 mm. Prerequisite for long-term treatment success was a working recall system and maintaining excellent oral hygiene over the treatment period and beyond.

CONCLUSION: In patients with reduced, but inflammation-free periodontium orthodontics provides an adequate means for long-term improvement of both function and aesthetics. As this conclusion is based largely on analysis of case reports it is necessary to conduct further randomized clinical trials in order to develop guidelines.

#### SP374 EFFECT OF VIBRATION ON ALVEOLAR BONE FORMATION AFTER TOOTH EXTRACTION\*\*\*

Jose Alejandro Lopez, Hiba Alabdullah, Jacqueline Heath, Edmund Khoo, Consortium for translational Orthodontic Research, New York, USA

AIMS: To evaluate the effect of high frequency acceleration (HFA) on alveolar bone loss and the rate of bone formation after tooth extraction.

MATERIALS AND METHOD: Sixty adult Sprague Dawley rats divided into three groups: control, sham (static load), and experimental (HFA). All groups had the upper right third molar removed. Experimental group animals were exposed to HFA for 5 minutes per day applied to the second molar. Sham animals received the same magnitude of static load for the same duration. Control group animals did not receive any intervention. Some animals were injected with fluorescent bone markers at different time points. Samples were collected 28 and 56 after extraction for fluorescent microscopy, microcomputed tomographic scan, histology, protein and RNA analysis. Comparisons between groups were assessed by analysis of variance. Pairwise multiple comparison analysis was performed with the Tukey *post hoc* test.

RESULTS: The results demonstrated significant osteogenic activity in the area of the extraction which was accompanied by a faster bone formation rate and significant prevention of alveolar bone loss. None of the animals in any groups showed discomfort or side effects from these procedures.

CONCLUSION: HFA is a non-invasive safe treatment modality that can be used in daily dentistry to prevent alveolar bone loss and/or accelerate bone healing after tooth extraction.

#### SP375 EFFECT OF OESTROGEN DEFICIENCY ON ALVEOLAR BONE DENSITY DURING ORTHODONTIC TOOTH MOVEMENT

Ayat Alzaki, Carly Gutstein, Hye sung Kim, Bert chi Chan, Consortium for Translational Orthodontic Research, New York University College of Dentistry, New York, USA

AIMS: To evaluate the effect of orthodontic tooth movement on alveolar bone density in osteoporotic rats.

MATERIALS AND METHOD: Sixty female adult Sprague Dawley rats divided into three groups: Ovariectomized animals, which had surgery to remove ovaries (experimental), animals that had surgery without removal of ovaries (sham), and animals that did not receive any surgery (control). A low mineral diet was administered to all groups for 3 months to induce osteoporosis. Day counting started after the end of the third month (Day 0). Experimental, sham, and control animals received a force of 25 cN on the maxillary left first molar to induce tooth movement. Samples were collected at day 28, for RNA and protein analyses, microcomputed tomography, histology and fluorescent microscopy. Comparisons between groups were assessed by analysis of variance. Pairwise multiple comparison analysis was performed with the Tukey's *post hoc* test.

RESULTS: Ovariectomy induced significant osteoporosis in alveolar bone. Orthodontic forces induced additional osteopenia, accompanied by a higher rate of tooth movement in osteoporotic rats. Markers of osteoblast activity decreased significantly while markers of osteoclast activity increased in these animals when compared to the sham and control.

CONCLUSION: Undiagnosed osteoporosis in adult patients can have destructive effects on alveolar bone, which may significantly worsen bone loss associated with osteoporosis.

#### SP376 GENETIC SYNDROMES ASSOCIATED WITH LONG FACE MORPHOLOGY

Azza Al-Ani, Mohamad Al-Dujaili, Joseph Antoun, Florence Bennani, Mauro Farella, University of Otago, Dunedin, New Zealand

AIMS: Long face morphology (LFM) is a multifactorial trait, with a significant genetic component. Despite this, very few genes involved in the morphogenesis of this trait have been identified thus far. Recent research, however, suggests that some of the causative genes involved in genetic syndromes may also influence normal facial morphology. The aim of this study was to identify potential candidate genes of the LFM by searching the literature for well-characterised syndromic conditions that present with increased vertical face height.

**MATERIALS AND METHOD:** A targeted search of PubMed, Embase and Scopus databases was undertaken using relevant medical subject headings. Articles published prior to April 2013 were included in the review.

**RESULTS:** A wide range of scientific articles were identified, including case reports, case series, family and twin studies. The initial search yielded 120 studies. Following the application of various inclusion and exclusion criteria, 24 articles qualified for the study. Twenty-two conditions were identified, including Sotos syndrome otherwise known as gigantism (OMIM 117550, 5q35.2-q35.3), Cri-du-chat (OMIM 123450, 5p15.2), Fragile X syndrome (OMIM 300624, Xq27.3), Treacher-Collins (OMIM 154500, 5q31.3-32) and Marfan (OMIM 154700, 15q21.1) syndromes.

**CONCLUSION:** A number of well-characterised genetic syndromes were found to be associated with increased vertical face height, suggesting there may be an association between the genes involved in these syndromes and the long face phenotype. Future genetic studies investigating the aetiology of long face morphology should therefore include these candidate genes.

### SP377 CONSIDERING THE CURVE OF WILSON FOR A CONSISTENT SPACE ANALYSIS\*\*\*

Erol Akin, Ahu Topkara, Department of Orthodontics, Istanbul Aydin University, Turkey

**AIMS:** To determine the significance of the amount of space provided by uprighting of the lower posterior teeth and its influence on dental arch width and length.

**MATERIALS AND METHOD:** In this retrospective study, linear measurements were made on three-dimensional scanned (3Shape) orthodontic cast models. Required measurements were made and the data was processed using the Mimics software (Materialize). Three measurements were made for each of the curve of Spee and the curve of Wilson. For the curve of Spee the first measurement was the total linear amount between the tip of the lower canine and distobuccal cusp tip of the lower molar for each tooth (measurement A). The second was the line between the distobuccal cusp tips of the molars and the tip of the canines (measurement B). The last was the vertical linear distance between the line (measurement B) and the deepest point of curve of Spee (measurement C). For the curve of Wilson an imaginary sphere tangent to the distobuccal and distolingual cusp tips of the lower left and right molars was created. The first measurement (A) was the curve of the sphere between the distobuccal cusp tips of the molars. The second (B) was defined as a plane directly between the distobuccal cusp tips of the molars and C was the vertical linear distance between the plane and the deepest point of the sphere. Kruskal-Wallis and one-way ANOVA analyses were undertaken for evaluation of the data using SPSS statistical software.

**RESULTS:** Uprighting of the lower posterior teeth resulted approximately in a 5 mm increase in dental arch width whereas flattening the curve of Spee resulted in a 2.5 mm decrease in dental arch length.

**CONCLUSION:** The curve of Spee is frequently taken into consideration in orthodontic space analysis. However, straightening the curve of Wilson in patients with lingually inclined lower posterior teeth may reduce the space requirement. The curve of Wilson should be considered in orthodontic space analysis.

### SP378 CLINICAL AND PSYCHOSOCIAL ASPECTS OF LONG FACE MORPHOLOGY

Joseph Antoun<sup>1</sup>, Roberto Rongo<sup>2</sup>, William Murray Thomson<sup>1</sup>, Tony Merriman<sup>1</sup>, Mauro Farella<sup>1</sup>, <sup>1</sup>Department of Oral Sciences, University of Otago, Dunedin, New Zealand and <sup>2</sup>Department of Neurosciences, Section of Orthodontics, University of Naples 'Federico II', Italy

**AIMS:** The long face morphology is a relatively common clinical presentation, although the functional and psychosocial impacts of this condition are still unclear. The objective of this study was to compare differences in: (1) oral behaviour patterns; (2) functional limitations; (3) and, oral health-related quality of life (OHRQoL) between long (case) and normal (control) face individuals.

**SUBJECTS AND METHOD:** Eighty patients with a distinctively long face (mandibular plane angle greater than 2 standard deviations, or 42°) and 80 controls were individually matched for age, gender, ethnicity, and treatment stage. Patients were administered several self-report questionnaires, including the Oral Behaviour Checklist (OBC), Jaw Functional Limitation Scale (JFLS-8), and Oral Health Impact Profile (OHIP-14). Two of the OBC items were related to sleep-time behaviour, while the other 19 were related to wake-time behaviour.

**RESULTS:** The sample had a mean age of  $17.2 \pm 4.6$  years, with the majority of the participants being female (65.0%). Nearly one-fifth of the long face sample had an anterior open bite. There were no significant differences in the mean number of OBC items between long ( $25.6 \pm 9.0$ ) and normal face individuals ( $25.3 \pm 9.9$ ;  $P > 0.05$ ). In contrast, significant differences in OBC scores were noted for other variables such as gender, age and treatment stage. Likewise, there were few differences in the JFLS-8 scores between cases and controls, although long face individuals reported greater limitations in chewing both soft (cases =  $2.0 \pm 11.1$ , controls =  $0.6 \pm 1.0$ ;  $P > 0.05$ ) and tough foods (cases =  $2.7 \pm 2.5$ , controls =  $2.0 \pm 2.2$ ;  $P > 0.05$ ). The mean overall OHIP-14 score was higher in long face individuals ( $9.3 \pm 6.5$ ) than in controls ( $7.5 \pm 6.8$ ;  $P < 0.05$ ). The prevalence of experiencing at least one impact in the social disability domain was also greater in cases ( $n = 8$ , 10.0%) than controls ( $n = 1$ , 1.3%;  $P < 0.05$ ).

**CONCLUSION:** Facial morphology is not necessarily associated with jaw function or oral behaviour patterns. Long face individuals, however, are more likely to self-report poorer OHRQoL, especially with respect to social functioning.

### SP379 THREE-DIMENSIONAL EVALUATION OF PALATAL BONE THICKNESS FOR MINI-IMPLANT PLACEMENT IN DIFFERENT FACIAL HEIGHTS

Ana Mora, Natalia Zamora, Ignacio Faus, Jose Luis Gandia, Department of Orthodontics, University of Valencia, Spain

**AIMS:** To evaluate palatal bone thickness for the insertion of orthodontic mini-implants using cone-beam computed tomographic (CBCT) images of adults with low, normal and increased face heights.

**MATERIALS AND METHOD:** CBCT of 60 patients with ages ranging between 16 and 52 years were analysed using the software, InVivoDental® (Anatomage, San Jose, California, USA). Palatal bone thickness was measured along the midpalatal suture at four distances (5, 10, 15, and 20 mm) and paramedian areas (at 5 and 10 mm left and right of the midpalate) from the distal edge of the incisal foramen in 20 different sites. The patients were assigned to the low-, normal, and high-angle groups using the software Nemoceph 3D® (Nemotec Dental Studio®). Statistical analysis was carried out using SPSS software. Two-way ANCOVA and Bonferroni tests were used. The standard level of significance was 0.05.

**RESULTS:** The palatal bone thickness mean distances ranged from 6.35 to 1.64 mm and tended to progressively decrease from the incisal foramen to the posterior areas. The midpalatal bone was much thicker than the paramedian palatal bone at 10, 15 and 20 mm. The paramedian palatal bone showed the greatest thickness at 5 mm (6.35 mm; SD, 2.18 and 6.26 mm; SD 2.14). The thinnest palatal bone was found 20 mm from the incisive foramen. There were statistically significant differences between the groups regarding age and gender. Palatal bone thicknesses were significantly lower in young patients and female groups. No statistically significant differences were found between the groups regarding different face heights.

**CONCLUSION:** The thickest part of the palatal bone is the anterior region, especially the paramedian area. Clinicians should be aware of the probability of thin palatal cortical bone thickness in the posterior region, in order to avoid the risk of failures in mini-implant placement.

### SP380 EVALUATION OF CORTICAL BONE THICKNESS FOR ORTHODONTIC MINI-IMPLANT PLACEMENT WITH CONE-BEAM COMPUTED TOMOGRAPHY

Ana Mora, Natalia Zamora, Ignacio Faus, Jose Luis Gandia, Department of Orthodontics, University of Valencia, Spain

AIMS: To evaluate alveolar cortical bone thickness between interradicular sites for mini-implant placement using cone-beam computed tomography, in diverse age groups and facial patterns.

MATERIALS AND METHOD: Sixty cone-beam computed tomographs obtained for oral surgical purposes were selected. The cortical bone thickness and the alveolar process width from canine to second molar were measured at two different vertical levels (5 and 8 mm) from the cemento-enamel junction (CEJ) in the maxilla and mandible. Thirty two measurements were obtained for each patient using the software InVivoDental® (Anatomage, San Jose, California, USA). The patients were assigned by ages and facial patterns (low-angle, normal, and high-angle groups) using the software Nemoceph 3D®. For statistical analysis two-way ANCOVA and Bonferroni test were used.

RESULTS: There were statistically significant differences between the groups regarding the age and gender. The greatest thickness was between the mandibular second and first molar which tended to increase with the age of the patients. Buccal cortical bone thickness and alveolar process widths were significantly lower in the young patient group and the female group. In low-angle patients, higher values of cortical bone thickness were found with a statistically significant difference ( $P \leq 0.05$ ).

CONCLUSION: In order to increase primary stability for mini-implants, clinicians should be aware of the variability of cortical bone thickness between ages, genders and facial patterns.

### SP381 EFFECTS OF OSTEOTOMY OF THE ALVEOLAR PROCESS WITH A PIEZOTOME ON THE VELOCITY OF ORTHODONTIC TOOTH MOVEMENT

Nikos Papadopoulos<sup>1</sup>, Nicola Beindorff<sup>2</sup>, Winfried Brenner<sup>2</sup>, Paul-Georg Jost-Brinkmann<sup>1</sup>, Thomas Präger<sup>1</sup>, <sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics and <sup>2</sup>Clinic of Nuclear Medicine, Charité - Universitätsmedizin Berlin, Germany

AIMS: Recently it has been shown that orthodontic tooth movement can be accelerated by osteotomies in the alveolar process. The aim of this study was to investigate the effect of an osteotomy of the maxillary alveolar process with a piezotome on the speed of tooth movement in a split mouth design.

MATERIALS AND METHOD: Twelve male Wistar-rats (age: 10 weeks) were randomly allocated to two groups. In the first group, a vertical osteotomy of the maxillary alveolar process, mesial of the first molar, was performed by means of a piezotome on the right side and in the second group the same intervention was carried out on the left side. Subsequently, the adhesively combined maxillary molars on both sides were moved mesially against the combined maxillary incisors by means of a closed Nitinol coil spring (25 cN on each side) for four weeks. Immediately before placement of the orthodontic appliance and again after four weeks, all animals underwent microcomputed tomography. The ratio of the movement of the molars on the one side to that of the other side was determined in all animals except for two drop outs.

RESULTS: In all animals that completed the study an increase of the velocity of tooth movement on the osteotomy side could be observed, but remarkable interindividual differences were detected. The range of acceleration was between 17 and 100 per cent, median 43 per cent.

CONCLUSION: Osteotomy of the maxillary alveolar process by means of a piezotome seems to be able to speed up mesial tooth movement. However, this effect is subject to great inter-individual differences.

### SP382 RAPID MAXILLARY EXPANDER EFFICACY IN OBSTRUCTIVE SLEEP APNOEA TREATMENT

Mariana Albergaria, Adriana Guimarães, Luísa Maló, Francisco Vale, Faculty of Medicine of the University of Coimbra, Portugal

AIMS: To review the literature to assess the effectiveness of rapid maxillary expansion (RME) in the treatment of children with obstructive sleep apnoea (OSA).

MATERIALS AND METHOD: A research was developed over the following primary and secondary electronic databases Medline/PubMed, Embase, CINAHL, LILACS, Cochrane and OvidSP. A search strategy was made using the English terms: 'palatal expansion

technique' [MeSH] AND 'sleep apnoea, obstructive' [MeSH] limited to randomized controlled trials, cohort studies, systematic reviews and meta-analyses, in Portuguese and English, performed in humans under 18 years and regarding articles published between January 1st 2000 and January 2014.

RESULTS: A total of 36 articles were identified, 17 of which were considered potentially relevant. After applying the inclusion and exclusion criteria, six publications were accepted. Among these, only three had a positive result after the Critical Appraisal Skills Programme quality assessment and were included in this study.

CONCLUSION: RME is effective in the treatment of children with OSA combined with inadequate respiratory capacity and transverse maxillary deficiency, resulting in improvement of polysomnographic variables, especially in the apnoea-hypopnea index.

### SP383 DENTAL AND BASAL ARCH FORMS AND MESIODISTAL TOOTH DIAMETERS OF CLASS I CROWDED MALOCCLUSIONS COMPARED WITH NORMAL OCCLUSION IN A JAPANESE POPULATION

Ikuyo Oda, Souichiro Oda, Kazuhito Arai, Department of Orthodontics, Nippon Dental University, Tokyo, Japan

AIMS: Dental crowding of the mandibular anterior teeth is thought to be a multifactorial problem. The dental and basal arch size and tooth diameter are critical for orthodontic diagnosis and treatment planning in terms of the decision to extract or not to extract based on crowding. Dental crowding may represent a disparity in the relationship between the basal and dental arches as well as tooth crown size. The aim of this study was to compare the dental and basal arches and tooth size among normal occlusion and Angle Class I crowded malocclusion samples in Japan.

MATERIALS AND METHOD: Archived mandibular dental casts with normal occlusions (N group, n = 36, male =18, female =18, mean age: 21.3 ± 1.6 years, mean irregularity index: 0.85 ± 0.55 mm) and Angle Class I crowded malocclusions (C group, n = 36, male = 18, female = 18, mean age: 22.7 ± 2.4 years, mean irregularity index: 8.43 ± 3.77 mm). The casts were analysed using a three-dimensional laser scanning system (VMS-250R, UNISN, Osaka, Japan). The widths and depths of both dental and basal arches at the canine and first molar as well as the mesiodistal tooth diameters from the central incisor to the first molar were measured. Furthermore, the sum of the six anterior and 12 overall tooth diameters was calculated. The mean and standard deviation (SD) of the measurements were calculated and statistically compared ( $P = 0.05$ ) between the two groups.

RESULTS: The dental and basal arch widths were significantly smaller in the C group than in the N group. The mesiodistal tooth diameters from the central incisor to the first molar were all statistically larger in the C group than in the N group. Furthermore, in the C group, 69.4 per cent of the six anterior and 75 per cent of the 12 overall tooth diameters were larger than +1 SD of those in the N group.

CONCLUSION: Small dental and basal arch widths and large mesiodistal tooth diameters were identified in the sample of Japanese Class I crowded malocclusions. Based on the results, not only small dental and basal arches but also a large mesiodistal tooth diameter may be factors that are responsible for dental crowding.

### SP384 CHANGES IN DENTAL ARCH FORM AFTER EXTRACTION AND NON-EXTRACTION TREATMENT

Souichiro Oda<sup>1</sup>, Leslie A. Will<sup>2</sup>, R. Matthew Miner<sup>2</sup>, Ikuyo Oda<sup>1</sup>, Kazuhiro Arai<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Nippon Dental University, Tokyo, Japan and <sup>2</sup>Department of Orthodontics and Dentofacial Orthopedics, Boston University Henry M. Goldman School of Dental Medicine, Boston, USA

AIMS: To compare pre- and post-treatment dental arch forms of Angle Class I malocclusions between four first premolar extraction and non-extraction treatments.

MATERIALS AND METHOD: Pre- and post-treatment mandibular dental casts of Angle Class I crowded malocclusion subjects treated at Boston university orthodontic clinic with a comprehensive orthodontic treatment of non-extraction (NE group, mean age: 16.7 years, N = 30) and four first premolar extractions (E group, mean age: 16.4 years, N = 30) were

randomly selected and analysed. The dental casts were laser-scanned using a non-contact three-dimensional cast-measuring system (VMS100F, UNISN, Osaka, Japan), and reference points in the middle of the labio-buccal surface of the tooth as a facial axis (FA) point were identified from the central incisor to the first molar in each digital model using the inspection and mesh-processing software (GOM inspect ver 7.0, Germany). The x, y, and z coordinates of the points were subsequently exported into Excel (Microsoft Excel 2007, Microsoft, Redmond, Washington, USA) to measure the dental arch width and depth at the canine and first molar. The measurements were compared statistically between the pre- and post-treatment (paired *t*-test,  $P < 0.05$ ) and between the two treatment strategies (unpaired *t*-test,  $P < 0.05$ ).

**RESULTS:** There were no statistically significant differences in pre-treatment arch width or depth in either the NE or E group ( $P > 0.05$ ). In the NE group, the dental arch width was not significantly changed during treatment, while there was a significant increase in first molar depth post-treatment ( $0.92 \pm 1.46$  mm). In the E group, there was a significantly increased canine width ( $1.85 \pm 1.97$  mm), decreased first molar width ( $-2.09 \pm 2.76$  mm), decreased first molar depth ( $-5.84 \pm 1.68$  mm) and increased canine depth ( $1.01 \pm 1.48$  mm) post-treatment.

**CONCLUSION:** Although the mandibular dental arch width was likely to be maintained during non-extraction, there was a significant increase in the depth of the first molar. Changes in the dental arches in terms of both widths and depths were significant with four first premolar extraction treatment.

#### SP385 COMPARISON OF GONIAL ANGLES IDENTIFIED ON PANORAMIC AND LATERAL CEPHALOMETRIC RADIOGRAPHS

Carolina Nieto, Manuel Míguez, Sonia Arauz, Cristina Gallego, Martín Romero, Orthodontic Department, Rey Juan Carlos University, Madrid, Spain

**AIMS:** To determine the right and left gonial angles on panoramic radiographs and to compare them with those obtained from lateral cephalometric radiographs, to assess the accuracy of panoramic radiography.

**SUBJECTS AND METHOD:** One hundred and eighteen patients (50 males, 68 females) with an age range of 6-30 years. The subjects were divided into three groups according to the sagittal skeletal Class (CI, CII, and CIII). The gonial angle was determined from two tangents which were drawn from the inferior border of the mandible and the most distal borders of the ramus and condyle on both panoramic and cephalometric radiographs. Multiple comparison tests (ANOVA), Pearson's correlation coefficient and paired *t*-tests were used to determine differences between the three groups. The predictability level of the cephalometric measurements from panoramic radiographs was determined using regression equations.

**RESULTS:** The mean gonial angle was  $125.07 \pm 7.25$  and  $126.49 \pm 7.27$  degrees on panoramic and cephalometric radiographs, respectively. There was correlation between left and right gonial angles measured on panoramic radiographs. A positive correlation between panoramic and cephalometric radiographs was established, although there were significant differences between them. There was statistically significant gender difference in gonial angle, with higher values in females ( $P = 0.02$  and  $P = 0.05$  on panoramic and cephalometric radiographs, respectively). However, there were no significant differences between Class I, II, and III sagittal skeletal groups ( $P > 0.05$ ).

**CONCLUSION:** 1. The value of the gonial angle measured on panoramic radiographs is comparable to that measured on routinely used cephalometric radiographs. 2. The cephalometric gonial angle may be predicted from panoramic radiographs, when it is useful to know the skeletal pattern, without further radiographic exposure. 3. Gender influences the gonial angle, with higher values in females. 4. There is no relationship between the sagittal skeletal Class and gonial angle.

#### SP386 INFLUENCE OF DENTAL TRENDS IN TEENAGERS: PERCEPTION OF A MIDLINE DIASTEMA

Laura Hernández Horlock, Marta Benéitez Bermejo, Bendición Delgado Ramos, Manuel Míguez Contreras, Martín Romero Maroto, Department of Orthodontics, Rey Juan Carlos University, Madrid, Spain

**AIMS:** To determine the social perception of a midline diastema by teenagers aged 13 to 16 years.

**SUBJECTS/MATERIALS AND METHOD:** Surveys assessing general and dental aesthetics were distributed to a total of 97 students in a school in Madrid, Spain. Their self-esteem and what they considered necessary for a beautiful smile were registered. In addition, they chose between two images of celebrities with and without a midline diastema. Finally it was determined whether they thought it was fashionable, if they would like to have it and if they would go to the dentist to get one. Statistical analysis was performed using SPSS 22.0® software (IBM, Armonk, USA). The statistical tests used were *t*-test for independent samples, one-factor ANOVA, Bonferroni test and Pearson correlation test ( $P < 0.05$ )

**RESULTS:** Most teenagers have a neutral or positive self-image and do not feel self-conscious about their smile. Similarly, they believe that their peers see them in a neutral or positive manner. The factors considered important for having a nice smile in ascending order were: absence of diastemas, misaligned teeth, white teeth and clean teeth. When photographs of celebrities with and without diastema were shown, there was a clear preference for those without a diastema. Females, those who preferred entertainment of a social nature and those who did not give importance to the presence of diastemas for a nice smile were the ones who had the most perception of a midline diastema as a dental trend. About one-third of respondents felt that a diastema is fashionable while 97.9 per cent responded negatively to the question of wanting to have a diastema.

**CONCLUSION:** 1. Approximately one-third of respondents felt that a diastema is fashionable. 2. Although teenagers are exposed to dental trends, they are not influenced by them. In particular, none of the respondents would like to have a midline diastema. 3. It is important to raise awareness of fleeting dental trends such as a midline diastema which could have a negative impact on general dental health.

#### SP387 DENTAL ANXIETY: A COMPARISON BETWEEN DENTAL ANXIETY WITH REGARD TO AGE, DENTAL SPECIALTIES AND GENDER

Marta Navarro, Laura De la Sen, Maria José Martínez, Maria José González, Martín Romero, Rey Juan Carlos, Madrid, Spain

**AIMS:** To identify dental fear and anxiety levels in dental patients and to analyze differences in levels of dental anxiety and fear according to dental specialties, age and gender

**SUBJECTS AND METHOD:** Questionnaires based on Spielberg's STAI scale were given to 102 patients (males and females) aged 25 years or older who were to be treated by specialists of implants, periodontics, endodontics and orthodontics. These patients signed an informed consent and the Ethics Committee and Human Research granted permission for the project. Statistical analysis was performed through SPSS 22.0 software (IBM, Armonk, USA). Once differences were detected between gender and through a Student's *t*-test, several studies were carried out through ANOVA testing to relate anxiety depending on age and specialty.

**RESULTS:** Females generally scored a higher level of anxiety. A higher rate of anxiety was found in the group of patients aged 18-30 years. The specialties of endodontics and restorative dentistry showed the highest mean scores and orthodontics the lowest scores. Regarding anxiety, no statistically significant differences were detected between age ( $P < 0.3$ ) and gender ( $P < 0.6$ ). Highly statistically significant differences were found for anxiety between the total specialties of dentistry ( $P < 0.002$ ).

**CONCLUSION:** 1. There were no significant differences in dental fear and anxiety on the grounds of gender, although there is a trend of increasing anxiety in females. 2. There is no significant relationship between age and dental anxiety but younger patients tend to suffer more anxiety than older patients. 3. Dental patients who showed higher levels of anxiety and fear were those who underwent surgery and endodontic treatment.

### SP388 BISPHOSPHONATES AND COMPRESSIVE FORCES INFLUENCE THE RECEPTOR ACTIVATOR OF NUCLEAR FACTOR KAPPA-B LIGAND / OSTEOPROTEGERIN SYSTEM OF HUMAN OSTEOBLASTS

Sarah Grimm<sup>1</sup>, Christian Walter<sup>2</sup>, Heinrich Wehrbein<sup>1</sup>, Collin Jacobs<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Oral and Maxillofacial Surgery, University Medical Centre of Mainz, Germany

**AIMS:** Bisphosphonates affect bone remodelling via the receptor activator of nuclear factor kappa-B ligand (RANKL) / osteoprotegerin (OPG) system. Clinical studies have demonstrated reduced orthodontic tooth movement in patients taking bisphosphonate drugs. This study investigated how bisphosphonate clodronate influences the effect of compressive forces on the RANKL/OPG system of human osteoblasts (HOBs).

**MATERIALS AND METHOD:** HOBs were cultured with 0.5 or 5 µM clodronate for 48 hours and subjected to compressive forces (40.8 g/cm<sup>2</sup>) for 3 hours *in vitro*. Viability was measured via MTT assay. Production of RANKL and OPG were investigated at the transcriptional and protein levels using real-time polymerase chain reaction, ELISA and immunocytochemical staining.

**RESULTS:** Compressive force did not have a significant effect on the viability of HOB. Clodronate (5 µM) slightly reduced the viability of HOB with and without compressive force. Compressive force induced a 4.2-fold increased gene expression of RANKL, clodronate (5 µM) and compressive force reduced the effect to a 1.8-fold increase. Compressive force both with and without clodronate (0.5 µM) inhibited OPG gene expression, whereas 5 µM clodronate and compressive force did not change OPG gene expression. Enhanced RANKL/OPG ratio induced by compressive force was reduced in combination with clodronate. OPG protein synthesis increased due to compressive force, whereas combination with clodronate significantly decreased OPG protein synthesis. Immunocytochemical staining demonstrated an increased RANKL protein synthesis by compressive force, with a smaller dimension in combination with clodronate.

**CONCLUSION:** Compressive force influences the effect of bisphosphonates on the OPG/RANKL system of HOBs. Increased RANKL/OPG ratio as a result of compressive force corresponds to the early beginning of orthodontic tooth movement with an activation of bone resorption on the compression side. Inhibition of this process by clodronate results in reduced bone turnover and could provide an explanation for clinically slowed orthodontic tooth movement during bisphosphonate therapy.

### SP389 EFFECTS OF CLASS II TREATMENT WITH A STAINLESS STEEL CROWN HERBST APPLIANCE ON ROOT RESORPTION: A RETROSPECTIVE STUDY

Dilara Ažeker, Kevser Kurt Demirsoy, Ahmet Yağci, Department of Orthodontics, Erciyes University, Faculty of Dentistry, Kayseri, Turkey

**AIMS:** To retrospectively analyse the teeth in 20 adolescents with an Angle Class II division 1 malocclusion treated with a crown Herbst appliance to check for apical root resorption.

**MATERIALS AND METHOD:** Panoramic radiographs were taken of every patient at the beginning and after completion of functional orthopaedic treatment. The magnification of the area of the anterior and posterior teeth was determined individually for every radiograph. The vestibular root lengths and area of the first molars, premolars and anterior teeth were then assessed. To assess root length and root area changes, the difference between the lengths and areas of the teeth before and after treatment was calculated. The distribution of data was assessed using the Shapiro-Wilk test and Q-Q plots. A paired *t*-test was used to compare the length and area measurements at the beginning and end of treatment.

**RESULTS:** After treatment with a crown Herbst appliance, there was no difference between the root area ( $P > 0.05$ ), but there was a tendency toward a decrease in root length in the mandibular anterior teeth (mandibular left canine  $-2.9 \pm 4.71$  mm; mandibular left lateral  $-2.7 \pm 4.32$  mm; mandibular left central  $2.64 \pm 4.62$  mm; mandibular right central  $2.47 \pm 4.02$  mm; mandibular right lateral  $2.26 \pm 3.52$  mm; mandibular right canine  $2.03 \pm 4.02$  mm).

**CONCLUSION:** The crown Herbst appliance might deliver unphysiologic forces to mandibular anterior teeth, thereby exposing them to a higher risk of root resorption than other teeth incorporated into the anchorage either directly via crowns or indirectly via

occlusal or approximal contacts. To avoid undesirable root resorption on mandibular anterior teeth, different Herbst designs may be preferred that involve mandibular anterior crowns. If there is a susceptibility to root resorption, different functional treatment devices may be preferred.

#### SP390 CHANGES OF HYOID AND TONGUE POSITION AFTER MANDIBULAR SETBACK SURGERY BY INTRAORAL VERTICAL RAMUS OSTEOTOMY

In-Sil Kim, Cheolhong Shin, Yoon Jeong Choi, Chooryung J. Chung, Kyung-Ho Kim, Department of Orthodontics, Gangnam Severance Dental Hospital, College of Dentistry, Yonsei University, Seoul, Korea, South

**AIMS:** To assess changes in hyoid, tongue, airway and head posture in patients who had mandibular setback by intraoral vertical ramus osteotomy (IVRO) and to investigate the influence of Le Fort I osteotomy.

**SUBJECTS AND METHOD:** Sixty skeletal Class III patients had mandibular setback via IVRO and 45 patients had additional Le Fort I osteotomy. Lateral cephalograms were taken before, immediately after, 1 month after, and at least 1 year after surgery.

**RESULTS:** The hyoid moved significantly inferoposteriorly immediately after surgery and relapsed superoanteriorly during observation. The final hyoid and tongue position was significantly posterior to its pre-surgical position. Cervical hyperflexion was strongly correlated with anterior hyoid movements. The hyoid and tongue position was similar for the one and two-jaw groups at the long-term observation period.

**CONCLUSION:** Careful monitoring of the airway may be needed after mandibular setback surgery via IVRO.

#### SP391 SHEAR BOND STRENGTHS OF FOUR PRIMERS COMBINED WITH A CONVENTIONAL ADHESIVE

Julia Helen Seeliger, Kerstin Andrea Seeliger, Tomasz Gedrange, Ute Ulrike Botzenhart, Department of Orthodontics, University Medical Center, TU Dresden, Germany

**AIMS:** To evaluate the influence of a self-etching primer (Helio Primer = HP) usually used for fissure sealing, a fluoride releasing primer (Opal Seal Primer = OSP) and two widely used primers (Transbond XT Primer = TXTP; Transbond SEP = TSEP) on the shear bond strength (SBS) of orthodontic brackets.

**MATERIALS AND METHOD:** Sixty bovine maxillary permanent incisors were embedded in a silicone mould with cuboid shaped notches with an autopolymerizable self-curing resin. After hardening, the teeth, including blocks, were divided into four groups, of 15 blocks each, according to their luting agent: group A: HP; group B: OSP; group C: TXTP; group D: TSEP. In each group two metal brackets were bonded on the buccal surface with the corresponding primer and Transbond XT adhesive, respectively. SBS and the Adhesive Remnant Index (ARI) were recorded. All results were statistically analysed.

**RESULTS:** No clinically relevant differences in SBS and ARI were found between the groups.

**CONCLUSION:** All tested primers revealed sufficient bond strength and can be used for orthodontic purpose.

#### SP392 DEVELOPMENT OF A DIAGNOSTIC TOOL IN EARLY ORTHODONTIC TREATMENT NEED: PRIOR SYSTEM

Banu Aras<sup>1</sup>, Shilpi Ajwani<sup>2</sup>, Joseph Descallar<sup>3</sup>, M Ali Darendeliler<sup>4</sup>, Sameer Bhole<sup>2</sup>,  
<sup>1</sup>Department of Orthodontics, Sydney Dental Hospital, <sup>2</sup>SLHD Oral Health Services and Sydney Dental Hospital, <sup>3</sup>Ingham Institute for Applied Medical Research, Sydney, and <sup>4</sup>Discipline of Orthodontics, University of Sydney, Australia

**AIMS:** To develop and validate a system composed of a new tool - PrIOR and guidelines for the diagnosis and management of early orthodontic and orthopaedic problems of children and adolescents eligible for public dental services.

**MATERIALS AND METHOD:** A pilot version of the PrIOR tool was developed based on the current literature on early orthodontic malocclusions. The orthodontic conditions were

classified into 'exclude/monitor', 'accept' or 'refer' categories depending on the necessity or complexity of the preventive or interceptive orthodontic treatments. Validation of the pilot tool showed a low level of agreement, therefore the PrIOR tool was simplified and combined with decision making flowcharts to develop the PrIOR system. The PrIOR system was introduced to an expert panel (15 orthodontists with minimum of 10 years of clinical/academic experience, 3 rounds with GRADE classification) and modified based on the consensus opinion of the panel. A validation study for the PrIOR system was conducted with seven orthodontists, 20 dentists and nine oral health therapists and one gold standard assessor using the PrIOR system in the assessment of 37 case records. Inter-examiner reliability was evaluated using the Kappa coefficient. Sensitivity and specificity were also determined.

**RESULTS:** In the initial pilot study using the PrIOR tool alone, there was fair agreement between the gold standard assessor and dentists ( $\kappa = 0.37$ ); and moderate agreement between the gold standard assessor and orthodontists ( $\kappa = 0.48$ ). Using the PrIOR system, the average Kappa and sensitivity across assessors and orthodontic conditions was highest amongst orthodontists ( $\kappa = 0.77$ , sensitivity = 73%), followed by dentists ( $\kappa = 0.72$ , sensitivity = 67%) and oral health therapists ( $\kappa = 0.71$ , sensitivity = 65%). The average specificity across all conditions was similar amongst all dental professional groups of about 99 per cent.

**CONCLUSION:** The PrIOR tool along with decision making flowcharts can be used as an alternative system for the identification of preventive and interceptive orthodontic treatment needs in public dental services.

### *Clinical Posters*

#### CP01 THE RIGHT POINT OF TIME: GROWTH-DEPENDENT INITIATION OF ORTHODONTIC TREATMENT - EARLY OR LATE?

Andreas Köneke<sup>1</sup>, Carolin Jagst<sup>2</sup>, Maren Adam<sup>3</sup>, <sup>1</sup>Kieferorthopädische Fachpraxis Dr. Andreas Köneke und Kollegen, Kiel, Germany and <sup>2</sup>Tannbuen AS, Oslo, Norway

**AIMS:** Decisive for initiation of growth-dependent orthodontic treatment is the growth potential of a patient within the next 2 years. In order to determine the average growth potential of a child or adolescent at the time of examination, the growth curves of the World Health Organization (WHO) were used. There is a growth peak in puberty and an even higher growth potential in the early infant development period. The aim of the study was to investigate, if a modified interpretation of the growth curves of the WHO irrespective the current body size leads to changes in therapeutic regards.

**SUBJECTS AND METHOD:** This study was concerned with the use of body size-related individual measurements in the calculation of growth rate. This involved analyzing the growth curves of children with respect to growth rate at different points in time. The age-related growth rates were compared not in absolute values but in relation to body size.

**RESULTS:** Using the same basic data, the pubertal growth maximum takes place about 2 years earlier, the early infant growth potential seems to be greater and the growth peak in puberty seems to be lower when the growth rate is relatively applied. In young girls the growth peak in puberty disappears almost completely. Recommendations to initiate therapy not until the growth maximum in puberty for the greatest possible efficiency, therefore lose importance.

**CONCLUSION:** In the literature, the earliest possible time point for therapy is recommended if dysfunctions are present. Dysfunctions are present in most patients with orthodontic or orofacial abnormalities. The correction of oral dysfunction is more easily possible when carried out as early as possible. Regarding the outcomes of this study, the earliest possible point in time is defined exclusively according to the mental capacity of the children for therapy. Not only functional appliances, but also functional training units focussing on the present dysfunctions are required. In this way greater success can be achieved with smaller therapeutic measures.

#### CP02 MINIMALLY INVASIVE ORTHODONTIC THERAPY IN THE PERIODONTAL PRE-INJURED DENTITION – REPORT OF A CASE

Ute Botzenhart<sup>1</sup>, András Végh<sup>2</sup>, Tomasz Gedrange<sup>1</sup>, <sup>1</sup>Department of Orthodontics, TU Dresden, Germany and <sup>2</sup>Department of Orofacial Orthopedics and Orthodontics, Heim Pál Children's Hospital, Budapest, Hungary

**AIMS:** The correction of the position of tooth 11, which had been elongated and protruded due to distinctive periodontal pre-injury with horizontal and vertical bone loss of at least 7 mm at the most affected side.

**SUBJECT AND METHOD:** A female patient, aged 36 years, who wished treatment for an elongated and protruded tooth 11 due to periodontal injury, which she reported had changed position within at least the last year. Clinical evaluation showed an elongation with vertical divergence to tooth 21 of 2 mm and protrusion of 2 mm combined with anterior crowding. The periodontal status showed distinctive horizontal and vertical bone loss with a probing depth of at least 7 mm at the most affected side but no signs of periodontal inflammation or loosening. Microdontia of tooth 12 with distal spacing was also observed. Due to the wish of the patient and as treatment would involve an aesthetically sensitive area, minimally-invasive therapy with an aligner appliance was carried out. Spacing of tooth 12 permitted a space gain for the retrusion of tooth 11, so that its position was successively improved in the set-up. The intrusion was realized with vertical elastics, fastened to buttons bonded at the buccal and palatal surface of the aligner. Power transmission on the tooth was implemented due to an incisal slot opening in the aligner. The intrusion force was less than 10 g.

**RESULTS:** Treatment included a total of three aligner series, with a thickness in each case of 0.5 mm, 0.6 mm and 0.8 mm, and a total of six set-ups. Wear time was 24 hours per day, excluding teeth-cleaning and nutrition. The total treatment time was 6 months. The result was stabilized with a bonded retainer. Radiographic control after conclusion of active therapy showed no further progress of the periodontal destruction. Treatment outcome was stable even after one year post-control.

**CONCLUSION:** Minimally-invasive orthodontic aligner treatment in an aesthetically sensitive area is possible even in a case of distinctive bone loss.

#### CP03 EARLY FUNCTIONAL THERAPY OF HFMCCC (PSEUDO-HEMIFACIAL MICROSOPIA). THE L.A.1-L.A.2 COMBINED TREATMENT

Clelia Lettieri, Giuliana Laino, Alberto Laino, Ortognatodonzia, Federico II, Naples, Italy

**AIMS:** Pseudo hemimandibular hypoplasia or HFMccc is a type of mandibular hypoplasia that presents a particular mandibular morphology: a condylar-coronoid collapse (ccc) but no soft tissue involvement. The objective of this presentation is to introduce a new appliance (L.A.1-L.A.2 combined appliance) for early functional treatment of HFMccc

**MATERIALS AND METHOD:** In the literature different appliances are reported, but protocols and timing of treatment are controversial. In this work a new protocol in order to treat HFMccc very early (before school age) is proposed. Two combined appliances: L.A.1-L.A.2 will be shown.

**RESULTS:** The success of the appliances was confirmed in the clinical evaluation and radiographic records. The L.A.1 increased vertical lengthening of the mandibular ramus on the affected side. L.A.2 allowed changes in morphology of the condyles and created a new glenoid cavity (which is absent in these deformities)

**CONCLUSION:** In the HFMccc cases L.A.1-L.A.2 combined treatment allows correction of asymmetry and recreates the function of the temporomandibular joint; after therapy a new glenoid cavity, condylar growth and changes in the morphology of the coronoid process were observed. Furthermore as these appliances are easy to wear treatment can start very early (before school age), which is an important aspect for functional development and psychosocial implications

#### CP04 IMPROVED SUPERELASTIC WIRE FOR IMPROVING THE FACIAL PROFILE OF A SKELETAL CLASS III PATIENT

Chien-cheng Chen, Division of Orthodontics, Department of Dentistry, Taipei Tzu Chi General Hospital, Taipei, Taiwan

AIMS: Non-surgery orthodontic treatment of a skeletal Class III patient in whom Improved superelastic nickel titanium wire (ISW) was used as the main archwire for treatment.

SUBJECT AND METHOD: A 27 year-old female with mild mandibular protrusion diagnosed with a skeletal Class III malocclusion. Non-surgical treatment was planned. ISW was selected as the archwire. In order to improve the facial profile, the bite was raised then molar extrusion was performed by archwire adjustment. After 1 year 3 months, orthodontic active treatment finished and the patient began to wear a retainer.

RESULTS: The vertical dimensions of the patient's bite were increased by molar extrusion. After treatment, the patient's facial profile and occlusion improved. 1. The molars extruded and resulted in mandibular downward and backward rotation. 2. The inclination of the maxillary and mandibular incisors improved. 3. The patient's facial profile also improved.

CONCLUSION: In mild skeletal Class III and non-surgery treatment cases, molar extrusion and mandibular clockwise rotation are the factors that could help to improve the patient's profile and Class III malocclusion. ISW can be used as an effective material for molar extrusion. However, long-term follow-up still needed.

#### CP05 ORAL MANIFESTATIONS OF CROHN'S DISEASE DURING ORTHODONTIC TREATMENT

Ayla Üsküdar<sup>1</sup>, José Roberto Gonzales<sup>2</sup>, Jörg Meyle<sup>2</sup>, Stefan Gattenlöhner<sup>3</sup>, Sabine Ruf<sup>1</sup>, Departments of <sup>1</sup>Orthodontics, <sup>2</sup>Periodontology and <sup>3</sup>Institution of Pathology, University of Giessen, Germany

AIMS: This case report presents a female patient with an anamnestic history of Marfan syndrome. During the retention period at the age of 12 years she developed localized gingival hyperplasia of unknown origin mainly in the anterior region.

SUBJECT AND METHOD: The patient showed various craniofacial manifestations of Marfan syndrome: high arched palate, crowding of teeth, excessive overjet, open bite, hypermobility of the joint capsule and the condyle in association with generalized ligamentous laxity. The patient presented initially unilateral, then symmetrical gingival hyperplasia of unknown origin. The anti-infective periodontal therapy improved the superimposed inflammatory part of the hyperplastic gingival condition, but a substantial amount of hyperplasia persisted.

RESULTS: The suspected diagnosis of oral Crohn's disease was histologically confirmed by a biopsy. It showed a chronic and histiocytic granulomatous and giant cell-rich gingivitis characteristic of an initial oral manifestation of Crohn's disease. This was subsequently confirmed by an internistic endoscopy. In the literature there are no indications of an association between Marfan syndrome and Crohn's disease.

CONCLUSION: The average age of patients undergoing orthodontic treatment corresponds to the age in which systemic diseases often manifest themselves for the first time. As oral symptoms can be the first signs of systemic disease, such as in this case Crohn's disease, orthodontists have to be adequately trained in this context. In practice an unclear or unusual pathology should be identified as early as possible and a diagnostic examination and treatment should be initiated.

#### CP06 CRANIOFACIAL FEATURES IN CHERUBISM

Maarit Kemola, Sirpa Arte, Department of Oral and Maxillofacial Diseases, Helsinki University Central Hospital and University of Helsinki, Helsinki, Finland

AIMS: To analyse craniofacial and dental features of cherubism.

SUBJECTS AND METHOD: Six Caucasian children (2 boys, 4 girls) aged 4-15 years, diagnosed with cherubism (mutation in the SHBP2-gene) in the paediatric unit of Helsinki University Hospital. Bony involvement was graded according to Steward and Hankey (1957). Radiographic findings and the dental age of the patients was assessed from panoramic tomograms. Dental age was determined with the method of Demirijian and Goldstein (1976), using corrected norms for Finnish children. Standard deviation for dental age were calculated from the centile curves of Demirijian and Goldstein. Craniofacial features were analysed from lateral cephalograms corrected for enlargement of 0 per cent with Viewbox 3dhal.com.

**RESULTS:** Bony involvement was grade 2 in all patients and the disease was in the active phase. From the panoramic tomograms typical findings were missing teeth due to agenesis, surgical removal or extraction. The lower jaw was more affected than the upper jaw. Dental age was assessed at two different times for five children and once for one child. The age range was 7.2-11.8 years. At 7.2-8.5 years of age dental age was delayed except for one 8.5 year old girl. At 10.1-11.8 years of age dental age was also delayed except for one 8 year old girl and a 10.1 year old boy. Putting the scores of studied patients in to the scale representing the dental maturity percentiles for Finnish girls and boys, it was shown that dental age in both genders was delayed at the younger age and was near to normal or even mildly ahead at the older age. Cephalometric analysis showed that all had their own characteristic size of the jaws and growth pattern, which was not affected by cherubism.

**CONCLUSION:** All of the children with cherubism had dental disorders and interruption of root development Craniofacial anatomy in lateral cephalometric analysis did not differ from that of the control group. Dental age in children with cherubism was delayed at the younger age but was near to normal or even a little ahead at the older age.

#### CP07 CORRECTION OF THE PREMAXILLARY POSITION OF A BILATERAL CLEFT LIP AND PALATE PATIENT WITH AN ORTHODONTIC-SURGICAL APPROACH: A CASE REPORT

Evren Oztas, Eda Erorta, Department of Orthodontics, Istanbul University Faculty of Dentistry, Turkey

**AIMS:** Treatment of a cleft palate starts with pre-operative orthodontic treatment from birth and requires a multidisciplinary approach which includes orthodontics and orthognathic surgery in the long-term. This case report shows the correction of the premaxillary position with orthodontic treatment and an orthognathic surgery approach of a bilateral cleft palate (BCP) patient.

**SUBJECT AND METHOD:** A 7 year old female with a BCP had a skeletal and dental Class II relationship, a narrow maxilla and a premaxilla which was displaced 5 mm to the front side and extruded 3 mm according to clinical and radiographic examination. Following maxillary expansion with a bonded type rapid palatal expander, orthodontic brackets were bonded on the upper teeth with a transpalatal arch. After levelling and aligning, the premaxilla was intruded 3.7 mm and moved 5 mm posteriorly and grafted with iliac bone grafting material using an orthognathic surgical approach. The surgical splint was kept *in situ* 2 months for good stabilization of the segments.

**RESULTS:** The premaxilla was safely repositioned with multidisciplinary orthodontic and orthognathic surgery treatment protocols. No stabilization or mobilization problems were observed after removing the surgical splint. No necrosis of the soft tissues were detected during or after the healing period.

**CONCLUSION:** This treatment approach enabled repositioning of the premaxilla anatomically and functionally into the correct position in three dimensions with better symmetry. This stage will be followed by fixed orthodontic treatment mechanics and the new position of the premaxilla will enable attainment of better aesthetics and orthodontic treatment results in the long-term.

#### CP08 PIEZOCISION ASSISTED RAPID LOWER CANINE RETRACTION WITH REVERSE CLOSING LOOPS: A CASE REPORT

Evren Oztas, Ibrahim Almahdi, Department of Orthodontics, Istanbul University Faculty of Dentistry, Turkey

**AIMS:** The length of orthodontic treatment is still a major concern even though there are new advances in treatment mechanics. The application of cortical incision has significantly facilitated orthodontic tooth movement in young and adult patients. The aim of this report is to show piezocision-assisted rapid lower canine retraction.

**SUBJECT AND METHOD:** A 16 year 2 month old male with the lower canines in a Class II position treated by lower first premolar extraction due to 7.2 mm crowding in the lower arch. Due to maximum anchorage needs and the vestibulo and infra position of the right lower canine, piezocision-assisted surgery was performed to the lower canines and 0.017 × 0.025

inch TMA T loop sectional archwires were inserted and activated after a latent period of five days. The loops were activated weekly in order to use the high turnover of bone cells by the rapid acceleratory phenomena.

**RESULTS:** After 10 weeks the canines were in a Class I position and the piezocision-assisted retraction was completed without any damage to pulp vitality or the surrounding soft tissues. Model and radiographic analysis showed that the canines were retracted 7 mm without any anchorage loss or distal tipping.

**CONCLUSION:** Rapid orthodontic tooth movement is a contemporary approach in orthodontics. The accelerated external plate of cortical and spongy bone metabolism after surgical intervention stimulates tooth movement up to 3-10 times. The total treatment time in adult patients could be shortened by piezosurgery and the lower canines could be retracted with reverse closing loop mechanics without the use of invasive distraction devices.

#### CP09 ORTHODONTIC TREATMENT NEED IN FEMALE ADOLESCENTS WITH DELAYED SEXUAL DEVELOPMENT

Lyubov Smaglyuk, Anastasia Liakhovska, Department of Orthodontic, Higher State Educational Establishment of Ukraine. Ukrainian Medical Dental Academy, Poltava, Ukraine

**AIMS:** To determine orthodontic treatment need (OTN) in girls with delayed sexual development (DSD).

**SUBJECTS AND METHOD:** Forty nine girls with violation of sexual development (DSD, aged  $15.6 \pm 1.96$  years and 42 healthy girls aged  $15.8 \pm 2.12$  years. Physical, anthropometric, biometric and statistical evaluation (Fisher  $X^2$ ,  $P < 0.05$ ) was undertaken.

**RESULTS:** A disproportion of growth and development of the body increased the severity of malocclusion in girls with DSD.

**CONCLUSION:** There is a high degree of orthodontic treatment need in girls with DSD.

#### CP10 TREATMENT OF AN IMPACTED INCISOR WITH SEVERE ROOT DILACERATION. CASE REPORT

Hong-Eek Jang<sup>1</sup>, Jong-moon Chae<sup>1</sup>, Jin-woo Cho<sup>1</sup>, Jin-Hyoung Cho<sup>2</sup>, 'Keun-Young Lee<sup>2</sup>, Departments of Orthodontics, <sup>1</sup>Deajeon Dental Hospital of Wonkwang University, Deajeon, and <sup>2</sup>Sanbon Dental Hospital of Wonkwang University, Gyeonggido, Gunpo, Korea, South

**AIMS:** The treatment of a dilacerated anterior tooth is challenging for the clinician, because of its difficult position and the abnormality of the root. The aim of this presentation is to show the treatment of a horizontally impacted and severely dilacerated maxillary right central incisor.

**MATERIALS AND METHOD:** A fixed appliance was used to create space for the impacted central incisor. After bonding brackets on the upper dentition, the impacted maxillary right central incisor was surgically exposed and a button was bonded to apply orthodontic force. After 1 year of traction, the maxillary right central incisor was successfully erupted into a normal position. The total treatment period was 48 months.

**RESULTS:** The treatment of dilacerated anterior teeth is always a clinical dilemma. Failure due to ankylosis, external root resorption, and root exposure during orthodontic traction are possible. In this case, the position of the central incisor was successfully corrected by continuous-force orthodontic traction combined with surgery. There was no need for additional treatment for root exposure.

**CONCLUSION:** An impacted tooth with severe root dilaceration was successfully treated with forced eruption. Retention results were favourable 15 months after debonding.

#### CP11 THREE-DIMENSIONAL SOFT TISSUE CHANGES AFTER MANDIBULAR SETBACK SURGERY USING CONE-BEAM COMPUTED TOMOGRAPHY AND A FACIAL SCANNER

Ye-Jin Chang, Hui-Tae Song, Yu-Jin Seo, Young-Guk Park, Ki-Ho Park, Department of Orthodontics, Kyung Hee University, Seoul, Korea, South

**AIMS:** To analyze the changes of the three-dimensional (3D) coordinate values of soft tissue landmarks and 3D soft tissue measurements after mandibular setback surgery, and to

evaluate the correlation and proportion of movements between hard and soft tissue points in the anteroposterior, transverse, and vertical direction.

**SUBJECTS AND METHOD:** Six skeletal Class III patients (3 males, 3 females;  $20.0 \pm 2.09$  years old). To evaluate skeletal change after mandibular setback surgery, craniofacial 3D cone beam computed tomographic images were taken 1 week before surgery and the day after surgery in centric occlusion, natural head position, and with reposed lip. To evaluate soft tissue change, 3D facial scans were recorded the day before surgery and 10 weeks after surgery. Wilcoxon signed rank test was used to examine significant differences in x, y, z coordinate values and linear measurements before and after mandibular setback surgery. Pearson's correlation test was used to assess a potential correlation between hard and soft tissue changes after orthognathic surgery.

**RESULTS:** In the transverse direction, all soft tissue landmarks moved to the contralateral side. An increasing gradient of transverse movement from pronasale to menton was observed. Soft tissue landmarks on the deviated side showed greater movement than contralateral side landmarks. There were significant decreases in nasal width and lip width. Although lower face height was significantly decreased, changes of lip height and vermilion height did not show any significance. In the transverse direction, soft tissue landmarks of the lower lip and chin showed high correlations with hard tissue. Landmarks of the lower lip and chin had correlation with soft tissue landmarks of the mandible in the anteroposterior changes. Correlations between soft and hard tissues in the vertical dimension were lower than in the horizontal dimension.

**CONCLUSION:** The changes of mandibular hard tissue landmarks were correlated to the change in the corresponding soft tissue landmarks in the horizontal and anteroposterior aspects but not in the vertical aspect. 3D evaluation using facial scan images is a useful tool for evaluating changes after orthognathic surgery in mandibular prognathism patients and allows assessment of changes that two-dimensional imaging methods do not.

#### CP12 STABILITY IN RETENTION OF DEEP OVERBITE CASES

Jun Yoshizumi, Yuki Iijima, Shusuke Shima, Teruo Sakamoto, Kenji Sueishi, Department of Orthodontics, Tokyo Dental College, Chiba, Japan

**AIMS:** To complete postgraduate orthodontic training at Tokyo Dental College, residents are required to report not only newly assigned cases, but also one long-term retention management case. The stability in retention is the critical issue in orthodontics, especially after correcting the vertical problems. A total of seven graduates of the 37th postgraduate training course, who finished in March 2014, studied stability in retention of deep overbite cases (overbite  $\geq 4$  mm) treated without orthognathic surgery.

**SUBJECTS AND METHOD:** The group consisting of seven subjects (4 females, 3 males) with a deep overbite of at least 4 mm (mean overbite,  $6.0 \pm 1.7$  mm) were randomly selected. Orthodontic treatment was initiated in the late mixed or permanent dentition (mean age 19 years 7 months  $\pm 5$  years 2 months). Four subjects were treated with extractions and three without extractions. Among three non-extraction subjects, two were in the late mixed dentition at initial records. All subjects used either a circumferential or fixed type retainer, or a combination of the two during retention. The average retention period was 3 years 4 months  $\pm 2$  years. All patients had lateral cephalograms taken pre-treatment (T1), post-treatment (T2), and post-retention of at least of 2 years (T3). FMA, L1 to MP, U1 to FH, overbite, overjet, amount of molar intrusion, and amount of incisor extrusion were measured to determine stability in retention.

**RESULTS:** At post-retention, overbite was increased in six subjects, in which extrusion of the incisors was observed in five subjects. IMPA was decreased in five subjects, FMA was decreased in three subjects, and the molars intruded in three subjects. Mandibular growth was detected in two subjects during the retention period.

**CONCLUSION:** Stable retention was observed in all subjects. However, relapse in overbite after retention relied highly on vertical changes of the incisors. Therefore, it is suggested that choosing particular types of the retainer may be the key for stability in retention of deep overbite cases.

#### CP13 SAFE TRANSFER OF SENSITIVE PATIENT DATA VIA E-MAIL

Andreas Detterbeck<sup>1</sup>, Jochen Kaiser<sup>2</sup>, Ursula Hirschfelder<sup>1</sup>, <sup>1</sup>Department of Orthodontics and Orofacial Orthopedics, University of Erlangen Medical School and <sup>2</sup>Klinikum Stuttgart, Germany

**AIMS:** To develop decision-making aids and recommendations for dental practitioners regarding the sharing of sensitive digital patient data via e-mail. Today, Internet e-mail is a common and useful channel of communication between clinicians. Healthcare facilities and private practices are routinely equipped with e-mail addresses and appropriate software. Yet in terms of security, sending an unencrypted e-mail message through the Internet is very much like sending a postcard by regular mail. Despite well-defined legal requirements, an all-inclusive technological solution does not exist.

**MATERIALS AND METHOD:** A need for a preliminary review and critical appraisal of common practices of data transfer prompted a search of the literature to identify methods of secure data exchange and to develop a flow chart with a strong focus on rapid data transmission via e-mail.

**RESULTS:** Secure e-mail encryption should be implemented via the S/MIME and PGP standards and appropriate software should be used for a low-risk file transfer.

**CONCLUSION:** Encryption of patient-related data should be routine but is often difficult to implement. S/MIME and PGP are viable standards for secure e-mail encryption for the sharing of data < 10 MB. Careful handling of sensitive patient data is mandatory, and it is the end-user's responsibility to meet any requirements for encryption, preferably by using open-source and hence transparent free software.

#### CP14 USING THREE-DIMENSIONAL MODELLING IN ORTHODONTICS PRACTICE\*\*\*

Nemanja Majstorović, Branislav Glišić, Department of Orthodontics, University, Belgrade, Serbia

**AIMS:** Three-dimensional (3D) models are now frequently used for determining precise movement of each tooth in the jaw. The purpose of this presentation is the application of 3D models in establishing translation and rotation parameters of each tooth in the jaw.

**MATERIALS AND METHOD:** With the patient's consent, impressions of the upper and lower jaw were obtained. The impressions were poured and the plaster models obtained were scanned on a 3D scanner of the latest generation, with an accuracy of 10 microns. 3D models were downloaded into the GOM Inspect program. The global coordinate system was defined in order to determine movement of the teeth. The *X*, *Y* and *Z*-axes were defined so that each of them coincided with one of the model planes-orthodontic plane. Improvement of the therapy was determined by reciprocal comparison of the models, with help from the referential geometrical entities. The impressions were taken at each control (every month), for six months. The master model was marked with a grey colour. Based on comparison, visual impression of tooth movement during therapy was obtained. Overlapping, analysis of the movement of each tooth in all three orthodontic planes of space was undertaken for each model.

**RESULTS:** Analysis of tooth movement in space (determined values), between master model and last control show that the lateral incisors had made the greatest movements in all directions (*X*, *Y*, *Z*).

**CONCLUSION:** Research in this area will continue in the following directions: (i) completion of the concept map of orthodontic parameters with the creation of digital files for patients in width (analysis and coverage parameters to the particular case) and depth (the initial state, monitoring of therapy, the final state), (ii) exploration of measurement uncertainty and measurement repeatability for measurements on plaster and digital models, and (iii) study of the geometric model of the cross-section of the teeth in the *x-y* plane *z*-axis, and for defining and monitoring the new orthodontic parameters - the rotation of teeth around its axis of symmetry.

#### CP15 ENLARGEMENT OF NON-EXTRACTION TREATMENT RANGE THROUGH SKELETAL ANCHORAGE

Can Yoon Lee, Yoon Sik Moon, Sang Jin Sung, Department of Orthodontics, Ulsan College of Medicine, Asan Medical Center, Seoul, Korea, South

AIMS: The concept concerning orthodontic extractions continues to change. Angle argued non-extraction, whereas in the 1930s Tweed proposed extractions. In the 1970s, non-extraction increased again, and the controversy of non-extraction and extraction treatment is even now in progress. Problems of extraction: If the amount crowding is 4-5 mm, extraction is likely to result in space remaining after space closure. There is likely to be overly linguoversion of anterior teeth. The treatment period is longer. Patients may have a reluctance for extractions. Problems of non-extraction: If the arch is expanded non-extraction, canine width is changed, and it is disadvantageous to stability, particularly in the mandible. Patients may have a reluctance for interproximal reduction.

SUBJECTS AND METHOD: Case 1. Using group distal drive with miniscrews: a patient with lower anterior crowding, anterior edge to edge bite and Class III tendency molar key (20 year old, male). Case 2. Using miniscrew assisted rapid palatal expansion: a patient with upper anterior crowding and a posterior edge-to-edge bite. (25 year old, female)

RESULTS: Case 1. The lower anterior crowding was improved without causing an anterior crossbite or excessive lingual inclination. Case 2. Space was acquired for alignment without surgery and a correct posterior overjet was obtained. Using skeletal anchorage, it is possible to obtain adequate sagittal, horizontal space without problems of extraction or non-extraction.

CONCLUSION: With the correct use of skeletal anchorage, it is possible to enlarge the range of non-extraction orthodontic treatment.

#### CP16 ORTHOPAEDIC TREATMENT OF CLASS III SKELETAL MALOCCLUSIONS IN GROWING PATIENTS. CASE REPORTS

Clelia Lettieri, Giuliana Laino, Alberto Laino, Ortognatodonzia, Federico II. Naples, Italy

AIMS: To show the orthopaedic treatment by Delaire's appliance of skeletal Class III malocclusions without previous maxillary expansion.

SUBJECTS AND METHOD: Two patients, 9 year old females with skeletal Class III malocclusions, one of whom showed maxillary contraction. Instead of expanding the contracted palatal bone using an orthodontic appliance, she underwent myofunctional therapy in order to correct the tongue position at rest and during swallowing. The objective was to stimulate palatal bone growth. The second patient did not show maxillary contraction. In both patients a Delaire orthopaedic appliance was used to correct the Class III malocclusion. The appliance was worn 14 hours daily for 12 months. The force applied was 500 g each side. Radiographs were obtained before and after treatment

RESULTS: The post-treatment radiographs showed perfect correction of the skeletal Class III malocclusions. The maxillary bones moved forwards and the occlusions became Class I, without a crossbite.

CONCLUSION: Delaire's appliance is today the only non-invasive treatment for skeletal Class III malocclusion correction during growth. The correction was without expansion (see Baccetti-Franchi theory).

#### CP17 CLINICAL CONSIDERATIONS IN ACHIEVING EXCELLENT RESULTS IN SUBJECTS WITH MISSING UPPER ANTERIOR TEETH

Marina Karamolegkou<sup>1</sup>, Nikoleta Konstantoni<sup>2</sup>, Alkisti Konti<sup>2</sup>, Dimitrios Konstantonis<sup>1</sup>,  
<sup>1</sup>Department of Orthodontics, University of Athens, School of Dentistry and <sup>2</sup>Private practice, Athens, Greece

AIMS: In patients with missing upper teeth two main orthodontic treatment options are employed; prosthetic replacement or orthodontic space closure. When the latter is selected a specific treatment protocol implementing adequate biomechanics within a multidisciplinary approach is recommended.

SUBJECTS AND METHOD: Three subjects with missing teeth in the anterior region are presented and analyzed. The first an adult female with missing upper lateral incisors who was treated with space closure, replacing the missing lateral incisors by mesial movement of the canines. The second case an adolescent male with a congenitally missing upper left lateral incisor. He was treated with the same protocol, moving the upper canine mesially to

replace the missing lateral incisor. The third case an adult male with an avulsed upper central incisor and spontaneous space closure. The treatment implemented all the appropriate biomechanics that resulted in the substitution of the missing central by the lateral incisor.

**RESULTS:** When the space closure protocol is decided, specific features must be taken into consideration. The teeth must be moved to the ideal anteroposterior and vertical position, which will not only desirably modify the gum line but also will facilitate their restoration either with composite or ceramic veneers. Tooth whitening may be needed to balance out the colour of the incisors and canines. Additionally, the gum line is of major aesthetic importance. Periodontal gingivoplasty is often necessary to achieve the desirable aesthetic results.

**CONCLUSION:** In subjects with missing upper anterior teeth the treatment protocol must be selected with caution due the high aesthetic importance of this region. All three patients were treated with space closure. The treatment plan was based on their age, occlusion and gingival smile line. Space closure is a treatment modality that when correctly executed can achieve results of superior aesthetic and functional value.

#### CP18 PREMATURE TOOTH LOSS IN THE PRIMARY DENTITION – A CASE REPORT OF ODONTOHYPOPHOSPHATASIA

Alina Hinrichs, Isabelle Graf, Julia Neuschulz, Bert Braumann, University of Cologne, Germany

**AIMS:** To present a case of odontohypophosphatasia (odonto-HPP), a rare congenital disease characterized by a genetic deficiency of tissue-nonspecific alkaline phosphatase (ALP) due to ALPL-gene mutation. Clinical features of odonto-HPP are premature loss of primary teeth without prior root resorption, deformities and discolouration of teeth as well as the susceptibility to caries.

**SUBJECT AND METHOD:** The 3 year girl presented in 2012 with no history of disease or abnormal development except for premature loss of her primary anterior teeth in the upper and lower jaws. Due to the absence of trauma, periodontitis or excessive loading that would have been plausible to explain primary tooth loss, a genetic background was suspected. Genetic consultation detected low ALP levels of 67 U/l (minimum level 125 U/l). ALPL-gene analysis confirmed the suspected diagnosis of odonto-HPP.

**RESULTS:** Currently seven forms of ALPL-gene mutation presenting as hypophosphatasia, are differentiated by means of disease onset (prenatal-lethal, prenatal benign, early infantile, infantile juvenile, adult, odonto-HPP and pseudo-hypophosphatasia). The time of onset correlates with the impact on bone metabolism, odonto-HPP being the mildest form. Due to enzyme malfunction, bone and tooth mineralization are impaired. Dental tissues are highly sensitive to phosphate metabolism dysregulation. Therefore it is hypothesized that milder forms of ALPL-gene mutation have an impact only on the dentition. As genotype-phenotype relationships have not been clearly defined, it is important to identify milder forms of mutations for genetic counselling of parents.

**CONCLUSION:** Odonto-HPP is an inherited disorder of mineral metabolism that should be interdisciplinarily recognized by dental professionals as a possible cause of premature primary loss of primary teeth.

#### CP19 A COMPARISON OF ALIGNER SYSTEMS – A PRACTICE ORIENTATED REPORT

Hisham Hammad, Praxis Dr. Hammad, Dortmund, Germany

**AIMS:** This presentation is based on clinical experience with the Invisalign® Clear Aligner and Twin Aligner, among others. It aims to serve as an orientation and decision aid for practitioners and patients.

**SUBJECTS AND METHOD:** Sixty patients were treated with one of these three systems. From a practical point of view, the comparison was based on the following criteria: material used, fabrication process, comfort and invisibility, precision of the required treatment goal, efficiency, duration of treatment and cost.

**RESULTS:** Differences based on the comparison criteria were found with respect to treatment duration, efficiency and cost.

**CONCLUSION:** The results can simplify the decision-making process from case to case, and increase the chances of success of invisible and high-quality treatment.

#### CP20 COMPUTER-AIDED SURGICAL PLANNING AND STEREOPHOTOGRAMMETRIC EVALUATION OF SKELETAL CLASS II MALOCCLUSION TREATED WITH MULTISEGMENTAL LE FORT I SURGERY

Kadir Beycan<sup>1</sup>, Kemal Uğurlu<sup>2</sup>, Mustafa Ateş<sup>3</sup>, <sup>1</sup>Department of Orthodontics, Marmara University, Faculty of Dentistry, Istanbul, <sup>2</sup>Plastic Surgeon, Private Practice, Istanbul and <sup>3</sup>Orthodontist, Private Practice, Istanbul, Turkey

**AIMS:** To present the three-dimensional (3D) surgical planning and treatment protocol of a patient treated with multisegmental maxillary Le Fort I surgery and mandibular setback.

**SUBJECT AND METHOD:** A 17-year-old female who complained of crowding, had an asymmetrical face, incompetent lips, high smile line with non-consonant smile arc, convex profile, retrusive lower lip and chin. The patient's dental malocclusion was Class II, and the maxilla was constricted. The lower right first molar was extracted due to early infection. Cephalometric analysis showed a Class II skeletal relationship, high angle vertical pattern with retroclined upper and proclined lower incisors. The aim was to correct the skeletal and dental relationships with multisegmental maxillary Le Fort I surgery and mandibular setback. The upper arch was aligned in three segments, the lower right posterior molars were mesialized via a miniscrew which was placed between the lower right premolars. After orthodontic preparation, before surgery, a cone-beam computed tomography (CBCT) image and digital dental models were obtained. A precise skull model was created by incorporating digital dental models into the 3D-CBCT model of the face and 3D multisegmental Le Fort I model surgery was performed on a computer. A 3D intermediate surgical splint was fabricated via stereolithography. The final treatment results were evaluated using stereophotogrammetry.

**RESULTS:** At the end of treatment the patient's dental and skeletal Class II relationship had improved to Class I and the profile has significantly improved. The asymmetry and maxillary constriction were corrected. The final outcome was stable after 14 months of retention.

**CONCLUSION:** 3D surgical planning and treatment protocol successfully aided in planning the multisegmental Le Fort I surgery. This case report shows that new technologies such as 3D CBCT-based surgical planning can make orthodontic treatment and orthognathic surgery more efficient and effective.

#### CP21 ERUPTION OF A HORIZONTALLY IMPACTED MAXILLARY CENTRAL INCISOR: A CASE REPORT

Hatice Akinci Cansunar<sup>1</sup>, Melike Busra Ducan<sup>2</sup>, Enis Guray<sup>3</sup>, <sup>1</sup>Inonu University, Malatya, and Private Clinics, <sup>2</sup>Istanbul and <sup>3</sup>Ankara, Turkey

**AIMS:** To present the successful orthodontic treatment of a patient with horizontally impacted maxillary central incisor.

**SUBJECT AND METHOD:** A 16 year 4 month old female with a well-balanced facial profile with the chief complaint of unerupted teeth. The patient had a Class I molar relationship and anterior diastema. The impacted incisor tooth was not palpable as a labial bulge high in the sulcus. The impacted tooth was exposed surgically and light traction force applied. Skeletal anchorage with a spring wire and two miniscrews were used. After 25 months of treatment the tooth was in a correct position in the dental arch.

**RESULTS:** At the end of orthodontic treatment an ideal overjet and overbite and Class I molar relationship were obtained. The impacted maxillary central incisor was successfully positioned into a correct position in the dental arch. After completion of treatment the incisors had an acceptable gingival contour and attached gingiva and but there was root resorption of the maxillary central and lateral incisors.

**CONCLUSION:** At the end of treatment, a Class I relationship in the molar region, a functional occlusion and a nice smile have been obtained.

#### CP22 ARE THERE SPECIAL NEEDS IN THE CORRECTION OF TRANSVERSE DEFICIENCY IN PATIENTS WITH CLEFT LIP AND PALATE? CASE REPORT

Dietmar Paddenberg, Christian Fode, Bettina Paddenberg, Tobias Schütte, Private Office, Paderborn, Germany

**AIMS:** The comprehensive treatment of patients with (bi-) lateral cleft lip and palate (CLP) requires an interdisciplinary approach for functionally and aesthetically pleasing results. This case report describes the post-surgical orthodontic treatment, after transpalatal distraction, which resulted in overcorrection and severe rotation of both lateral segments.

**SUBJECT AND METHOD:** A boy, 12 years 6 months of age, with a bilateral CLP, Class III skeletal relationship, severe midface hypoplasia, displaced upper canines treated directly after surgical bone-based transpalatal distraction in a modified manner, particularly using segmental archwires and flexible transpalatal arches.

**RESULTS:** Correction of the upper dental arch was accomplished through rotation of both lateral segments with anterior expansion and moderate posterior compression. Moreover, alignment of the teeth, particularly the teeth adjacent to the region of cleft augmentation and the palatally displaced canines, was achieved. These are besides others requirements for the upcoming surgical correction of the Class III.

**CONCLUSION:** Patients with (bi-) lateral CLP and transverse maxillary deficiency are often treated with bone-supported transpalatal distraction, that can lead to rotation of the lateral segments. This can be corrected with modified and individually adjusted orthodontic mechanics. Based on sufficient primary bone augmentation, alignment of the lateral incisors and displaced canines is promising without major complications. To prevent the risk of sleep apnoea, backward displacement of the lower jaw should be avoided. For that reason, only maxillary orthognathic surgery will be carried out to correct the malocclusion.

#### CP23 CLINICAL SUCCESS OF ORTHODONTIC TREATMENT USING CLEAR ALIGNERS

Mariia Mizhura<sup>1</sup>, Ella Golik<sup>2</sup>, <sup>1</sup>Kiev State Dental Hospital, Ukraine and <sup>2</sup>Private practice, Dubai, United Arab Emirates

**AIMS:** To demonstrate the effectiveness of transparent aligners, Easy Align, in orthodontic treatment using as an example a clinical case.

**SUBJECT AND METHOD:** An 18 year old male with the diagnosis of a dentoalveolar malocclusion, Class II division 2, mild crowding in the anterior maxilla, rotation of teeth 11, 21, 22 and 23 and an oral position of the teeth 12 and 11. The patient was not satisfied with the position of the anterior maxillary teeth - he wanted an 'invisible' treatment. The retention and guide attachments (retention points) were set on teeth 16, 13, 21, 23, 24 and 26. Each aligner was used 22 hours per day during 14 days and removed only during hygiene and meals.

**RESULTS:** For the entire period of treatment the patient had 12 aligners which he wore only at night during the treatment period. Two aligners were lost and replaced. Therefore, the length of treatment. instead of the expected 168 days. took 364 days. At the end of treatment, the following results were achieved: a slight extension of the upper dental arch, which allowed levelling of the crowded teeth in the upper jaw, and correction of the position of the rotated and lingually placed teeth. After removing the retention points, a non-removable retainer was placd.

**CONCLUSION:** This aligner system is a good alternative to non-removable techniques as an example of compromise aesthetic orthodontic treatment.

#### Cp24 EVALUATION OF TOOTH ANGULATION MEASURED ON CONE BEAM COMPUTED TOMOGRAPHS AND PANORAMIC RADIOGRAPHS

Ed Karim, Craig Dreyer, Wayne Sampson, Department of Dentistry/Orthodontics, University of Adelaide, Australia

**AIMS:** To assess dental angulation measurements generated by two panoramic X-ray machines versus measurements from cone beam computed tomographic (CBCT) images.

**MATERIALS AND METHOD:** A dry human skull with an inserted typodont was imaged using two different panoramic machines in addition to a CBCT machine. The angles between

adjacent teeth were measured on 'dental pantomographic extrapolation' and focal trough specific extrapolations'.

RESULTS: A wide range of variation in tooth angulation was found between the measurements of each machine.

CONCLUSION: Panoramic radiographs should be interpreted with caution when assessing tooth angulation.

#### CP25 A DENTAL CARE APPROACH IN PATIENTS WITH OSTEOPETROSIS.

Valentine Detailleur, Vansteenkiste Griet, Anna Verdonck, KUL, Leuven, Belgium

AIMS: To describe the dental and dentofacial characteristics observed in four patients diagnosed with osteopetrosis and to advise on the dental care approach in these patients. A summary of the disease characteristics is given.

SUBJECTS AND METHOD: Four patients clinically diagnosed with osteopetrosis, characterized by increased bone density which causes fragility of bones, bone marrow failure, blindness and deafness due to compression of the cranial nerves. The diagnosis was based on medical files, clinical research, radiographs, clinical photographs and dental casts. All patients differed in age (age range: 2.5 to 31 years). Three had been treated with a bone marrow transplant at the ages of 7 months, 3.1 and 4 years, respectively.

RESULTS: All patients showed similar dental characteristics but the severity and extensiveness of the symptoms differed. Dental pits, abnormalities in form and agenesis in enamel deformations were seen. Eruption of the permanent dentition occurs at a slow rate, the primary teeth can persist, can have no successors and the aberrant form of the primary/permanent teeth can delay eruption. Uneven surfaces and atypical dental crowns combined with visual impairment makes brushing of the teeth and plaque removal more difficult to manage.

CONCLUSION: Dental problems such as crown anomalies, agenesis and delay in tooth eruption are all seen in the patients diagnosed with osteopetrosis, although the severity and extensiveness of the symptoms differ. Treatment management: Frequent dental follow-ups are advised for guiding eruption and professional dental cleaning. Impaction and slow eruption rate can be due to different bone formations, exposing the teeth can sometimes aid eruption. In case of surgical interventions, antibiotic prophylaxis is advised since there is an inhibited blood supply in the periosteum which can possibly result in osteomyelitis or to prevent other infections. The role of bone marrow transplants in dental problems needs further research.

#### CP26 EAGLE SYNDROME: AN INCIDENTAL FINDING IN A PATIENT WITH CRANIOMANDIBULAR DYSFUNCTION. A CASE REPORT

Isabelle Graf<sup>1</sup> Timo Dreiseidler<sup>2</sup>, Alina Hinrichs<sup>1</sup>, Julia Neuschulz<sup>1</sup>, Bert Braumann<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Oral and Maxillofacial Surgery, University of Cologne, Germany

AIMS: Eagle syndrome is a rare condition of an elongated styloid process and/or partial or entire ossification of the stylohyoid ligament. Only a small number of those affected have associated symptoms and the majority are asymptomatic. The aim of this presentation is to show an orthodontically treated adult patient with both Eagle syndrome and craniomandibular dysfunction and marked craniofacial symptoms such as myalgia and vertigo. The difficulty of identifying the correct cause of the symptoms is being discussed.

SUBJECT AND METHOD: A 38-year-old male with a bilateral posterior open bite as well as maxillary and mandibular retrognathia and ongoing left-sided head pain, myalgia and recurrent vertigo. He had been treated with fixed orthodontics *alio loco* for the past two years in the context of combined orthodontic-orthognathic therapy.

RESULTS: Eagle syndrome was an incidental finding. A cone-beam computed tomography (CBCT) image showed elongation of the left styloid process. In addition, arthrosis of the left temporomandibular joint was diagnosed correlated with marked craniomandibular dysfunction. Theoretically, both Eagle syndrome and craniomandibular dysfunction could have been the cause of the patient's symptoms. He was referred to a specialist surgeon for orthognathic surgery to be carried out as this might lead to a relief of the symptoms.

Afterwards, the symptoms will be re-evaluated with a possibility of resection of the elongated styloid process.

**CONCLUSION:** Orthodontists should be aware of the possibility of incidentally finding the rare condition of Eagle syndrome in the course of everyday orthodontics, especially when using CBCT. However, the mere presence of an elongated styloid process does not automatically indicate a symptomatic type of the Eagle syndrome.

#### CP27 THREE-DIMENSIONAL SURGICAL PLANNING OF A PATIENT WITH SEVERE DENTOFACIAL DEFORMITY AND POST-OPERATIVE TREATMENT RESULTS VIA STEREOPHOTOGRAMMETRY

Kadir Beycan<sup>1</sup>, Nazan Küçükkeleş<sup>1</sup>, Kemal Uğurlu<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Marmara University, Faculty of Dentistry, Istanbul and <sup>2</sup>Plastic Surgeon, Private Practice, Istanbul, Turkey

**AIMS:** To present the treatment procedure in a patient with severe dentofacial deformity due to early osteomyelitis treated with three-dimensional (3D) surgical planning and treatment protocol.

**SUBJECT AND METHOD:** A 20-year-old male, with a missing right condyle and ramus behind the coronoid process, had a skeletal and dental Class II malocclusion; previously two alloplasts had been placed in the right corpus and left gonial ramus areas. He had an asymmetrical face with an underdeveloped right side, incompetent lips, high and asymmetric canting smile line, non-consonant smile arch, and convex profile with decreased lower face height. The treatment plan was to extract the lower left first premolar, retract the lower anterior teeth, align and level the upper arch with continuous arch mechanics prior to double jaw surgery comprising differential maxillary impaction and advancement and mandibular multisegmental step osteotomy. Before surgery a cone-beam computed tomography (CBCT) image and digital dental models were obtained. A composite skull model was created by incorporating digital dental models into the 3D-CBCT model of the face. Skeletal asymmetry was analysed and quantified and surgery was simulated in a computer. A 3D intermediate surgical splint was fabricated via stereolithography and the surgery plan was transferred to the patient. Post-operative treatment results were evaluated using stereophotogrammetry.

**RESULTS:** After treatment, the skeletal discrepancies, including the facial asymmetry and malocclusion, were significantly improved; the mandibular asymmetry and cant of the occlusal plane were corrected. An aesthetic profile with significant facial symmetry was obtained together with a favourable occlusal result with acceptable interdigitation and incisor relationship.

**CONCLUSION:** Orthognathic surgery combined with new technologies and techniques can make orthodontic treatment and orthognathic surgery more efficient and effective for patients with complex dentofacial deformities.

#### CP28 CONSIDERATIONS FOR MAXILLARY CENTRAL INCISOR EXTRACTIONS. CASE REPORTS

Ilgon Kim, Jhyun Jung, Gajirun-e dental clinic, Gwangju, Korea, South

**AIMS:** If the roots of the teeth are too short or of poor prognosis due to trauma, maxillary central incisor extraction could be a good alternative instead of premolar extractions. However, it requires a different approach and planning.

**SUBJECTS AND METHOD:** Two cases will be shown of patients with short central incisor roots. In the first case, to resolve crowding and in the second case, to promote the profile, central incisor extraction was performed.

**RESULTS:** The extraction spaces of central incisors are too wide and there is variable, periodontal regeneration. After orthodontic treatment, crown enlargement was necessary.

**CONCLUSION:** Maxillary incisor extraction is a good alternative choice. However, during space closure and after orthodontic treatment, periodontal treatment and prosthodontic restoration may be required.

#### CP29 ORTHOGNATHIC SURGICAL TREATMENT OF A SKELETAL CLASS III MALOCCLUSION: A CASE REPORT

Huseyin Alkis<sup>1</sup>, Seval Karabulut<sup>1</sup>, Yavuz Fındık<sup>1</sup>, Timuçin Baykul<sup>1</sup>, Asım Aydın<sup>2</sup>, Faculties of <sup>1</sup>Dentistry and <sup>2</sup>Medicine, Suleyman Demirel University, Isparta, Turkey

**AIMS:** To present the treatment of a patient with a skeletal Class III malocclusion treated with bimaxillary orthognathic surgery.

**SUBJECT AND METHOD:** A 23 year old female with the chief complaint of mandibular prognathism and a concave profile. She had a Class III canine and molar relationship. Her overjet and overbite were -4 mm and -2 mm, respectively. There was no crowding in the maxillary arch but there was 5 mm crowding in the anterior region of the mandibular arch. Lateral cephalometric analysis revealed a skeletal Class III anomaly (ANB: -3°) and a mild increased vertical pattern (SnGoGn: 37°). In view of these findings, two surgical treatment alternatives were considered: 1. Mandibular setback and counter clockwise rotation of the mandible and 2. Maxillary 3 mm posterior impaction and 4 mm advancement with 4 mm mandibular setback. The advantages and disadvantages were explained to the patient following which the second alternative was selected. The goals of pre-surgical orthodontics were aligning the maxillary and mandibular teeth and correcting the mandibular anterior crowding by stripping. The antero-posterior and transverse decompensation involved correction of the maxillary and mandibular incisor positions and 3 mm constriction of the maxillary dental arch, respectively.

**RESULTS:** As a result of treatment, the overjet and overbite were 3 mm, the molar and canine relationships were Class I and interocclusal digitation was good. The patient had a straight profile. The maxillary incisors-upper lip harmony was good at rest and during smiling. At the end of the treatment, lateral cephalometric analysis revealed increased ANB (3°) and SNA (4°) angles while SNB and SnGoGn angles decreased by 1 and 6 degrees, respectively (SnGoGn: 31°).

**CONCLUSION:** The patient was treated with bimaxillary orthognathic surgery. The surgical tools were a maxillary Le Fort I osteotomy and a mandibular bilateral sagittal split osteotomy. To correct the dentofacial skeletal deformities, treatment planning is important for successful results.

#### CP30 TREATMENT OF A PATIENT WITH SUPERNUMERARY TEETH AS THE CAUSE OF AN IMPACTED CENTRAL INCISOR: A CASE REPORT

Seval Karabulut, Huseyin Alkis, Suleyman Demirel University Faculty of Dentistry, Isparta, Turkey

**AIMS:** To present the treatment of a patient with supernumerary teeth as the cause of an impacted central incisor.

**SUBJECT AND METHOD:** An 11 year old male with the complaint of supernumerary teeth. The canine and molar relationships were Class II on the left and Class I on the right. His overjet and overbite were 2 mm. There was 4 mm and 1.5 mm crowding, respectively, in the anterior region of the maxillary and mandibular arch. Lateral cephalometric analysis revealed no sagittal anomaly (ANB: 3°). On the cone beam computed tomographic image, two supernumerary teeth were observed in the left central incisor area. The crown and root shape of the impacted left central incisor was normal. It was decided to extract the supernumerary teeth and provide space for the impacted central incisor. Combined headgear was used for 4 months to obtain space and a Class I molar and canine relationship. The left central incisor had nearly spontaneously erupted 6 months after extraction. The patient was then treated with fixed orthodontic appliances.

**RESULTS:** As a result of treatment, the overjet and overbite were 3 mm, the molar and canine relationships were Class I and interocclusal digitation was good. The impacted central incisor erupted and was symmetric.

**CONCLUSION:** The presence of a supernumerary tooth is the most common cause for failure of eruption of maxillary incisors. Delayed eruption of the central incisors may result in medial movement of the lateral incisors, reduction in dental arch space and diminished development of dentoalveolar height with failure of the central incisors to erupt fully. As the cause of an impacted tooth, removal of supernumerary teeth can allow eruption of the impacted tooth spontaneously.

### CP31 A KINESIOGRAPHIC• STUDY OF MANDIBULAR MOVEMENTS

Tatiana Klimova, Nabi Nabiev, Anna Rusanova, Natalia Pankratova, Kirill Zavyalov, Department of Orthodontics, MSMSU, Moscow, Russia

AIMS: To study the characteristics of mandibular movements.

SUBJECTS AND METHOD: Ninety three patients with physiological occlusion divided into groups: 7-9, 10-12, 13-15 years of age. The kinesiographic method on a 'Kinesiograph' tracking device was used.

RESULTS: According to age, there was a difference between all groups in mandibular movements.

CONCLUSION: It is necessary to have age indices of mandibular movements.

### CP32 ELECTROMYOGRAPHY OF MAXILLOFACIAL MUSCLES DURING FULL PRESSURE OF TEETH

Nabi Nabiev, Tatiana Klimova, Anna Rusanova, Natalia Pankratova, Tatiana Ivanenko, Department of Orthodontics, MSMSU, Moscow, Russia

AIMS: To determine muscle biopotential in patients with distal and physiological occlusion.

SUBJECTS AND METHOD: Eleven patients (8-9 years of age) and 13 patients (16-17 years of age) with distal occlusion were examined using the electromyographic method.

RESULTS: A discrepancy between the two groups was observed.

CONCLUSION: it is necessary to take into account the muscle biopotential aspect in patients with distal occlusion.

### CP33 CLASS III MALOCCLUSION TREATMENT PROTOCOL IN A GROWING CHILD

Ovidiu Radescu<sup>1</sup>, Alin Serbanescu<sup>1</sup>, Doina Todea<sup>2</sup>, Silviu Albu<sup>3</sup>, Simion Bran<sup>4</sup>, <sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics, <sup>2</sup>Pneumology Department, <sup>3</sup>ENT Department and <sup>4</sup>Department of Maxillofacial Surgery and Implantology Department, University of Medicine and Pharmacy 'Iuliu Hatieganu', Cluj Napoca, Romania

AIMS: To describe the orthopaedic phase in the treatment of a severe Class III malocclusion in a growing patient.

SUBJECT AND METHOD: A 13 year old child with a severe Class III malocclusion, an anterior and posterior crossbite, negative overjet and overbite, depression of the upper lip and a concave profile. In the first phase a bonded modified palatal expander (for transverse expansion and sagittal protraction) was applied for 12 months. The fixed expander had hooks located in the upper incisor and canine area, gingival and above the occlusal plane, which placed the force vector near the centre of resistance of the maxilla. A force of approximately 400 g per side was applied up to 14 hours per day with extraoral elastics and facemask maxillary protraction. Facial and intraoral photographs, dental casts, dental pantomogram and lateral cephalogram were obtained at the beginning of treatment

RESULTS: Correction of the severe skeletal Class III malocclusion was obtained by transverse and forward growth of the maxilla and by restricting forward growth of the mandible.

CONCLUSION: Early treatment with orthopaedic forces using a rapid palatal expander in combination with a protraction facemask, improves facial appearance as well as function. Phase 1 treatment was implemented to try to improve the patient's masticatory function, speech ability, and quality of life.

### CP34 ASSESSMENT OF SOFT TISSUES WITHIN THE TEMPOROMANDIBULAR JOINT BY SOFTWARE PROCESSING OF CONE BEAM COMPUTED TOMOGRAPHY DATA ENHANCING IMAGE CONTRAST

Flor Otero<sup>1</sup>, Pablo G. Tahoces<sup>1</sup>, Antonio Mera<sup>2</sup>, Jorge Mira<sup>3</sup>, <sup>1</sup>Centro Singular de Investigación en Tecnoloxías da Información, Campus Vida, Universidade de Santiago de Compostela, <sup>2</sup>Rheumatology Service, Hospital Hospital Clínico Universitario, Santiago de Compostela and <sup>3</sup>Departamento de Física Aplicada,, Universidade de Santiago de Compostela, Spain

AIMS: To assess the degree of inflammation in the temporomandibular joint (TMJ) of patients with juvenile idiopathic arthritis (JIA) using cone beam computed tomography (CBCT) and to determine the competitiveness of this new technique.

MATERIALS AND METHOD: Software was developed to enhance the contrast of anatomical structures arising from a CBCT scanner and the resulting images were compared with magnetic resonance images (MRI), which are the current gold standard to assess the degree of inflammation within the TMJ.

RESULTS: The images obtained after software processing yielded a contrast in TMJ soft tissues which clearly allowed visualization of different anatomical structures. Synovial differences between the TMJs of the same JIA patient could also be observed allowing diagnosis of the inflammation processes. With this image software processing, in some cases, it was possible to detect features not observed by MRI.

CONCLUSION: This software image processing yields images that improve the range of use of CBCT for the analysis of the TMJ. In this way, CBCT, which is usually used for implantology and orthodontics where accurate quantitative information relative to bone is required, could be also used as a tool for soft tissue analysis.

#### CP35 TREATMENT OF CLASS II DIVISION 1 MALOCCLUSION WITH A BARRIER RAPID MAXILLARY EXPANSION APPLIANCE: A CASE REPORT

Cenk Doruk, Baran Talay, Hasan Babacan, Department of Orthodontics, Cumhuriyet University Faculty of Dentistry, Sivas, Turkey

AIMS: To present the correction of a Class II division 1 malocclusion and transverse maxillary discrepancy with a barrier rapid maxillary expansion (RME) appliance.

SUBJECT AND METHOD: An 11 year 3 month-old female with a Class II division 1 malocclusion, excessive overjet (8 mm), transverse maxillary deficiency and convex profile. Cephalometric analysis revealed a skeletal Class II malocclusion (ANB: 7°) with a retrognathic mandible (SNB: 73°, SNA: 80°). The maxillary incisors were labially inclined (U1-SN: 107°) and the mandibular incisors were lingually inclined (L1-MP: 87°). The appliance was a fully bonded acrylic RME with an acrylic barrier behind the upper incisors which produced an advancement of the mandible to the correct position. The appliance provided both maxillary expansion and mandibular advancement. After expansion was completed the appliance was removed and a removable Hawley appliance with an acrylic barrier was used by the patient for 6 months. Roth 0.018 inch slot type brackets were used at the second stage of treatment for 13 months.

RESULTS: A Class I occlusion with a normal overjet and overbite were achieved in 20 months. The transverse maxillary deficiency and convex profile were corrected. Post-treatment cephalometric evaluation showed SNB was significantly increased (SNB: 77°) and a skeletal Class I relationship was achieved (ANB: 3°). Inclination of the upper and lower incisors was corrected (U1-SN: 102°, L1-MP: 91°).

CONCLUSION: A Class II division 1 malocclusion characterized by transverse maxillary deficiency with a retrognathic mandible was treated using a barrier RME appliance without the need to use other functional appliances. Facial aesthetics were improved and resulted in a straight profile.

#### CP36 TREATMENT OF AN ANTERIOR CROSSBITE WITH AN ESSIX PROTRUSION APPLIANCE: CASE REPORT

Cenk Doruk, Baran Talay, Hasan Babacan, Department of Orthodontics, Cumhuriyet University Faculty of Dentistry, Sivas, Turkey

AIMS: To accomplish non-extraction treatment whilst maintaining the posterior relationship in a subject with an anterior crossbite (AOB) and severe crowding, in addition to a sagittal maxillary deficiency, with a Class I molar relationship patient using the Essix protrusion appliance (EPA).

SUBJECT AND METHOD: A 12 year 10 month old female with a Class I molar and Class III canine relationship with an ectopically positioned maxillary right canine, an AOB and severe maxillary crowding (8.6 mm). Cephalometric analysis revealed a skeletal Class III malocclusion with a retrognathic maxilla (SNA: 78° SNB: 81° ANB: -3°) and slightly palatally

inclined maxillary incisors (U1-SN: 100°, U1-PP: 106°). The appliance was covered with acrylic after placement of a 90 degree rotated hyrax screw which was fixed on stone model of the patient. After 4 months of EPA therapy a normal overjet and overbite were achieved and the ectopically positioned canine was corrected. In the second stage of treatment, fixed appliance therapy was carried out (0.018 inch Roth system) for 18 months.

**RESULTS:** A Class I canine and molar relationship was achieved and the AOB and sagittal maxillary deficiency were corrected at the end of the treatment. Cephalometric evaluation showed that SNA, SNB and ANB were 83, 82 and 1 degree, respectively. The upper incisors were proclined significantly by the effect of EPA (U1-SN: 106°, U1-PP: 114°) resulting in better upper lip prominence and an improved facial profile.

**CONCLUSION:** Maintaining a posterior relationship is desired in patients with an AOB. The EPA can be considered as an alternative to traditional facemask treatment to achieve the desired results with.

#### CP37 POST-PUBERTY FUNCTIONAL ORTHOPAEDIC TREATMENT OF SKELETAL CLASS II MALOCCLUSIONS: REPORT OF TWO CASES

Cenk Doruk, Hasan İlhan Mutaf, Selman Dursun, Halil Akis, Department of Orthodontics, Cumhuriyet University, Sivas, Turkey

**AIMS:** To present the functional treatment results of skeletal Class II patients in the post-puberty period.

**SUBJECTS AND METHOD:** Case 1: A 14 year-old female with a Class II division 1 malocclusion and severe overjet (12 mm). Cephalometric analysis showed a skeletal Class II malocclusion (SNA: 83°, SNB: 76°, ANB: 7°), upper incisors with the lower incisors labially inclined (U1-SN: 118°, U1-PP: 130°, IMPA: 100°, Co-Pg:103 mm). A monobloc and occipital headgear appliance was used for 18 hours a day for 9 months. Case 2: A 15 year-old male with a retrognathic mandible and convex profile. Intraorally, the upper central incisors were significantly retrusive (U1-SN: 73°), the overbite excessive, and a bilateral Class II molar and canine relationship. The initial cephalometric analyses showed SNA: 79°, SNB: 72°, IMPA: 92°, Co-Pg:112 mm. The treatment plan included protrusion of the upper incisors with 2 × 4 mechanics followed by functional orthopaedic treatment. On hand-wrist radiographs both patients were found to be in the stage of MP3u skeletal maturity. These cases were treated using Roth 0.018 inch slot type brackets after functional treatment.

**RESULTS:** A Class I molar and canine relationship, normal overjet and overbite were achieved in both cases. Case 1: SNA: 82°, SNB: 79°, ANB: 30°, U1-SN: 102°, U1-PP: 114°, IMPA: 103°, Co-Pg:106 mm. Case 2: SNA: 77°, SNB: 75°, U1-SN: 103°, IMPA: 98°, Co-Pg: 117 mm were measured in post-treatment.

**CONCLUSION:** After functional and fixed orthodontic treatment better occlusions and aesthetics were achieved in post-puberty patients.

#### CP38 NON-SURGICAL TREATMENT OF AN ORTHOGNATHIC SURGERY PREDICTED PATIENT WITH A SEVERE SKELETAL CLASS III MALOCCLUSION

Cenk Doruk, Halil Akis, Serhat Mertoğlu, Department of Orthodontics, Cumhuriyet University, Sivas, Turkey

**AIMS:** To present the non-surgical and non-extraction treatment of an orthognathic surgery predicted and severe skeletal Class III non-growing patient.

**SUBJECT AND METHOD:** A 15 year-old female with a Class III molar and canine relationship and an anterior crossbite. Cephalometric analysis showed a skeletal Class III malocclusion (SNA: 80°, SNB: 84°, ANB: -4°), the upper incisors were labially inclined (U1-SN: 111°, U1-PP: 121°) and the lower incisors lingually inclined (IMPA: 80°). Roth 0.018 inch slot type brackets were used for 15 months. A chin cup was used for the first 8 months of treatment. Class III elastics were used for 7 months after chin cup therapy.

**RESULTS:** The anterior crossbite and sagittal discrepancy were corrected without extraction. A Class I molar and canine relationship, normal overjet and overbite were achieved. Cephalometric evaluation showed that, SNA remained at 80°, SNB was slightly decreased to 83° and ANB was slightly decreased to -3°. The upper incisors were

significantly proclined (U1-SN: 120°, U1-PP: 130°) and lower incisors slightly retruded (IMPA: 79°).

**CONCLUSION:** The patient was successfully treated by non-extraction and non-surgical orthodontic treatment. At the end of treatment, the occlusion was improved, a normal overjet and overbite were achieved and the aesthetics were improved. The stable occlusion was maintained a year after treatment.

#### CP39 TREATMENT OF A PARTIALLY IMPACTED MANDIBULAR SECOND MOLAR WITH A MINI-IMPLANT

Cenk Doruk, Baran Talay, M. Erdal Yıldırım, Department of Orthodontics, Cumhuriyet University Faculty of Dentistry, Sivas, Turkey

**AIMS:** Treatment of a Class II division 1 malocclusion with functional appliances and alignment and angulation of a partially impacted mandibular second molar with a mini-implant.

**SUBJECT AND METHOD:** A 13 year-old male with a Class II division 1 malocclusion, severe overjet (11 mm), convex profile and a partially impacted mandibular second molar. Cephalometric evaluation showed a skeletal Class II malocclusion characterized by mandibular retrognathism. A monobloc appliance was used for 18 hours per day during 10 months. After correction of the sagittal discrepancy, Roth 0.018 inch slot type Empower self-ligating brackets were used for 10 months. A mini-implant, placed at the interradicular area of the second premolar and first molar, was used with a nickel titanium segmental arch and open coil spring to correct the abnormal angulation of eruption of the partially impacted mandibular second molar.

**RESULTS:** A significant improvement in facial profile, skeletal and dental Class I occlusion, normal overjet and overbite were achieved. The partially impacted mandibular second molar was corrected.

**CONCLUSION:** Monobloc treatment of a Class II division 1 malocclusion provided the desired results. The partially-impacted second molar was corrected using a mini-implant with a nickel titanium segmental arch and open coil spring.

#### CP40 TWO DIFFERENT MECHANIC DESIGNS FOR EXTRUSION OF HIGH CANINES

Özkan Semih Çankaya, Cenk Doruk, Ömer Faruk Uçar, Department of Orthodontics, Cumhuriyet University Faculty of Dentistry, Sivas, Turkey

**AIMS:** The extrusion of high canines is time consuming so that treatment is prolonged. This case report shows the treatment of high upper canines by rapid extrusion without tipping using two different mechanics.

**SUBJECT AND METHOD:** A 14 year old female with a complaint concerning the high positions of her upper canines. Since there was insufficient space for the canines, the upper first premolars were extracted. Following extraction, for the right side; a spring made of 0.016 × 0.022 inch was designed. A TMA sectional archwire was placed between the upper first molar and the canine, and the spring was activated from a miniscrew by an elastic chain. For the left side; a 0.016 × 0.016 inch crimple hook was attached. A nickel titanium sectional archwire was placed between the upper first molar and canine and a miniscrew inserted into the mesial of the lower left molar. The patient was instructed to use the elastics full time from miniscrew to hook. Thus, the high canines were extruded and distalized without tipping.

**RESULTS:** Three months later, the right canine was extruded parallel to the arch level, but the left canine position was not ideal, probably caused by poor patient cooperation. After this stage, the canines were included in the archwire and the alignment process commenced.

**CONCLUSION:** This case report shows that the designed mechanics for high canines are very effective in a short time.

#### CP41 TREATMENT OF DISTAL MALOCCLUSION IN THE EARLY MIXED DENTITION WITH THE FRÄNKEL APPLIANCE – CASE REPORT

Martina Rudolf, Martin Bradač, Bojan Horvat, ORTOEstetik LLC, Maribor, Slovenia

**AIMS:** To present the treatment of a Class II division 1 malocclusion at an early age, using the functional Fränkel appliance type I. According to Fränkel's theory, correction of skeletal and dentoalveolar malformations can be attained with the help of neuromuscular activity induced by a functional appliance.

**SUBJECT AND METHOD:** A 10-year old female with a Class II division 1 malocclusion in the early mixed dentition. Clinical examination revealed excessive protrusion of the upper anterior teeth, a deep bite with traumatization of the palatal gingiva and a Class II molar relationship on both sides. An incompetent lip seal was also present. Extra- and intraoral photographs, dental casts, a panoramic radiograph and lateral cephalograph were taken at baseline and at the end of treatment. The patient was treated with a functional Fränkel appliance type I. She wore the appliance 5 hours per day at the beginning and gradually prolonged wear time to 24 hours a day.

**RESULTS:** The patient cooperated well and after 12 months of treatment the overjet decreased from 10 mm to 4 mm. Sagittal correction was achieved through growth modification and retroclination of the upper incisors. Improvement of the facial profile and lip competency were achieved.

**CONCLUSION:** Treatment of mandibular retrognathism and a severe overjet with a Fränkel appliance type I is effective if the appliance is worn regularly during the growth spurt. An important achievement is the establishment of normal orofacial functions, thus reaching normal further development and stable results. Use of the appliance is also required during the retention period to prevent relapse. If required, continuation with fixed appliance treatment can be undertaken for detailing of the occlusion.

#### CP42 TREATMENT OF BIMAXILLARY CROWDING IN THE PERMANENT DENTITION - CASE REPORT

Martina Rudolf, Martin Bradač, Bojan Horvat, ORTOEstetik LLC, Maribor, Slovenia

**AIMS:** To present the non-extraction treatment of severe bimaxillary crowding in a teenage patient with a combination of cervical headgear and fixed orthodontic appliances.

**SUBJECT AND METHOD:** A 13-year old female with the chief complaint of overlapping teeth and a high position of the upper canines. Clinical examination revealed bimaxillary crowding, an ectopic position of the upper canines and a Class II molar relationship on both sides. The teeth were of normal shape and size. Dental cast analysis showed -7 mm of crowding in the upper dental arch, -8.5 mm of crowding in the lower dental arch and narrowness of both dental arches. Cephalometric analysis showed a skeletal Class II relationship. To provide sufficient space for tooth alignment in both dental arches, a combination of cervical headgear and fixed orthodontic appliances (Discovery brackets, Dentaaurum) was used. The fixed orthodontic appliance was worn continuously for 2 years. Headgear was worn for 15 hours per day in the first 9 months of treatment and then only at night for retention. RII intermaxillary elastics were worn in the 10th month of treatment.

**RESULTS:** Treatment was successful, despite severe crowding at the beginning, because the patient regularly wore headgear and RII intermaxillary elastics. After 2 years of treatment the teeth were correctly aligned and an optimal relationship between the teeth was achieved. Space for aligning the upper teeth in the correct position was assured by distalization of the first upper molars and expansion of the upper dental arch. Space in the lower dental arch was achieved by proclination and mesio-distal enamel reduction of the lower incisors. A Class I molar and canine relationship, normal overjet and more natural profile were achieved.

**CONCLUSION:** Crowding of the anterior teeth is one of the most frequent orthodontic problems. The undesirable consequences of crowding in the permanent dentition can be successfully treated with a combination of cervical headgear and fixed orthodontic appliances.

#### CP43 THE INTERDISCIPLINARY MANAGEMENT OF CONGENITALLY MISSING LATERAL INCISORS: A CASE REPORT

Birim Altuntaş<sup>1</sup>, Mustafa Ersoz<sup>1</sup>, Muhammet Yalcin<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Restorative Dentistry, Inonu University, Malatya, Turkey

**AIMS:** The maxillary lateral incisors are among the most common congenitally missing teeth and there are several treatment options for managing this situation. The ideal treatment is the most conservative alternative that satisfies individual aesthetic and functional requirements. The aim of this presentation is to show a case where fibre-reinforced composite (FRC) technology was successfully used to restore anterior edentulous areas in terms of aesthetic perspective and functionality.

**SUBJECT AND METHOD:** A 14-year-old male with the chief complaint of aesthetics because of anterior spacing. Clinically the profile was convex, there was an Angle Class I molar and Class II canine relationship, lower arch poly-diastemas, a wide upper midline diastema, a 3 mm overbite and missing maxillary lateral incisors. Cephalometric evaluation showed both maxillary and mandibular incisors were protruded. The patient was treated with fixed appliances to create space for direct restorations in the missing maxillary lateral sites. A directly made FRC bridge was chosen in order to provide good aesthetics, preserve tooth substance, and postpone more invasive treatment. The prosthetic treatment was completed during one appointment.

**RESULTS:** Total treatment lasted 14 months and Class I molar and canine relationships were achieved with an ideal overjet and overbite at end of treatment. The FRC bridge was applied after debonding in one appointment. Essix retainers were used after restoration.

**CONCLUSION:** Missing lateral incisors are one of the most common congenital dental anomalies. New technology and materials offer a wide variety of treatment options for the replacement of missing teeth in order to improve aesthetics and restore function. Chair side, prefabricated FRC bridges are an excellent treatment option for a clinician to consider as fixed, aesthetic tooth replacement and space-stabilization solutions for a post-orthodontic patient with congenitally missing lateral incisors.

#### CP44 ORTHOGNATHIC SURGERY OF A PATIENT WITH FACIAL ASYMMETRY USING THREE-DIMENSIONAL SIMULATION

Sangjin An, Jaechan Ahn, Kyoungwon Kim, Junghoon Kim, Jiyeon Lee, Department of Orthodontics, National Health Insurance Service Ilsan Hospital, Ilsan-donggu, Korea, South

**AIMS:** To introduce the case of orthognathic surgery for a patient with facial asymmetry using a three-dimensional (3D) simulation program which is useful for diagnosis and establishing a treatment plan.

**SUBJECT AND METHOD:** A 25-year old female who had a maxillary transverse discrepancy and facial asymmetry with menton deviation and canting of the maxilla. She had undergone orthodontic treatment with four first premolar extractions 10 years earlier. During pre-operative orthodontic treatment, the maxillary transverse discrepancy and central incisor axis was improved by maxillary expansion using mini-implant assisted rapid palatal expansion (MARPE). Bimaxillary surgery was planned for asymmetry correction.

**RESULTS:** The tentative surgery plan, including canting correction and posterior impaction of the maxilla, was decided by two-dimensional (2D) cephalometric analysis. This plan was simulated by 3D analysis. In this simulation, menton deviation and canting of the maxilla were improved, but not the asymmetry of the mandibular body because of the yaw of the maxilla and mandible. Yawing control was also needed to correct asymmetry for the patient. It is difficult to determine asymmetry with yawing in 2D analysis. Using 3D surgical simulation, including yawing control, the final surgical plan was decided. After treatment, asymmetry of mandible and the position of menton were corrected.

**CONCLUSION:** Surgical treatment planning with 2D diagnosis is not sufficient in asymmetry patients as it is difficult to find the cause of asymmetry in a patient with yaw. The 3D simulation program overcomes the limitations of 2D diagnosis and corrects asymmetry more completely. There are however limitations in that 3D diagnosis lacks normative data, the landmark system. and the predictability of post-operative soft tissue profile.

#### CP45 EFFICIENCY AND EFFECTIVENESS IN PRE-SURGICAL ORTHODONTICS: AESTHETIC MULTIDISCIPLINARY TREATMENT OF AN ADULT

Gabriella Ceretti<sup>1</sup>, Piergiorgio Menegazzo<sup>2</sup>, Roberto Benetti<sup>2</sup>, Cosimo Damiano Napolitano<sup>1</sup>, Giovanni Freschi<sup>1</sup>, <sup>1</sup>Department of Maxillofacial Surgery, Regional University Hospital-Udine, and <sup>2</sup>Private practice, Venezia, Italy

AIMS: Orthodontic pre-surgical treatment is poorly accepted by adult patients for aesthetic inconvenience and the long treatment. Alternative approaches could be suggested

SUBJECT AND METHOD: A 20 year old Italian male with a skeletal Class III malocclusion, resident in the USA and not easily available for treatment sessions. He sought very fast therapy with reduced sessions. Treatment was performed in the first phase with aligners (Invisalign). The progression of the aligners was accelerated by piezocision. After 4 months of treatment aesthetic brackets were applied and surgical correction performed. Five months later the brackets were removed and refinement performed with aligners.

RESULTS: A combination of aligners and piezocision proved to be satisfactory and allowed good clinical results in a very short time.

CONCLUSION: Improvement of surgical tools and orthodontic techniques offer new ways to make orthodontic pre-surgical treatment more pleasant, acceptable by patients and at the same time ergonomically efficient.

#### CP46 CLINICAL USE OF ORTHODONTIC SKELETAL ANCHORAGE SCREWS AND ANCHORAGE PLATES: UDINE EXPERIENCE

Cosimo Damiano Napolitano, Renata De Gotzen, Alessandro Scipio Stenico, Antonella Dovier, Patrizia Poletto, Department of Maxillofacial Surgery, Regional University Hospital, Udine, Italy

AIMS: Temporary anchorage devices (TADs) are recognized as a useful tool to improve orthodontic treatment efficiency and to allow tooth movements in a vertical or anteroposterior direction. Their use in combination with plates and anchorage arms further expand their efficiency: our experience is described.

MATERIALS AND METHOD: The component system used is very versatile with a selection of implant heads and plates designed to simplify their use in most situations.

RESULTS: The use of temporary anchorage systems (screws and plates) proved to be essential for the resolution of selected cases, especially in some phases of treatment that otherwise would be probably impossible or inefficient.

CONCLUSION: TADs facilitate orthodontic movements that are rarely achieved with traditional systems, and are often the cause of unwanted tooth or root movements.

#### CP47 ROOT MALFORMATION OF THE FIRST MOLAR: A CASE STUDY

Ann-Sophie Storms<sup>1</sup>, Griet Vansteenkiste<sup>2</sup>, Esther Hauben<sup>2</sup>, Anna Verdonck<sup>1</sup>, Department of Oral Health Sciences, <sup>1</sup>Orthodontics, <sup>2</sup>Pediatric dentistry, and <sup>3</sup>Department of Pathology, University Hospitals Leuven, Belgium

AIMS: To present the clinical, radiographic and histological characteristics of two unrelated patients with a similar type of root malformation of all permanent first molars and to describe possible aetiological factors.

SUBJECTS AND METHOD: Two patients with a similar type of root malformation of all first permanent molars were documented and their medical history was verified. Each patient revealed a significant medical problem during the first year of postnatal life. In one patient an excision of a cardiac haemangioma was performed and in the other a sacrococcygeal teratoma was removed. The aberrant teeth were extracted in each patient and were examined histologically after haematoxylin-eosin staining.

RESULTS: Clinically, the crowns of the first molars were normal in appearance. Radiographically, the roots of the permanent first molars were tapered and barely visible. After extraction, the roots of these molars were found to be thin and rather short. Microscopic findings showed a constriction between crown and root with aberrant tissue formation. In this area, a combination of enamel, dentine, cementum and connective tissue was found which caused a dissociation of crown and root.

CONCLUSION: These findings may indicate that a significant medical intervention in the postnatal period can have an impact on the formation of the first permanent molars, which

also occurs at this age. It is presumed that intervention in early life causes disturbances of the pulpal blood supply, leading to aberrant tissue formation at the cemento-enamel junction. This malformed area causes a dissociation between crown and root. The results seem to confirm the histological findings of previous research.

#### CP48 TREATMENT OF A SKELETAL CLASS II DIVISION 1 PATIENT WITH FUNCTIONAL APPLIANCES ANCHORED ON MINIPLATES: A CASE REPORT

Ezgi Cakir<sup>1</sup>, Siddik Malkoc<sup>1</sup>, Mustafa Kirtay<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Oral and Maxillofacial Surgery, Inonu University Faculty of Dentistry, Malatya, Turkey

**AIMS:** Skeletal anchorage systems are increasingly used in orthodontics. Skeletal anchorage has widened orthodontic treatment opportunities due to its independence from patient compliance. Although these systems are often used to treat patients with Class III or an open bite, they are also practical for Class II division 1 malocclusion treatment. The aim of this case report is to present the dentofacial changes obtained with bone anchorage in Class II patients with moderate or severe crowding.

**SUBJECT AND METHOD:** A 14.5 year-old male with a dolichofacial type, convex profile and a skeletal and dental Class II relationship with increased overjet (5.6 mm) with increased lower incisor inclination. After evaluation, functional treatment with bone anchorage and four first premolar extractions was decided as a treatment approach. Buccal shelves were selected as safe anatomical region. Mucoperiosteal flaps were elevated for bone exposure and three-hole miniplates were placed on the buccal shelves of the mandibular second and third molars. The hook of the anchor was revealed from the first molar level. After surgery, four first premolars were extracted to retract the protrusive lower incisors. The upper and lower first molars were banded and a lip bumper was inserted in an attempt to apply elastics and to help distalize the first maxillary molars. Orthodontic forces of 400 g were applied immediately after placement originating from the miniscrews to the hooks of the appliance to advance the mandible. The canines were distalized during functional treatment using lacebacks.

**RESULTS:** Adverse effects of functional treatment on the lower dental arch were avoided. After 20 months of treatment, the patient had a dental and skeletal Class I relationship, the mandible was advanced, the maxilla was restrained and the overjet decreased. A normal lip seal was obtained.

**CONCLUSION:** Bone-anchored functional appliances are promising alternatives to functional treatment along with extraction in Class II patients. The treatment time is reduced by this approach. This treatment approach should be considered as an alternative to functional therapy.

#### CP49 TREATMENT EFFECTS OF FIXED APPLIANCES WITH LOWER INCISOR EXTRACTION: REPORT OF A CASE

Selin Alpağan, Ahmet Ahmet Yalçın, Department of Orthodontics, Akdeniz University Faculty of Dentistry, Antalya, Turkey

**AIMS:** Mandibular incisor extraction is considered an unusual option for orthodontic treatment because a normal overjet and overbite relation is not possible. In this case report a patient treated with fixed appliances with extraction of a lower incisor is demonstrated. The purpose of this study was to evaluate the efficacy of mandibular incisor extraction in a patient with a skeletal Class III malocclusion.

**SUBJECT AND METHOD:** A 19 year old female with malaligned teeth. According to clinical and radiographic examination; the patient had a moderate discrepancy in both arches, a dental Class I relationship and low angle growth pattern. After comprehensive evaluation, a treatment approach was planned, including extraction of tooth 41 and fixed appliance therapy. The treatment time was 10 months.

**RESULTS:** Favourable changes induced by lower mandibular incisor extraction were achieved, and the results were satisfactory. Normal overjet and overbite relationships were obtained. The Class I molar relationship was maintained.

**CONCLUSION:** If carefully planned, mandibular incisor extraction can be an effective treatment option for camouflage treatment that produces functional and aesthetic results with

minimal orthodontic involvement, and normal overjet and overbite relationships can be achieved.

#### CP50 TREATMENT EFFECTS OF HEADGEAR AND CLASS III ELASTICS : REPORT OF TWO CASES

Selin Alpağan, Ahmet Yalçın Güngör, Department of Orthodontics, Akdeniz University Faculty of Dentistry, Antalya, Turkey

**AIMS:** Dental Class I malocclusions with mild crowding can be treated in several ways. In this case report two different treatment models are shown. One treated non-extraction with dental protrusion and the other with headgear and Class III elastics. This report compares the treatment results of these two different treatment modalities in dental Class I malocclusions.

**SUBJECTS AND METHOD:** Both patients were 12 years of age with mild crowding in the upper and lower arches. Patient 1 was treated by cervical headgear and Class III elastics. In the other patient, crowding was resolved only by dental protrusion. Standard metal brackets were used in both patients. The treatment times were 8 months for patient 1 and 10 months for patient 2.

**RESULTS AND CONCLUSION:** Protrusion of the lower incisors was observed in both patients but the amount of protrusion was greater in patient 2. Normal overjet and overbite relationships were obtained in both patients. The Class I molar relationship was maintained.

#### CP51 PRE-PROSTHETIC ORTHODONTIC TREATMENT FOR MANAGEMENT OF A PARTIALLY EDENTULOUS PATIENT

Birim Altuntas, Siddik Malkoc, Department of Orthodontics, Inonu University, Malatya, Turkey

**AIMS:** Pre-prosthetic orthodontic treatment is often an important part of comprehensive oral rehabilitation. This case report describes the orthodontic treatment of an adult patient with partial edentulous spaces in the maxilla and mandible before prosthodontic rehabilitation.

**SUBJECT AND METHOD:** A 25 year old female with the complaint of protrusive upper teeth and edentulous spaces. The patient was diagnosed as having Angle Class II maxillary protrusion, a skeletal Class II jaw base relationship, and high mandibular plane angle. The treatment plan involved retraction of the upper and lower incisors and creating adequate space for dental implants. As the patient's molar teeth were missing, four miniscrews were used to provide adequate anchorage. Orthodontic appliances were placed on the maxillary and mandibular teeth for levelling. The miniscrews were used for incisor retraction and premolar uprighting

**RESULTS:** At the end of treatment a normal overjet and overbite was achieved. The position of the anterior teeth was improved to provide for optimal aesthetics after prosthetic treatment. Uprighting and intrusion of the maxillary premolars was obtained with miniscrews.

**CONCLUSION:** Restoration of optimal occlusal function, consistent with desirable aesthetics and a favourable long-term prognosis, is the clinical goal for management of malocclusions in partially edentulous patients. Pre-prosthetic orthodontics will continue to gain significance in aesthetic-functionally orientated dentistry and it is important to integrate this treatment protocol into multidisciplinary rehabilitation.

#### CP52 AUTOTRANSPLANTATION COMBINED WITH ORTHODONTIC TREATMENT TO RESTORE AN ADULT'S POST-TRAUMATIC DENTITION

Jong Hee Kim, Woo Kang Yoon, Yoon Jeong Choi, Kyung-Ho Kim, Chooryung J. Chung, Department of Orthodontics, Gangnam Severance Dental Hospital, College of Dentistry, Yonsei University, Seoul, Korea, South

**AIMS:** This case report describes the successful treatment of an adult with a skeletal Class II division 2 post-traumatic dentition with consequential restorations.

**SUBJECT AND METHOD:** A subject with a skeletal Class II division 2 malocclusion and severe crowding. The treatment objectives were to relieve the crowding, establish a functional occlusion, and maintain the soft tissue profile.

**RESULTS:** Loss of several premolars after trauma is traditionally treated with prosthetics or dental implants. However, when severe crowding is noted, orthodontic treatment might help to reduce the number of prosthetic replacements and result in more favourable outcomes.

**CONCLUSION:** This case report illustrates the diagnosis and treatment process of a patient with a skeletal Class II post-traumatic dentition. Multidisciplinary treatment, including the recycling of an extracted premolar by autotransplantation, successfully improved aesthetics and established a functional occlusion for the patient.

#### CP53 LONG-TERM RETENTION AFTER TREATMENT OF DEEP BITES USING A T-LOOP IN NON-GROWING PATIENTS

Jong Hee Kim, In-Sil Kim, Yoon Jeong Choi, Chooryung J. Chung, Kyung-Ho Kim, Department of Orthodontics, Gangnam Severance Dental Hospital, College of Dentistry, Yonsei University, Seoul, Korea, South

**AIMS:** This case report shows a non-growing patient with a deep bite treated by absolute intrusion of the anterior teeth using a T-loop and stable long-term retention

**SUBJECTS AND METHOD:** A skeletal Class II subject with a deep bite and upper anterior protrusion. The treatment objectives were to correct the deep bite and upper anterior protrusion by pure intrusion and retraction of the upper anterior teeth.

**RESULTS:** The deep bite was resolved by absolute intrusion of the maxillary anterior teeth. The vertical position of the anterior teeth was scarcely changed after treatment, consequently, the treatment results were successfully maintained during the retention period.

**CONCLUSION:** Non-growing patients with deep bites can be successfully treated by absolute intrusion of the anterior teeth using a T-loop, and the results show long-term stability.

#### CP55 TREATMENT OF SKELETAL OPEN BITE MALOCCLUSION WITH LYMPHANGIOMA OF THE TONGUE

In-Sil Kim, Cheolhong Shin, Yoon Jeong Choi, Chooryung J. Chung, Kyung-Ho Kim, Department of Orthodontics, Gangnam Severance Dental Hospital, College of Dentistry, Yonsei University, Seoul, Korea, South

**AIMS:** Lymphangioma of the tongue causes tongue enlargement, leading to an open bite. This presentation shows an improvement of an excessive open bite after reduction of the tongue.

**SUBJECT AND METHOD:** A female diagnosed with a skeletal Class II open bite and lymphangioma of the tongue. To correct the open bite, tongue-reduction surgery was indicated. Following growth modification, orthodontic camouflage treatment or surgical correction were considered.

**RESULTS:** After several tongue-reduction surgeries, progressive open bite closure could be seen but as the hyperdivergent growth pattern remained, growth modification was attempted and second phase treatment was undertaken in stage 8 of skeletal maturity. The result remained stable.

**CONCLUSION:** Macroglossia can be a major cause of an open bite. Correct diagnosis and timely intervention produced a favourable outcome.

#### CP56 INFLUENCE OF THE SURROUNDING ORGANIZATION IN THE GROWTH AND DEVELOPMENT IN A MANDIBULAR INCISOR USING CONE BEAM COMPUTED TOMOGRAPHY

Tatsuya Suzuki, Nobuhide Koizumi, Kenji Oketa, Yoshihiro Saitou, Nobutoshi Takahashi, Meikai University, Sakado City, Japan

**AIMS:** The mandible possesses a mandibular canal, and an inferior alveolar nerve and a lower alveolar vein. The foramen mentale opens outside the bone at a foramen mentale. The lower foramen mentale called the incisive canal, and is said that they connect with a tongue foramen, but there are few reports about a incisive canal. I A-V A of Hellman tooth age made

during a period of study of the subject to establish a change in the area with the growth and the growth and the length of the incisive canal.

**SUBJECTS AND METHOD:** 5 individuals for in each tooth age period of Hellman were analysed. CBCT photographic device was used for mandibular photography; photography time was set to 33 seconds by tube voltage 90kV, current 4 mA and a high-definition mode. A high-speed picture analyzer (VPA PLUS, Tokyo) of three dimensions was used for image analyses, and each obtained forehead cut image was analyzed.

**RESULTS:** (1) An incisive canal becomes oblong when there is a tooth germ.

(2) When there are no tooth germs after period III A, the length and the size in the side changed.

**CONCLUSION:** The nerve wasn't identified if it was II A from I A, measurement was difficulty and impossibility.

#### CP57 EVALUATION OF PIEZOCISION ASSISTED RAPID CANINE DISTALIZATION WITH THREE-DIMENSIONAL MODEL ANALYSIS: A CASE REPORT

Berra Calik<sup>1</sup>, Sertac Aksakalli<sup>1</sup>, Merve Sucu<sup>1</sup>, Hakki Oguz Kazancioglu<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Oral and Maxillofacial Surgery, Bezmialem Vakif University Faculty of Dentistry, Istanbul, Turkey

**AIMS:** One important challenge in orthodontics, faced by both patients and clinicians, is total treatment time. To overcome this challenge, several techniques have been developed including piezocision. Piezocision is a minimally invasive surgical technique to achieve rapid orthodontic tooth movement. The aim of this case report is to demonstrate the efficiency of piezocision assisted canine distalization using three-dimensional (3D) superimposition of cast models.

**SUBJECT AND METHOD:** A 16 year old boy with the chief complaint of crowding. He had a Class I molar relationship on the right side, no molar relationship on the left, and a Class II canine relationship on both sides. After levelling and alignment, piezocision surgery was performed on the mesial and distal sides of the upper left canine. No piezocision was applied to the left canine, which was used as the control. Canine distalization was initiated by placement of 150 g closed coil springs. The patient was examined at 2-weekly intervals and the distalization force was checked. 3D scanning of the dental casts was performed using the 3Shape Ortho System. To measure canine movement and compare both sides, pre- and post-treatment scans were superimposed in the rugae region.

**RESULTS:** According to 3D measurements, the total amount of canine movement was greater on the piezocision side. Distalization of the maxillary left canine was completed in 55 days while canine distalization on right side was completed in 103 days.

**CONCLUSION:** Based on the results of this case report, the following conclusions can be drawn: 3D model analysis is a reliable and easy method to compare pre- and post-treatment results; piezocision can decrease total treatment time and accelerate canine movement.

#### CP58 DISCORDANT GROWTH PATTERNS IN TWO IDENTICAL TWINS: AETIOLOGIC HYPOTHESIS

Pablo Garcia-Camba, Margarita Varela Morales, Department of Orthodontics, Hospital Universitario Fundación Jiménez Díaz, Madrid, Spain

**AIMS:** To demonstrate the relationship between chronic obstruction of the upper airway and the skeletal facial growth pattern. It has been an important topic of study and analysis in orthodontics, but this relationship is not easily demonstrable in a specific individual. In fact it is not possible to establish that a subject with a vertical growth pattern and chronic upper airway obstruction would have had a more horizontal growth pattern with an unobstructed upper airway.

**SUBJECTS AND METHOD:** The maxillofacial skeletal growth of a pair of identical twins was followed from 6 to 16 years of age. The anatomic characteristics of the upper airway were also serially evaluated. The medical antecedents of upper respiratory obstruction were recorded.

**RESULTS:** The growth pattern of the twins was discordant: mesofacial orthognathic and dolichofacial with a mild mandibular prognathism, respectively. The second twin had suffered

frequent episodes of upper airway obstructive disease and showed an upper airway narrower on the lateral telerradiograph.

**CONCLUSION:** This finding in monozygotic twins strongly supports the theory of a relationship between impaired permeability of the upper airway and development of a more vertical facial growth pattern.

#### CP59 A NEW PERSPECTIVE ON OSTEOTOMY FIXATION FAILURES BASED ON RECENT BONE BIOLOGY RESEARCH

David McAnerney<sup>1</sup>, Maria Kwiatkowski<sup>2</sup>, Richard Cousley<sup>3</sup>, Departments of <sup>1</sup>Oral & Maxillofacial and <sup>3</sup>Orthodontics, Peterborough Hospital and <sup>2</sup>St Bartholomew's and the Royal London, U.K.

**AIMS:** To help clinicians understand current concepts in the bone healing process around fixation screws, that can account for early relapse in mandibular advancement cases.

**MATERIALS AND METHOD:** A literature review on current bone biology and mini-implant stability research. In addition, the presentation of two mandibular advancement cases in which clinical failure occurred, to highlight the relevance in the clinical setting.

**RESULTS:** Both *in vitro* and *in vivo* studies have shown that close proximity to roots has a detrimental effect on screw fixation stability. There is also a decrease in this initial stability over the first four weeks due to localised bone remodelling. This loss of stability can be further potentiated by excessive torque on screw placement leading to focal areas of pressure necrosis and microfractures. Recommendations: 1) Clear understanding and assessment of underlying dental anatomy for appropriate screw positioning. 2) A standardised torque between 5-15 mN on screw insertion to optimise primary stability. 3) Close monitoring of occlusion, specifically any reduction of overbite, over the first 3-6 weeks post-operatively. 4) Intervention with heavy Class II elastics and weekly assessments if an anterior open bite occurs. 5) Surgery for correction before week 6 if conservative management is unsuccessful.

**CONCLUSION:** While it is important to appreciate the traditional theories involved in early relapse of mandibular advancement cases, new research has identified localised influences such as screw positioning and screw stability during primary and secondary bone remodelling as contributing factors to early relapse. Ways for avoidance, monitoring and managing potential early fixation failure, leading to the relapse in mandibular advancement orthognathics have been proposed.

#### CP60 AGENESIS – COMPLEX ORTHODONTIC TREATMENT PHASE

Ovidiu Radescu<sup>1</sup>, Alin Serbanescu<sup>1</sup>, Doina Todea<sup>2</sup>, Silviu Albu<sup>3</sup>, Simion Bran<sup>4</sup>, <sup>1</sup>Department of Orthodontics and Dento Facial Orthopedics, <sup>2</sup>Pneumologie Department, <sup>3</sup>ENT Department and <sup>4</sup>Maxillofacial Surgery and Implantology Department, University of Medicine and Pharmacie Iuliu Hatieganu, Cluj Napoca, Romania

**AIMS:** To present a subject with successful orthodontic treatment care.

**SUBJECT AND METHOD:** A 17 year old female with a traumatic occlusion, a congenitally missing upper lateral incisor, lower arch crowding and incisor protrusion. A bimaxillary fixed appliance prescription, Roth 22 was used . The primary goal was to open space for 1.2 by extracting 2.5 and for that a miniscrew was used for control of mechanics and to correct the midline shift. In the retention phase a Hawley retainer with a 1.2 acrylic tooth was used, for aesthetic reasons, until a dental implant and rehabilitation with a crown could be undertaken.

**RESULTS:** Treatment time was 27 months and a stable occlusion was achieved with good functional movement and balanced facial aesthetic.

**CONCLUSION:** Treatment of missing teeth often requires a multidisciplinary approach. Orthodontic space opening is a common treatment protocol for congenitally missing lateral incisors and for this situation implants are often used to replace the missing teeth to establish ideal aesthetics without restoring the adjacent teeth.

#### CP61 TREATMENT OF BIMAXILLARY CROWDING WITH ECTOPIC CANINES

Ekrem Çitaku<sup>1</sup>, Emire Çitaku<sup>1</sup>, Minire Çitaku<sup>2</sup>, Fatos Mujaj<sup>1</sup>, Burak Shabani<sup>3</sup>, <sup>1</sup>Orthodontics, Magjik Dent, Prishtina, <sup>2</sup>Pediatrics, Prishtina, Kosovo and <sup>3</sup>Department of Labour Medicine, Policlinic Skopje, Former Yugoslav Republic of Macedonia

AIMS: To describe the treatment of bimaxillary crowded teeth with ectopic canines in an adolescent patient.

SUBJECT AND METHOD: A 13 year old male complaining about very crowded teeth and the high position of the upper canines. Extraoral examination: asymmetric face, flat profile. Intraoral examination: permanent dentition, poor oral hygiene, Class I malocclusion, primary bimaxillary crowding, teeth with a normal shape and size, ectopic canines, locked bite of the upper lateral incisors, crossbite on the right side. Treatment: In the first phase of therapy extraction of the teeth was undertaken; Second phase: active mobile appliances were used; Third phase fixed appliances were inserted; Final phase: appliances were used for retention.

RESULTS: The duration of treatment was 18 months. The following results were achieved: overjet 2 mm, overbite 2 mm, correction of the inclination and rotation of the teeth, correction of the locked bite and crossbite. The teeth were correctly aligned in the arches, an optimal relationship was achieved between the teeth and the jaws and patient was satisfied with his appearance. No relapse was observed six months post-treatment.

CONCLUSION: Crowding is a serious condition that needs to be treated correctly. This is because not only can it create various problems that will affect dental health, but it can also be a very unaesthetic feature. This condition should be treated early, because the longer it is delayed, the poorer will be the prognosis.

#### CP62 INTERDISCIPLINARY TREATMENT OF A MEDIAN DIASTEMA AND MICRODONTIA IN ADULT PATIENT

Ekrem Çitaku<sup>1</sup>, Emire Çitaku<sup>1</sup>, Blerim Mehmeti<sup>2</sup>, Minire Çitaku<sup>3</sup>, Shkurte Çitaku<sup>4</sup>, <sup>1</sup>Department of Orthodontics, Magjik Dent, Prishtina, <sup>2</sup>Department of Orthodontics, QKSUK, Prishtina, <sup>3</sup>Department of Pediatrics, Prishtina and <sup>4</sup>Department of Family Medicine, QKMF, Prishtina, Kosovo

AIMS: To describe the interdisciplinary treatment of a median diastema and microdontia in adult patient.

SUBJECTS AND METHOD: A 23 year old female complaining about spacing between the upper central incisors that was causing her aesthetic problems. Extraoral examination revealed an asymmetric face with a normal facial profile and competent lips. Intraoral examination showed an Angle Class I malocclusion, healthy soft tissues, a 5 mm maxillary median diastema between the central incisors and microdontic upper lateral incisors. After detailed analysis of her oral condition in consultation with the patient, orthodontic-conservative interdisciplinary co-operation was agreed. Treatment: Fixed appliances were used in the first phase of orthodontic therapy. In the second phase, a specialist conservative dentist placed composite veneers on both microdontic upper lateral incisors of an appropriate shape and size.

RESULTS: The duration of interdisciplinary treatment of this patient was approximately 1 year. As a result of the combined orthodontic-conservative treatment, good aesthetic and functional results were achieved. The patient was more than happy with her new look.

CONCLUSION: Interdisciplinary co-operation of orthodontic correction and conservative restoration can achieve optimal results in the treatment of median a diastema and microdontia in adults.

#### CP63 COLLABORATION BETWEEN MAXILLOFACIAL SURGEON AND ORTHODONTIST†††

Francesco Coppola, Antonella Dovier, Cosimo Damiano Napolitano, Giulio Pradal, Guido Bissolotti, Department of Maxillofacial Surgery, Regional University Hospital, Udine, Italy

AIMS: In a maxillofacial surgery department patients with a skeletally based malocclusion may be treated jointly by private orthodontic practitioners. In this presentation the clinical experience in Udine will be shown.

**MATERIALS AND METHOD:** To support the pre-surgical treatment by orthodontists it is mandatory that patient and clinical records are examined together. In this way there is agreement on diagnosis and treatment planning.

**RESULTS:** By applying strict protocols a common working method can be obtained.

**CONCLUSION:** Work organization is a key to providing the best outcome for all patients and operators.

#### CP64 OBSTRUCTIVE SLEEP APNOEA: DIAGNOSIS AND TREATMENT†††

Antonella Dovier, Cosimo Damiano Napolitano, Renata De Gotzen, Patrizia Poletto, Cristian Bozzo, Department of Maxillofacial Surgery, Regional University Hospital, Udine, Italy

**AIMS:** To describe the organization for the diagnosis and treatment of obstructive sleep apnoea patients in the University Hospital Udine.

**SUBJECTS/MATERIALS AND METHOD:** All patients are examined by a multidisciplinary team. The overall assessment of the patient allows for correct diagnosis and therapy.

**RESULTS:** The main result is a therapeutic programme that may include any need for specialist treatment.

**CONCLUSION:** This organization of work tends to optimize common resources, management of the patient and monitoring over time

#### CP65 HISTORY OF THE CENTER FOR DIAGNOSIS AND TREATMENT OF SKELETALLY BASED MALOCCLUSIONS

Gabriella Ceretti, Antonella Dovier, Cosimo Damiano Napolitano, Francesco Coppola, Marco Salerno, Department of Maxillofacial Surgery, Regional University Hospital, Udine, Italy

**AIMS:** The Center for Diagnosis and Treatment of Skeletally Based Malocclusions in Udine University hospital was officially named 15 years ago, but was gradually built, as described.

**MATERIALS AND METHOD:** Local and regional needs were studied and a qualified group of specialists was formed. This work was done in collaboration with the Postgraduate School of Orthodontics at the University of Padua.

**RESULTS:** The department follows multidisciplinary as well as pre- and post-surgical orthodontic treatment.

**CONCLUSION:** The center's specialized team is a regional but also a national reference point for the treatment of skeletally based malocclusions

#### CP66 OPEN BITE TREATMENT BY MEANS OF ZYGOMATIC MINIPLATES

Esra Özic, Zafer Sari, Department of Orthodontics, Akdeniz University, Faculty of Dentistry, Antalya, Turkey

**AIMS:** This case report presents the treatment process of a patient with a Class I skeletal malocclusion and skeletal anterior open bite (AOB) who was treated through intrusion of posterior teeth with zygomatic miniplates (Trimed, Turkey).

**SUBJECT AND METHOD:** A 15-year-old female with the chief complaint of an AOB, had a symmetrical face, competent lips, convex profile and high angle growth pattern. Intraoral examination showed that the buccal segments were in a Class I relationship. There was an AOB (overbite -6.2 mm). Upper and lower incisor inclinations were normal. Before treatment two miniplates were placed in the zygomatic buttress areas and a modified cap splint appliance with posterior bite blocks was inserted. Intrusive force application was done through the elastic chains which were renewed every two weeks.

**RESULTS:** Posterior dentoalveolar intrusion was achieved in 6 months. During the treatment process the patient showed no signs of discomfort. At the end of intrusion, the AOB was corrected at the rate of 1 mm per month. The maxillary posterior teeth were intruded with a force of 350 g, which resulted in counterclockwise rotation of the mandible and clockwise rotation of the occlusal plane. Anterior face height decreased. No radiographic pathology of the intruded teeth was observed in terms of resorption or widening of the periodontal space.

**CONCLUSION:** Skeletal anchorage is a reliable and effective method for the treatment of an AOB through the intrusion of posterior teeth.

#### CP67 MANAGING MULTIPLE IMPACTED TEETH: A LITERATURE REVIEW.

Caterina Candido, Stefania Migliaccio, Valentina Caridi, Ersilia Barbato, Gabriella Galluccio, Department of Oral and Maxillo Facial Sciences, University of Rome Sapienza, Italy

**AIMS:** Teeth included are non-erupted in the arch, whose diagnosis is based on clinical and radiographic evaluation. Pathways leading to abnormal eruption within the process dentoalveolar can cause serious clinical implications.

**MATERIALS AND METHOD:** Thirty five papers published from June 2002 to August 2014 were analysed. The inclusion criteria was: patients in the mixed or permanent dentition with transverse maxillary anterior growth failure, patients with abnormal development, sequential approach to the inclusions and the anchorage devices. The exclusion criteria was: patients with systemic disease or endocrine disorders, contemporary approach to the inclusions.

**RESULTS:** Interdisciplinary treatment may allow the recovery of the impacted teeth, paying considerable attention to the anchorage employed, especially in the presence of multiple impactions within the same arch (upper or lower).

**CONCLUSION:** Careful planning is needed to achieve the goals of treatment. This work tries to emphasize the importance of correct diagnosis and treatment planning for success in the eruption of impacted teeth. The development of a sequence of treatment, determining appropriate anchorage, and the planning and execution of a proper biomechanics can be a challenge.

#### CP68 DENTAL AND CRANIOFACIAL CHARACTERISTICS AND ORTHODONTIC APPROACH IN SINGLETON-MERTEN SYNDROME PATIENTS: A CASE REPORT

Aurelia Zelderloo<sup>1</sup>, Vicky Verhaeghe<sup>1,2</sup>, Isabelle Ballieul<sup>2</sup>, Dominique Declerck<sup>2</sup>, Anna Verdonck<sup>1</sup>, Department of Oral Health Sciences, <sup>1</sup>Orthodontics and <sup>2</sup>Pediatrics, University hospitals Leuven, Belgium

**AIMS:** To describe the craniofacial and dental characteristics in a patient with Singleton-Merten syndrome and the impact on the orthodontic approach.

**SUBJECT AND METHOD:** A 14-year old girl with delayed eruption of the permanent teeth and lack of primary teeth exfoliation. Her medical file showed moderate intellectual disability, epilepsy, Delta storage pool disease and retarded developmental milestones. Clinical and radiographic examination revealed a Class III skeletal relationship with hypoplasia of the maxilla, a Class III molar occlusion, a dysmorphic face with prominent ears, agenesis of tooth 15, persistent 54-63-64-65-74-75-84-85, a central diastema, failure of eruption of tooth 37, upper anterior teeth with short roots and the presence of chromogenic bacteria. Family history showed similar findings in both her brother and mother. The mother had generalized short roots of all permanent teeth and agenesis of 12 and 14; her brother presented with acute root resorption of the upper anterior teeth. Earlier reports found similar dental anomalies: delayed eruption, immature root formation and acute resorption of primarily the anterior permanent teeth, early loss of permanent teeth due to short roots, high caries activity and aggressive alveolar bone loss.

**RESULTS:** An orthodontic treatment plan was made to create a stable occlusion as soon as possible. Extraction of the persistent primary teeth and a follow-up of the eruption of the permanent teeth for about 2 years was carried out. Extraction of 55 was undertaken in order to induce spontaneous mesialisation of tooth 16. Tooth 37 was also extracted because of primary failure of eruption and to induce spontaneous mesialisation of tooth 38. A removable plate in the lower jaw for about 6 months was necessary to extrude the premolars.

**CONCLUSION:** Singleton-Merten patients need an individual orthodontic approach. The orthodontist should be aware of possible dental anomalies, including short roots, acute root resorption and delayed eruption of permanent teeth with retention of primary teeth.

#### CP69 POSITION OF THIRD MOLAR BUDS AT DIFFERENT STAGES OF THEIR FORMATION

Natalia Pankratova, Kseniya Morozova, Tatiana Repina, Julia Rodinova, Maksim Kolesov, MSMSU, Moscow, Russia

AIMS: To study the presence of third molar buds and changes of their position  
MATERIALS AND METHOD: Dental pantomograms of 866 patients aged 7-18 years divided into four age groups  
RESULTS: The largest number of third molars was found in 10-15 year old patients. The size of the angles used to describe the position of third molars depends on age.  
CONCLUSION: The maximum angle size was observed in patients at the age of 13 years (51-720 grad).

#### CP70 SURGICAL ORTHODONTIC TREATMENT OF A PATIENT WITH MAXILLARY PROTRUSION AND A RETROGNATHIC MANDIBLE: A CASE REPORT

Hiroko Ishimaru, Ryuzo Kanomi, Kanomi Orthodontic Office, Himeji, Japan

AIMS: In non-growing patients, severe skeletal disharmonies are often corrected by orthodontic surgery. Orthognathic surgery can improve morphology and contribute to functional development. Patients with severe skeletal disharmonies tend to show unfavourable oral functions due to their abnormal morphologies. Furthermore, skeletal disharmonies worsen through dysfunction, and unfavourable oral functions are promoted by skeletal deformities. Improvements in oral functions are thus very important for patients treated with orthognathic surgery. The surgical orthodontic treatment of a skeletal Class II patient with retrognathic mandible is described and the importance of oral myofunctional therapy (MFT) is examined.

SUBJECT AND METHOD: A 23-year-old Japanese female with skeletal Class II morphology treated by orthodontic surgery. She showed maxillary protrusion with a retrognathic mandible and an Angle Class II molar relationship. On initial examination, interference of lip seal and habitual mouth breathing were observed, together with excessive overjet and proclined incisors. She also had tongue habits caused by ankyloglossia and a narrow airway due to the retrusive mandible. Pre-surgical orthodontic treatment was performed for 16 months using a multibracket system with extraction of the upper and lower first premolars and third molars. A lingual fraenotomy was carried out, and MFT was started prior to orthognathic surgery. At orthognathic surgery, the maxilla was rotated counterclockwise by a Le Fort I osteotomy, and the mandible was repositioned forward by a sagittal split ramus osteotomy. Post-operative orthodontic treatment was continued for 7 months together with continuous MFT.

RESULTS: The patient achieved a tight occlusion and ideal profile, and intercuspation and facial harmony were significantly improved. In addition, she acquired a wider airway through surgical advancement of the mandible. Oral dysfunctions were also improved by continuous MFT and morphological corrections.

CONCLUSION: Surgical orthodontic treatment offers one of the best approaches for patients with severe skeletal disharmony, and can contribute to functional development. MFT supports surgical orthodontic treatment, and has an important role to play in achieving ideal, stable treatment outcomes for morphology and function.

#### CP71 ELECTROMYOGRAPHY AND MUSCLE BIOPOTENTIALS IN CHILDREN WITH PHYSIOLOGICAL OCCLUSION

Tatiana Klimova<sup>1</sup>, Nabi Nabiev<sup>1</sup>, Anna Rusanova<sup>1</sup>, Natalia Pankratova<sup>1</sup>, Maria Rybakova<sup>2</sup>,  
<sup>1</sup>MSMSU, Moscow and <sup>2</sup>Polyclinic No. 9, Moscow, Russia

AIMS: To study the bioelectric activity of the stomatognathic muscles.

SUBJECTS AND METHOD: Thirty five children aged 6-9 years with physiologic occlusion. An electromyograph (BKN16) was used.

RESULTS: During physiological rest, the bioelectric activity of muscles that lift the mandible was higher than that of the descending muscles. During maximal pressure of the teeth, the bioelectric activity of the study muscles increased 10 times

CONCLUSION: It is necessary to study electromyographic indices.

#### CP72 CONSEQUENCES OF A UNILATERALLY IMPACTED MAXILLARY SECOND PRIMARY MOLAR: A CASE REPORT

Réka Gyergyay<sup>1</sup>, Krisztina Mártha<sup>2</sup>, Silvia Pop<sup>2</sup>, Departments of <sup>1</sup>Pedodontics and <sup>2</sup>Orthodontics, UMF Tîrgu Mureş, Tîrgu Mureş, Romania

**AIMS:** Impaction of primary teeth is considered to be a rare condition. It may have serious consequences in the dentition by blocking one or more permanent teeth in their eruption. The aim of the following report is to present the case of a patient who exhibited an impacted maxillary second primary molar on the right side. This resulted in the impaction of the first upper permanent molar and second premolar.

**SUBJECT AND METHOD:** A 10 year 1 month old female patient referred for orthodontic treatment due to the absence of upper right lateral teeth. The dental pantomograph revealed the presence of the maxillary right second primary molar, second premolar and upper first and second permanent molars in the bone as well as anodontia of the lower left second premolar. The dental age of the entire dentition, except for the right lateral region in the maxillary arch, was consistent with the patient's chronological age. Clinical examination showed a 3 mm shift of the upper midline to the right.

**RESULTS:** The impacted primary molar was surgically extracted in the first phase of treatment. Although the two permanent teeth (upper first molar and second premolar) presented spontaneous descent in the bone, due to the severity of the impaction and the age of the patient, surgical disclosure of both teeth was performed after 6 months. The second premolar was first brought into the arch followed by the first molar. A stable occlusion on the right side and correction of the upper midline was achieved with the use of intermaxillary elastics. The overall treatment lasted for 4 years 2 months.

**CONCLUSION:** Emphasis has to be placed on the importance of interceptive orthodontic treatment. Prevention or reduction of orthodontic treatment time may be possible through early diagnosis.

#### CP73 MULTIDISCIPLINARY THINKING: INTEGRATION OF DIGITAL SMILE DESIGN PROTOCOL IN ORTHODONTICS

Fabio Federici Canova, Practice, Monticelli Terme (PR), Italy

**AIMS:** 'Think multidisciplinary' is a paradigm in modern dentistry. Today patients demand a higher level of dental care and this implies an approach that integrates orthodontics, periodontics, prosthetics and surgery. Dentist, orthodontist and technician must work together, and nowadays the use of new digital technologies such as the digital smile design (DSD) can improve the communication process among specialists.

**MATERIALS AND METHOD:** The DSD is a multi-use conceptual dental treatment planning tool that is used in aesthetic dentistry to strengthen the overview, improve communication and enhance predictability throughout treatment. All records collected (photographs, video and models) are organized in a simple software slideshow (Keynote©-MAC or Powerpoint©-PC) to create a digital drawing of the smile: the virtual profile of the patient can be tested and analyzed even in their absence. Further, individual files can be easily viewed by all members of the team using modern file-sharing technology, greatly simplifying communication. The classical use of the DSD has been integrated with orthodontic analysis: the standard protocol has been combined with the data acquired by orthodontic records, radiographs and three-dimensional digital models and this new protocol has been applied in 15 multidisciplinary patients where it was necessary to move the teeth before prosthetic finalization. Through a wide range of clinical cases, the steps of this technique: how to calculate dental proportions, how to simulate movement of the elements and how to position the incisors in relation to the soft tissue and lips will be discussed.

**RESULTS:** The integration of orthodontic analysis within the DSD and the application of this new protocol has proven to be successful in resolving more aesthetically complex cases.

**CONCLUSION:** Today patients demand a young and attractive smile. Aesthetic treatment often requires collaboration among various disciplines to get the best result, and in this multidisciplinary approach orthodontics plays a key role. It is therefore essential for the specialist to know the basics of a digital smile and communication protocols between prosthodontist and laboratory.

## CP74 GINGIVAL RECESSION – A COMBINED ORTHODONTIC AND PERIODONTAL APPROACH

Anaïs Lebbe, Elisabeth Behaeghe, Guy Willems, KU Leuven, Belgium

**AIMS:** To evaluate the effect of combined orthodontic and periodontal treatment of an adult patient showing gingival recession in the lower anterior region.

**SUBJECT AND METHOD:** A 22 year-old female with Miller Class II gingival recession of 4 mm on the buccal surface of the mandibular right central incisor (Miller, 1985), and no loss of the papilla on the mesial or distal side of tooth 41. She presented with an Angle Class II division 1 left malocclusion, an overjet of 2 mm and an overbite of 0.5 mm. Some buccogingival decalcifications, which probably arose during earlier orthodontic treatment due to lack of oral hygiene, were also noticed. Cone beam computed tomography showed the buccal surface of the root of tooth 41 being positioned beyond the alveolar bone. This might have contributed to the progression of the gingival recession. The patient was referred to her dentist for conservative treatment. Orthodontic treatment involved fixed appliances in the lower jaw only. Tooth 41 was given lingual root torque by means of a multiloop stainless steel archwire. The patient was instructed to brush with chlorhexidine gel (0.1%) once a day.

**RESULTS:** The duration of active orthodontic treatment was 9 months. The gingival recession was reduced to 1.5 mm and its mesio-distal width also became smaller. The gingival margin appeared less infected. Six months after bracket removal, a connective tissue graft was placed on the remaining recession. The recession was covered using a tunneling technique.

**CONCLUSION:** When treating gingival recessions, a multidisciplinary team approach is advocated. A connective tissue graft should be performed after proper root positioning in the alveolar bone, thus increasing the chance of achieving more favourable results.

## CP75 SOTOS SYNDROME: A CASE REPORT

Anaïs Lebbe, Anna Verdonck, KU Leuven, Belgium

**AIMS:** To describe the craniofacial characteristics in a patient diagnosed with Sotos syndrome.

**SUBJECT AND METHOD:** A patient diagnosed with Sotos syndrome was documented from birth until the end of orthodontic treatment, using medical files, orthodontic records and radiographs. The medical history of the patient showed: polyhydramnios at 24 weeks *in utero*. At birth generalized hypotonia, macrosomia (3900 g) and slight dysmorphism (hypertelorism, dysplastic ears, downslanting palpebral fissures and low implanted fifth toe) was detected. Respiration showed a mild stridor and increased need of oxygen during the first two days. Cardiac function lead to peripheral pulmonary stenosis being detected. Postnatal motoric and speech development was slow. There was no report of behavioural problems. At 10 months head circumference stayed harmonically above the 97th centile. At 4 years bone age was advanced by 1 year, 4 months and 2 days. An evaluation of craniofacial growth at this age showed a convex profile, a tendency to double protrusion of the maxilla and the mandible, an open lip relationship and a slight distorelationship of the jaws, a Class I molar relationship, anterior open bite, crowding and eversion of the lower and upper teeth. There was premature eruption of the large, permanent teeth. At 7 years of age, a full dentition was present, except for the second molars.

**RESULTS:** Early orthodontic treatment was advised: four premolar extractions followed by fixed appliances to reduce the biprotrusion and crowding. Permanent retention was placed in both arches.

**CONCLUSION:** Rare syndromic cases with specific craniofacial problems need an individual approach and a careful follow-up of craniofacial growth.

## CP76 IS EARLY TREATMENT OF ORTHODONTIC PATIENTS STILL NECESSARY?

Lida Marinaki<sup>1</sup>, Polytimi Paschalidi<sup>2</sup>, Alexios Katsadouris<sup>1</sup>, Apostolos Tsolakis<sup>1</sup>, Departments of <sup>1</sup>Orthodontics, and <sup>2</sup>Oral & Maxillofacial Surgery, National and Kapodistrian University of Athens, Greece

AIMS: Many skeletal discrepancies of the craniofacial complex become apparent at a young age. The early recognition of these problems may allow the provision of appropriate treatment as soon as possible to avoid, or at least limit, the extent of the discrepancy in the future. The aim of this study is to highlight the importance of treatment of specific discrepancies and also to describe the most suitable treatment modalities for each case.

MATERIALS AND METHOD: Based on current scientific data, the contemporary treatment options are presented, which allow treatment of orthodontic problems at an early stage with simpler mechanotherapy. Such problems are discrepancies in the transverse, horizontal and vertical plane of space. Carefully selected clinical cases are presented to represent the most common skeletal discrepancies faced in everyday orthodontic practice.

RESULTS: Indications for early treatment of skeletal discrepancies are subjects with maxillary deficiency, excessive growth of the maxilla and mandibular deficiency according to the anteroposterior direction. Moreover, patients with a narrow palate have to be treated as soon as the discrepancy is recognized. Patients with mandibular shift, which may result in facial asymmetries, must also be treated early.

CONCLUSION: In the literature it has been stated that early intervention in specific orthodontic cases has beneficial results for the patient. In addition, a first phase of treatment prepares the craniofacial complex and the oral cavity for an easier and a shorter second phase of treatment. Each case should be assessed individually, so that every patient is treated in the most appropriate way and at the right moment.

#### CP77 AN EFFECTIVE TREATMENT PLAN AND CORRECT MANAGEMENT OF A SKELETAL CLASS III MALOCCLUSION: A CASE REPORT

Ljiljana Stojanovic<sup>1</sup>, Tina Pajevic<sup>1</sup>, Ljiljana Vucic<sup>1</sup>, Slobodan Ivic<sup>2</sup>, <sup>1</sup>Department of Orthodontics, School of Dental Medicine, University of Belgrade and <sup>2</sup>Health Center, Velika Plana, Serbia

AIMS: A Class III is considered to be one of the most difficult malocclusions to treat. Class III is generally classified into two categories: skeletal and dental. The diagnosis is important due to the different treatment approaches. Generally a dental Class III can be treated with orthodontics alone, while a true skeletal Class III requires a combination of orthodontics and surgery. There are three main treatment options for a skeletal Class III malocclusion: growth modification, dentoalveolar compensation (orthodontic camouflage), and orthognathic surgery. In each case the decision must be made on the basis of frontal and profile treatment objectives, occlusion, and the needs of the patient. Surgery for the Class III patient is equally predictable and stable, whether the maxilla or the mandible is moved.

SUBJECT AND METHOD: A 13 year old female who was diagnosed with a skeletal Class III malocclusion with a long list of problems. The treatment goals for the patient were: to eliminate the CR-CO discrepancy and anterior crossbite; to establish a Class I canine relationship; to eliminate maxillary and mandibular arch length discrepancies; to align the arches; to align the midlines; to finish with about 2 mm of overbite and 2 mm of overjet and to provide an aesthetic smile.

RESULTS: Treatment was completed with a positive overbite and acceptable occlusion. A positive overjet was established, with good torque control of the upper incisors while the mandibular incisors were retracted resulting in better incisal inclination after orthodontic and surgical treatment. On completion of active treatment, further occlusal adjustment was performed and maxillary and mandibular fixed retainers were inserted. The patient was happy with her new appearance and function.

CONCLUSION: A Class III discrepancy should be diagnosed and classified according to its aetiology and treated with appropriate surgery, including, if necessary, not only mandibular but also maxillary surgery to achieve a normal facial appearance. In any case, as the field of orthodontics continues to develop technologically and philosophically, advances in diagnosis and treatment planning are imminent and inevitable.

#### CP78 CAMOUFLAGE THERAPY OF A PATIENT WITH VERTICAL TYPE OF CRANIOFACIAL GROWTH – CASE REPORT

Predrag Janosevic<sup>1</sup>, Mirjana Janosevic<sup>1</sup>, Gordana Filipovic<sup>1</sup>, Maja Stosic<sup>1</sup>, Milan Spasic<sup>2</sup>, <sup>1</sup>Medical Faculty University of Nis, and <sup>2</sup>Dental Clinic, Nis, Serbia

AIMS: Patients with a vertical type of craniofacial growth are difficult to treat orthodontically. Sever forms of vertical malocclusions require orthodontic surgical therapy. In patients with moderate vertical problems camouflage therapy is one solution. Camouflage therapy involves intrusion of molars, extrusion of incisors or extraction of premolars. The aim of this presentation is to show the camouflage therapy of a Class I patient with a narrow maxillary arch and a vertical type of growth.

SUBJECT AND METHOD: A 15 year old females complaining of respiratory problems and crowding in the upper arch. The lower facial third was increased and the lower lip and chin were in a distal position in the biometric field. Functional analyse showed oral respiration and lip incompetency. Intraoral and examination of the dental casts showed a narrow maxillary arch, an overbite of 0.5 mm, a bilateral crossbite, upper and lower anterior crowding, a vestibular position as well as missing space in dental arch for the upper canines and a palatal position of the lateral incisors. Analysis of the profile radiograph showed a skeletal Class I (ANB 4°), bimaxillary retrognathism (SNA 78°, SNB 74°) retroinclination of the mandible (MP/NS 54°), vertical type of growth (Björk: 414°), protrusion of the upper and retrusion of the lower anterior. The maxillary corpus was 6.6 mm shorter compared to the cranial base. The diagnostic findings were analyzed using profile radiographs, dental casts and photographs of the patient.

RESULTS: After rapid maxillary expansion and extraction of all first premolars, therapy with fixed orthodontic appliances was conducted.

CONCLUSION: The results of camouflage therapy were good, the functional occlusion was corrected and the aesthetics of the patient's smile and face were improved. Functional improvements were also achieved. As a result of rapid palatal expansion, the patient now has nasal respiration and competent lips.

#### CP79 A MULTIDISCIPLINARY APPROACH IN THE TREATMENT OF MALOCCLUSIONS – CASE REPORT

Mirjana Janosevic<sup>1</sup>, Predrag Janosevic<sup>1</sup>, Gordana Filipovic<sup>1</sup>, Maja Stosic<sup>1</sup>, Milica Janosevic<sup>2</sup>,  
<sup>1</sup>Medical Faculty University of Nis and <sup>2</sup>Dental Clinic Janosevic, Nis, Serbia

AIMS: Contemporary orthodontics often involves a multidisciplinary approach in the treatment of malocclusions. The aim of this report is to present the results of orthodontic-surgical therapy of patient with facial asymmetry and impaction of the maxillary right canine.

SUBJECT AND METHOD: An 18 year old female with aesthetic and severe functional problems. Anamnestic data pointed to an injury in early childhood. Facial analysis showed mandibular deviation to the right. Intraorally there was persistence of the upper right primary canine and occlusal disorders with contacts only on the central incisors and left molars. The dental pantomogram showed impaction of the maxillary right canine, an asymmetric mandible with a shorter ramus and corpus on the right side. A different condyle shape was noted on the cone beam computed tomographic image.

RESULTS: Orthodontic-surgical therapy was conducted in four phases. After surgical exposure of the impacted canine, pre-operative orthodontic therapy with fixed appliances was undertaken. When nivellation of the dental arches had been completed, a bilateral sagittal split osteotomy was performed. During surgery two intra-operative splints were used for positioning of the condyles and mandible. In the last phase of therapy orthodontic finishing was carried out to achieve maximal intercuspation.

CONCLUSION: Multidisciplinary therapy resulted in improved aesthetics of the face and good function.

#### CP80 PRE-PROSTHODONTIC ADULT ORTHODONTIC TREATMENT USING MINISCREW IMPLANT ANCHORAGE: A CLINICAL CASE

Anastasia Pouliaki, Kleopatra Tsiouli, Zoe Triantopoulou, Moschos A. Papadopoulos, Aristotle University of Thessaloniki, Greece

AIMS: To present and discuss the orthodontic treatment of an adult patient (following treatment of generalized periodontal disease) using miniscrew implants (MIs) as anchorage for movement of the anterior teeth.

**SUBJECT AND METHOD:** A 56 year old female with an increased overjet, deep bite with traumatic occlusion, intense flaring and over-eruption of #21 and a diastema between the upper central incisors. A MI was initially inserted in the anterior area of the palate and a button was bonded on the palatal surface of #21 to correct its inclination utilizing elastic chains. Bonding of the upper arch took place for initial levelling, alignment and space closure of the upper anterior teeth. Then, MIs were inserted bilaterally initially in the anterior area for intrusion, and later in the posterior area for retraction of the upper anterior teeth. Conventional orthodontic treatment was followed in the lower arch.

**RESULTS:** Treatment of this patient was successfully completed without any further periodontal damage, while there was a reduction of 7 mm and 4 mm of the overjet and overbite, respectively. The smile aesthetics were greatly improved.

**CONCLUSION:** The contribution of MIs to the orthodontic treatment of periodontally compromised patients is of great significance, since it leads to an optimum outcome without any undesirable side effects at the periodontal tissues.

#### CP81 ORTHODONTIC TREATMENT UTILIZING MINISCREW IMPLANTS IN ADULT PERIODONTALLY COMPROMISED PATIENTS: A CLINICAL CASE

Zoe Triantopoulou, Kleopatra Tsiouli, Anastasia Pouliaki, Moschos A. Papadopoulos, Aristotle University of Thessaloniki, Greece

**AIMS:** To present and discuss the orthodontic treatment of a patient with extended bone loss and intense flaring of the upper four incisors, which was undertaken with the utilization of miniscrew implants (MIs) in the palate.

**SUBJECT AND METHOD:** A 54 year old male with severe spacing and increased flaring of the upper incisors. His chief complaint was the protruded upper anterior teeth and the poor smile aesthetics. Two MIs, inserted bilaterally in the paramedian region of the anterior area of the palate provided the necessary skeletal anchorage. Two lingual brackets were bonded on the palatal surface of the central incisors and intrusion and correction of their inclination was achieved with the application of elastic forces. Treatment of the lower arch was completed with conventional orthodontic appliances.

**RESULTS:** The duration of elastic force was 8.5 months, and movement of the upper incisors was successfully completed. An overjet reduction of 6 mm, space closure, correction of incisor flaring and significant improvement of the smile aesthetics were observed. No further periodontal damage was detected.

**CONCLUSION:** The use of MIs is considered to be an effective method, which offers maximum anchorage eliminating any undesirable side effects on the adjacent teeth. Moreover, it offers high aesthetics and is indicated for non-compliant patients.

#### CP82 CORRECTION OF A SKELETAL CLASS III MALOCCLUSION WITH THE SURGERY-FIRST APPROACH – CASE REPORT\*\*\*

Seung-hwan Koo, Kyung-hwa Kang, Department of Orthodontics, Wonkwang University, Iksan, Korea, South

**AIMS:** To describe the treatment plan and treatment results of a skeletal Class III patient with mandibular prognathism and facial asymmetry treated by the surgery-first approach.

**SUBJECT AND METHOD:** A 16 year-old boy who complained about his mandibular prognathism. Because he wanted to obtain improvement of his appearance quickly, surgery-first orthodontic treatment was planned. After orthognathic surgery, the case was finished in 8 months. The results were stable over 7 months.

**RESULTS:** Correction of the skeletodental dysplasia was successfully achieved by surgery-first orthodontic treatment in a relatively short period of 8 months total treatment duration. After treatment, a good occlusion were retained.

**CONCLUSION:** The surgery-first approach has advantages such as it immediately resolves the chief complaint and decreases treatment time through the regional acceleratory phenomenon. On the other hand, there are disadvantages such as the accuracy of the surgical treatment objective is decreased with increasing complexity. Therefore, case selection should be done carefully.

CP83 CORRECTION OF FACIAL ASYMMETRY AND UNILATERAL POSTERIOR CROSSBITE WITH THE SURGERY-FIRST APPROACH – CASE REPORT

Sung-kwon Choi, Kyung-hwa Kang, Department of Orthodontics, Wonkwang University, Iksan, Korea, South

AIMS: To describe the treatment plan and treatment results of a patient with severe facial asymmetry and unilateral posterior crossbite who was treated by the surgery-first approach.

SUBJECT AND METHOD: A 29 year-old female with severe facial asymmetry and a unilateral posterior crossbite treated with orthodontics combined with a bilateral sagittal split ramus osteotomy (BSSRO). To resolve the facial asymmetry, a differential set-back of the mandibular body was planned. After BSSRO was performed, post-operative orthodontic treatment was carried out. Transverse dental decompensation was done by posterior intrusion via mini-implants unilaterally.

RESULTS: The total period of active treatment was 18 months. Both her occlusion and facial appearance were significantly improved by the surgery-first approach.

CONCLUSION: Treatment outcomes balanced with facial aesthetics, function, and stability can be achieved with surgery-first orthodontic treatment once correct case-selection, diagnosis, and treatment planning are established.

CP84 MOLAR DISTALISATION WITH THE PENDULUM APPLIANCE IN A GROWING PATIENT: A CASE REPORT

Gokhan Yuksel, Hatice Gokalp, Department of Orthodontics, Ankara University Faculty of Dentistry, Turkey

AIMS: To evaluate the treatment effects of the pendulum appliance in a growing patient with an Angle Class II molar and skeletal Class I relationship.

SUBJECT AND METHOD: A 12-year 4-month-old male presented for correction of a dentoalveolar Class II malocclusion. The patient was in the permanent dentition with moderate maxillary crowding. The molar and canine relationship was Class II on either side. The maxillary incisors were protrusive, the overjet and overbite was 4.0 mm. and 2.5 mm., respectively. Skeletal analysis showed a Class I facial pattern with an ANB angle of 1 degree, a normal facial profile and lower anterior face height. The pendulum appliance consisted of a large Nance acrylic button that was stabilized with four wires that were bonded as occlusal rests to the first and second premolars, as described by Hilgers. The appliance incorporated 0.032 inch TMA springs that were inserted into lingual sheaths on the bands attached to the maxillary first molars. The TMA springs exerted a force of 200 to 250 g as the springs were activated from 60 to 90 degrees. The total activation time was 9 months. When the molars achieved a full Class III occlusion, the second premolars were released from the anchorage unit and allowed to drift distally by a sectional arch with a reverse closing loop extended to the upper first molars. When desired, second premolar distalization was achieved, the appliance was removed and the sectional arch extended from the upper first molars with increased anchorage by a transpalatal arch to the first premolars to distalise them.

RESULTS: All maxillary molars were distalised 9 mm. in 9 months with a little tipping. Face height was controlled during treatment.

CONCLUSION: The pendulum appliance is an effective appliance for distalizing maxillary molars and correcting Class II malocclusions in growing patients.

CP85 EFFECTIVE TREATMENT OF A SKELETAL R II MALOCCLUSION WITH FIXED MANDIBULAR BITE GUIDE MANUFACTURED BY SELECTIVE LASER MELTING

Anita Fekonja<sup>1</sup>, Tjasa Zupancic Hartner<sup>2</sup>, <sup>1</sup>Orthodontic Department, Health Centre Maribor, and <sup>2</sup>3D MED, Maribor, Slovenia

AIMS: Recently, digitizing and automation have gained an important place in fabrication of medical and dental components. Additive manufacturing could also be suitable for dental as well as orthodontic applications due to its complex geometry, low volume and strong individualization. This presentation shows the effective treatment of a skeletal R II

malocclusion in a growing patient using a fixed mandibular bite guide (FMBG) produced by digital and fast procedure of selective laser elting.

**SUBJECT AND METHOD:** A 14 year 8 month old patient in the permanent dentition with a convex profile due to a retrognathic mandible, and a deep mentolabial fold. Intraoral examination and pre-treatment study casts confirmed an overjet (8 mm), a deep overbite (7 mm) and an accentuated lower curve of Spee. The midlines were coincident and the molar relationship was a full Class II on both sides. The lateral cephalogram showed a skeletal Class II discrepancy with mandibular retrognathism, a skeletal deep bite, reduced lower anterior face height, proclined upper and lower incisors and an excessive lower curve of Spee.

**RESULTS:** Post-treatment there was a well balanced face, a nice profile and a pleasant smile. Intraorally a reduction of overjet and overbite was noted in the dental relationship as well as a good Class I relationship.

**CONCLUSION:** The FMBG was effective in treating a Class II malocclusion due to a retrognathic mandible and produced favourable dentofacial effects. Predictable results with minimal side effects can be achieved with an individualized treatment plan undertaken with sound biomechanical principles and appropriate control of orthodontic mechanics. The FMBG is made individually from biocompatible material. It is also very important that incisor inclination can be controlled.

#### CP86 ORTHODONTIC TREATMENT MONITORING USING SMARTPHONE

Vladimir Gushin<sup>1</sup>, Bart Vande Vannet<sup>2</sup>, Departments of Orthodontics, <sup>1</sup>Saint Petersburg, , Russia and <sup>2</sup>Vrije Universiteit Brussel, Belgium

**AIMS:** In recent years, there has been a significant increase in the use of digital technology. More and more patients use smartphones and are in contact over social networks. As communication is an important component of patient care, the aim of this research was to test mobile applications for patient to orthodontist contact.

**MATERIALS AND METHOD:** The possibility to use two apps: 'Whatsapp' and 'Telegram app' was communicated in the informed consent in accordance with the Declaration of Helsinki. One hundred consecutively treated patients were given this information. Data were collected after 1, 3 and 6 months of treatment.

**RESULTS:** All patients received a confirmation message after insertion of the appliance. In total 60 patients used the possibility to communicate. Three hundred and sixty five communications were established during the first month, 170 between 1 and 3 months and 150 between 3 and 6 months. No technical problems were observed during this testing period. Whatsapp was preferred (75%) over Telegram (25%).

**CONCLUSION:** Sometimes the patient gains therapeutic benefit just from venting concerns in a safe environment with a caring clinician. Appropriate reassurance or pragmatic suggestions to help with problem solving and setting up a structured plan of action may be an important part of the patient care. This technique allows us to choose a more adopted treatment strategy, less displacement of patients but more effort to the practice. The use of these communication tools could enhance the compliance of patients.

#### CP87 EFFECTIVE ORTHODONTIC TREATMENT OF AN OPEN BITE: CASE REPORT

Ljiljana Stojanovic<sup>1</sup>, Slobodan Ivic<sup>2</sup>, Marija Minic<sup>3</sup>, Vesna Popov<sup>3</sup>, <sup>1</sup>Department of Orthodontics, School of Dental Medicine, University of Belgrade, <sup>2</sup>Health Center, Velika Plana and <sup>3</sup>Private practice, Belgrade, Serbia

**AIMS:** An effective treatment plan and appropriate management of open bite cases is dependent on correct diagnosis that requires careful evaluation and a broad knowledge of the various aetiological factors that may cause this type of malocclusion. Open bites are generally classified as either skeletal or dental. A dental open bite is associated with the following characteristics: normal craniofacial pattern, proclined incisors, under erupted anterior teeth, normal or slightly excessive molar height, and thumb or finger sucking habits. The craniofacial characteristics most consistently associated with a skeletal open bite are an increased mandibular plane angle, increased gonial angle, long anterior face height, increased total face height, palatal plane tipped anteriorly, and a retrognathic mandible. Most

open bite malocclusions show some aspects of both dental and skeletal types. The difficulty lies in distinguishing whether a patient should be classified as a dental or a skeletal open bite.

**SUBJECT AND METHOD:** A 18-year-old female who had a vertical pattern (SN-MP: 46°), an open bite malocclusion and tongue thrust, refused surgery. Her soft tissue profile exhibited a long face syndrome with her lips apart when relaxed. With no other options, the patient agreed to be treated non-extraction and to wear headgear at the beginning of therapy. Treatment was finished with a positioner.

**RESULTS:** The most significant changes were in the soft tissue profile and smile, The high-angle skeletal pattern also had a very nice symphysis, and soft tissue pogonion gave the profile a nice balance.

**CONCLUSION:** Careful diagnosis and timely intervention with the correct appliance will improve the success of treating this malocclusion. Stability is a particular concern with open bite cases. Although correction of an open bite cannot always be perfectly maintained, there are many cases which will benefit from treatment with only orthodontic appliances.

#### CP88 ORTHODONTIC TREATMENT OF A SEVERE ANTERIOR OPEN BITE BY GUMMETAL ARCHWIRE: A CASE REPORT

Kazuhiisa Ikeda<sup>1</sup>, Hideaki Akagi<sup>1</sup>, Tomo Murakami<sup>1</sup>, Yohei Nakamura<sup>1</sup>, Kiyoshi Tai<sup>2</sup>, <sup>1</sup>Private practice, Okayama and <sup>2</sup>Department of Orthodontics, A.T.Still University, Okayama, Japan

**AIMS:** A severe anterior open bite (AOB) is considered to be one of the most difficult malocclusions to treat. The objective of the study was to evaluate the effect of gummetal archwires with tip-back bends and anterior elastics in the treatment of an AOB.

**SUBJECT AND METHOD:** A 10 year 10 month old boy displayed a high angle skeletal pattern, with a severe AOB. After initial levelling, 0.018 × 0.025 gummetal archwires were placed, with anterior elastics engaged in the canine regions. Kick-back bends and step bends were incorporated to the gummetal archwires.

**RESULTS:** After 10 months of therapy a correct overbite and overjet were achieved together with correction of the Class II molar and canine relationships. There was a reduction in the mandibular plane angle to FH. After superimposition of the pre- and post-treatment radiographs, counter-clockwise mandibular rotation was observed.

**CONCLUSION:** Gummetal archwires are useful to treat a severe AOB.

#### CP89 UNILATERAL MOLAR DISTALIZATION WITH A TEMPORARY ANCHORAGE SUPPORTED SLIDING JIG – CASE REPORT

Ece Bay, Ahmet Yalcin Gungor, Department of Orthodontics, Akdeniz University, Antalya, Turkey

**AIMS:** This case report presents a practical and effective method for intraoral molar distalization.

**SUBJECT AND METHOD:** A 15-year-old male with the chief complaint of crowded teeth. He had a skeletal Class II malocclusion, convex profile and retrusive lower lip and chin. Intraoral examination showed that the buccal segments were in a Class II relationship on the right side and a Class I on the left side. There was an increased overjet. Fixed appliance therapy was initiated with standard metal brackets in the MBT system. A miniscrew of 9 mm in length and 1.2 mm in diameter (Aarhus, Orthosystem) was inserted between the roots of the upper second premolar and first molar teeth. A sliding jig was made from 0.032 inch diameter stainless steel wire. Distalization force was applied through the coil springs attached from the temporary anchorage device to the jig. Treatment time was 13 months.

**RESULTS:** At the end of treatment an ideal Class I molar and canine relationship and ideal overbite and overjet were all achieved. A considerable improvement in smile aesthetics was obtained.

**CONCLUSION:** Satisfactory results can be achieved with this non-compliance therapy in terms of comfort both for the patient and orthodontist.

#### CP90 A THREE-DIMENSIONAL ASSESSMENT OF CLASS II TREATMENT WITH A BITE JUMPING APPLIANCE: A CASE REPORT

Hideaki Akagi<sup>1</sup>, Akira Kanao<sup>2</sup>, Tomo Murakami<sup>1</sup>, Yohei Nakamura<sup>1</sup>, Kiyoshi Tai<sup>3</sup>, <sup>1</sup>Private practice, Okayama, <sup>2</sup>Department of Orthodontics, Nihon University at Matsudo, Okayama, and <sup>3</sup>Department of Orthodontics, A.T.Still University, Okayama, Japan

**AIMS:** A skeletal Class II malocclusion involves maxillary protrusion, mandibular retrusion, or a combination of both. There are multiple reasons which lead to a Class II malocclusion. When mandibular retrusion is the cause, a functional appliance is often used to advance the mandible. This poster demonstrates forward movement of the mandible using a bite jumping appliance (BJA). A three-dimensional cone beam computed tomographic (3D CBCT) superimposition technique was used for pre- and post-treatment comparison.

**SUBJECT AND METHOD:** A 9-year-old female in the mixed dentition with the chief complaint of maxillary protrusion. Clinical examination revealed a convex facial profile and a full Class II molar relationship. The overjet was 8.7 mm, and the overbite 3.9 mm. The treatment objective was to reduce the overjet and to correct the Class II occlusion using a BJA after Biobloc stage 1.

**RESULTS:** After 18 months of therapy, a successful treatment outcome was achieved by correcting the overjet, the Class II molar relationship, and facial convexity. Superimposition between the pre- and post-treatment 3D CBCT images was performed to visualize the dental, maxillary and mandibular changes.

**CONCLUSION:** This case shows that orthopaedic changes can be obtained with BJA treatment, with protraction of the mandible. This outcome was verified by the 3D CBCT superimposition technique.

#### CP91 SLICING OF PRIMARY TEETH: A SMART OPTION IN SPACE MANAGEMENT IN A CROWDED MIXED DENTITION

Daniel Celli, Anna Lucia Greco, Simone Sferra, Catholic Roberto Deli, Catholic University of the Sacred Heart, Rome, Italy

**AIMS:** Mandibular incisor crowding in the mixed dentition is one of the most common problems presenting to the orthodontist. Primary tooth slicing optimizes the eruption and alignment patterns of the permanent teeth.

**SUBJECT AND METHOD:** The treatment protocol for children with lingually displaced lower incisor and lower crowding in the range of 2-4 mm is, as the first option, slicing of the primary canines to reduce their mesiodistal diameter thus providing additional space to improve the position of the adjacent permanent incisors.

**RESULTS:** The disking of the mesiolingual corner of the primary canines provides a 'sluiceway' for the lingually positioned incisors to slide forwards under the muscular pressure of the tongue. Bilateral disking of the mesiolingual aspect of the primary canines readily provides space of 1 mm and up to 2 mm per side for the incisors. Long-term dental health benefits of early mandibular incisor alignment are described in a patient followed up for 19 years.

**CONCLUSION:** Labial movement of lingually displaced incisors may actually increase the midline arch length and overall arch circumference as the arch form is rounded out in a forward direction by the action of the tongue.

#### CP92 THE USE OF APPS IN ORTHODONTICS\*\*\*

Andreas Stippig<sup>1</sup>, Markus Emerich<sup>2</sup>, Isabelle Graf<sup>1</sup>, Bert Braumann<sup>1</sup>, <sup>1</sup>Department of Orthodontics, University of Cologne and <sup>2</sup>Department of Otorhinolaryngology, Albert-Ludwigs-University Freiburg, Germany

**AIMS:** Advanced mobile communication and portable computation combined in handheld devices such as smartphones and tablets become more and more part of daily life. This affects both patients and practitioners. Third-party software called apps (applications) is starting to have an impact on modern medicine. This poster will give an overview about apps on the market designed for orthodontic patients. Moreover, it will present a study about the abilities and reliability of certain apps.

**MATERIALS AND METHOD:** Research regarding apps in orthodontics was undertaken in the App Store (Apple Inc., Cupertino, California, USA) for iPhone and iPad apps with

multiple keywords. Apps designed for orthodontic patients were filtered. Five apps to monitor sleep behaviour were selected and the apps' competence to count snoring noises was evaluated.

**RESULTS:** Searching the App Store with the keywords 'orthodontics' and 'braces' resulted in over 300 hits. The tested sleep apps were able to monitor and record snoring noises as long as they were used in a soundproof environment. In a real life setting with various disturbing noises the tested apps showed difficulties in identifying snoring sounds from other noises.

**CONCLUSION:** The market of health apps in the field of orthodontics is abundant and growing. The tested sleep apps were a helpful addition but were not sufficiently accurate to replace the common diagnostic standard in therapy. Further scientific research and clearly defined guidelines are necessary to develop useful health apps for both patients and practitioners.

#### CP93 UNILATERAL POSTERIOR CROSSBITE – A THREE-DIMENSIONAL EVALUATION OF EARLY TREATMENT

Vinka Rajković<sup>1</sup>, Jasmina Primožič<sup>2</sup>, Stephen Richmond<sup>3</sup>, Franc M. Farčnik<sup>1</sup>, Maja Ovsenik<sup>2</sup>,  
<sup>1</sup>Orthos, Ljubljana and <sup>2</sup>University of Ljubljana, Slovenia and <sup>3</sup>Cardiff University, U.K.

**AIMS:** To report the orthodontic treatment of a unilateral posterior crossbite in the primary dentition using a three-dimensional (3D) contemporary diagnostic technique.

**SUBJECT AND METHOD:** A 5-year-old girl with a unilateral posterior crossbite on the left side. Facial asymmetry in the the lower third of the face, intraorally midline deviation and crossbite of all the primary teeth on the left side, together with transverse discrepancy of 4 mm were diagnosed by study cast analysis. Palatal expansion with rapid maxillary expansion (RME) was performed. RME was activated 2 turns a day (0.20 mm per turn) for 20 consecutive days to achieve an overcorrection of 2 mm on both sides of the arch. The facial appearance and soft tissue analysis were assessed quantitatively and qualitatively, using a 3D laser scanner technique before treatment (T0), after orthopaedic expansion (T1) and after 12 months follow-up (T2).

**RESULTS:** Maxillary expansion was achieved after 20 days (T1) and the posterior crossbite was overcorrected with reference to the posterior transverse interarch relationship. The same appliance was maintained in place as a retainer, during the retention period of 6 months and then removed. A transpalatal arch with the Fränkel function regulator III modified appliance (Farčnik, 2008) were used after T2. 3D scans were repeated at T1 and T2 and superimposed on the facial scans taken at T0. The result was improvement of facial asymmetry of the lower part of the face without a mandibular shift.

**CONCLUSION:** Early treatment of a unilateral crossbite in the primary dentition is necessary to create conditions for normal occlusal and facial development.

#### CP94 MANAGEMENT OF PALATALLY IMPACTED CANINES WITH THE OPEN SURGICAL TECHNIQUE AND A CRIMPABLE SUSPENDER

Sabahattin Bor, Mehmet Savaş Kayasan, Fatih Kazanci, Department of Orthodontics, Yuzuncu Yil University, Van, Turkey

**AIMS:** The maxillary canine is second only to the mandibular third molar in its frequency of impaction, with a prevalence of about 1.5 per cent. Ectopic canines occur palatally with twice the frequency than they do buccally. Various forms of inter- and intra-arch mechanics have been devised for the eruption of impeded and impacted teeth. The crimpable suspender (BioMateryal Korea Inc.) is a new option to applying lateral and vertical eruptive force.

**SUBJECT AND METHOD:** A female patient aged 15 years referred because of persistent teeth 53, 63 and 83. Orthodontic examination revealed: persistent upper primary canines and a persistent mandibular right canine, increased overbite with a skeletal Class II and Angle dental Class II subdivision and compressed maxillary arch with 2-3 mm of space discrepancy. By intraoral palpation and radiographic evaluation, the position of the maxillary canines was determined. Because of the close position of the canines to the roots of the incisors and premolars, a cone beam computed tomograph was taken. A fixed appliance was placed firstly in the maxillary arch and adequate space for the canines was gained using

0.016 × 0.025 copper nickel titanium with an open coil spring. After 6 months sufficient space was gained for canine eruption and the open window surgical technique was used. The impacted canines were left self-erupt for two months, then buttons were bonded to the canines for traction. The crimpable suspender was bent and fixed to 0.019 × 0.025 stainless steel. An elastic chain was stretched from the crimpable suspenders to buttons; the elastic chain was changed at 3 weekly intervals.

**RESULTS:** The palatally impacted maxillary canines were positioned in alignment with the remaining teeth after 6 months. The overall treatment period was 21 months at which time an Angle Class I molar relationship, a pleasant smile and reduced overbite had been achieved.

**CONCLUSION:** The crimpable suspender is a multifunctional auxiliary that is simple to place, easy to adjust, can be used with elastic chain and requires no special patient compliance. The position of the crimpable suspender can be easily changed to adjust lateral and vertical eruptive force.

#### CP95 USING A CHAT ROOM TO IMPROVE COMPLIANCE IN ORAL HYGIENE OF YOUNG ORTHODONTIC PATIENTS: A PILOT STUDY

Francesca Zotti, Rinaldo Zotti, Laura Laffranchi, Claudia Tosi, Domenico Dalessandri, Department of Orthodontics, Dental School, University of Brescia, Italy

**AIMS:** To evaluate the effectiveness of using a chat room to improve compliance in oral hygiene in young orthodontic patients.

**SUBJECTS AND METHOD:** Twenty adolescent patients scheduled to start orthodontic multibracket treatment were randomly divided into two equal groups. White spots, plaque index (PI), gingival index (GI), and caries presence were recorded in all patients and they were instructed regarding domestic oral hygiene maintenance on the day of bracket insertion (T0) and quarterly (T1, T2, T3, T4) during the first year of treatment. The study group patients were enrolled in a chat room based competition and instructed to share weekly with the other participants two self-photographs (selfies) showing their oral hygiene status.

**RESULTS:** The study group participation in the chat room was regular and active throughout the observation period. At T2, T3, and T4, they had significantly lower values in both PI and GI and a lower incidence of new white spots and caries compared with the control group.

**CONCLUSION:** Utilization of new technologies in a standard oral hygiene motivation protocol is effective in improving adolescent patients' compliance and in improving their oral health status during orthodontic multibracket treatment.

#### CP96 USING A CHATROOM IN POST-ORTHODONTIC RETAINER FOLLOW-UP IN YOUNG PATIENTS: PILOT STUDY

Francesca Zotti, Rinaldo Zotti, Francesca Paiocchi, Laura Laffranchi, Corrado Paganelli, Department of Orthodontics, Dental School, University of Brescia, Italy

**AIMS:** To determine whether the use of the new 'social' technology is useful in improving the follow-up of retainers after orthodontic treatment in young patients.

**SUBJECTS AND METHOD:** Thirty post-orthodontic patients (age 16-19 years) in a protocol based on training and motivation supported by the experience of orthodontists and the contribution of new technologies. The patients agreed to be present in an anonymous chat room for one year after the removal of fixed appliances. Everyone, in addition to monthly checks, sent monthly chatting snapshots showing their occlusion and the degree of oral hygiene after revealing any plaque. Compliance in oral hygiene and the absence of relapse were notified in a ranking published every two months in the chat by the orthodontic's department administrator.

**RESULTS:** After one year participation was 100 per cent. There were no signs of relapse either during clinical examination or virtually. Oral hygiene was very satisfactory.

**CONCLUSION:** The idea of involving patients in a 'race' and make them responsible for follow-up was effective. The use of media content is key to educate and motivate patients who use technology every day.

#### CP97 SIMPLE THERAPY FOR ANTERIOR CROSSBITE CORRECTION OF A SINGLE TOOTH IN THE EARLY MIXED DENTITION

Georgios Vasilakos, Athanasios Koniaris, Benita Jung, Koniaris Private Practise, Cologne, Germany

**AIMS:** To present a simple method for the correction of anterior crossbite of a single tooth without any orthodontic appliances.

**SUBJECT AND METHOD:** A healthy 6-year-old patient with a caries-free dentition presented with an anterior crossbite of an anterior tooth (#21). Bilateral occlusal build-ups fabricated from LC Block-Out Resin (Ultradent) were bonded on the occlusal surfaces of the mandibular second primary molars (#75 and #85). The occlusal build-ups increased the vertical dimension of the occlusion in order to permit labial tipping of tooth #21.

**RESULTS:** The anterior crossbite self-corrected after 4 weeks and the occlusal build-ups were removed. The correction was performed by the natural force applied by the function of the tongue. One year post-treatment the correction remained stable and a positive overjet (2 mm) and overbite (1.5 mm) were observed.

**CONCLUSION:** This treatment of an anterior crossbite in the early mixed dentition is low-cost, fast and does not rely on patient compliance. The whole procedure can be completed in only a few visits without the need for any orthodontic appliances that require patient cooperation. Relapse is usually prevented by the restoration of normal overjet/overbite relationships.

#### CP98 SKELETAL AGE PARAMETER USED IN EARLY OR LATE TREATMENT DECISIONS OF DENTO-MAXILLARY ANOMALIES

Elena Teodorescu<sup>1</sup>, Viorica Milicescu<sup>1</sup>, Ella Galan<sup>2</sup>, Angelica Bencze<sup>1</sup>, Dan Marii<sup>1</sup>,  
<sup>1</sup>Department of Orthodontics and Dento-Facial Orthopaedics, University of Medicine and Pharmacy 'Carol Davila', Bucharest and <sup>2</sup>Private Practice, Bucharest, Romania

**AIMS:** In the labelling of early or late treatment of dento-maxillary anomalies, an important role in the contemporary paediatric population, is biological age.

**MATERIALS AND METHOD:** The difficulty of assessing biological age and treatment prognosis after height and weight evaluation, often with early onset of puberty, and the variation of tooth eruption, make bone age one of the biological age parameters relatively more stable and less affected by contemporary typology; the skeletal age was assessed through hand wrist radiographs and angularity of the cervical spine. The research was conducted on problematic cases.

**RESULTS:** Complete orthodontic investigation, clinical and paraclinical, and collaborating with clinics of paediatric endocrinology, genetic, metabolic diseases, radiology and anthropology, has minimized the risk of inaccurate diagnosis, and permitted the development of a individualized, but therapeutic concept, based on implementation of skeletal maturation age in the diagnosis and therapeutic judgment.

**CONCLUSION:** The findings advocate comprehensive investigation of patients who raise questions regarding the behaviour of facial structures during orthodontic treatment. A difficult and complex analysis of the case, aimed at determining the growth potential of the patient, child or adolescent, is necessary, in order to comply with the prevention, interception, treatment, recovery, based on the skeletal age that can play decisive role.

#### CP99 CORRELATIONS BETWEEN UPPER AIRWAYS AND BONE AND SOFT TISSUE CEPHALOMETRIC PARAMETERS IN FACIAL ASYMMETRY

Elena Teodorescu<sup>1</sup>, Angelica Bencze<sup>1</sup>, Ecaterina Ionescu<sup>1</sup>, Stefan Milicescu<sup>2</sup>, Viorica Milicescu<sup>1</sup>, Departments of <sup>1</sup>Orthodontics and Dento-Facial Orthopaedics and <sup>2</sup>Fixed Prosthodontics, University of Medicine and Pharmacy 'Carol Davila', Bucharest, Romania

**AIMS:** Normally, function of the upper airway, nasal cavity, oropharynx and nasopharynx is dependent on the development of the facial muscles and skull. In reciprocity, perhaps from 'function creates the organ', functional disorders of the stomatognathic system fall on massive facial morphology.

**SUBJECTS AND METHOD:** Fifty six patients aged 7-44 years in who functional disorders of facial asymmetries were studied on postero-anterior (frontal) cephalometric radiographs interpreted by two examiners, three times for each parameter, which resulted in six values for each parameter, in order to minimize measurement error.

**RESULTS:** In subjects with functional facial asymmetries, the middle landmarks were diverted without involvement of deeper structures. In subjects with facial asymmetries due to structural underdevelopment (syndromes of the first and second branchial arches), the mid-points are moved toward the affected side.

**CONCLUSION:** It identifies in facial asymmetry and the following features:

- Involvement of craniofacial structures and upper airway functionality;
- Functional respiratory disorders, especially those installed early, influence overall increase quality and quantity;
- In the studied cases, on the side with deficient development, the analyzed elements of the upper airways (nostrils, nasal passages and sinuses) showed varying degrees of underdevelopment.

#### CP100 EARLY TREATMENT OF SKELETAL CLASS III: A CASE REPORT

Francesca Zotti, Rinaldo Zotti, Fabio Savoldi, Claudia Tossi, Luca Visconti, Department: Orthodontics, Dental School, University of Brescia, Italy

**AIMS:** To demonstrate how early intervention in Class III malocclusions can improve the profile, function and social impact in a child patient.

**SUBJECT AND METHOD:** A 7 year old, with maxillary retrusion normodivergent, anterior crossbite, concave profile treated with a facemask for 14 months with the following protocol: the mask was worn for 10 hours a day for 10 months, 8 hours a day for 2 months, and for 8 hours every 2 days for 2 months. Cephalometric radiographs in lateral projection were obtained before treatment and 2 months after the removal of the splint. It was not necessary to expand the maxilla before application of the facemask.

**RESULTS:** After 14 months of treatment there was a significant improvement of the profile, resolution of anterior crossbite and overcorrection of the skeletal Class.

**CONCLUSION:** In agreement with the literature, early treatment of Class III by maxillary retrusion with a facemask, is effective in the improvement of the profile of the skeletal Class III avoiding the need for future surgery.

#### CP101 EARLY TREATMENT OF A SKELETAL CLASS III PATIENT: A CASE REPORT

Asif Remili, Nathalie Verly, Michal Charezenski, Alain Balon-Perin, Regine Glineur, Department of Stomatology, Université Libre de Bruxelles, Brussels, Belgium

**AIMS:** To describe the treatment of a patient with a Class III malocclusion, an anterior open bite (AOB) and unilateral crossbite associated with functional mandibular deviation by functional therapy of palatal disjunction/expansion joined with Delaire facemask followed by fixed orthodontic treatment

**SUBJECT AND METHOD:** A 9-year-old girl with a Class III malocclusion due to maxillary skeletal deficiency in three planes. She showed an AOB and a unilateral crossbite with functional mandibular deviation. The complaints of the patient were functional and aesthetic. Interceptive treatment consisted of palatal expansion immediately followed by maxillary protrusion with a Delaire facemask. The patient also had speech therapy. The duration of treatment was 9 months. The second phase of treatment, lasting 9 months, took place in the permanent dentition and consisted of bimaxillary fixed appliances (Roth prescription, slot size 0.022 × 0.028).

**RESULTS:** The orthodontic finishing phase improved and stabilized the final occlusion. The final aesthetic and functional results were very satisfying.

**CONCLUSION:** An optimal outcome in this patient with dentofacial deformity was obtained as a result of a multidisciplinary approach and early management.

#### CP102 TREATMENT OF A DEEP BITE IN GROWING PATIENTS WITH A PRE-FIXED APPLIANCE: CASE REPORTS

Matteo Colosimo, Michela Baroni, Beatrice Dapei, Department of Orthodontics University of Tor Vergata, San Pietro Hospital, Rome, Italy

AIMS: To describe clinical cases of early deep bite treatment in patients during the mixed dentition.

MATERIALS AND METHOD: Excessive incisor overlapping is frequently named as a cause for periodontal and dental traumatic lesions, temporomandibular disorders and unfavourable perception of teeth, indicating an early and preventive orthodontic treatment need, especially in patients with an excessive anterior rotation of the mandibular plane, due to a tendency toward a worsening malocclusion with growth.

RESULTS: Elastomeric pre-fixed appliances represent an approach for interceptive treatment to correct a deep bite, to guide the eruption of permanent teeth, to improve aesthetic conditions and to maintain clinical results. They are also useful for functional problems associated with swallowing, tongue thrusting, and breathing.

CONCLUSION: Pre-fixed appliances represent a good choice for early treatment of deep bites; they are easy to use and safe.

#### CP103 VIZUALISATION OF ORTHOPAEDIC MODIFICATIONS BY DELAIRE'S ANALYSIS DURING EARLY TREATMENTS OF MAJOR DYSMORPHOSIS†††

Patrick Fellus, Department of Orthodontics, Robert Debre Hospital, Paris, France

AIMS: To determine the effect of early treatment on growth.

MATERIALS AND METHOD: By Delaire's analyses in early treatment.

RESULTS: The early stimulation of growth has an effect on dysporphosys

CONCLUSION: It is important, even with major occlusal deformation, to begin treatment early.

#### CP104 INDICATIONS, ADVANTAGES AND LIMITATIONS OF THE CLEAR ALIGNER SYSTEM. CASE PRESENTATIONS

Georgios Damanakis, Konstantinos Karamesinis, Alina Cocos, Apostolos Tsolakis, Margarita Makou, Department of Orthodontics, National and Kapodistrian University of Athens, Greece

AIMS: To discuss the indications, treatment planning, advantages and limitations of the Invisalign orthodontic system.

SUBJECTS AND METHOD: Patients treated with Invisalign aligners will be presented.

RESULTS: The Invisalign system is commonly used in the treatment of malocclusions without underlying skeletal problems, in adult orthodontic treatment and in patients presenting with relapse after the removal of fixed appliances. The indications for Invisalign treatment include space discrepancies up to 5 mm, molar tipping, deep bite cases requiring intrusion of the incisors and some cases with extraction of one lower incisor. The Invisalign system offers an aesthetic treatment option and allows patients to maintain a better level of oral hygiene compared to conventional fixed appliances. However, there are contra-indications including skeletal anomalies, extraction cases and those requiring control of root movement. The main disadvantages of the system are the high demand for patient compliance, the cost and the high frequency of relapse after treatment.

CONCLUSION: Adult and adolescent patients presenting with minor to moderate malocclusions can be successfully treated with Invisalign aligners. Orthodontists should consider the limitations of this treatment regimen and choose carefully the candidate patients. The precise biomechanical control of the Invisalign system together with the use of tooth attachments will improve the effectiveness of the aligners and expand their application in more demanding cases.

#### CP105 SECOND MOLAR UPRIGHTING AFTER PREMATURE LOSS OF MANDIBULAR FIRST MOLAR – CASE REPORT

Eduard Radu Cernei<sup>1</sup>, Irina Nicoleta Zetu<sup>1</sup>, Andreea Neculescu<sup>2</sup>, <sup>1</sup>Orthodontics and Dentofacial Orthopedics, Surgery Department, Gr. T. Popa University of Medicine and Pharmacy, Faculty of Dentistry, Iasi and <sup>2</sup>Private practice, Galati, Romania

AIMS: Uprighting a tipped molar using an uprighting spring is a fundamental orthodontic treatment technique. Following weak anchorage only of the anterior teeth the permanent lower second molar will rotate around its centre of resistance, and the distalizing movement will occur its extrusion. Following this reaction, the mandibular anterior teeth will have an intrusive movement. All these elements will lead to an anterior open bite. Correction of vertical problems has become easier with the advent of mini-implants. The aim of this presentation is to show the treatment of a patient with aesthetic and functional disorders.

SUBJECT AND METHOD: A 24 year old subject presenting for aesthetic and functional disorders. On extraoral examination, the facial changes were not relevant. Clinical examination revealed an intraoral Class I molar malocclusion on the right, a narrow upper arch with a slight overbite, and both permanent first molars on the left side lost prematurely. Tooth 37 was inclined at 45 degrees to the occlusal plane. To avoid an anterior open bite, an orthodontic miniscrew was inserted between the canine and first premolar on the same side to achieve second molar uprighting.

RESULTS: Lower second molar uprighting was achieved without unwanted movements in the anterior mandibular region and without molar extrusion.

CONCLUSION: Using mini-implants for uprighting a tipped molar will achieve the desired tooth movement and will reduce the number of unwanted side effects and eventually improve aesthetics.

#### CP106 AIMING TO PERFECTION BY PROPOSING A MULTIDISCIPLINARY APPROACH FOR PATIENTS WITH TEETH WITH A DOUBTFUL PROGNOSIS

Konstantinos Karamesinis<sup>1</sup>, Theodora Diamantatou<sup>2</sup>, Dimitrios Konstantonis<sup>1</sup>, Margarita Makou<sup>1</sup>, Stefanos Kourtis<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Prosthodontics, National and Kapodistrian University of Athens, Greece

AIMS: Patients with displaced teeth due to periodontitis or malocclusion can greatly benefit if proper orthodontic treatment precedes prosthetic restoration. When an integrated approach is selected then a specific treatment protocol must be implemented.

SUBJECTS AND METHOD: Two cases with maxillary anterior teeth with doubtful prognosis are presented and analyzed. The first case was an adolescent girl with a fractured central incisor, which it was decided to restore after orthodontic forced eruption. Subsequent to orthodontic treatment, the incisor was restored with an all-ceramic crown that was stable in the mouth for 19 years. The second case was a periodontically compromised adult female with pathological migration of the anterior teeth. Prosthetic reconstruction would require maximum intervention with endodontic treatment and posts due to the increased flaring of the teeth. Orthodontic treatment aimed to achieve correct alignment of the incisors and maximum preservation of the dental structure.

RESULTS: In both cases the treatment decision was determined by the aesthetic demands, the periodontal condition and the patient's needs. Additionally, orthodontic treatment offered alternatives to complicated treatment plans. The key-factor in decision-making for this treatment approach is careful monitoring of treated patients especially when they are periodontitis-susceptible. The presented cases show that the dental team has a delicate palette of treatment options.

CONCLUSION: In a modern multidisciplinary approach to dental treatment, functional, aesthetic and biological reconstructions can be accomplished. Integrated treatment facilitates the correct positioning of the teeth, thus securing an adequate occlusion and periodontal support. The prosthetic restoration of orthodontically repositioned teeth can achieve outstanding results with excellent long-term prognosis.

#### CP107 EARLY TREATMENT OF DEEP BITES WITH AN ELASTODONTIC APPLIANCE

Martina De Scisciolo, Antonella Maselli, Silvia Schiavoni, Department of Orthodontics, San Pietro Hospital University of Tor Vergata, Roma, Italy

AIMS: Orthodontics identifies the incorrect development of the mouth as early as possible to eliminate dysfunctional forces which may act on the dental imprinting and skeletal pattern.

SUBJECTS AND METHOD: Ten young patients from 6 to 8 years of age with a Class I malocclusion in the primary and mixed dentition with a deep bite. Interruption of an altered

sequence of binomial tooth muscles in subjects with deep bites using flexible devices must be determined.

RESULTS: The results are much faster and visible when the deep bite has been corrected in the primary dentition than intercepted in the first phase of the mixed dentition.

CONCLUSION: Paediatric orthodontics must direct its resources and energy to monitoring the oral development of children towards a more correct biological objective.

#### CP108 EARLY TREATMENT PROTOCOL FOR ANTERIOR OPEN BITE MALOCCLUSIONS: LONG-TERM OUTCOMES

Daniel Celli, Simone Sferra, Anna Lucia Greco, Roberto Deli, Catholic University of Sacred Heart, Rome, Italy

AIMS: Patterns of facial growth are established early in development. If an open bite malocclusion is left untreated and allowed to progress until the permanent dentition stage, the opportunity for growth modification could be lost, and surgical correction may remain as the only option. Early treatment gives the best results for long-term stability.

MATERIALS AND METHOD: The treatment protocol for an anterior open bite (AOB) malocclusion in children in the early mixed dentition stage includes a rapid maxillary expander, lingual grid, lingual arch, myofunctional therapy and occlusal grinding of primary teeth.

RESULTS: Early treatment of an open bite leads to an altered direction of condylar growth, favours a counterclockwise rotation of the jaw and clockwise rotation of the maxilla, increased posterior face height, and decreased anterior face height. It also controls maxillary and mandibular molar eruption and increases overbite.

CONCLUSION: Early treatment of an AOB intercepts the malocclusion, reduces the need for treatment during adolescence, facilitates normal tooth eruption and improves growth patterns.

#### CP109A SIMPLIFIED NOVEL APPROACH TO SKELETAL ANCHORAGE IN ORTHODONTICS

Nelson Rossi<sup>1</sup>, Rosa Rossi<sup>2</sup>, Nelson Carrieri Rossi<sup>3</sup>, Monica Dualibi<sup>1</sup>, Silvio Dualibi<sup>1</sup>,  
<sup>1</sup>Department of Translational Surgery and <sup>2</sup>Otorrhinolaryngology, Universidade Federal de São Paulo and <sup>3</sup>Department of Orthodontics, Funorte, São Paulo, Brazil

AIMS: The introduction of temporary skeletal anchorage into orthodontic appliances, allows elimination of the forces applied directly to the teeth. The aim of this report is to present a simplified kit of tools for skeletal anchorage that prevents poor oral hygiene, application of excessive forces or moments during insertion, peri-implantitis from placement in the mucosa, and less discomfort at removal.

SUBJECTS AND METHOD: The application of this system will be demonstrated in four different cases in which skeletal anchorage was needed to avoid unwanted results. Rapid palatal expansion with less tipping of the dentition, upper molar distalization without advancement of anterior teeth, skeletal anchorage to a facemask approach and a patient with a mutilated dentition will be presented to show the advantages of this procedure.

RESULTS: The advantages of this system include ease of clinical practice, use of flapless surgical procedures, minimal risk of damage to neurovascular bundles, and multiple applications.

CONCLUSION: The simple appliance design appears to offer significant skeletal, periodontal and biomechanical advantages, which will be verified with more clinical studies.

#### CP110 PATIENT-SPECIFIC NUMERICAL FINITE ELEMENT MODELS

Guillaume Boonen<sup>1</sup>, Stijn Debruyne<sup>2</sup>, Quentin de Crevoisier de Vomécourt<sup>1</sup>, Geert Bekaert<sup>2</sup>, Bart Vande Vannet<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Vrije Universiteit Brussel and <sup>2</sup>Faculty of Engineering Technology | Technology Cluster WIT Research Group Propolis, KU Leuven Campus Oostende, Belgium

AIMS: Creating numerical models of anatomical areas to estimate tissue adaptation processes and dental displacements induced by mechanical stimulus in lingual orthodontic

appliances. These models simulate and predict the behaviour of biological tissues in order to evaluate the clinical and histological effects, and to realize new dental appliances or improve existing ones.

**MATERIALS AND METHOD:** The general and diverse finite element (FE) method is used for analysis of coupled dental displacements. This method treats teeth, brackets, connection wire and cancellous bone as a set of structural components. Each of these is characterized by elastic properties such as Young's modulus, shear modulus and Poisson's ratio of its isotropically assumed material. By dividing each structural component into a coupled finite number of small elements, a numerical analysis of component stress or structural deformations. STL files obtained with an intraoral three-dimensional camera (Trios®, 3D shape, Denmark) and cone beam computed tomography (Vatech, New Jersey, USA) were converted to STEP files. Using Siemens NX software it was possible to convert the data to solid geometry. In a first approximation teeth were supposed to be infinitely stiff. This is allowed as teeth have a stiffness which is in orders of magnitude larger than stiffness of jaw bone. The outer surfaces of the teeth were merely used to establish contact between the teeth. Forces were transferred to the dental root via RBE2 elements, which were of infinite stiffness. The lingual brackets were modelled with solid elements. This enabled their connection to the teeth and contact between lingual brackets and single bracket connection wire was established. The driving force which caused the teeth to move relative to the jaw bone was modelled by a preload in the one-dimensional connection wire between brackets.

**RESULTS:** The different steps in setting up a FE model suitable for adequate numerical analysis of coupled dental deformations were performed. In detail important relevant numerical issues such as the optimal estimation of elastic properties of cancellous bone were incorporated.

**CONCLUSION:** This research demonstrates the possibilities of the FE method for these types of analysis and indicates the limitations. Patient-specific FE-models are in reach.

#### CP111 OCCLUSION AS THE FRAMEWORK OF THE FACE, EXTRACTIONS AS A TOOL OF BEAUTY: A CASE REPORT

Alessandro Musci<sup>1</sup>, Claudia Pisani<sup>2</sup>, Private Practices, <sup>1</sup>Casamassima and <sup>2</sup>Padova, Italy

**AIMS:** This case report describes how it is possible to obtain aesthetic improvement of the face with orthodontic treatment aimed not only at dental alignment but based on a broader view of the dento-maxillo-facial complex.

**SUBJECT AND METHOD:** A 23 year-old female complaining about her excessive proclined anterior teeth and the presence of dental crowding. To address this complaint, the patient had undergone previous orthodontic treatment carried out without extractions. Once the complete diagnostic records had been collected, it became evident that she had significant bimaxillary dental protrusion resulting in lip incompetence. The proposed orthodontic treatment included the extraction of the four second premolars as these were the most crowded teeth and also slightly dysplastic. Bimaxillary fixed orthodontic therapy was carried out with maximum anchorage mechanics for retraction of the incisor group of teeth.

**RESULTS:** At the end of the orthodontic therapy, the patient's chief complaint was fully addressed and a Class I ideal occlusion with the absence of dental crowding was achieved. Moreover, improved lip competence with dramatic ameliorative effects on the component of the facial profile and of the entire facial harmony was gained.

**CONCLUSION:** Correct repositioning of the teeth in the context of the dento-maxillo-facial complex can lead to benefits not only for the occlusion, chewing function and smile aesthetics but also to harmony of the entire face. During the diagnostic process it is important to go beyond the amount of dental crowding in the alveolar arches as the key factor for extraction or non-extraction therapy. As has been successfully demonstrated, orthodontists should evaluate, in each patient, the position of the dentition in to the morphologic landmarks of the naso-labial-unit for the upper incisors and of the labio-mental-unit for the lower incisors. Correct positioning of the incisors with respect to these maxillo-facial boundaries is the real key to be considered in the diagnostic process in order to achieve satisfactory results.

## CP112 AN INTERDISCIPLINARY APPROACH IN MULTIPLE TOOTH AGENESIS IN GROWING PATIENTS

Laura Andreeva<sup>1</sup>, Yassen Dimitrov<sup>2</sup>, Vesela Tsarik<sup>3</sup>, <sup>1</sup>Department of Orthodontics, Medical University - Sofia, Faculty of Dental Medicine and <sup>2</sup>Private Practice, Sofia, Bulgaria and <sup>3</sup>Private Practice, Moscow, Russia

**AIMS:** Multiple tooth agenesis is seen more frequently in orthodontic practice. It is identified at 8-9 years of age, but definitive treatment takes place 10 years later with implant restorations. The aim of the current study was to systemize the problems of growth and development of the facial skeleton and dental arches in patients with multiple tooth agenesis, which complicate orthodontic preparation of the dental arches for prosthetic restoration, e.g. interradicular distance at the implant site and alveolar bone quality and parameters.

**SUBJECTS AND METHOD:** Eight patients, (3 males, 5 females) with multiple tooth agenesis. The missing teeth were 12, 22, 15, 25, 31, 41, 35 and 45 and in three of the cases 37 and 47. Orthodontic diagnosis on cone beam computed tomographic images included growth, available space and alveolar bone parameters. Implant surgery and prosthetic restoration was planned and carried out with the interdisciplinary team specialists.

**RESULTS:** Patients with multiple tooth agenesis showed a delay of 2 years in dental age; an underdeveloped lower facial third; an asymmetric orbicularis oris muscle, which contributed to an irregular smile line; decreased mesio-distal width of the present teeth and/or irregular shape of the canines. Based on these results, treatment protocol was presented concerning dental arch size and form correction, space management, aesthetics and functional occlusion.

**CONCLUSION:** Multiple tooth agenesis requires an evidence-based orthodontic approach and prognosis of facial development of the patient and comprehensive orthodontic treatment of the dental arches and occlusion for complex functional and aesthetic restoration of the dentition.

## CP113 NOONAN SYNDROME: A CLINICAL CASE

Paola Di Giacomo, Stefania Migliaccio, Silvia Senatore, Angelica D'Errico, Gabriella Galluccio, 'Sapienza' Roma, Roma, Italy

**AIMS:** To illustrate the main and dental features of Noonan syndrome in a 11-year old male and its orthodontic approach.

**MATERIALS AND METHOD:** Medical records and clinical data were collected and compared with the scientific literature.

**RESULTS:** Cranio-dento-facial anomalies, learning and speech disabilities were evaluated.

**CONCLUSION:** Noonan syndrome is rare and orthodontic management is difficult.

## CP114 RETENTION PROTOCOL

Pilar España, Carmen Ruiz, Giselle Lambo, Maria Muñoz, Vicente Torres, Department of Orthodontics, Universidad Europea De Valencia, Spain

**AIMS:** To perform an analysis of the causes of relapse in orthodontics, the most used types of retainers and retention protocols.

**MATERIALS AND METHOD:** A literature review was performed on the basis of PubMed database using the keywords relapse, retention and orthodontics, obtaining a total of 75 articles found for humans, published in English in the last 5 years and in dental journals, of which 30 items were selected.

**RESULTS:** There is a short-term recurrence, due to periodontal remodelling after orthodontic treatment and a long-term recurrence, which responds to changes in the post-retention period, in which multiple causal factors are considered. The current most frequent types of retainers used are fixed in the lower arch and removable in the upper arch. An orthodontic retainer protocol, designed to achieve maximum stability post-treatment, will be presented.

**CONCLUSION:** There is no consensus among authors as to the type of retention or time of use. However, in the physiological basis of retention, there is scientific confirmation that the remodelling of the periodontal fibres requires an approximate minimum of 6-7 months.

#### CP115 ROOT ABSENCE OF THE FOUR FIRST PERMANENT MOLARS: A CLINICAL CASE

Anastasia Pouliaki, Zoe Triantopoulou, Aristotle Eleutherios G. Kaklamanos, Smaragda Kavvadia, Aristotle University of Thessaloniki, Greece

**AIMS:** To present a rare clinical case in which the first permanent molars (M1) in both dental arches had either no roots or extremely small root-like formations.

**SUBJECT AND METHOD:** A 12 year old female in the permanent dentition with an Angle Class II division 2 malocclusion. Her medical history was free of endocrinological or other systemic disorders and her dental history revealed no previous orthodontic treatment. Although clinical examination showed healthy periodontal tissues and the patient was free of pain or other complaints, radiographic examination at 7 years of age revealed total root absence in the upper M1 and partial in the lower. The rest of the dentition demonstrated general normal root morphology and size, even 1 year after orthodontic treatment with light and intermittent forces, despite the exfoliation of upper M1.

**RESULTS:** The absence of the roots of M1 in this case could be a result of either root resorption or aberrant root formation. Although application of orthodontic procedures could be a contributory factor to root resorption, these findings were already present at the age of 7 years and did not progress over time. As far as the aberrant root formation is concerned, this could be a possible explanation only if one stipulated incomplete penetration, as it usually involves almost the whole of the dentition.

**CONCLUSION:** Root development and tooth eruption remain among the least studied subjects in dentistry. Until there is greater comprehension of these processes, one can approach orthodontically such cases only by using light forces, as indicated in the relevant literature regarding teeth with short roots.

#### CP116 OSTEOGENESIS IMPERFECTA AND ORTHODONTIC TREATMENT: A CLINICAL CASE

Stefania Migliaccio, Caterina Candido, Giovanni Battista, Alessandra Putrino, Gabriella Galluccio, La Sapienza, Roma, Italy

**AIMS:** To describe a clinical case of osteogenesis imperfecta, associated with literature review.

**SUBJECT AND METHOD:** The facial facial traits and the malocclusion of a patient will be presented.

**RESULTS:** A triangularly shaped face and a Class III malocclusion were some of the distinctive traits of this patient.

**CONCLUSION:** Osteogenesis imperfecta is relevant to orthodontists.

#### CP117 AUTOTRANSPLANTATION USING THREE-DIMENSIONAL PRINTED MODELS: CASE REPORTS

Alexios Katsadouris<sup>1</sup>, Konstantinos Karamesinis<sup>1</sup>, Alina Cocos<sup>1</sup>, Polytimi Paschalidi<sup>2</sup>, Demos Kalyvas<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Oral & Maxillofacial Surgery, National and Kapodistrian University of Athens, Greece

**AIMS:** To present the use of three-dimensional (3D) printed models in assisting treatment planning and surgical procedures for improved outcome in autotransplantation cases.

**MATERIALS AND METHOD:** A literature review was conducted and the findings will be presented together with the therapeutic approach of two clinical cases. The first case was an 11 year old female with agenesis of both lateral incisors and both second premolars in the maxillary arch. It was decided to autotransplant the second mandibular premolars to the maxillary second premolar positions. In the second case of a 9 year old male with a supernumerary maxillary incisor and a fused central incisor, the supernumerary was transplanted to the position of the extracted fused incisor. In both cases, a 3D-printed model of the tooth to be transplanted was constructed from cone-beam computed tomography (CBCT) images. The tooth model was used during the surgical procedure to prepare the recipient site. This ensured that the time-critical procedure from extraction to transplantation

was rapid and direct, without the root of the transplanted tooth coming in contact with other objects or remaining exposed for more than a few seconds.

**RESULTS:** Both cases healed uneventfully and the transplanted teeth did not show any signs of inflammation, root resorption or ankylosis more than 6 months after the procedure. Tooth autotransplantation is an effective alternative approach for the treatment of patients with extracted or congenitally missing teeth. Thorough examination and diagnosis, careful treatment planning and choice of the correct donor tooth will guarantee high success rates.

**CONCLUSION:** CBCT imaging and 3D-printed models allow effective recipient site preparation that minimizes root exposure and periodontal ligament trauma, which lead to the success of autotransplantation, thus providing the clinician with an excellent treatment alternative to establish functional occlusion and achieve an aesthetic treatment result.

#### CP118 COMMONLY USED ORTHODONTIC RETAINERS

Jasna Petrovska<sup>1</sup>, Dragan Petrovski<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Prosthodontics, UKIM Faculty of Dentistry, Skopje, Former Yugoslav Republic of Macedonia

**AIMS:** Teeth tend to change throughout life due to use, wear, muscular and skeletal maturation. Retention is a phase of orthodontic treatment that attempts to keep teeth in the corrected positions after orthodontic treatment. Without a phase of retention there is a tendency for the teeth to return to their initial position. To prevent relapse every patient who has orthodontic treatment will require some type of retention. The aetiology of relapse is not fully understood, but relates to a number of factors, including periodontal and occlusal factors, soft tissue pressures and growth. Retention can be achieved by placing removable or fixed retainers. Retainers must maintain the teeth in position without compromising oral health. They must also be acceptable to the patients and be reliable.

**MATERIALS AND METHOD:** A recent survey carried out in the Department of Orthodontics at the Dental Clinic in Skopje, identified the most commonly used retainers, according to a questionnaire given to the clinicians who worked in the department. They had to choose between different retainer designs, such as removable retainers with labial bow, removable vacuum formed retainers, fixed bonded retainers and combination of fixed with removable retainers. They also had to select which type of retainer they preferred to use in the upper or lower arch, in cases with or without extraction, in cases with crowding and with spacing and according to the age of patient (child or adult).

**RESULTS:** The most frequently used were removable retainers with a labial bow, in both jaws, while removable vacuum-formed retainers were rarely used. Combinations of fixed with removable retainers were used in cases with crowding and without extractions. Fixed bonded retainers were mostly used in adults with crowding.

**CONCLUSION:** Teeth will move unless retainers are worn consistently and permanently. There are no exceptions to this statement.

#### CP119 TREATMENT OF A SKELETAL OPEN BITE WITH FIXED APPLIANCES – CASE REPORT

Zorana Stamenkovic, Vanja Raickovic, Nenad Nedeljkovic, Biljana Rakovic, Boris Milosavljevic, Department of Orthodontics, School of Dentistry, University of Belgrade, Serbia

**AIMS:** To show that a patient with a skeletal open bite can be successfully treated with upper and lower fixed appliances.

**SUBJECT AND METHOD:** An 18 year old male in the permanent dentition with a skeletal open bite treated with upper and lower fixed appliances. Clinical examination, study cast analysis, a dental pantomogram and a lateral cephalogram were obtained before treatment. Pre-treatment the overbite was -2.5 mm and the overjet 0 mm. The lateral cephalogram showed a decreased SN/SpP angle (anteinclination of the upper jaw), increased SN/MP angle (retroinclination of the lower jaw), increased basal angle (B) and infraposition of the upper and lower anterior teeth. Fixed appliances were worn for 16 months and, in the final stage, vertical intermaxillary elastics for correction of the open bite for 3 months.

**RESULTS:** At the end of the treatment, the overbite was 2 mm and the overjet 2 mm, SN/SpP angle increased and SN/MP angle decreased, the vertical interjaw relationship (B

angle) was corrected and the vertical position of the upper and lower anterior teeth was normalized. The patient is now in retention without signs of relapse and wears splints every night.

**CONCLUSION:** Mild forms of a skeletal open can be successfully treated without orthognatic surgery, but with upper and lower fixed appliances. The results of treatment were stable with a good occlusion, correct orofacial functions and acceptable facial aesthetics.

#### CP120 COMPUTER ASSESSMENT OF CERVICAL VERTEBRAL MATURATION USING DIGITAL LATERAL CEPHALOGRAMS

Vildana Dzemidzic<sup>1</sup>, Alisa Tiro<sup>1</sup>, Samra Salaga-Nefic<sup>2</sup>, Lejla Redzepagic-Vrazalica<sup>1</sup>, Enita Nakas<sup>1</sup>, <sup>1</sup>Department of Orthodontics, University of Sarajevo, School of Dental Medicine, Bosnia and Herzegovina and <sup>2</sup>Private practice, Bern, Switzerland

**AIMS:** To examine the reliability of a computer program for assessing the cervical vertebral maturation (CVM) stages.

**MATERIALS AND METHOD:** Digital lateral cephalograms of 99 subjects (47 males, 52 females) aged 9-16 years. For the purpose of this study a computer program was created 'Cephalometar HF V1'. Using this program, contours of the second, third and fourth cervical vertebrae were drawn on the digital lateral cephalograms which enabled computer determination of CVM stages. The assessment was carried out by one previously trained examiner. The assessment was undertaken according to the principles of Hassel and Farman. The degree of agreement between the computer program and the examiner was assessed by means of the quadratic weighted kappa test.

**RESULTS:** The agreement between computer and examiner assessment of CVM stages was a kappa coefficient of 0.985.

**CONCLUSION:** The Cephalometar HF V1 computer program is a reliable method for assessing CVM stages. This program could assist orthodontists in identifying CVM stages when planning treatment for patients with skeletal discrepancies.

#### CP121 THREE-DIMENSIONAL DEVIATION OF THE LOWER SECOND PREMOLAR ERUPTIVE PATH AND ITS POSSIBLE RELATIONSHIP WITH PALATAL DISPLACEMENT OF MAXILLARY CANINES

Maria Aurora Peiró-Guijarro, Natalia Zamora, Beatriz Tarazona, Vanessa Paredes, Jose Luis Gandia, Department of Stomatology, University of Valencia, Spain

**AIMS:** Palatal displacement of the maxillary canine is a clinical condition, which aetiology presents many doubts. Recent research relates it to other dental anomalies and asseverates that they share a single origin. In a previous investigation the association between palatal displacement of the maxillary canines and deviation of the mandibular second premolar eruptive path on panoramic radiographs was confirmed and an angle was established for early detection of this situation. The aim of this study was to develop a measurement method for the correct characterization of mandibular second premolar inclination on a cone beam computer tomograph (CBCT) and to determine whether there is a relationship between the inclination of these and palatal displacement of the maxillary canine.

**MATERIALS AND METHOD:** A retrospective analysis of all orthodontic cases with palatal displacement of the maxillary canines and CBCT evaluation was performed. A new system for determining the inclination of the second premolar was introduced measuring four angles on each CBCT. To characterize measurement reproducibility, intra- and interobserver coefficients of variation (CV) were found for each of the four angles. To quantify intraobserver reproducibility, 20 randomly selected CBCTs were traced and measured one week later by the principal examiner, while these same 20 CBCTs were traced and measured by a second observer to analyze interobserver CV.

The results were compared with the same measurements performed in a control group.

**RESULTS:** The CV suggested that there is no trend towards a greater or lower evaluation between measurements.

**CONCLUSION:** Measuring the angulation of unerupted lower second premolars on a CBCT is reproducible.

## CP122 MULTIDISCIPLINARY APPROACH TO OBTAIN MAXILLARY ANTERIOR AESTHETICS: A CASE REPORT

Mehmet Canpolat<sup>1</sup>, Hüseyin Alkış<sup>1</sup>, Uğur Burak Temel<sup>2</sup>, Departments of <sup>1</sup>Orthodontics, and <sup>2</sup>Restorative Dentistry, Suleyman Demirel University, Faculty of Dentistry, Isparta, Turkey

**AIMS:** To present the results of orthodontic therapy combined with conservative veneer treatment of a patient with anterior dental discrepancy.

**SUBJECT AND METHOD:** Fixed orthodontic treatment was planned for a 13 year old female referred regarding diastemas. Radiographic evaluation showed that the maxillary lateral incisors were congenitally absent. Intraorally it was observed that the maxillary molars had an Angle Class II molar and canine relationship, and the maxillary canines and central incisors a narrow mesio-distal width. After orthodontic treatment, the maxillary canines and central incisors were restored with laminate veneer. The teeth were not subjected to any preparation. Impressions were taken using polyvinyl-siloxane impression material. All laminate veneers were fabricated using an indirect composite material.

**RESULTS:** Fixed orthodontic treatment resulted in an Angle Class II molar relationship. With indirect composite laminate veneer, the diastemas were closed and lateral incisor form was given to canine teeth.

**CONCLUSION:** The conservative laminate veneer technique can be safely used for recontouring teeth and closing diastemas after fixed orthodontic treatment. Therefore, treatment can be undertaken preserving the sound tooth substance.

## CP123 RECORRECTION OF A CENTRAL INCISOR WITH A VACUUM-FORMED RETAINER AFTER ORTHODONTIC TREATMENT

Mehmet Savaş Kayasan, Sabahattin Bor, Fatih Kazanci, Department of Orthodontics, Yuzuncu Yil University Faculty of Dentistry, Van, Turkey

**AIMS:** To show the recorreption of an impacted right central incisor by elastic traction with vacuum-formed retainer (VFR) based anchorage

**SUBJECT AND METHOD:** A 15-year-old girl whose active orthodontic treatment had been completed. Just after debonding VFRs were placed and the patient was informed about how to use the appliances. The patient attended a follow-up control after one month but at the 3 month control it appeared that the patient had not worn her appliances. During this period, intrusion and protrusion was observed of the right maxillary central incisor. Two buttons were placed on the palatal aspect of the VFRs and the tooth was extruded and retracted with elastics from buttons between the central incisor and appliance. After 5 weeks the tooth was aligned and a circumferential supracrestal fiberotomy was carried out and a fixed retainer placed.

**RESULTS:** Using elastics for 5 weeks resulted in the central incisor being retracted into its original position.

**CONCLUSION:** Tooth movements can be accomplished by elastic traction. Using VFRs as an anchorage appliance is convenient because of its simple use and aesthetic properties.

## CP124 EFFICACY OF THE CLEAR ALIGNER SYSTEM IN PERIODONTAL RECESSIONS: CASE REPORT

Francesca Pegna, Matteo Colosimo, Silvia Schiavoni, Alessandra Greci, Department of Orthodontics, San Pietro Hospital-University of Tor Vergata, Roma, Italy

**AIMS:** The aesthetics of the smile in dentistry is an important aspect in prosthetic, conservative and orthodontic treatment planning and, not least, periodontal rehabilitation. The aim of this work is to demonstrate, through the presentation of a clinical case, the aesthetic results, following periodontal treatment, of the use of removable orthodontic aligners (Invisalign), in a patient with multiple periodontal recessions.

**SUBJECT AND METHOD:** A 24 year old female with periodontal recession in quadrants I and II and also a dental Class II malocclusion, anterior open bites and atypical swallowing. It was decided to proceed primarily with periodontal rehabilitation and simultaneous correction of the atypical swallowing and, finally, to undertake orthodontic treatment through the use of clear aligners.

**RESULTS:** The aesthetic results obtained allowed the Invisalign to be considered as the orthodontic system of choice in periodontal patients, both for the simple oral hygiene procedures (during the treatment) and the application of light orthodontic forces, without the use of invasive techniques.

**CONCLUSION:** Invisalign can be considered an aesthetic system to address and resolve different malocclusions in patients with periodontal disease, when it is not recommended to use heavy orthodontic forces. Good oral hygiene is a prerequisite for healthy periodontal tissues.

#### CP125 THE DISCREPANCY INDEX EVALUATED BY CONE BEAM COMPUTED TOMOGRAPHY

Elena de Vicente, Beatriz Tarazona, Maria Aurora Peiró-Guijarro, Vanessa Paredes, Jose Luis Garcia Franco, Department of Orthodontics, Universidad de Valencia, Spain

**AIMS:** Arch discrepancy measurement is an important calculation for correct diagnosis and treatment planning. The aim of this study was to assess the reliability and accuracy in measuring arch discrepancy using cone beam computed tomography (CBCT) and to compare it with the same measurements obtained using a two-dimensional (2D) digital method.

**SUBJECTS AND METHOD:** Fifty patients were randomly selected. Plaster study models and a CBCT image were obtained. The CBCT used was the Picasso Master 3D® (Ewo Technology, South Korea, 2005) with a voxel resolution of 0.1 mm and a field of view of 0.4 × 0.4 × 0.4 mm. The images were sent in Dicom format to the InVivo Dental Company to be segmented and to obtain three-dimensional images of the models. Plaster study casts were made for the 50 patients and then digitised and measured using the 2D digital method. Tooth measurements were undertaken for each of the models.

**RESULTS:** No significant differences were found between the measurements from the two methods. The differences existing between both methods were clinically acceptable.

**CONCLUSION:** CBCT allows determination of upper and lower arch discrepancy measurement accurately and reproducibly in comparison with those of digital models obtained from the digitization of traditional plaster casts.

#### CP126 HYBRID MOLAR DISTALIZATION APPLIANCE FOR UPPER MOLAR DISTALIZATION: A CASE REPORT

Gökhan Serhat Duran, Alaattin Tekeli, Serkan Görgülü, Department of Orthodontics, Gulhane Military Medical Academy, Ankara, Turkey

**AIMS:** To evaluate the effects of a palatal miniscrew anchored intraoral appliance designed for upper molar distalization on dentofacial structures.

**SUBJECT AND METHOD:** A 13 year-old female with the chief complaint of irregularly placed upper teeth. Cephalometric analysis revealed a protrusive maxilla and retruded mandible having Class II skeletal bases with an ANB angle of 5 degrees. Intraoral examination showed an Angle Class II molar relationship on both sides and a severely ankylosed maxillary left central incisor displaced 5 mm apically relative to the adjacent central incisor. A traumatic injury at the age of 11.5 years had resulted in avulsion and root resorption of the maxillary left central incisor, which was later reimplanted and endodontically treated. Non-extraction molar distalization treatment was planned for the anterior crowding and Class II molar relationship. The anchorage unit was prepared by placing two miniscrews in the anterior palatal area. Orthodontic bands were then placed on the maxillary first molars. Stainless steel abutments and molar bands were soldered to Hyrax screw arms. Pre- and post-treatment dental casts were scanned to create three-dimensional (3D) models using a 3D scanner and assessed with reverse engineering software. Molar, premolar and incisor movements were evaluated after distalization and preadjusted fixed appliances were placed in both arches for levelling and alignment.

**RESULTS:** A bilateral Class I molar and canine relationship with optimal alignment of both arches was obtained. Successful distalization of the maxillary molars into a Class I position was achieved in 4 months. After distalization, 3D dental cast analysis revealed no significant sagittal anchorage loss or increase in anterior crowding. In addition to the distal tipping of

premolars, the maxillary first molars moved a mean of 8.2 mm in the Y plane, 0.94 mm in the X plane and were intruded 0.4 mm in the Z plane.

**CONCLUSION:** The palatal miniscrew anchored distalization appliance is a fixed appliance, which does not rely on patient compliance and is clinician-controlled. Lack of need for patient compliance, and bodily molar distalization without anchorage loss in the anterior area are the main advantages of the appliance.

#### CP127 THE MIDPLANE IDENTIFICATION OF THE FACE IN THREE-DIMENSIONAL VOLUME ANALYSIS OF A SELECTION OF CASES

Tamas Vizkelety<sup>1</sup>, Zsolt Markella<sup>2</sup>, Adrienn Dobai<sup>1</sup>, Adrienne Rosta<sup>3</sup>, József Barabás<sup>1</sup>,  
<sup>1</sup>Department of Oral and Maxillofacial Surgery and Dentistry, Semmelweis University, Budapest, <sup>2</sup>Kálmán Kandó Faculty, Óbuda University, Budapest and <sup>3</sup>Dento-Cura Ltd., Budapest, Hungary

**AIMS:** To evaluate cephalometric landmarks in three-dimensional (3D) database produced by a cone beam computed tomographic (CBCT) scan that are acceptable to determine the midplane of the head in extreme cases, i.e. traumatic cases or craniofacial deformities.

**MATERIALS AND METHOD:** Looking through the literature of the classical lateral headplate in the region about the skull base as points in the midplane, nasion, sella and basion are generally used. Crista galli is just mentioned in the antero-posterior headplate as cephalometric landmark. Sixty randomly selected cases were analysed. The dimension of the applied voxel was 0.4 mm. The above mentioned five points were analysed using CranioViewer software. It shows the volumes in five different forms: CT-sections, radiographic view, MIP, AMIP and X-ray slice.

**RESULTS:** Transverse standard deviations were never more than 0.5 mm. Sagittal standard deviations, but only in the case of crista galli, were more than 0.5 mm, but under 1.0 mm and all other landmarks under 0.5 mm. The standard deviations in the vertical direction were under 0.5 mm except for crista galli and dens point (the centre of the coronal section of the dens axis where it is the greatest sagittally and transversally). The distance between the regression plane, which represents the midplane of the face, and the five points was also evaluated. The mean of them was smaller than 0.1 mm.

**CONCLUSION:** Based on the examined data, the validity of the points are similar to each other in the coronal plane in a transverse direction. The results show if one of the above points is injured or deformed by an accident it can be replaced with another if we accept that three points are enough to determine a plane.

#### CP128A CLASS II MALOCCLUSION TREATED WITH AN ADVANCED IMPLANT-SUPPORTED DISTALISATION APPLIANCE.

Maria Kourakou<sup>1</sup>, Ilias Mistakidis<sup>1</sup>, Argiro Kechagia<sup>2</sup>, Moschos Papadopoulos<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Aristotle University of Thessaloniki and <sup>2</sup>Private Practice, Athens, Greece

**AIMS:** Conventional orthodontic treatment of patients with a Class II malocclusion presenting poor cooperation can be challenging, while non-compliance distalisation appliances are associated with anchorage loss. The aim of this presentation is to present and discuss the orthodontic treatment of a patient with a bilateral Class II malocclusion by means of the advanced molar distalisation appliance (AMDA) supported by miniscrew implants (MIs).

**SUBJECT AND METHOD:** An 11-year old boy with a bilateral Class II malocclusion and increased overjet and overbite. Initially, the AMDA was used, which was supported by two MIs inserted in the paramedian region of the anterior palate, in order to distalise the maxillary first molars. Following distalisation, the same appliance was used after intraoral modification to support posterior anchorage during anterior tooth retraction, which was accomplished with fixed appliances.

**RESULTS:** After 5.5 months of distalisation, a bilateral Class I molar relationship was achieved. During this period, the maxillary premolars and canines drifted distally due to the pull of the transseptal fibres. Following anterior tooth retraction and an additional 14 months of fixed appliance treatment, Class I molar and canine relationships were established with satisfactory interdigitation of the posterior teeth and acceptable overjet and overbite, while

facial aesthetics was improved. No anchorage loss was observed during the distalisation period or during anterior tooth retraction.

**CONCLUSION:** Comprehensive treatment of a Class II malocclusion with the AMDA can be considered as an effective non-compliance treatment option diminishing common side effects.

#### CP129 ASYMMETRIC, NON-COMPLIANCE MOLAR DISTALISATION UTILISING AN ADVANCED IMPLANT-SUPPORTED DISTALISATION APPLIANCE

Ilias Mistakidis<sup>1</sup>, Maria Kourakou<sup>1</sup>, Eleni Alexiou<sup>2</sup>, Moschos Papadopoulos<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Aristotle University of Thessaloniki and <sup>2</sup>Private Practice, Athens, Greece

**AIMS:** Unilateral distalisation of maxillary molars is considered challenging when performed by conventional means, such as extraoral headgear. The aim of this report is to present and discuss the orthodontic treatment of a patient with a unilateral Class II molar relationship by means of the advanced molar distalisation appliance (AMDA) supported by miniscrew implants (MIs).

**SUBJECT AND METHOD:** A 14-year old girl with a unilateral Class II malocclusion. Her chief complaint was an impacted right maxillary canine. The AMDA was used to asymmetrically distalise the right maxillary first molar. Skeletal anchorage was provided by two MIs, inserted paramedian in the anterior region of the palate. Treatment was followed by conventional full fixed appliances in the upper and lower arch.

**RESULTS:** The right maxillary first molar was successfully distalised to a Class I relationship in 5 months, while no side effects were observed in the left quadrant. During that period the right maxillary premolars drifted distally with the help of the transseptal fibres. The right maxillary canine erupted spontaneously and was guided towards the arch as space was created using an open coil spring. After 28 months of fixed appliance treatment, Class I molar and canine relationships were established, with satisfactory interdigitation of the posterior teeth, and an acceptable overjet and overbite.

**CONCLUSION:** This case report illustrates the use of AMDA to asymmetrically distalise the maxillary molars, providing an aesthetic, non-compliance, non-extraction, and efficient approach for the orthodontic treatment of patients with a unilateral Class II malocclusion.

#### CP130 TREATMENT OF A SEVERE ASYMMETRIC SKELETAL OPEN BITE WITH SKELETAL ANCHORAGE IN AN ADULT PATIENT WITH AMELOGENESIS IMPERFECTA: CASE REPORT

Claudia Schumacher, Irene Kapogianni, Benedict Wilmes, Dieter Drescher, Department of Orthodontics, University of Dusseldorf, Germany

**AIMS:** A skeletal anterior open bite (AOB) is one of the most challenging malocclusions to correct because it is difficult to establish absolute anchorage for molar intrusion with traditional orthodontic mechanics. An AOB is often seen in patients with amelogenesis imperfecta. This presentation will show the treatment of a patient with amelogenesis imperfecta Type I and a severe skeletal AOB.

**SUBJECT AND METHOD:** The 18.5 year old male patient presented a severe AOB (-7 mm) and increased anterior lower face height. Asymmetric molar intrusion was performed using a so-called mouse trap appliance anchored by two orthodontic mini-implants (Benefit System, 2 × 9 mm) in the anterior palate. After six months, intrusion of the molars was sufficient to achieve a vertically symmetric dental arch. The skeletal discrepancy was corrected by a subsequent bimaxillary osteotomy with impaction of the maxilla and a set back of the mandible. After completion of post-surgical orthodontics the teeth were fitted with crowns by the prosthodontist.

**RESULTS:** Comprehensive orthodontic, surgical, and prosthodontic care resulted in a functionally and aesthetically pleasing result.

**CONCLUSION:** Molar intrusion with skeletal anchorage proved to be a useful treatment option in pre-surgical orthodontics.

#### CP131 THE USE OF CONE BEAM COMPUTED TOMOGRAPHY IN TREATMENT PLANNING IN CASE OF MESIODENS

Elena Papuzzo, Martina De Scisciolo, Stefano Di Vecchio, Francesca Pegna, Antonella Maselli, Department of Orthodontics, Fatebenefratelli San Pietro Hospital, Rome, Italy

**AIMS:** To illustrate the use of three-dimensional (3D) diagnosis [cone beam computed tomography (CBCT)] to facilitate the treatment planning process and to develop the most correct and minimally invasive procedures in young subjects with supernumerary teeth.

**SUBJECTS AND METHOD:** Young patients aged 8 to 9 years, with the presence of supernumerary teeth (mesiodens) detected on conventional radiographs, were submitted to CBCT in order to study the real 3D position of the mesiodens and the relationship with the radicular surfaces of the incisors. Then surgical extractions were performed and, in most cases, post-surgical orthodontic treatment was not necessary.

**RESULTS:** CBCT provides the chance to develop the most accurate and least invasive treatment plan. The decision to use CBCT should be based on the diagnostic information required, and in most cases provide the clinician with more details, more contrast, and the 3D position of the mesiodens.

**CONCLUSION:** CBCT is crucial for exact localization, treatment planning and to perform a minimally invasive surgical approach in young patients with supernumerary teeth.

#### CP132 CAN CLEAR ALIGNERS BE USED IN SEVERE MALOCCLUSIONS AND COMPLEX MULTIDISCIPLINARY CASES?

Alessandra Greci, Beatrice Dapei, Elena Papuzzo, Stefano Di Vecchio, Department of Orthodontics, San Pietro Hospital University of Tor Vergata, Rome, Italy

**AIMS:** Since the introduction of the Invisalign system, there have been numerous controversies regarding its routine applicability for treating difficult orthodontic malocclusions. These clinical cases aim to confirm whether the use of the Invisalign system may represent an effective and efficient alternative for treating complex cases compared with traditional techniques.

**SUBJECTS AND METHOD:** The study analyzed a group of five patients with different severe malocclusions treated using the Invisalign system.

**RESULTS:** Complex malocclusions could be successfully treated achieving a correct occlusion, physiological functional parameters and good aesthetic results. Extrusion in open bite and crossbite malocclusions represented the most difficult movements to control, and required a long treatment plan.

**CONCLUSION:** New innovations, such as deep bite attachments, bite ramps, optimized attachment, pressure point and power ridge, have been introduced to improve control over dental movements and anchorage thus facilitating the resolution of severe malocclusions. In addition to above, the use of the Invisalign system contributed to a simplification in personal maintenance and improved aesthetic treatment that was the key factor in motivating adult patients to undergo orthodontic treatment that could not be otherwise obtained by more traditional approaches.

#### CP133 ORTHODONTIC MANAGEMENT OF COOLEY'S ANAEMIA. A CASE REPORT

Giovanni Battista, Stefania Migliaccio, Silvia Zicari, Paola Di Giacomo, Gabriella Galluccio, 'Sapienza' Università di Roma, Italy

**AIMS:** To evaluate the feasibility of orthodontic treatment in a patient with  $\beta$ -thalassaemia.

**SUBJECT AND METHOD:** A young patient who underwent bone-marrow transplantation and orthodontic therapy.

**RESULTS:** Facial abnormality can be prevented by combined haematological and orthodontic therapy.

**CONCLUSION:** Orthodontic therapy can be easily performed.

#### CP134 A RARE CASE OF CHERUBISM – CASE REPORT

Raluca-Maria Vieriu<sup>1</sup>, Liviu Zetu<sup>2</sup>, Alexandru Ogodescu<sup>3</sup>, Sorana Rosu<sup>4</sup>, Irina Zetu<sup>1</sup>, <sup>1</sup>1st Department, Discipline of Orthodontics and Dentofacial Orthopedics and <sup>2</sup>2nd Department, Discipline of Periodontology, Grigore T.Popa' University of Medicine and Pharmacy, Faculty of Dental Medicine, Iasi, <sup>3</sup>2nd Department, Discipline of Paedodontics-Orthodontics, 'Victor

**AIMS:** To present a rare case of cherubism and to review the clinical and radiological features in order to facilitate diagnosis and treatment planning of the disease.

**SUBJECT AND METHOD:** A male aged 9 years, with a history of cherubism. Extraorally, he presented a round facial form with broad cheeks and painless bilateral enlargement of the lower face. The vertical thirds were not well balanced, with an increased lower vertical floor. Intraorally, he was in the early permanent dentition stage. Generalized spacing of the teeth was observed in both arches. There was an increased overjet and a Class II dental relationship. A maxillary diastema of 5 mm was present between the central incisors. A posterior dental crossbite was noted on the left side and delayed eruption and numerous dental malpositions were observed. The panoramic radiograph revealed multilocular bilateral lesions in the mandible extending from the body to the ramus associated with displacement of teeth out of their normal position. The teeth appeared to be floating in radiolucent spaces. Multiple tooth impaction and a delayed eruption pattern was observed. The second mandibular premolars and permanent second and third molars were missing in all quadrants. The treatment plan included maxillary expansion with a quadhelix in order to correct the crossbite, surgical removal of the impacted second upper premolars and a fixed appliance for correcting the dental malposition and Class II relationship.

**RESULTS:** Multidisciplinary treatment planning is required in order to provide the best clinical results. Good collaboration between the oral surgeon and the orthodontist is needed to determine the long-term prognosis of the dentition. The patient is currently at the beginning of orthodontic treatment to correct the crossbite.

**CONCLUSION:** The management of cherubism varies between individual cases. Conservative management is the preferred treatment as cherubism has a self-limiting course and begins to regress after puberty. Active orthodontic treatment helps reposition the impacted teeth, guide dental eruption, and correct the dental discrepancies in order to obtain a good and stable occlusion.

#### CP135 SEVERE DEEP BITE TREATMENT WITH CLEAR ALIGNERS AND CUSTOMIZED RAMPS†††

Chiara Colasante, Mario Greco, Aldo Giancotti, Department of Orthodontics, University of Rome Tor Vergata, Italy

**AIMS:** To illustrate the use and efficacy of a new generation of clear aligners (Invisalign G5) in subjects with a severe deep bite.

**SUBJECTS AND METHOD:** Thirteen young adult patients aged 30 and 35 years of age, with a Class I malocclusion, severe deep bite, moderate crowding, hypodivergent skeletal pattern. Panoramic radiographs were obtained before and after treatment. All patients were treated by means of a new generation of clear aligners with deep bite features represented by customized anterior occlusal ramps positioned on the maxillary central and lateral incisors, for posterior disclusion and lateral optimized attachments for premolar extrusion. The customized ramps moving from aligner to aligner in a more occlusal position.

**RESULTS:** All patients showed, at the end of treatment, a Class I molar and canine relationship with a correct overbite. Correction of the overbite was achieved with more predictability and matching more precisely digital projection.

**CONCLUSION:** New generation clear aligners proved to be an efficient technique to manage a severe deep bite in adult patients.

#### CP136 ASSESSMENT OF TONGUE POSTURE IN AN ANTERIOR OPEN BITE SUBJECT USING THREE-DIMENSIONAL ULTRASONOGRAPHY. A CASE REPORT

Sanda Lah Kravanja<sup>1</sup>, Maja Marolt Mušič<sup>2</sup>, Irena Hočevar Boltežar<sup>3</sup>, Maja Ovsenik<sup>4</sup>,  
<sup>1</sup>Orthodontics, Dental centre dr. Lah Kravanja, Bovec, <sup>2</sup>Institut of Oncology, University Medical Centre, Ljubljana, <sup>3</sup>Clinic of Otorhinolaryngology and Cervikofacial Chirurgy, University Medical Centre, Ljubljana and <sup>4</sup>Department of Orthodontics and Maxillofacial Orthopaedics, University of Ljubljana, Medical Faculty and University Medical Centre, Ljubljana, Slovenia

**AIMS:** To present and objectify functional diagnostics in orthodontics using three-dimensional ultrasound (3D US) assesment of tongue posture,. and to evaluate the association of ear-nose-throat (ENT) conditions and speech disorders in anterior open bite (AOB) in the primary dentition in preschool children.

**SUBJECT AND METHOD:** A 5 year-old girl with an AOB in the primary dentition. Clinical examination, questionnaires, facial and intraoral photographs and dental casts were taken at baseline. The girl was also examined by an ENT specialist and a speech therapist for ENT condition, phonetic and speech disorders and a kindergarten speech therapist was consulted. 3D US diagnostics was performed by an experienced radiologist and orthodontist independently using 3D US Voluson 730 Expert with 3D convex conductor (RAB 2-5 MHz, GEH). Tongue posture was assesed twice and compared with a referential tongue position in children without an AOB in the primary dentition. Differences in tongue positions were assessed with 4D View Program, Version 5.0. The data were analyzed using the statistical program SPSS (Chicago, Illinois, USA).

**RESULTS:** Clinical findings showed that the girl's face was symmetrical, the lip seal was incompetent, she breathed through the nose and mouth, there was a visceral type of swallowing, improper tongue posture. and speech disorders. Intraoral examination revealed a Class II malocclusion with an increased overjet and the presence of an AOB. 3D US of tongue posture showed the tongue to be on the mouth floor and in the interdental gap, which differed from the resting tongue position.

**CONCLUSION:** Non-invasive US of tongue posture together with functional clinical examination of the face can be an important tool in early diagnostics of tongue irregularities as well in the assessment of space conditions of the oral cavity. Furthermore, US could also more objectively evaluate the role of the tongue in the early aetiology of an AOB in the primary dentition, treatment planning and retention in preschool children.

#### CP137 CASE REPORT OF OCULOFACIOCARDIODENTAL SYNDROME

Mao Sato, Yoshiyuki Baba, Division of Pedodontics and Orthodontics, National Center for Child Health and Development, Tokyo, Japan

**AIMS:** Oculofaciocardiodental (OFCD) syndrome is a condition that affects development of the eyes, facial features, heart, and teeth. The prevalence of this syndrome is approximately 1/1,000,000, and only females present with this condition because of its X-linked inheritance. The clinical diagnosis of OFCD syndrome can be challenging because the symptoms vary widely. The dental characteristics include very rare conditions that require comprehensive dental management, such as canine radiculomegaly, delayed dentition, oligodontia, persistent primary teeth, microdontia, and macrodontia. The aim of this presentation is to demonstrate the dentofacial features of a growing patient with OFCD syndrome.

**MATERIALS AND METHOD:** Cephalograms, dental pantomograms, dental casts, oral and facial photographs, and medical records were used to assess craniofacial and dentoalveolar characteristics.

**RESULTS:** The patient, a Japanese girl, was 5 years 10 months of age at her first visit. Her birth weight and height were 3315 grams and 49.4 centimeters, respectively. The patient had an atrial heart septal defect, microphthalmia, congenital cataract, glaucoma, deformity of the extremities, and a cleft palate. A long facial appearance, thick upper and lower lips, and a high nasal bridge and broad nasal tip were also noted. Cephalometric analysis revealed a lack of skeletal discrepancy in both jaws ( $SNA = 82.3^\circ$ ,  $SNB = 77.8^\circ$ ), but a high mandibular angle ( $FMA = 36.5^\circ$ ). Dental anomalies included radiculomegaly of the lower left and microdontia of the upper left primary canines. The upper primary central and lateral incisors were fused on both sides, and both lower primary lateral incisors, both lower lateral incisors, the upper right second premolar, and the lower left second premolar were congenitally missing. At 9 years 11 months of age, a diagnosis of OFCD syndrome was verified by genetic analysis, in which mutations in the BCOR gene were found.

**CONCLUSION:** This patient demonstrated a wide variety of dental anomalies. The radiculomegaly in the primary teeth noted in this case implies that a diagnosis of OFCD syndrome can be made by clinical findings during the primary or mixed-dentition stage.

## CP138 SKELETAL CLASS II TREATMENT WITH REMOVABLE APPLIANCES

John Brabant, Evolve Orthodontics, Albury, Australia

**AIMS:** To evaluate if Class II skeletal malocclusions can be treated without fixed appliances, namely by a combination of a Twin Block (TB) appliance and Teen Invisalign.

**SUBJECTS AND METHOD:** A study was undertaken to evaluate treatment of growing Class II skeletal patients with removable appliances only. An initial period of TB therapy utilising the Clark TB appliance was used, creating changes in three dimensions, antero-posterior, vertical and transverse as required. A second phase of therapy involved the use of the Teen Invisalign to evaluate if this treatment modality could align the dentition and correct the large lateral open bites left at the completion of TB therapy. Five patients were evaluated.

**RESULTS:** Photographs, radiographs and cephalometric superimpositions showed that all five patients were treated successfully with the combination technique of a TB appliance followed by the Teen Invisalign. All cases were treated to Class I occlusions with greatly improved profiles and lip postures.

**CONCLUSION:** Skeletal Class II malocclusions in growing patients can successfully be treated by a combination of removable appliances without the need for fixed appliances.

## CP139A SEVERE ANTERIOR OPEN BITE AND SKELETAL CLASS II HIGH ANGLE MALOCCLUSION TREATED WITH BIMAXILLARY MOLAR INTRUSION USING SKELETAL ANCHORAGE

Yuji Ishida, Takashi Ono, Department of Orthodontic Science, Tokyo Medical and Dental University, Japan

**AIMS:** To describe the treatment of a patient with a severe anterior open bite (AOB) and skeletal Class II high-angle malocclusion using skeletal anchorage. This alternative treatment is based on scientific findings concerning correcting an AOB with a Class II molar relationship, excessive facial height and difficulty in speech.

**SUBJECT AND METHOD:** A 20-year-old female with a severe AOB, Class II molar relationship, lip protrusion, tongue thrust and difficulty in speech and mastication. Her chief complaints were difficulties in pronunciation of the /i/ sound, mastication and closing her mouth. Clinical examination showed an AOB with an overjet of 5.5 mm, an overbite of -7.5 mm, and bilateral Angle Class II canine and molar relationships. Cephalometric analysis revealed a skeletal Class II relationship (ANB: 9.0°), a large mandibular plane angle (FMA; 32.0°), and an excessive lower face height. The treatment objectives included intrusion of the posterior teeth in both arches, attainment of a Class I molar relationship, and elimination of the bimaxillary protrusion. Before and after treatment with a fixed appliance, mandibular movement and surface electromyographic (EMG) activity of the masticatory muscles were recorded.

**RESULTS:** After a 31-month treatment period, intrusion of the maxillary and mandibular molars and elimination of the bimaxillary protrusion were achieved by extracting four premolars and using skeletal anchorage. Improvement of the profile and masticatory and speech function was observed. Maximum jaw-opening and lateral jaw movement were increased after treatment. EMG activity also increased after treatment.

**CONCLUSION:** Intrusion of the maxillary and mandibular posterior teeth using skeletal anchorage provided satisfactory results in an adult patient. An ideal dental occlusion, aesthetic improvement and correction of oral function were achieved. This approach should be considered as an alternative treatment option for adults with a severe AOB.

## CP140 SURGICALLY ASSISTED LATERAL EXPANSION IN TRANSVERSE DEFICIENCY ADULT CASES

Teruo Sakamoto, Kenji Sueishi, Department of Orthodontics, Tokyo Dental College, Chiba, Japan

**AIMS:** Transverse maxillo-mandibular discrepancies are a major component of several malocclusions. Orthopaedic and orthodontic forces are routinely used to correct transverse deficiency in young patients. Correction of transverse deficiency in a skeletally mature

patient results in problems such as gingival recession and hyperesthesia because the mechanical stress is loaded on the cervical region of teeth. Surgically assisted lateral expansion has gradually gained popularity as a treatment option to correct transverse deficiency in adults. The aim of this presentation is to show the procedure and the therapeutic effects.

**SUBJECTS AND METHOD:** Case 1, a 22-year old female with the chief complaint of an open bite and mastication disorders. The patient was diagnosed with mandibular prognathism and a skeletal open bite with contraction of the maxillary arch. The treatment plan was maxillary lateral expansion with a hyrax type expander with an osteotomy and sagittal splitting ramus osteotomy. Case 2, a 17-year old male with the chief complaint of maxillary protrusion. This case was diagnosed as skeletal maxillary protrusion with a bilateral posterior scissor bite (Brodie bite) due to constriction of the mandibular arch. The aim of treatment was to expand the mandibular arch using a fixed type expander with a corticotomy and extraction of the left maxillary first premolar to improve maxillary protrusion.

**RESULTS:** In case 1, the canine to canine width of upper jaw was increased 4 mm and the first molar width 10 mm after treatment. Facial asymmetry and mandibular protrusion was improved. In case 2, the lower canine to canine width was increased 7 mm and the molar width to 7 mm after treatment. Maxillary protrusion was improved and a good profile was gained. Both subjects showed satisfactory cosmetic and functional results. A correct overjet and overbite and tight interdigitation was achieved. Gingival recession, root exposure and hypersensitivity were not noted. Seven years after retention (case 1) and 2 years 7 months after retention (case 2), there was no relapse; the canine to canine width and molar width was maintained and stable.

**CONCLUSION:** Surgically assisted lateral expansion using osteotomy or corticotomy is effective in adult patients with transverse deficiency.

#### CP141A NEW APPROACH FOR TREATMENT OF SKELETAL CLASS III MALOCCLUSIONS – THE SURGERY FIRST APPROACH

Sunil Muddaiah Kanjithanda, Sanju Somaiah, Balakrishna Shetty Shetty, Department of Orthodontics, Coorg Institute of Dental Sciences, Virajpet, India

**AIMS:** The 'surgery first approach' (SFA) is a new treatment philosophy in which orthognathic surgery precedes orthodontic treatment. In selected cases by eliminating the pre-surgical phase SFA can decrease treatment duration and improve the patient's profile from the very beginning of orthodontic treatment. Here the treatment of a skeletal Class III subject with dentofacial asymmetry with SFA is described.

**SUBJECT AND METHOD:** A 24-year-old female with the chief complaint of a forwardly placed lower jaw. She had a skeletal Class III malocclusion with a normal growth pattern and a Class III molar and canine relationship. The upper midline was shifted towards the right by 0.5 mm and the lower midline was shifted towards the left by 2.5 mm. She was treated with the SFA in which a bilateral sagittal split osteotomy set back was carried out followed by orthodontic therapy.

**RESULTS:** There was remarkable change in the patient's profile and smile aesthetics. A Class I molar and canine relationship was established with correct intercuspation. The advantage of this technique is that the pre-surgical phase is eliminated and the patient's chief complaint is addressed from the beginning.

**CONCLUSION:** The SFA is a viable treatment protocol in selected subjects. Indications for SFA are patients with minimal crowding, a flat or mild curve of Spee, normal incisor inclination and mild facial asymmetry. By careful case selection and precise treatment planning, SFA can bring about a paradigm shift in the future of orthognathic surgery.

#### CP142 LONG-TERM ORTHOPAEDIC AND ORTHODONTIC TREATMENT IN A SKELETAL CLASS III KOREAN MALOCCLUSION SUBJECT\*\*\*

Sung Ho Jang, Hyun-Ju Kim, Yon Sei Gajirun-e Dental Office, Mok Po, Korea, South

**AIMS:** Early treatment of a Class III malocclusion is a challenge in orthodontics because growth of the jaws does not guarantee the success of early treatment. In addition, the stability of the corrected occlusion depends not only on the relative amounts of maxillary and

mandibular growth, but also on growth of the cranial base involving the position of the articular fossa. Therefore, the decision as to which form of treatment is allocated to patients is made with reference to the severity of the malocclusion, remaining growth and prognosis for its correction by orthodontic means.

**SUBJECT AND METHOD:** A 10-year-old female who had a severe skeletal Class III malocclusion, an anterior crossbite, a severe high-angle, moderate crowding on both arches and eruption space loss (#25). In spite of the poor prognosis, a decision was made to undertake orthodontic treatment because of the parents' desires. Orthopaedic appliances, periodic growth evaluation and fixed appliances accompanied premolar extractions after skeletal maturation were performed during almost a 7 year treatment period.

**RESULTS:** Pre- and post-treatment and retention photographs demonstrated a good occlusion, aesthetically pleasing treatment results and stability.

**CONCLUSION:** Periodic growth evaluation, orthopaedic and fixed orthodontic treatment over a long time period were performed in a patient with a severe skeletal Class III resulting in a pleasant occlusion and profile

#### CP143 STABILITY OF THE UPPER INTERMOLAR DIAMETER: SURGICALLY ASSISTED MAXILLARY EXPANSION VERSUS MULTIBRACKET APPLIANCE

Francesca Zotti, Rinaldo Zotti, Linda Sangalli, Marino Bindi, Paola Fontana, Department of Orthodontics, Dental School, University of Brescia, Italy

**AIMS:** To determine the difference in stability at 5 years of the upper intermolar diameter of adults who have undergone surgically assisted maxillary expansion and adults undergoing treatment only with multibrackets

**SUBJECTS AND METHOD:** Two groups, each of 20 adult patients. Both groups showed before treatment (T0) an intermolar diameter of 43.55 mm (SD 3.58). The patients in group 1 (mean age  $35.2 \pm 6$  years) were treated with surgical expansion of the maxilla and multibracket appliances for Class II correction for at least 18 months, while those in group 2 (mean age  $33 \pm 5.9$  years) were treated only with multibracket appliances for at least 18 months. Both groups wore upper and lower Hawley retainers, group 1 for a period of 2.7 years (SD 0.7) and group 2 for 2.9 years (SD 0.7). Three measurements were performed for each group of the upper intermolar diameter on plaster models: T0, at the end of treatment (T1) and 5 years after the end of treatment (T2). The results were analyzed using the statistical test of Chi square.

**RESULTS:** At T2 the upper intermolar diameter of the subjects in group 1 was more stable than that of group 2 patients. The diameter of the patients in group 1 was not significantly changed between T1 and T2, while in group 2 there was a decrease in the intermolar diameter between T1 and T2.

**CONCLUSION:** Surgically assisted maxillary expansion makes the increase of intermolar diameter more stable.

#### CP144 EARLY TREATMENT OF CLASS III MALOCCLUSION ASSOCIATED WITH MACROGLOSSIA

Laura Laffranchi, Claudia Tosi, Carlo Tian, Francesca Zotti, Stefano Bonetti, Dental School, University of Brescia, Italy

**AIMS:** Macroglossia is commonly defined as an increase in volume of the tongue that protrudes permanently from the rhyme of the lips. The aim of this presentation is to report a case of Class III malocclusion associated with dental and skeletal macroglossia in a young patient without a syndrome, evaluating the effectiveness of interceptive orthodontic treatment associated with surgical therapy.

**SUBJECT AND METHOD:** A 6.4 year old male who presented destructive caries of the primary molars, upper primary and permanent mesiodens, a dental Class III malocclusion, open bite, unilateral right and anterior crossbite, proclination of the lower incisors, macroglossia, short sublingual fraenum and infantile swallowing. 21/03/2011 Home treatment for 20 hours a day, after the extraction of two mesiodens (primary on 07/01/11; permanent on 05/03/2011), with functional device 'PFB', built with vestibular shield like lip bumper, expansion springs and protrusive shields, monthly checks for its activation.

26/02/2013 Consulting with Pediatric Maxillo Facial Surgery Department and auxological investigation for the exclusion of associated syndrome. Observation of MRI do not detect focal abnormalities in the body of the tongue and/or in the surrounding tissues. 06/09/2013 Surgery of tongue with partial glossectomy according to Egyedi-Obwegeser, partial reduction V-shaped of the tip of the tongue and rhomb shaped of the body of the tongue with reconstruction of the mucous and muscular tissue. Speech therapy evaluation and beginning of postural re-education during language development was commenced in 2013. Insertion of TMA springs in the PFB between upper lateral incisors palatally, re-motivation to constant use for 20 hours per day of PFB.

**RESULTS:** Resolution of the anterior open bite and the unilateral anterior crossbite; improvement of the tongue's correct position during rest, swallowing and phonation together with the muscular balance and in the tongue's tone, motility and functionality.

**CONCLUSION:** The case treated is a rare occurrence in daily practice but demonstrates a pattern of favourable growth which can be disrupted by an impaired muscle function.

#### CP145 NEW THERAPEUTIC MINIMAL INVASIVE STRATEGIES WITH AN ALL-CERAMIC SYSTEM AFTER ORTHODONTIC TREATMENT

Claudia Tosi, Laura Laffranchi<sup>2</sup>, Michelangelo Rizzo<sup>2</sup>, Francesca Zotti<sup>1</sup>, Ingrid Tonni<sup>1</sup>,  
<sup>1</sup>Dental School/University of Brescia and <sup>2</sup>Scientific Consultant DenMat Italia, Baronissi

**AIMS:** To restore the aesthetics and function for patients with hypodontia or loss of permanent teeth after orthodontic treatment using prosthetic ceramic solutions without dental preparation with the new Cad-Cap method. Considering the relevance of the site of absence of permanent teeth, it was decided to use prosthetic retention until the final restoration using implants.

**SUBJECTS AND METHOD:** Two young patients treated with removable orthodontic appliance, bi-maxillary multi-bracket fixed for alignment and anchorage (for 18 and 24 months, respectively), Roth technique. Both subjects presented with a deep bite at the beginning of treatment. The first case was a female, 11 years old, with dental agenesis of 12 and 22 and the second a 7 year old male with unerupted 13 and 23; during the second phase of treatment it was necessary to surgically remove 23 (with its follicular cyst) and surgically expose 13. Both cases were finished with a prosthetic adhesive fixed appliance built of feldspathic ceramic enriched with leucite crystals (Cerinate®, DenMat) to replace, in a minimally invasive method, the missing upper teeth.

**RESULTS:** Recovery of the anterior-canine guidance and improvement of the aesthetics of the smile without any prosthetic preparation, and without any injury to the teeth was achieved with simultaneous orthodontic retention until the end of growth.

**CONCLUSION:** Due to the new technology of digital design CAD / CAP and with the use of Cerinate®, it is possible to assume its use as a therapeutic alternative to a traditional Maryland bridge. The benefits derived from the combination between the advantage of a minimally invasive tooth reduction using lumineers veneers with the hardness of the material allows the realization of the tooth cantilevered entirely in Cerinate ceramic. The lack of buccal or lingual preparation of the neighbouring teeth allows their *restitutio ad integrum*.

#### CP146 ORAL APPLIANCE THERAPY VERSUS NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE IN OBSTRUCTIVE SLEEP APNOEA: LITERATURE REVIEW AND CLINICAL CASES

Asmaa Elmabrak<sup>1</sup>, Hakima Aghoutan<sup>1</sup>, Lahcen Ousehal<sup>1</sup>, Fatimi Kadiri<sup>2</sup>, Mohammad Mahtar<sup>3</sup>, <sup>1</sup>Hassan II University, Faculty of Dentistry, <sup>2</sup>Maxillo-Facial Surgeon, private practice and <sup>3</sup>Chu Ibn Rochd, Casablanca, Morocco

**AIMS:** To perform a literature review to give a comprehensive account of the evidence based about the outcomes of oral appliances (OAs), surgical treatment with those of continuous positive airway pressure (CPAP) in the treatment of patients with obstructive sleep apnoea (OSA) and to show some related clinical cases.

**MATERIALS AND METHOD:** OSA is a sleep disorder in which breathing is briefly and repeatedly interrupted during sleep, caused by complete or partial obstruction of the upper airway producing apnoea or hypopnea. It can be graded as mild, moderate or severe. In

particular, OSA is characterized by snoring and repetitive cessation of breathing during sleep, resulting in oxygen desaturation and sleep fragmentation.

RESULTS: OSA treatment modalities aim at increasing life expectancy, decreasing the disease problems and improving the quality of life. Currently, CPAP is the gold standard treatment of OSA. Unfortunately, adherence rates are poor. Alternative therapies are mandibular advancement devices and maxillomandibular advancement osteotomy .

CONCLUSION: Differences in efficacy and compliance of these treatments are likely to influence improvements in health outcomes.

#### CP147 THE OCCLUSAL RAISING: A SYSTEMATIC REVIEW

Maria Rosaria Abed<sup>1</sup>, Alessandra Putrino<sup>1</sup>, Ettore Accivile<sup>2</sup>, Valeria Ferrara<sup>3</sup>, Gabriella Galluccio<sup>1</sup>, <sup>1</sup>Department of Odontostomatological and Maxillo-facial Sciences, University 'Sapienza', Rome, <sup>2</sup>Department of Orthodontics and TMJ, George Eastman Hospital, Rome, and <sup>3</sup>Private Practice, Rome, Italy

AIMS: Occlusal raising is acclaimed for its dento-skeletal and muscular effects during treatment: this systematic review evaluates these aspects from a scientific point of view.

MATERIALS AND METHOD: Using the PRISMA method, PubMed, Medline and Medscape were screened for perspective and retrospective studies and human and animal studies, on growing or adult patients, where the dento-skeletal or muscular effect of the device were evaluated. The key words were 'orthodontics and posterior bite-blocks', 'orthodontics and occlusal raising', 'orthodontics and build-up' and 'orthodontics and occlusal disclusion'.

RESULTS: Eleven papers met the inclusion criteria: The devices were active or passive, removable or fixed, aiming to manage the vertical dimension during growth. The effects were detected using cephalometrics, electromyography, photometry and analysis of electrical potential. The effects were a growth redirection, with a strengthening of the muscles during posture (active devices) or a progressive adjustment to the new position (passive devices).

CONCLUSION: Occlusal raising is useful to redirect growth, modify the occlusal plane and re-coordinate the masticatory muscles.

#### CP148 PRE-SURGICAL NASOALVEOLAR MOULDING IN PATIENT WITH UNILATERAL CLEFT OF LIP AND PALATE: A CASE REPORT

Fırat Öztürk<sup>1</sup>, Erdem Hatunoğlu<sup>2</sup>, Sedat Altındış<sup>2</sup>, Pelin Acar<sup>2</sup>, Departments of Orthodontics, Faculties of Dentistry, <sup>1</sup>Pamukkale University, Denizli and <sup>2</sup>Inonu University, Malatya, Turkey

AIMS: Nasoalveolar moulding (NAM) is a method used to correct the flattened nose prior to surgery, and facilitates nose repair at the time of lip repair. The aim of this case report is to present the results of NAM and surgical treatment of an infant with a cleft lip and palate (CLP)..

SUBJECT AND METHOD: A 15-day-old female with a unilateral CLP anomaly. In the clinical examination; a 10 mm cleft gap and widely separated lip, deviated nasal tip to the left, insufficient nasal projection and columella length were observed. Pre-surgical NAM treatment was planned and weekly adjustments were performed on the NAM appliance. After six month of treatment primary surgical repair of the nose and upper lip was performed.

RESULTS: Alveolar cleft distance was decreased and the columella length was increased considerably with NAM treatment. Nasal tip deviation from the mid-sagittal plane reduced prior to surgery and it was recovered completely after the operation.

CONCLUSION: Pre-surgical NAM treatment helped to reduce the alveolar cleft gap, improve the nasal asymmetry and approximate the lip segments.

#### CP149 SUCCESS RATE AND REASONS FOR FAILURES IN ORTHODONTIC MINISCREW IMPLANTS

Janos Horvath, Gabor Turi, Eva Tokai, Orsolya Nemeth, Department of Community Dentistry, Semmelweis University, Budapest, Hungary

AIMS: To prospectively investigate the success rate of orthodontic miniscrew implants and to compare the findings with the other references.

**SUBJECTS AND METHOD:** Forty-five implants placed in the maxilla, mandible, and hard palate were inserted for 20 patients. The age of patients was 16-40 years. Three type of miniscrews were inserted (Jeil, Leone, AbsoAnchor). The reasons for failure such as loosening, bad position, peri-implantitis, and breakage of screws were analysed.

**RESULTS:** Mini-implant survival rate is location dependent, with those placed in the palate showing higher success rates. In addition, failures most commonly occur because of surgery-related factors.

**CONCLUSION:** An adequate operating technique, correct treatment planning and the choice of a good recipient area can improve the success of orthodontic treatment with miniscrews.

#### CP150 SEGMENTAL ALVEOLAR DISTRACTION IN A PATIENT WITH A BILATERAL CLEFT LIP AND PALATE\*\*\*

Murat Tozlu<sup>1</sup>, Derya Germec Cakan<sup>1</sup>, Nigora Azimova<sup>1</sup>, Nihal Durmus Kocaaslan<sup>2</sup>, Ozhan Celebiler<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Yeditepe University/Dental Faculty, Istanbul, and <sup>2</sup>Department of Plastic and Reconstructive Surgery, Marmara University Hospital, Istanbul, Turkey

**AIMS:** To present segmental alveolar distraction of a patient with a bilateral cleft lip and palate (BCLP), wide bilateral alveolar clefts and severe maxillary retrognathia.

**SUBJECT AND METHOD:** A 19 year old male with a BCLP. His clinical and radiographic evaluation revealed a brachifacial growth pattern, Class III skeletal relationship with retroclined premaxilla, 4 mm negative overjet, bilateral posterior crossbite, congenitally missing maxillary lateral incisors and left second premolar, oronasal fistula and large clefts. The interdisciplinary treatment plan consisted of expansion of the maxilla, alignment, decompensation, orthognathic surgery and alveolar bone grafting. Before secondary grafting, an alveolar distraction was planned to reduce the size of the clefts. A novel intraoral distraction device with a distraction path following the dental arch was applied. The segmental osteotomies were performed. Following 5 days of latency, distraction started at the rate of 1 mm/day.

**RESULTS:** After 10 days of distraction, the alveolar clefts were reduced which enabled better grafting. A parallel movement of the transport segments was achieved and tipping of the teeth was eliminated using this rigid distractor.

**CONCLUSION:** Alveolar distraction with newly designed distractor was an effective method to approximate the bony segments, reduce the alveolar gap, generate new bone and enable soft tissue expansion for better secondary bone grafting.

#### CP151 TREATMENT OF ADULT CLASS III PATIENTS WITH MINI-IMPLANTS

Hyunjung Park<sup>1</sup>, Woo-Sung Son<sup>2</sup>, Birte Melsen<sup>3</sup>, <sup>1</sup>Private practice - Busan and <sup>2</sup>Department of Orthodontics, National University Busan, Korea, South and <sup>3</sup>Section of Orthodontics, Aarhus University, Denmark

**AIMS:** Treatment of adult patients is complicated and the correction of malocclusions is limited to the dento-alveolar changes as growth has ceased. Moreover, the severity of a malocclusion is often beyond conventional orthodontic treatment and can best be addressed by orthognathic surgery. However, orthognathic surgery is expensive and may be accompanied by complications. The aim is to demonstrate the treatment of adult patients with Class III malocclusions where mini-implants (temporary anchorage devices) in the buccal cortical bone near the lower second molar have been used for anchorage allowing for large tooth movements for improving the occlusion and mandibular protrusion.

**SUBJECTS AND METHOD:** Six patients (average age: 24 years 6 months) with skeletal and dental Class III malocclusions. The maxillary arch was expanded with a transpalatal arch to gain sufficient transverse dimension for ideal buccal occlusion. The Class III molar relationship was corrected by retraction of the lower dentition against mini-implants inserted in the buccal cortical bone near the lower second molar. A 0.017 × 0.025 inch stainless steel wire was inserted in the lower arch and retraction was performed with a force of 300 g applied bilaterally to the lower canine from the mini-implants.

**RESULTS:** The entire mandibular dentition distalized an average of 3 mm resulting in counterclockwise rotation of the mandibular occlusal plane. No inflammation of the soft tissue around the mini-implants was observed. The result showed improvement of the occlusion, function and facial aesthetics in the patients.

**CONCLUSION:** Correction of the Class III malocclusion was obtained in all six patients and no complications were observed. When using mini-implants inserted in the buccal cortical bone near the lower second molar without soft tissue flaps as anchorage, a Class III malocclusion can be camouflaged satisfactory avoiding without orthognathic surgery. This non-surgical approach is safe and inexpensive compared to orthognathic surgery and is an effective treatment option even though there are several limitations such as a severe asymmetric Class III case.

#### CP152 MAXILLARY MOLAR DISTALIZATION USING THE MGBM SYSTEM: CASE REPORT

Yagmur Lena, Gökhan Önçağ, Department of Orthodontics, Ege University Dentistry Faculty, Izmir, Turkey

**AIMS:** Treatment of Class II malocclusions frequently requires distalization of the maxillary molars. There are methods which need patient compliance and prevention of anchorage loss. To avoid anchorage loss, recent studies have been directed toward the use of miniscrews as anchorage units. The MGBM system was introduced as a non-compliance based system for non-extraction treatment of Class II malocclusions that combines sliding mechanics with the use of miniscrews for anchorage control. The purpose of this report is to present treatment by using the MGBM system.

**SUBJECT AND METHOD:** A 15-year-old male with a Class II subdivision malocclusion, a mild overjet and crowding and a midline deviation. Non-extraction treatment was planned and an intraoral skeletal anchorage system was used for upper molar distalization. Self-tapping orthodontic miniscrews were progressively inserted in the palatal bone between premolars with a hand screw-driver. The miniscrews were 1.5 mm in diameter and 6 mm long. A transpalatal arch was bonded to the first premolars occlusally and attached to palatal miniscrews with  $\approx$ .010 ligature wires. Sectional 0.016  $\times$  0.022 stainless steel wire with a nickel titanium coil spring from first premolar to the first molar and 0.017  $\times$  0.025 superelastic Nitinol wire for the second molars were used. After achieving an overcorrected Class I relationship in 4 months, stainless steel wire was attached to the screws to the upper first molars. Impressions of the upper arch were obtained for controlling anchorage loss using the superimposition method. The digital upper arch model was superimposed using the palate as a reference area via surface-to-surface matching software with the ruga-palate superimposition method, and the changes in premolar tooth movement were calculated. Fixed (0.018 inch slot) appliances were placed. After levelling, stainless steel arch wires (0.017  $\times$  0.025 inch) were used for completion. Triangular intermaxillary elastics from the maxillary canine to the mandibular canine and first premolar improved intercuspation. Treatment was completed in 26 months.

**RESULTS:** The upper molars were successfully distalized into an overcorrected Class I relationship. The system does not need any cooperation of the patient. There was anchorage loss on the premolars. Maxillary premolar mesial movement was 1.55 mm.

**CONCLUSION:** Although the system is efficient for distalizing the maxillary molars using skeletal anchorage, more research is needed to discover the rationale behind the premolar mesialization.

#### CP153 OBJECTIVE ASSESSMENT OF THE MODIFIED FRÄNKEL APPLIANCE WEAR-TIME AFTER ORTHOGNATHIC SURGERY OF MANDIBULAR PROGNATHISM IN THE RETENTION PERIOD

Maša Farkaš, Tomaž Košorok, Franc Marjan Farčnik, Institute Orthos, Ljubljana, Slovenia

**AIMS:** To present and objectively assess the modified Fränkel type 3 functional regulator wear-time in the retention period in an adult patient after orthognathic surgery of mandibular prognathism and incorrect tongue posture.

**SUBJECT AND METHOD:** An adult patient with a Class III malocclusion is presented before and after orthodontic treatment, before and after orthognathic surgery and in the retention period. The Frankel function regulator was modified by Farčnik (2007) by adding lingual shields and an acrylic pad to the palatal arch to improve tongue posture from the mouth floor to the palate. The appliance wear-time was reliably assessed and documented over a period of six months using the temperature-sensitive microsensor (TheraMon microelectronic system; Sales Agency Gschladt, Hargelsberg, Austria), incorporated into the appliance by polymerisation. The wear-time graph presented the average wearing time in the 6 months treatment period. The values were compared with the recommended wear time values.

**RESULTS:** The mean wear-time value was 12 hours, which corresponds to the recommended values.

**CONCLUSION:** The success and stability of orthognathic surgery depends also on regular wear of retention appliances. Irregular orofacial functions, especially irregular tongue posture on the mouth floor, are diagnosed in the majority of patients with a Class III malocclusion. Lingual shields as well as the acrylic pad on the palatal arch of the modified Fränkel type 3 appliance are used as a muscle training device for physiotherapy of the tongue muscle and may therefore improve the dynamic imbalance of the orofacial area due to the irregular tongue posture and function. Microelectronic wear-time of the modified Frankel 3 functional appliance may in future standardize optimal wear-time in Class III patients after orthognathic surgery.

#### CP154 THE EFFECT OF A GEMINATED TOOTH ON THE DENTAL ARCH AND THE MULTIDISCIPLINARY TREATMENT POSSIBILITIES

Athina Chatzigianni, Kleopatra Tsiouli, Maria Kourakou, Sossani Sidiropoulou, Department of Orthodontics, Dental School, University of Thessaloniki, Greece

**AIMS:** To present the effects of a geminated tooth on the dental arch and occlusion as well as the possible treatment procedures.

**SUBJECTS/MATERIALS AND METHOD:** Tooth gemination is defined as a failed attempt of tooth bud to divide. This partial division occurs before tooth development is completed, resulting in a larger tooth with a bifid crown and a single root with one large root canal, whereas the total number of teeth in the dentition is normal. Tooth gemination is often confused with fusion and in most cases the clinical differentiation is almost impossible. Gemination occurs more frequently in the primary dentition (0.5% of prevalence) than in the permanent dentition (0.07-0.22%) . It is usually unilateral and affects commonly the upper incisors. The role of cone beam tomography (CBCT) is important in order to diagnose a case of gemination (one single root canal) or fusion (two root canals). Treatment of choice may be endodontic followed by surgical division of the crown. In some cases reduction of the mesiodistal diameter of the tooth, composite restoration and orthodontic arrangement is also advised in order to improve aesthetics .Extraction of the geminated tooth, orthodontic treatment and prosthetic replacement is sometimes selected. Cases with gemination, resulting in occlusal disturbances, dental crowding, ectopic laterals and malocclusion are presented.

**RESULTS:** The presented cases were treated with different approaches, either with reduction of the mesiodistal diameter of the tooth and orthodontic arrangement or with extraction of the geminated tooth and orthodontic treatment. The extracted giant tooth will be replaced later with an implant.

**CONCLUSION:** The problem of a geminated tooth and the effect on the dental arch and the occlusion needs an individualized multidisciplinary treatment procedure.

#### CP155 PRE-SURGICAL ORTHODONTIC TREATMENT OF A NEWBORN WITH A UNILATERAL CLEFT LIP AND PALATE

Julija Radojicic<sup>1</sup>, Andrija Radojicic<sup>2</sup>, Aleksandar Radojicic<sup>2</sup>, Tatjana Cutovic<sup>3</sup>, <sup>1</sup>Faculty of Medicine, University of Nis, <sup>2</sup>Ortodent, Nis and <sup>3</sup>Military Medical Academy, Belgrade, Serbia

**AIMS:** To present the effects of orthodontic activity of the RBJ stimulator used in the early orthodontic treatment of a newborn female with a unilateral cleft lip and palate (UCLP). This

effect was studied by monitoring changes that occurred during therapy in the three-dimensional structure of the damaged upper jaw.

**SUBJECT AND METHOD:** Consecutive palatal impressions were taken of the female immediately after birth and 1, 3 and 6 months (before cheiloplasty) and after 6 months (after cheiloplasty). The palatal casts were measured and compared three-dimensionally.

**RESULTS:** The cleft width decreased significantly during therapy.

**CONCLUSION:** The positive effect of the RBJ stimulator on the size of the cleft in a newborn with a UCLP occurs as a result of active participation screws are included in the RBJ stimulator and selective gringing acrylic stimulator.

#### CP156 FEEDING A NEWBORN WITH A GOTHIC PALATE

Julija Radojicic<sup>1</sup>, Tatjana Cutovic<sup>2</sup>, Gordana Filipovic<sup>1</sup>, Tatjana Perovic<sup>1</sup>, Andrija Radojicic<sup>3</sup>,  
<sup>1</sup>Faculty of Medicine, University of Nis, <sup>2</sup>Military Medical Academy, Belgrade and <sup>3</sup>Ortodent, Nis, Serbia

**AIMS:** To describe the design and application of a RBJ obturator immediately after birth of a premature newborn with a Gothic palate and low birth weight. The natural nutrition through breastfeeding of a prematurely born baby with low birth weight is problematic due to overall frailty. Furthermore, if the baby has a Gothic palate, breastfeeding is almost impossible, given that they are not able to create the negative pressure in the oral cavity necessary for suction. Such babies have to be fed with a gastric probe. To avoid feeding with gastric probe, the formation of a RBJ obturator was attempted (artificial palate). Hereby the procedure of obturator making with an explanation of its function are presented.

**MATERIALS AND METHOD:** Immediately after birth, access to the Gothic palate to take the impression. Based on the impression and plaster model, the first RBJ obturator was constructed to act as an artificial palate. Restraint by the obturator, creates a negative pressure needed to extract milk from a bottle. Seven days after the construction of the second allows effects on alveolar edges of the upper jaw. In the next period to 18 months, stimulants are produced in a month.

**RESULTS:** The RBJ obturator significantly improves feeding of newborns with a Gothic palate.

**CONCLUSION:** Delicate treatment of premature babies with a Gothic palate is thus much easier. Providing nutrition without the use of a gastric probe is good for parents, and progress in the weight of a newborn is obvious.

#### CP157 IDIOPATHIC ROOT RESORPTION IN THE PERMANENT DENTITION: REPORT OF A CASE

Aylin Pasaoglu, Alev Cinsar, Department of Orthodontics, Ege University, Izmir, Turkey

**AIMS:** There are two types of tooth resorption: internal and external. Root resorption is a multifactorial process that results in loss of tooth structure. Idiopathic root resorption is the term being appropriate in cases where an aetiological factor cannot be found. Multiple idiopathic external root resorption is an unusual condition that may present in a cervical or an apical form. Local factors are the most frequent causes of resorption, most commonly excessive pressure and inflammation. At present there is no curative treatment for external apical root resorption. Tooth eruption depends on the presence of osteoclasts to create an eruption pathway through the alveolar bone. It is common that primary teeth have been resorbed by permanent teeth but it is uncommon that permanent teeth have been resorbed by permanent teeth.

**SUBJECT AND METHOD:** A 17-year-old healthy and normally developed Turkish female. The patient had no systemic or endocrine disease, or history of dental trauma. Multiple apical root resorptions was found on the panoramic radiographic of teeth 16, 17, 26, 27 and 46 like a step formation. The patient also had lack of two maxillary lateral incisors.

**RESULTS:** Teeth 16, 17, 26 and 27 showed step formation resorptive region with the aetiology related to tooth eruption. The lower right molar (46) had a large restoration. The aetiology of this resorption may could be related to inflammation and this large filling.

**CONCLUSION:** Multiple idiopathic apical root resorption involves a wide age range with unknown aetiology. The current management for these patients is symptomatic, minimal

intervention and long-term monitoring. Careful examination should be undertaken before starting orthodontic treatment.

#### CP158 PALATAL EXPANSION EFFECTS ON CRANIOCERVICAL POSTURE

Maria Chiara Camastro, Carlo Iilli, Riccardo Fusco, Monica Castellano, Gabriella Galluccio, Sapienza, Roma, Italy

AIMS: To evaluate expansion effects on craniocervical posture.

MATERIALS AND METHOD: On lateral radiographs cephalometric analysis was performed pre- and post-rapid palatal expansion and the values were compared.

RESULTS: No changes in cervical posture were observed; an important correlation was seen between cervical posture and breathing.

CONCLUSION: Respiratory function and cervical posture are correlated.

#### CP159 ADJUSTING SPLINTS USING POSTUROGRAPHY IN ANGLE CLASS II/2 PATIENT WITH VERTIGO

Fabian Liebegall<sup>1</sup>, Evi Koch<sup>2</sup>, Elisabeth Meyer<sup>1</sup>, Ines Repik<sup>3</sup>, Joachim Weber<sup>1</sup>, <sup>1</sup>Kieferorthopädie, Ludwigshafen, <sup>2</sup>Praxis für Osteopathie, Bad Dürkheim and <sup>3</sup>Universitäts-HNO-Klinik, Mannheim, Germany

AIMS: This case presentation shows an option of integrated therapy for pain patients with vertigo before Class II division 2 orthodontic treatment. For improvement of temporomandibular dysfunction (TMD), splints to decrease pain and vertigo, posturographic measurements should be taken to verify the progress of the patient.

SUBJECTS AND METHOD: A patient with vertigo since 12 months and a pain history over 30 years was checked with computed tomographic scans, magnetic resonance imaging, Doppler ultrasound, transthoracic echocardiography, neurosonology, laboratory-chemical examinations, electroencephalogram and long-term electrocardiogram without pathological findings. Only with the help of physiotherapy, osteopathy and an oral splint a minor improvement could be reached. The splint was made according to the methods of the University of Michigan. To optimize the result it was decided to control the progress of therapy through posturographic measurements using: posturography screening before treatment, with the splint inserted, while adjusting the splint in relation to the results and at follow-up with the adjusted splint. For measurement and balance assessment a posturographic device called 'Tetrax Sunlight' (Neurodata Handels-GmbH Austria) was used. In total four follow-up measurements were taken over a period of three months. These follow-ups were repeated until the patient was subjectively pain free and a further improvement of the collected measurements seemed not to be possible.

RESULTS: Integrated treatment under posturographic control showed a very good improvement of the vertigo symptoms as well as of the TMD pain. The main issue for the patient was to turn his incapacity to work back to a normal work ability. He reported that the splint now has a switch on/off function for his vertigo.

CONCLUSION: The improvement in this case shows that good balance control of the head is very important. Dentistry and orthodontics may have a key position in the integrated therapy of pain and/or vertigo. Posturography seems to be a good tool for more precise diagnosis and follow-up of progress during integrated therapy. Especially dental splints may help patients with vertigo of unknown origin.

#### CP160 THE STABILITY OF EARLY MAXILLARY DISTRACTION OSTEOGENESIS FOR DYSPLASIA OF APERT SYNDROME

Tadashi Morishita, Department of Orthodontics, St. Mary's Hospital, Kurume, Japan

AIMS: Apert syndrome, which is a rare disease, is one of Craniosynostosis, and they have characteristic facial features. The feature has been caused by maxillary hypoplasia. A narrow nasal cavity leads to respiratory obstruction in the pharyngeal part and nose breathing is often disturbed. Distraction osteogenesis of the maxilla was performed for respiratory improvement in infancy. The aim of this study is to examine whether the results of surgery are stable.

**SUBJECTS AND METHOD:** Three female and a male with Apert syndrome who underwent maxillary distraction osteogenesis at 3 or 4 years of age. Cephalograms were taken before distraction (T1), after distraction (T3) and at diagnosis for the second phase of treatment (T3). The width of the respiratory tract was measured on the cephalograms.

**RESULTS:** The width of the respiratory tract at the pharyngeal part was expanded more than 10 mm by maxillary distraction osteogenesis. Three subjects had maintained airway width at T3, but in one patient respiration was obstructed.

**CONCLUSION:** Maxillary distraction osteogenesis was performed for respiratory improvement of Apert syndrome. Three subjects maintained the effect of an expanded airway in adolescence but in one respiration was obstructed again.

#### CP161 TREATMENT APPROACHES FOR IMPACTED TEETH: CLOSED VERSUS OPEN SURGERY TECHNIQUE – CASE REPORT

Aycan Yalçın<sup>1</sup>, Servet Doğan<sup>1</sup>, Meltem Özden<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Oral and Maxillofacial Surgery, Ege University Faculty of Dentistry, Bornova, Izmir, Turkey

**AIMS:** To present the treatment of a patient with impacted teeth and to observe the patient's perception after surgical exposure with the open technique and closed technique.

**SUBJECT AND METHOD:** A 21 year old treated for multiple impacted teeth. Digital photographs, digital models, radiographs and cone beam computed tomographs were obtained before treatment. Lateral cephalometric analysis revealed a skeletal Class I relationship. Teeth 11, 13, 21, 23, 24, 33, 34, 35, 43 and 44 were impacted and 22 was congenitally missing. 0.018 slot MBT brackets were used for alignment and to open space for the impacted teeth. Surgical exposure was carried out using the open technique for the lower right arch and the closed technique for lower left arch. All exposures were done under local anaesthesia by the same surgeon. The surgical procedure involved a standard mucoperiosteal flap, and bone removal was undertaken with a rotary instrument. Gold chains were bonded on the available surfaces of the impacted teeth during surgery. The lower right canine and premolars were left open in the mouth. After healing, further surgery was carried out on the lower left arch; gold chains were bonded on the impacted teeth and the flap was sutured back in its former place with gold chains present inside the mouth. A questionnaire with a visual analogue scale (VAS) was designed to assess the patient's perception of pain during recovery, discomfort during function and convenience of keeping the operation site clean. The patient was asked to answer the questions on two occasions: the day of surgery and 10 days post-surgery; by rating from 1 to 5.

**RESULTS:** Pain during recovery, healing time, discomfort during function were longer after the open technique. The convenience of keeping the operation site clean was found more difficult after the open technique. No differences were found concerning pain during orthodontic traction of the impacted teeth. Surgery time was longer for the closed technique.

**CONCLUSION:** Post-operative recovery was longer after the open technique compared with the closed technique. The patient experienced discomfort during orthodontic traction after both techniques.

#### CP162 CHANGES IN THE AESTHETIC ZONE AS A RESULT OF ORTHODONTIC TREATMENT IN PATIENTS WITH PATHOLOGICAL TOOTH MIGRATION

Liwia Minch, Anna Białą, Justyna Warmuz, Beata Kawala, Department of Maxillofacial Orthopaedics and Orthodontics, Wrocław Medical University, Poland

**AIMS:** To present interdisciplinary orthodontic-periodontic management in five subjects with pathological migration of the maxillary incisors caused by chronic periodontal disease.

**MATERIALS AND METHOD:** Aesthetics of the smile (the reason the patients were seeking orthodontic therapy), periodontal disease and chewing function were impaired. After primary periodontal treatment the patients were treated with fixed orthodontic appliances and miniscrews to reinforce anchorage. The posterior teeth and periodontium condition were not good enough to achieve proper anchorage.

**RESULTS:** In all patients significant improvement of occlusion and smile aesthetics were obtained. Periodontal parameters were also improved. Root apex resorption of intruded teeth was observed in one subject.

**CONCLUSION:** Orthodontic treatment of patients with periodontal disease enables significant improvement of smile aesthetics and gives the possibility to save teeth in aesthetic zone. There is always the risk of numerous complications with this type of treatment, that is why it should be performed very carefully.

#### CP163 ORTHODONTIC TREATMENT OF A CLASS II MALOCCLUSION USING MINISCREW ANCHORAGE IN THE BUCCAL INTERRADICULAR REGION: CASE REPORT

Deniz Erda Çelakıl, Murat Tozlu, Orthodontic Department, Yeditepe University Faculty of Dentistry, İstanbul, Turkey

**AIMS:** To present the treatment outcome of a patient with a Class II malocclusion using miniscrew anchorage in the buccal interradicular region for molar distalization.

**SUBJECT AND METHOD:** A 17 year-old girl with the chief complaint of dental crowding. Clinical examination revealed a Class II molar and canine relationship on the right side, midline shift and mild dental crowding. Cephalometric evaluation showed that she had a low angle growth tendency and skeletal Class I malocclusion. Following extraction of a malformed upper right second molar, the teeth were levelled and aligned by means of fixed orthodontic appliances. To avoid proclination of the upper incisors, a force of 200 g was applied by a nickel titanium closed coil spring from a canine bracket hook to the miniscrew during aligning. The miniscrew, which was placed in the right maxillary interradicular space between the first molar and second premolar, provided successful distal movement of the molar without patient compliance.

**RESULTS:** At the end of the orthodontic treatment, dental crowding and the midline shift were corrected and a Class I molar and canine relationship was achieved. The upper third molar, which erupted into the upper second molar place, showed satisfactory interdigitation.

**CONCLUSION:** Orthodontic treatment of patients with a Class II malocclusion who show poor compliance with conventional treatment modalities can be challenging. Miniscrews provide sufficient treatment effects with the use of a simple and straightforward device.

#### CP164 TREATMENT OF SEVERE CROWDING BY PERIODONTALLY ACCELERATED OSTEOGENIC ORTHODONTICS WITH PIEZOSURGERY: CASE REPORT

Deniz Erda Çelakıl<sup>1</sup>, Feyza Ülkür<sup>1</sup>, Gökser Çakar<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and <sup>2</sup>Periodontology, Yeditepe University Faculty of Dentistry, İstanbul, Turkey

**AIMS:** To present the treatment of a patient with Class II malocclusion and severe mandibular anterior crowding with periodontally accelerated osteogenic orthodontics (PAOO).

**SUBJECT AND METHOD:** An 18 year-old male with chief complaint of dental crowding. Clinical examination showed a Class II malocclusion, dental crowding, increased overbite and buccal corridors. Cephalometric evaluation revealed that the patient had a low angle growth tendency and a skeletal Class I malocclusion. PAOO, consisting of full-thickness flap reflection, selective buccal alveolar decortication by piezosurgery and bone grafting, was performed by a periodontologist and fixed orthodontic treatment was initiated immediately after. Alignment and levelling of the mandibular dentition with self-ligating brackets lasted 4 months. Following alignment, the Class II molar relationship was corrected with use of intermaxillary elastics.

**RESULTS:** At the end of the orthodontic treatment, the dental crowding was corrected, a proper overbite and Class I molar relationship were achieved and the buccal corridors projection improved. The treatment time for the mandibular dental arch significantly decreased due to the periodontal intervention.

**CONCLUSION:** PAOO with piezosurgery is an effective treatment approach to accelerate orthodontic treatment and reduce the risk of root resorption while increasing the intercanine width.

#### CP165 AN INNOVATIVE APPROACH TO MANAGE AN EARLY ANKYLOSED PRIMARY MOLAR WITH A PERMANENT SUCCESSOR

Afroditi Kouli<sup>1</sup>, Gerassimos Angelopoulos<sup>2</sup>, <sup>1</sup>Orthodontic Department, University of Athens, and <sup>2</sup>Private Practice, Athens, Greece

**AIMS:** The incidence of ankylosis in the primary dentition fluctuates between 1.3 and 38.5 per cent and may lead to occlusal disharmonies. The aim of this presentation is to describe an innovative approach of managing early ankylosed primary molars with permanent successors through a case presentation.

**SUBJECT AND METHOD:** A Caucasian girl aged 6.8 years with a severely ankylosed #55 (distance of 8 mm from the occlusal plane and angular bone level on a bitewing radiograph), inability of spontaneous resorption of its roots from the mesially displaced sperm of #15 and lack of space in the upper right quadrant with the upper midline 2 mm to the right of the midline of the face. The treatment plan aimed at relieving the eruption path of #15 through immediate removal of #54 to speed up the eruption of #14. In the meantime #55 was restored with composite resin in order to avoid tipping of the adjacent teeth and over-eruption of #85. A year later as #14 erupted the position of #15 improved and started resorbing the ankylosed roots of submerged #55. At this time the mesial part of #55 was reproximated to offer some of the leeway space to the canine area which was lacking space.

**RESULTS:** This innovative approach led to the spontaneous eruption of #15 while maintaining the space not only anteroposteriorly but also vertically and transversally with no appliances whatsoever for at least three years.

**CONCLUSION:** Early diagnosis and conservative management of the ankylosed primary teeth led to effectively resolving the ankylosis and avoided occlusal discrepancies and secondary impaction of the permanent successor. A study needs to be designed with more cases to validate the above treatment modality.

#### CP166 PROPOSAL AND VALIDATION OF A NEW APPROACH FOR THREE-DIMENSIONAL MONITORING OF ACTIVE ORTHODONTIC TREATMENT

Piero Antonio Zecca, Rosamaria Fastuca, Matteo Beretta, Aldo Macchi, Alberto Caprioglio, Department of Orthodontics, University of Insubria, Varese, Italy

**AIMS:** The proposal and validation of a system integrating pre-treatment cone beam computed tomography (CBCT) and progressive intraoral scans for monitoring orthodontic treatment in three dimensions with minimal invasiveness.

**SUBJECTS AND METHOD:** The method validation was carried out using an extraoral typodont. The method error was calculated by colour displacement maps on three-dimensional (3D) superimposition for evaluation of the discrepancy between the real and the expected position of the roots of the teeth of the model typodont. Five patients were enrolled for the pilot study with the following inclusion criteria: complete permanent dentition, absence of systemic and/or dental diseases. CBCT of the dental arches was performed before treatment (T0) and progressive intraoral scans were obtained before treatment (T0), during c treatment with fixed appliances (T1) and post-treatment (T2). The 3D teeth were obtained by matching the segmented roots on the CBCT and crowns on the introral scans. The position at every observation was registered based on the location of the crowns.

**RESULTS:** The colour displacement maps showed differences of between 0.2 and 0.3 mm for the upper jaw and between 0.1 and 0.2 mm for the lower jaw between the real and expected root positions of the typodont measured without (T0, T2) and with brackets (T1). The technique was successfully used *in vivo* on the examined patients and allowed an accurate assessment of the position of the roots of the teeth.

**CONCLUSION:** The proposed system proved to be reliable, effective and non-invasive in monitoring active orthodontic treatment. The limits of the proposed approach could be related to any imprecision *in vivo* due to differences in density and bone metabolism related to individual patient response.

#### CP167 RETENTION OF THE PRIMARY CANINE AS A CAUSE OF MANDIBULAR CANINE IMPACTION

Hristina Arnautska, Dilqna Mineva, Department of Prosthetic Dentistry and Orthodontics, Faculty of Dental Medicine, Medical University of Varna, Bulgaria

AIMS: To demonstrate mandibular canine impaction related to retention of the primary canine.

SUBJECTS AND METHOD: A 9 year old girl in the mixed dentition with a significantly inclined lower permanent canine (case 1) and an 18 year old girl in the permanent dentition and an impacted lower canine (case 2). In both cases the primary canines were extracted. The mesial angle formed between the long axis of the permanent canine teeth and the midsagittal plane (angle  $\lambda$ ) and the mesial angle between the long axis of the permanent canine and primary canine (angle  $\lambda_1$ ) were measured on dental pantomographs. Delayed resorption of the primary canines was also recorded.

RESULTS: In case 1 angle  $\lambda_1$  was 47 degrees and angle  $\lambda$  60 degrees at the beginning of treatment. After extraction of the primary canine in the mixed dentition, the lower impacted canine spontaneously straightened (angle  $\lambda = 12^\circ$ ) and it erupted in the correct position after 1.5 years. In case 2 angle  $\lambda_1$  was 50 degrees and angle  $\lambda$  47 degrees at the start of treatment. In the permanent dentition extraction of the primary canine did not lead to eruption of the permanent canine (angle  $\lambda$  increased to  $64^\circ$ ) and the patient was treated with fixed appliance.

CONCLUSION: Early detection and prompt preventive measures will lead to avoidance of the complications arising from impacted canines and will preserve the morphological and functional integrity of the incisors and the dentition. The prevention of a disturbed eruption of the canine by extraction of the primary canine is best carried out as early as the displacement is detected, mostly soon after 9 years of age. Usually, prevention will avoid the surgical and orthodontic treatment needed to align an impacted canine and may help prevent complications.

#### CP168 NON-SURGICAL ORTHODONTIC TREATMENT OF AN ADULT CLASS III LATEROGNATHY CASE WITH TEMPOROMANDIBULAR DYSFUNCTION\*\*\*

Erol Akin<sup>1</sup>, Ahu Topkara<sup>1</sup>, Tulay Akkol<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Istanbul Aydin University and <sup>2</sup>Private Practice, Denizli, Turkey

AIMS: To present the a treatment of a subject with severe temporomandibular dysfunction (TMD) due to early loss of the the upper and lower right permanent canines, an anterior crossbite and premature contacts.

SUBJECT AND METHOD: A 37-year-old female patient with complaints of severe head, neck and temporomandibular joint (TMJ) pain and bilateral TMJ clicking and crepitation. The TMJ pain was especially on the left side. The patient had a laterognathy to the right. Intraoral examination revealed that the lower and the upper right canines had been previously extracted and there was an anterior crossbite accompanied by a 3 mm upper and 5 mm lower midline shift to the right. A thick acrylic maxillary occlusal splint was applied to eliminate the anterior crossbite. It was planned to open a space for upper right canine and to correct the upper midline shift. After 3 months of use of the occlusal splint, a modified fan type anterior protrusion appliance with posterior bite blocks was applied and the lower teeth were bonded. Four months later, the upper teeth were bonded. The active fixed orthodontic treatment continued for 10 more months. A prosthetic restoration was made for the upper right canine.

RESULTS: The patient's pain disappeared and she was relaxed one week after the application of the occlusal splint. Protrusion of the upper incisors was obtained with the modified fan type protrusion appliance. The patient had satisfactory aesthetic and functional treatment results including facial and dental appearance.

CONCLUSION: It is important to undertake a good examination of the occlusion in patients with TMD to create a correct orthodontic treatment plan. The primary goal must be to solve the TMD and the pain caused by the abnormal occlusion.

#### CP169 EXTRACTION VERSUS NON-EXTRACTION CHOICE: EVIDENCE BASED CLINICAL DECISIONS AND LONG-TERM OUTCOMES

Daniel Celli, Simone Sferra, Cristina Grippaudo, Catholic University of Sacred Heart, Rome, Italy

AIMS: The role of extractions in orthodontic treatment has been a controversial subject for over a century. Evidence based clinical decisions provide the keys to clinical success, promote the stability of orthodontic treatment and the achievement of excellent long-term outcomes in extraction versus non extraction treatment.

MATERIALS AND METHOD: This presentation will show a variety of clinical cases to compare orthodontic treatment outcomes in borderline patients treated with and without extractions. Analyzing the choices of the type of treatment according to aesthetic, periodontal, temporomandibular joint and crowding.

RESULTS: The most common reason for extraction is the relief of crowding and the need to create space to gain good alignment of the teeth. Extracting teeth does not guarantee future stability and no evidence to suggest that extracting teeth in appropriate cases causes a 'dished in' appearance. Arch expansion shows higher levels of relapse.

CONCLUSION: For the best treatment outcomes, some patients need non-extraction treatment, some need extractions, and a key goal of diagnosis is gathering data on which to base this decision, not on which bracket to use. Evidence-based treatment is certainly the direction that modern orthodontics should be taking and each case should be properly treatment planned to give the greatest future stability, function and aesthetics.

#### CP170 TREATMENT OF CLASS II WITH MODIFIED *EN-MASSE* DISTALIZATION APPLIANCE AND EXTRAORAL TRACTION\*\*\*

Erol Akin<sup>1</sup>, Ahu Topkara<sup>2</sup>, Tulay Akkol<sup>2</sup>, Ibrahim Kasebdanende<sup>3</sup>, <sup>1</sup>Department of Orthodontics, Istanbul Aydin University and Private Practices, <sup>2</sup>Denizli and <sup>3</sup>Istanbul, Turkey

AIMS: To present the treatment of a Class II subject with suprapositioned upper permanent canines and severely damaged permanent first molars using a modified *en-masse* distalization appliance and extraoral force.

SUBJECT AND METHOD: A 16-year-old girl in whom clinical and radiographic examination showed that the lower left first molar was extracted previously, the upper and lower right first molars were severely damaged, and her upper canines were in supraposition. She had a skeletal and dental Class II relationship. It was decided to extract all the remaining first molars and to simultaneously distalize the upper first and second premolars. A modified acrylic bonded slow expansion appliance with a Hyrax screw and headgear tubes was designed for this purpose. Activation of the Hyrax screw was performed twice a week and one turn at a time to maintain the original posterior transverse arch width and to avoid a posterior crossbite at the premolar region. Extraoral cervical headgear was used for 16-18 hours a day. Fixed orthodontic treatment was initiated after four months of premolar distalization.

RESULTS: The premolars were effectively and easily distalized just in four months. The canines moved downward to the occlusal plane and upper incisors retruded spontaneously.

CONCLUSION: The modified *en-masse* distalization appliance with extraoral force should be considered as an effective treatment modality for selected cases.

#### CP171 TREATMENT OF A LATE ADOLESCENT SKELETAL CLASS III PATIENT WITH A MODIFIED FIXED TANDEM APPLIANCE\*\*\*

Ahu Topkara<sup>1</sup>, Erol Akin<sup>1</sup>, Onur Yilmaz<sup>1</sup>, Ibrahim Kasebdanende<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Istanbul Aydin University and <sup>2</sup>Private Practice, Istanbul, Turkey

AIMS: To present the effect of an intraoral modified fixed tandem appliance on a skeletal Class III patient in late adolescence.

SUBJECT AND METHOD: A 15-year-old girl with an edge-to-edge anterior bite and narrow maxillary arch with a Class III molar relationship. Intraoral examination revealed a missing upper left lateral incisor and previous extraction of the lower left first molar. The patient was vertically growing skeletal Class III and in between the developmental stages of Mp3 union and eadius union on radiographic evaluation. The patient did not want to use any kind of extraoral appliance or undergo any surgical procedure. As an alternative to an extraoral appliance, a modified fixed banded tandem appliance with a Hyrax screw was used for treatment. Activation of the Hyrax screw was performed with one-quarter turn per day for five weeks. The patient was instructed to use extraoral heavy elastics for 16-18 hours a day. Eight months later, the tandem appliance was removed and upper and lower fixed

orthodontic treatment was initiated. It was planned to close the gaps of the missing lateral and extracted molar with fixed orthodontic treatment mechanics.

**RESULTS:** The difference between the pre- and post-treatment cephalometric analyses indicated mild forward movement of the maxilla and mild posterior rotation of the mandible. Skeletally a Class I relationship was achieved, the occlusal status was improved and a positive overjet was obtained after use of the modified tandem appliance.

**CONCLUSION:** As an alternative to extraoral appliances, an intraoral modified fixed banded tandem appliance can be effectively used in the treatment of Class III, even in late adolescent patients. It was observed that the patient willingly tried to use the appliance and elastics as instructed. Therefore, it is concluded that the intraoral tandem appliance improves patient cooperation.

#### CP172 ORTHODONTIC-SURGICAL TREATMENT OF A SEVERE SKELETAL CLASS III MALOCCLUSION

Tatjana Cutovic<sup>1</sup>, Julija Radojicic<sup>2</sup>, Paulina Pandjaitan Donfrid<sup>1</sup>, <sup>1</sup>Military Medical Academy, Belgrade and <sup>2</sup>University of Nis, Faculty of Medicine, Serbia

**AIMS:** To show the results of orthodontic-surgical treatment of a patient with a severe skeletal Class III malocclusion.

**SUBJECT AND METHOD:** A 20 year old patient diagnosed with a severe skeletal Class III malocclusion, maxillary hypoplasia and mandibular prognathism. The maxillary incisors were inclined labially and the mandibular incisors had a lingual inclination due to the natural tendency for compensation of a large negative step (13 mm overjet). A full crossbite was present in both anterior and posterior regions due to width disharmony between the upper and lower jaw and an irregular form of the dental arches. Extensive orthodontic-surgical therapy was performed in three stages. In the first pre-surgical stage, the upper jaw was widened and the irregularity of the dental arch corrected, as well as the inclination of both the upper and lower incisors. In this way a temporary increase of the horizontal step was caused, but two almost ideal dental arches were achieved and balance of the dento-alveolar structures in respect to the bone bases was established. In the second, surgical stage, after placement of passive arches for immobilization, bimaxillary orthognathic surgery was performed (Le Fort I, sagittal split). After bone healing, the third post-surgical orthodontic stage was performed in order to finely adjust the position of certain teeth and achieve maximum intercuspation of the surgically repositioned jaws.

**RESULTS:** The results were satisfactory in both functional and aesthetic aspects. A stable occlusion was obtained, with significant improvement in the skeletal jaw relationship and soft tissue profile.

**CONCLUSION:** Treatment of patients with severe skeletal Class III malocclusions should, besides bimaxillary orthognathic surgery, include both pre- and post-surgical orthodontic therapy.

#### CP173 VARIABLE TORQUE PRESCRIPTION: STATE OF ART

Mariano Lacarbonara<sup>1</sup>, Ettore Accivile<sup>2</sup>, Maria Rosaria Abed<sup>3</sup>, Annalisa Monaco<sup>1</sup>, Mario Capogreco<sup>1</sup>, <sup>1</sup>Department of Life, Health and Environmental Sciences, University of L'Aquila, <sup>2</sup>University of L'Aquila and <sup>3</sup>Department of Odontostomatological Sciences, University 'Sapienza' of Rome, Italy

**AIMS:** To analyze the current status of variable prescription in orthodontics. The variable prescription is widely described under the clinical aspect: the clinics is the result of the evolution of the state of the art, aspect that is less considered in the literature.

**MATERIALS AND METHOD:** The literature has been scrutinised to describe the historical development of the appliances, from the origin of the pre-adjusted appliance until variable prescription orthodontics, especially regarding the change of the bracket-wire interaction and the change of the biomechanical principles underlying the various techniques, principles that justify different torque management.

**RESULTS:** Traditionally torque is achieved when a rectangular wire is fully engaged into the slot of the bracket: the full-size wire is the last one of the archwire sequence and it must allow sliding movement of the dentition and torque control at the same time. For many

practitioners the optimal bracket-archwire relationship is represented by a 0.022 × 0.028 slot and the 0.019 × 0.025 stainless steel wire: this combination does not permit a full-engagement of the archwire in the slot because there is play of the wire of 10 degrees. The orthodontist needs a more clear view about the variables concerning torque expression and, on this topic, some keys of comprehension are fundamental: the different effectiveness in torque expression of the different alloys, the effect of bracket position and dental morphology on torque expression, the influence of bracket design on its capacity to read the torque (friction and bracket/wire interaction).

**CONCLUSION:** The state of the art is the key to understanding not only how we reach where we are but also to learn how properly to manage the torque, focusing on the technical and biomechanical purposes that lead to the change of torque values over time. The aim of this study is updating the clinician on aspects that affect torque under the biomechanical sight, helping to understand how managing it, following the 'timeline changes' in the different techniques so that variable prescription orthodontics would be a suitable tool in every clinical case.

#### CP174 THREE-DIMENSIONAL CEPHALOMETRICS: A NEW NORM FOR DENTO-FACIAL AESTHETICS

Ilhan Metin Dagsuyu, Department of Orthodontics, Eskisehir Osmangazi University, School of Dentistry, Eskisehir, Turkey

**AIMS:** To analyze normative dento-facial characteristics of a young adult with new imaging modalities and three-dimensional (3D) cephalometrics.

**MATERIALS AND METHOD:** Full-head cone-beam computed tomographic data, 3D facial and intra-oral stereophotographs of a young adult female were imported and combined in orthodontic image processing software (SimPlant O&O and Dolphin 3D). The specific landmarks, reference lines and planes of a new 3D cephalometric analysis were introduced on cranio-facial reconstructions and normative airway, hard and soft tissue measurements were realized.

**RESULTS:** The relationship between stable cranial base landmarks and dento-facial structures, symmetry of the bilateral parts of skeletal framework, aesthetic parameters of the soft tissue envelope and interaction of airway, hard and soft tissues were re-identified in the context of 3D cephalometrics.

**CONCLUSION:** Development of contemporary imaging modalities requires sophisticated analysis methods to understand the complex nature of the dento-facial architecture related to facial aesthetics. In this case report, normative results of a new 3D cephalometric analysis system are shown.

#### CP175 AESTHETIC PARAMETERS: EVOLUTION IN ORTHODONTICS

Marta Iizarbe, Esther Llorens, Master Ortodoncia, Universidad Europea De Valencia, Spain

**AIMS:** To review the literature on the aesthetic goals that have been the basis of different orthodontic techniques over time.

**MATERIALS AND METHOD:** Articles with a high impact in PubMed on the aesthetic constraints of the requirements of different techniques from a collection of articles were reviewed.

**RESULTS:** There were significant differences between treatment goals depending on time.

**CONCLUSION:** There is an evolution in the aesthetic criteria conditioned by the canons of beauty of each moment.

#### CP176 COMPARISON BETWEEN A RAPID PALATAL EXPANDER AND A NICKEL TITANIUM PALATAL EXPANDER IN POSTERIOR CROSSBITE

Maria Rosaria Mannarino, Mario Guerra, Cristina Rossi, Benedetta Polidori, Leonardo Palazzo, Orthodontic Service, Hospital, Gubbio, Italy

**AIMS:** To compare the effects of a rapid palatal expander (RPE) and a nickel titanium (NiTi) palatal expander used for correction of a posterior unilateral or bilateral crossbite and to evaluate the virtues and vices of both appliances.

**SUBJECTS AND METHOD:** Eight patients (aged from 6 to 10 years) with a transverse discrepancy were treated with a RPE (4 patients) or NiTi palatal expander (4 patients). The amount of expansion was evaluated on plaster models and on cone beam radiographs, obtained immediately after and one month after treatment.

**RESULTS:** The crossbite was corrected in both groups of patients, but in the NiTi group more dental than skeletal expansion was observed, and in one case a scissor bite was observed as a side effect.

**CONCLUSION:** Despite the many benefits of the NiTi palatal expander, such as less patient compliance, it was noted that it needs a great and frequent control by the clinician. Thus the use of a RPE is more predictable and safe.

#### CP177 FIXED ANTERIOR BITE PLANE IN CLASS II DEEP BITE MALOCCLUSION

Nicoletta Staffolani, Mario Guerra, Maria Rosaria Mannarino, Salvatore Belcastro, Benedetta Polidori, Orthodontic Service, Hospital, Gubbio, Italy

**AIMS:** To evaluate the effectiveness of a fixed appliance in a very difficult form of malocclusion that requires a great deal of patient cooperation if treated with removable devices.

**SUBJECTS AND METHOD:** An anterior bite plane fixed to molar bands was used in a group of five patients with a severe deep bite and jaw retrusion, for a mean period of six months. The changes in clinical and cephalometric vertical and sagittal parameters were compared with Bolton standard parameters.

**RESULTS:** The appliance permitted rapid correction of a deep bite by causing eruption of the molars and premolars and intrusion of the lower incisors, improving the curve of Spee, and allowing the mandible to express its intrinsic growth potential.

**CONCLUSION:** This fixed appliance permits correction of a deep bite and improves a Class II malocclusion in patients with low cooperation.

#### CP178 EARLY TREATMENT OF BIMAXILLARY PROTRUSION WITH NEW A ORTHOPEDIC POSITIONER USING CONE-BEAM COMPUTED TOMOGRAPHY: A CASE REPORT

Akira Kanao<sup>1</sup>, Kazuhisa Ikeda<sup>2</sup>, Tomo Murakami<sup>2</sup>, Yohei Nakamura<sup>2</sup>, Kiyoshi Tai<sup>3</sup>,  
<sup>1</sup>Department of Orthodontics, Nihon University at Matsudo, Okayama, <sup>2</sup>Private practice, Okayama and <sup>3</sup>Department of Orthodontics, A.T.Still University, Okayama, Japan

**AIMS:** It is generally known that malocclusion and disharmony of the orofacial muscles inhibit growth of the alveolar process and dental arch. Hellman's dental age III B is known as the ideal treatment period for improvement of these disharmonies, but it is difficult to obtain anchorage from a tooth. In this case, a new orthopaedic positioner (NOP) was used with cone beam computed tomography (CBCT). Since there is both skeletal and dental effects when using this NOP, there was a significant change of jaw relationship and dental alignment that resulted in dramatic improvement of the facial profile.

**SUBJECT AND METHOD:** A 10-year-old female in the mixed dentition presented with the chief complaint of bimaxillary protrusion. Clinical examination revealed a brachyfacial pattern, a Class I molar relationship and flared upper and lower incisors. The unerupted tooth crown width was measured using CBCT data and a predictive set-up model was made as a permanent dentition. Furthermore, the NOP, which incorporated headgear in the tooth positioner, was made using the set-up model. The patient used NOP for 2 years at night and 1-2 hours during the day.

**RESULTS:** After two years of the treatment, a successful treatment outcome was achieved by correcting the incisors and controlling mandibular growth. The bimaxillary protrusion was improved.

**CONCLUSION:** Early treatment using CBCT and the NOP was effective.

#### CP179 A NOVEL APPROACH FOR TREATMENT OF IMPACTED UPPER INCISORS

Mohammed Almuzian, Alistair Gardner, Glasgow Dental Hospital and School, U.K.

**AIMS:** This case report demonstrates a novel treatment approach for dealing with a severely rotated and impacted upper central incisor in an adolescent patient.

**MATERIALS AND METHOD:** Cone beam computed tomography (CBCT) was utilised to localise an impacted central incisor, assess the space requirement, plan the orthodontic mechanics, and design and construct a precision attachment. The custom-made attachment was used to perform particular tooth movements which would be difficult with other conventional method of attachments.

**RESULTS:** Information derived from the CBCT scan helped in assessing the clinical condition of the region of interest, designing the orthodontic mechanics and assessing the space requirement. The mechanics used allowed the tooth to move and erupt within the attached palatal gingivae and prevented labial movement of the tooth which might cause bone fenestration and gingival recession. An additional factor that should be considered in the management of impacted incisors is the position of the teeth axially which has a significant impact on stability and relapse. The more rotated the position of the tooth, the higher the risk of relapse under the influence of superelastic fibre. The orthodontic mechanics used allowed early derotation, before the transseptal fibres had fully developed which will hopefully diminish the amount of relapse and improve stability.

**CONCLUSION:** The mechanics used allowed the use of an acrylic tooth during the whole alignment phase which would be difficult if a conventional attachment was used. Relapse of the derotated tooth and potential gingival recession of the upper central incisor were avoided and the intra-operative patient aesthetic requirement was addressed.

#### CP180 SKELETAL ANCHORAGE IN THE ORTHODONTIC TREATMENT OF A CLASS II MALOCCLUSION\*\*\*

Andreea Paun<sup>1</sup>, Radu Stanciu<sup>1</sup>, Ion Pătrașcu<sup>2</sup>, Departments of <sup>1</sup>Orthodontics and Dento-Facial Orthopaedics and <sup>2</sup>Dental Prosthetics Technology and Dental Materials, 'Carol Davila' University of Medicine and Pharmacy, Bucharest, Romania

**AIMS:** To present a clinical case of an Angle Class II malocclusion treated with premolar extractions and skeletal anchorage in order to establish facial and dental balance.

**SUBJECT AND METHOD:** After clinical and paraclinical evaluations, the patient was diagnosed with an Angle Class II division 2 malocclusion. The main objective of orthodontic treatment was maintaining anchorage after premolar extractions which was obtained with the aid of mini-implants.

**RESULTS:** At the end of the treatment, the facial aspect was greatly improved and the dental and occlusal parameters well restored.

**CONCLUSION:** Skeletal anchorage with orthodontic mini-implants provides the high needs of anchorage necessary for managing the space obtained after extractions.

#### CP181 ORTHODONTIC TREATMENT OF A DEEP OVERBITE MALOCCLUSION WITH MINISCREW IMPLANTS – A CASE REPORT

Hatice Kubra Olkun<sup>1</sup>, Sedat Baran<sup>2</sup>, Gulsilay Sayar Torun<sup>1</sup>, <sup>1</sup>Department of Orthodontics, Istanbul Medipol University and <sup>2</sup>Private practise, Antalya, Turkey

**AIMS:** To present the treatment of a deep overbite by upper incisor intrusion using miniscrew anchorage.

**SUBJECT AND METHOD:** A 16-year-old female with the chief complaint of crowding, a convex profile, retruded mandible and retrusive upper and lower lips. According to the intraoral examination, she had Class I canine and molar relationships on both sides with an overjet and overbite of 4 mm and 5 mm, respectively. There was a moderate arch discrepancy in both the upper and lower jaws. Cephalometric analysis showed a horizontal growth pattern and a Class II skeletal relationship due to the retrognathic mandible with retroclined upper and lower incisors. After levelling and alignment, in order to intrude the upper incisors, miniscrews with a diameter of 1.6 mm and a length of 8 mm were inserted bilaterally between the roots of the central and lateral upper incisors.

**RESULTS:** Orthodontic treatment lasted approximately 2 years with 6 months of upper incisor intrusion. At the end of full fixed treatment, crowding was eliminated, the upper incisor angulations were corrected, an bilateral Class I dental relationships with ideal overjet and overbite were achieved. A considerable improvement of the profile was obtained.

**CONCLUSION:** Upper incisor intrusion with miniscrew anchorage systems can be an effective treatment alternative in deep overbite correction.

#### CP182 EVALUATION OF ALVEOLAR CORTICAL BONE THICKNESS AND DENSITY FOR ORTHODONTIC MINI-IMPLANT PLACEMENT

Federica Altieri, Annalisa Dichicco, Silvia Del Prete, Gabriella Galluccio, Michele Cassetta, Department of Orthodontics, Sapienza University of Rome, Italy

**AIMS:** To evaluate alveolar cortical bone thickness and density differences between interradicular sites.

**MATERIALS AND METHOD:** Forty eight computed tomographic scans were selected from 3,223 patients.

**RESULTS:** Statistically significant differences in cortical bone thickness and density were found ( $P < 0.05$ ).

**CONCLUSION:** Cortical bone thickness and density were greater in males, in the mandible and in the oral-posterior region.

#### CP183 INTERACTIVE CASED-BASED ELEARNING FOR TRAINING OF GRADUATE AND POSTGRADUATE ORTHODONTIC STUDENTS IN DIAGNOSIS AND TREATMENT PLANNING\*\*\*

Johanna Radeke, Fayez Elkholy, Veronika Hofmann, Maria Lang, Bernd G. Lapatki, Department of Orthodontics, University of Ulm, Germany

**AIMS:** Basic orthodontic diagnosis and treatment planning is part of the clinical-practical education of graduate dental students and postgraduate orthodontic students. This process requires acquisition and evaluation of various diagnostic elements such as case history, clinical examination, photographs as well as different radiographs. To date, complete data on patients are available in purely digital form. Therefore, computer-based diagnosis and treatment planning is feasible. The aim of this project was to create a flexible eLearning platform for training of graduate and postgraduate students in orthodontic diagnostic skills and treatment planning.

**MATERIALS AND METHOD:** The basic structure of the eLearning program is a web-based interface with guidance of the students through the software by a virtual tutor. Case history and findings of the clinical examination are presented, and are to be filtered by the student with respect to their relevance for the specific case. For analysis of digital photographs, dentition model casts, panoramic radiographs and lateral cephalograms, special tools were built and external software was embedded, respectively. Different kinds of didactic tools such as hidden lists, multiple-choice questions and auto-correction were implemented to impart and consolidate the required skills and knowledge. Specific questionnaires were developed for media informatics and dental students to test the usability of the eLearning program.

**RESULTS:** Usability testing generally revealed a very positive feedback in both student groups. The informatics students observed certain deficiencies concerning the size of legends as well as colour choice, and suggested improvement of navigation within the different treatment planning steps. Dental students additionally criticized the need of paging back to get results necessary for continuing.

**CONCLUSION:** A web-based eLearning platform for training of graduate and postgraduate orthodontic students in diagnosis and treatment planning was successfully developed. The results of the usability tests are to be considered, and implementation of new cases has to be facilitated in an improved version of the eLearning program.

#### CP184 CHERUBISM: CLINICAL, RADIOLOGICAL AND THERAPEUTIC FEATURES – A CASE REPORT

Ana Sofia Bento, Mariana Albergaria, Sónia Alves, Ana Luisa Maló, Francisco Vale, Department: Post-graduation in Orthodontics, Faculty of Medicine of University of Coimbra, Portugal

AIMS: To report a non-familiar cherubism case, reviewing several clinical and radiological features and emphasizing the most important aspects, in order to find a correct diagnosis.

SUBJECT AND METHOD: Cherubism is an uncommon benign fibro-osseous disorder characterized mainly by bilateral, well-defined, multilocular radiolucent areas within the jawbones. It presents variable degrees of involvement and a tendency toward spontaneous remission. A 16-year-old boy with a previous diagnosis of cherubism and Noonan syndrome referred due to deformation of the lower and middle section of the face and displacement or absence of several teeth. The patient underwent head and neck magnetic resonance imaging and three-dimensional computed tomography in addition to other conventional two-dimensional radiographs, for imaging assessment. These revealed extensive multilocular, bilateral radiolucent areas, marked bony expansion in the mandible and maxilla and several retained teeth. These clinical features are compatible with Sward and Hankey's type II cherubism classification. The lesions were not evaluated from a histopathologic perspective due to the existence of a previous diagnosis and to the conservative approach that was chosen for this patient.

RESULTS: Cherubism generally regresses with age and treatment is indicated only in cases of aesthetic and functional problems. The standard approach consists in waiting until the end of puberty before performing any surgery, which is recommended only in the most aggressive cases. In this particular case, the patient was periodically controlled, with the final therapeutic decision pending on the regression of the lesions.

CONCLUSION: The radiographic characteristics of cherubism are not pathognomonic of the disease, although the diagnosis is strongly based on the presence of osseous lesions, usually symmetrical, bilateral and multilocular, in the mandible and maxilla. These features together with clinical and histopathological findings are suggestive of cherubism, however sometimes the diagnosis must be confirmed by genotypic characterization.

#### CP185 DIFFERENTIAL EXPRESSION OF CYTOKINES IN TEENS AND ADULTS IN RESPONSE TO ORTHODONTIC FORCES

Thapanee Vongthongleur, Rachel Kwal, Tali Elfersi, CTOR, New York, USA

AIMS: To evaluate if levels of inflammatory markers in the gingival crevicular fluid (GCF) and magnitude of tooth movement induced by orthodontic forces are different between teenagers (12-15 years) and adults (25-45 years).

SUBJECTS AND METHOD: Impressions, photographs and GCF samples were collected from four adults and four teenagers. Both groups were evaluated before orthodontic treatment, immediately before canine retraction, and 1, 7, 14, 28, 29, 56, and 57 days after canine retraction was initiated. Activity of IL-1, CCL2, RANKL was measured both mesial and distal of the canines at different time points. Comparisons between groups were assessed by analysis of variance. Pairwise multiple comparison analysis was performed with the Tukey *post hoc* test.

RESULTS: Adults demonstrated higher inflammatory reaction compared with teenagers. In spite of higher magnitude of inflammatory markers, the magnitude of tooth movement was higher in the teenagers. In addition both adult and teenagers demonstrated higher magnitudes of tooth movement in the second month of treatment.

CONCLUSION: Higher magnitude of inflammatory reaction and lower magnitude of tooth movement especially in first month of treatment requires lower forces in adults in comparison with teenagers.

#### CP186 MULTIDISCIPLINARY TREATMENT OF A PATIENT WITH A PEG-SHAPED LATERAL INCISOR

Nurbengü Yılmaz<sup>1</sup>, Cenk Doruk<sup>1</sup>, Seher Kaya<sup>2</sup>, Department of <sup>1</sup>Orthodontics and <sup>2</sup>Restorative Dentistry, Cumhuriyet University School of Dentistry, Sivas, Turkey

AIMS: This case report describes the multidisciplinary treatment of a patient with a peg-shaped upper lateral incisor and spacing with direct resin composite restorations following orthodontic treatment.

SUBJECT AND METHOD: A 14 year old female with a dental Class II malocclusion with spacing (11 mm maxillary, 11.6 mm mandibular arch discrepancy) and a peg-shaped lateral

upper lateral incisor (2.8 mm anterior mandibular Bolton discrepancy). Following fixed appliance therapy, the upper lateral incisor crowns were restored by direct composite resins.

**RESULTS:** An Angle Class I molar and canine relationship was achieved by fixed appliance therapy and the lateral crowns were restored with attention to ideal proportions of the teeth during the finishing stage.

**CONCLUSION:** Direct resin composite restorations can be easily used at the end of treatment to achieve optimal aesthetic appearance and function.

#### CP187 THE INDEX OF COMPLEXITY, OUTCOME AND NEED

Inês Francisco, Mariana Albergaria, Francisco Caramelo, Francisco Vale, Faculty of Medicine, University of Coimbra, Portugal

**AIMS:** The indices of orthodontic treatment need arose to improve the resource management and to reduce the subjectivity of the diagnosis. The Index of Complexity, Outcome and Need (ICON), in particular, has shown, based on available scientific evidence, advantages over other indices. The objective of this paper is to present a case where ICON was applied.

**SUBJECT AND METHOD:** An 11 year old female who underwent orthodontic treatment was selected and the ICON applied. The pre- and post-treatment dental casts were analyzed by two independent observers. The clinical history and diagnostic records were consulted in order to check both the dental discrepancy and the changes in tooth eruption. There was no time limit in the observation of the case.

**RESULTS:** This case had a high ICON treatment need (ICON: 87 > 43) and a 'very difficult' degree. Concerning the components of pre-treatment, dental aesthetics was the worst component, followed by the anterior vertical relationship. Nonetheless, despite the high complexity of treatment, the outcome was 'great improvement'.

**CONCLUSION:** Orthodontic indices provide information of the need, complexity and outcome of orthodontic treatments, being an essential diagnostic tool. For the case in question, it can be concluded that: (1) The patient had great treatment benefit; (2) The dentist treated the patient effectively.

#### CP188 EFFECTS OF AN ANTERIOR MANDIBULAR POSITIONING DEVICE ON UPPER AIRWAY RESISTANCE SYNDROME– CASE REPORT

Zehra Uz<sup>1</sup>, Mustafa Ersoz<sup>1</sup>, Hilal Ermis<sup>2</sup>, <sup>1</sup>Department of Orthodontics, Faculty of Dentistry and <sup>2</sup>Department of Chest Diseases, Faculty of Medicine, Inonu University, Malatya, Turkey

**AIM:** To determine the effects of an anterior mandibular positioning (AMP) device on a patient with upper airway resistance syndrome (UARS).

**SUBJECT AND METHOD:** A 39 year old male with a retrognathic mandible, upper anterior incisor retrusion, a deep overbite and an Angle Class II division skeletal pattern who had undergone overnight polysomnography due to symptoms of obstructive sleep disorder. The AMP device, made from acrylic resin manufactured in the orthodontic laboratory, was constructed using a wax bite with the mandible protruded in an edge-to-edge incisor relationship. The arousal index was based on all-night polysomnographic studies performed before and after approximately 3.6 months of appliance use and after 1 year without use of the device. Lateral cephalometric radiographs were taken before and after use of the device.

**RESULTS:** The patient's initial arousal index was 29.0/h. After 3 months of treatment with the device the arousal index was 15.9/h and after 6 months 8.3/h. After 1 year without use of the device the arousal index was 5.1/h and there was no snoring.

**CONCLUSION:** The AMP device achieved substantial success. After 1 year of treatment the arousal index was normal and the patient's symptoms of sleep disorder had been corrected. The patient's posterior airway was not expanded when the device was used. Normal values were obtained during sleep without the device due to muscle adaptation. There is no case report in the literature about UARS treated with AMP device. The patient is being followed-up.