ABSTRACTS

OF POSTERS

EUROPEAN ORTHODONTIC SOCIETY
76th Congress Hersonissos, Crete 2000
2–6 June

1 PREDICTION OF CANINE AND PREMOLAR SIZE WITH PARENTS' TEETH

K Abe, K Mishima, A Suzuki, Department of Orthodontics, Kyusyu University, Fukuoka, Japan

AIMS: To investigate whether more accurate prediction of canine and premolar size can be obtained when parents' teeth are used in regression analysis in addition to the subject's teeth.
MATERIALS: Plaster models of 221 subjects (87 males, 134 females) and their parents who had fully erupted teeth from the central incisor to the first molar, at least on one side of each upper and lower arch.
METHODS: After measurement of study casts, linear regression analysis, with the widths of the central and lateral incisors as independent variables, was carried out for prediction of the widths of the canine and premolars. In addition, multiple regression analysis was undertaken with teeth selected from the central and lateral incisors and first molar, and with teeth selected from parents; subject's teeth were independent variables. Selection of the independent variables was made by the stepwise method.
RESULTS: Correlation coefficients of the linear and multiple regression equations, with the subject's teeth as independent variables, were as follows: Upper $r = 0$ 65, $R = 0.71$ (males) $r = 0.68$, $R = 0.74$ (females), Lower $r = 0.60$, $R = 0.70$ (males) $r = 0.69$, $R = 0.77$ (females). Correlation coefficients of the multiple regression equations with subject's and parents' teeth as independent variables were as follows: Upper $R = 0.72$ (males) $R = 0.78$ (females), Lower $R = 0.77$ (males) $R = 0.82$ (female).
CONCLUSIONS: More accurate regression equations for canine and premolar size were obtained with the use of parents' teeth.

2 MASSETER AND TEMPORAL ELECTRO-MYOGRAPHIC AND TEMPOROMANDIBULAR JOINT ELECTRO VIBRATOGRAPHY CHARACTERISTICS IN CLASS I AND II MALOCCLUSIONS

J Abrão, J W Vigorito, Department of Orthodontics, University of São Paulo, Brazil

AIM: To study the electromyographic characteristics of the masseter and temporal muscles, and electrovibratography of the temporomandibular joints (TMJs).
SUBJECTS: Sixty Brazilian patients divided into two groups: 35 with Angle Class I, and 25 with Class II malocclusions.
METHODS: Electromyographs and electrovibratographs were obtained using the computer systems BioPAK and SonoPAK Q/S. The data underwent appropriate statistical analysis.
RESULTS: Quantitative analysis of the measurements obtained through electrovibratography revealed that Total Integral and Integral <300 Hz values were significant for the right and left sides, i.e. left side values were greater than those obtained for the right side. Analysis of the behaviour of Integral >300 Hz showed that measurements of Class II patients were significantly greater than those of Class I patients, considering both joints. The results demonstrated significant values for Total Integral and Integral <300 Hz in Class I patients; and Total Integral, Integral <300 Hz and Integral >300 Hz in Class II patients. Qualitative analysis demonstrated that 74.3 per cent of Class I patients presented normal sound quality, whereas in Class II subjects the corresponding result was 68 per cent. Comparison between Class I and II patients revealed that Integral >300 Hz measurements were significantly greater in Class II.
CONCLUSION: In Class II patients, electromyography of the masseter and temporal muscles in the rest position revealed hyperactivity in the right and left sides, individually, and for both sides. For the same group, in the central occlusion position, electromyographic figures for the temporal muscle were greater on the right than on the left side. Comparison of the measurements obtained through electromyography of the masseter muscles of Class I and II patients demonstrated that Class II figures were greater than those for Class I in the rest position.

3 CO-CR DISCREPANCY OF THE CONDYLE IN JAPANESE ORTHODONTIC PATIENTS

S Adachi, O Hidaka, T Miki, K Takada, Department of Orthodontics, Osaka University, Japan.

AIM: To identify the distribution of potential CO-CR discrepancies as well as the normal range of CO-CR discrepancies in a group of Japanese orthodontic patients before treatment.
SUBJECTS: A total of 150 orthodontic patients with an age range of 6–57 years.
METHODS: All the models were mounted on a Panadent articulator with the power centric CR bite. The mean value of right and left condyles for both vertical and anterior-posterior CO-CR displacements and horizontal displacement of the condyle were determined. The 150 patients were divided into three groups. Patients under age 10 were placed in group A, between 10 and 18 years in group B and those over 18 in group C. The number of subjects in each group was 53, 64, and 33, respectively.
RESULTS: ANOVA analysis revealed no difference in vertical and anterior-posterior discrepancy among the three groups. The histograms of all patients represented a normal distribution pattern. The mean was 1.0 mm (s.d. 0.7 mm) for the vertical discrepancy and 0.1 mm (s.d. 0.7 mm) for the horizontal. A statistically significant difference for horizontal discrepancy was found between groups B and C, but not between A and B, or between A and C. The mean and standard deviations were 0.0 and 0.4 mm for group A, 0.1 and 0.5 mm for group B and –0.2 and 0.7 mm for group C. The ratio of patients whose CO-CR displacement exceeded 1 mm vertically and antero-posteriorly and 0.5 mm horizontally was 41.16 and 21 per cent, respectively.
CONCLUSIONS: The vertical and horizontal CO-CR discrepancy in these Japanese orthodontic patients showed normal distribution around 1.0 mm and 0.1 mm, respectively. Although the horizontal discrepancy revealed a normal

distribution pattern, a larger discrepancy was identified in adult patients.

4 RELEASE OF NICKEL AND CHROMIUM FROM SIMULATED ORTHODONTIC APPLIANCES

G Ağaoğlu[1], T Arun[1], B Izgü[2], A Yarat[3], Departments of [1]Orthodontics and [2]Basic Sciences, Marmara University, and [3]Department of Basic Sciences, Uludağ University, Turkey

AIM: Most steel-based alloys used in orthodontics contain nickel and chromium. It is known that both nickel and chromium have toxic, dermatological and, possibly, mutagenic effects. The purpose of the study was to investigate nickel and chromium concentrations in saliva and serum of patients during different periods of orthodontic treatment.
MATERIALS AND METHOD: Saliva and blood samples were collected from 10 patients, aged 12 to 33 years. Twenty samples from each group were collected before insertion of the fixed appliances and after 1 week, 1 month and 1 and 2 years. Chemical analysis was undertaken using electrothermal atomic absorption spectrophotometry.
RESULTS: The results indicate certain differences in the amount of nickel and chromium released from different periods of stainless steel orthodontic appliances *in vivo*. The total amount of chromium released from the fixed appliance was significantly lower than the total amount of nickel.
CONCLUSIONS: Orthodontic appliances release measurable amounts of nickel and chromium when placed in the mouth but this does not cause a significant increase in saliva and serum nickel and chromium levels.

5 THE SIDE-EFFECTS OF SLOW MAXILLARY EXPANSION ON THE WIDTH OF THE MANDIBULAR ARCH

M S Ahmad Akhoundi, Department of Orthodontics, University of Tehran, Iran

AIM: Evaluation of the effects of slow maxillary expansion (SME) appliances on the width of the mandibular arch.
SUBJECTS AND METHODS: Fourteen patients requiring SME. Their average age was 10 years 6 months and the average activation interval was 117 days (expansion twice per week). Study models were obtained before and after the active phase of treatment. To evaluate the width of the lower dental arch, three reference points were marked on the study models at the crown, cervical line and 4 mm lower than the cervical line on the buccal alveolar mucosa. The pre- and post-treatment difference between interpremolar or interprimary molar and intercanine width was evaluated.
RESULTS: There were significant differences in the coronal intercanine width for 10 patients (mean 0.448, $P < 0.05$), coronal interpremolar width for one patient (mean 1.003 mm, $P < 0.05$), and coronal intermolar width for 13 patients (mean 1.623 mm, $P < 0.001$). There was a significant difference in the alveolar intermolar width for 10 patients (mean 0.499 mm, $P < 0.05$), but no significant difference for lower alveolar intercanine and interpremolar width. In addition, there were significant differences in all of the cervical intercanine, interpremolar and intermolar widths.
CONCLUSIONS: An increase in the width of the mandibular arch was evident. This effect is beneficial for some patients, but if not required, other procedures, such as a posterior bite plane in the SME appliance, are needed to prevent this type of side-effect.

6 FUZZY MODELLING FOR SELECTING HEADGEAR TYPES

M O Akçam, K Takada, Department of Orthodontics, Osaka University, Japan

AIM: To develop a computer system for deciding appropriate types of headgear appliances for orthodontic patients and evaluating its clinical validity as a decision-making aid for clinicians.
SUBJECTS: The proposed 'fuzzy logic' was tested by eight experienced orthodontists on 85 subjects (33 males, 52 females) who had been diagnosed as requiring headgear appliances.
METHODS: Fuzzy rule bases were created for overjet, overbite and mandibular plane angle variables, which were then transformed into membership functions following the aggregation operation for final inference. Thus the system could provide appropriate headgear type following the input of the above parameters. Eight orthodontic experts evaluated 85 cases to determine if they would 'agree', 'accept' or 'disagree' with the recommendations given by the system. Intra-examiner agreement was tested for repeated judges of a set of 30 orthodontic cases (10 males, 20 females) using kappa statistics.
RESULTS: The results showed that all of the examiners exceeded a kappa score of 0.7, allowing them to participate in the test run of the validity of the proposed inference model. The percentage of the examiners' satisfaction with the system's recommendations showed that the average was 95.6 per cent, and for 83 cases out of the 85 (97.6 per cent). The majority of the examiners i.e., equal to or more than 6 out of the 8 examiners were satisfied with the recommendations of the system.
CONCLUSION: The versatility of the proposed 'fuzzy inference logic' was confirmed.

7 A COMPARATIVE STUDY OF RAPID MAXILLARY EXPANSION USING BANDED VERSUS BONDED APPLIANCES

G A Almeida, W J S Ursi, Department of Orthodontics, University of Uberlândia and University of São José dos Campos, Brazil

AIM: To cephalometrically compare the short-term effects of two commonly used rapid maxillary appliances, one banded (Haas type) and one bonded (Howe/McNamara), on the dental and skeletal vertical facial components.

SUBJECTS: The banded group consisted of 15 patients (10 males, 5 females), with an initial mean age of 13 years 7 months and the bonded group 15 patients (8 males, 7 females), with an initial mean age of 11 years 11 months.
METHODS: The appliances were activated two quarter turns in the morning and evening. The appliances were removed after 4–5 months. Lateral cephalometric radiographs were taken prior to appliance cementation and following removal. Their effects were compared using Wilcoxon and Mann-Whitney-*U* statistical analysis.
RESULTS: The results demonstrated that although lower anterior face height increased in both groups, the mechanisms were different. In the banded group the whole maxilla was displaced downwards, while in the bonded group posterior tooth eruption was arrested while incisor vertical growth was enhanced.
CONCLUSION: The bonded expander seems to control the extrusion of the posterior teeth better than the banded expander during rapid maxillary expansion procedures.

8 FUNCTIONAL CHAOS IN DEEP-OVERBITE: A VERTICAL OR SAGITTAL ISSUE?

T Altiok, A Koklu, Department of Orthodontics, University of Ankara, Türkiye

AIM: To investigate the relationship between morphological characteristics of malocclusion and free mandibular movements by pantographic means in deep overbite subjects, which is considered as the most susceptible malocclusion as a causative factor of craniomandibular/temporomandibular dysfunction (TMD). Natural head and neck posture, which cannot be independent from mandibular function, was also considered.
SUBJECTS: Fifteen adult patients (9 female, 6 male) with a deep overbite, without a previous history of orthodontic treatment. TMD and temporomandibular symptoms were not used as selection criteria initially and only deep overbite existence was taken into consideration.
METHODS: The mandibular border functions were evaluated with an electronic pantograph (Pantronic/Denar, Fort Collins, CO, USA) by means of a pantographic reproducibility index (PRI). Additionally, postural and morphological measurements were carried out on lateral cephalograms taken in the natural head and neck posture. The relationship between PRI and postural and morphological parameters were determined by Pearson's correlation analysis.
RESULTS: Significant negative correlations were found between PRI and OPT/HOR, CVT/HOR angles ($P < 0.01$). Significantly high correlations were also found between other postural parameters and PRI. While there was no significant relationship between overbite and PRI, a positive correlation between overjet and PRI was apparent ($P < 0.01$).
CONCLUSION: It is generally suggested that deep overbite is an important TMD factor as it localizes the mandible posteriorly. However, the above results show that the morphological factor that affects mandibular function in deep overbite subjects is overjet. This finding, together that the relationship between posture and mandibular function, is important in diagnosis and treatment planning with regard to incisor position.

9 EVALUATION OF FUNCTIONAL ORTHOGNATHIC THERAPY EFFECTS ON TEMPOROMANDIBULAR JOINTS WITH SCINTIGRAPHY

M Arat, N Gökçora, H Gökalp, D Erdem, T Atasever, Department of Orthodontics, University of Ankara and Department of Nuclear Medicine, University of Gazi, Turkey

AIM: To investigate the effects of the Andresen activator on the temporomandibular joint (TMJ) with planar bone scintigraphy.
MATERIAL: Planar bone scintigraphs of 20 subjects with Class II division 1 malocclusions taken before and after the study. The treatment group consisted of 10 subjects treated with the Andresen activator and the control group 10 untreated subjects. The subjects in the treatment group were in the active pubertal growth period and those in the control group were in the early growth period.
METHOD: Scintigraphs of bilateral TMJs in maximum intercuspation were taken at the beginning of treatment and control periods. Scintigraphic TMJ imaging was performed 3 hours after an intravenous injection of 200 μCi/kg Tc-99m methylenediphosphonate. Lateral planar views of cranium and TMJ regions were taken by means of a gamma camera (General Electric/Maxus). All images were recorded on the computer. Rectangular regions of interest (ROI) were outlined over the temporomandibular (T) and parietal (P) regions and the average number of counts per pixel in each ROI was calculated and the ratio of T/P was determined for the right and left TMJ regions. All imaging and interpretation procedures were repeated 6 months after achieving a Class I molar relationship in the treatment group and after a similar time period in the control group.
RESULTS: The right and left TMJ region planar bone scintigraphy measurements were evaluated by means of a repeated measured design ANOVA test. Intergroup variations and the variations between treatment and control periods were not found to be statistically significant.
CONCLUSION: Significant changes could not be determined in bone activation of the right and left TMJ regions after activator therapy.

10 'EFFECTIVE' TEMPOROMANDIBULAR JOINT AND CHIN CHANGES DURING ACTIVATOR AND HERBST TREATMENT

S Baltromejus, S Ruf, H Pancherz, Department of Orthodontics, University of Giessen, Germany

AIM: To assess the amount and direction of 'effective' temporomandibular joint (TMJ) and chin changes during activator and Herbst treatment of Class II malocclusions.

MATERIAL: Lateral head films of 138 Class II division 1 patients (40 activator and 98 Herbst appliance). The radiographs were taken before and after treatment. The average treatment period was 2.6 years in the activator group and 0.6 years in the Herbst group.
METHOD: The cephalograms were evaluated by means of a modified method of Creekmore (1967). The net treatment effect (= total changes minus age related Bolton-value) was assessed.
RESULTS: The Herbst group showed a three times larger sagittal ($P < 0.001$) and only half the amount of vertical ($P < 0.001$) 'effective' TMJ changes than the activator group. Additionally the sagittal chin changes were five times larger in the Herbst group.
CONCLUSION: The 'effective' TMJ and chin changes achieved in the Herbst group exceeded those in the activator group and were directed in the desired (sagittal) therapeutic direction, while the changes in the activator group were more vertically orientated.

Creekmore T D 1967 Inhibition or stimulation of the vertical growth of the facial complex, its significance to treatment. The Angle Orthodontist 37: 285–297

11 ARCH MORPHOLOGY IN SUBJECTS WITH CLASS II MALOCCLUSIONS

E Barbato, D Proietti, G Fratto, Department of Orthodontics, University of Roma 'La Sapienza', Italy

AIM: To evaluate the size and morphology of dental arches in a group of untreated subjects with Class II malocclusions.
SUBJECTS AND METHOD: Twenty-five subjects (13 males, 12 females), aged from 14 to 18 years, with dental and skeletal Class II malocclusions. The control group consisted of 30 subjects (15 males, 15 females) with ideal occlusion. Dental cast analysis was performed according to Bishara; anterior arch length, posterior arch length and arch width at five different levels (lateral incisors, canines, first and second premolars and first molars) were measured. Student's *t*-tests were used to assess sexual dimorphism and to evaluate whether there were any significant differences between the sample and control group.
RESULTS: For males the upper arch width was larger at two levels (second premolars, first molars), whereas the lower arch was larger at three levels (first and second premolars, first molars). In the Class II subjects upper arch width was significantly smaller at three levels (canines and first and second premolars) than in the control group, whereas no differences were found for the lower arch.
CONCLUSIONS: Arch size is significantly influenced by sexual dimorphism and by the characteristics of the malocclusion. A narrow arch morphology may contribute to the occurrence of Class II malocclusions. Correction of the transverse dimensions may improve the sagittal relationship, since spontaneous movement of the mandible into a more forward position often occurs.

12 BODY MASS INDEX IN OBSTRUCTIVE SLEEP APNOEA: A CEPHALOMETRIC EVALUATION

J M Battagel, A Johal, B Kotecha, C B Croft, Department of Orthodontics, The Royal London and Guy's Hospitals, and The Royal National Throat, Nose and Ear Hospital, London, England

AIM: To compare the skeletal, oral and pharyngeal features of slim and obese subjects with obstructive sleep apnoea (OSA).
SUBJECTS: Twenty-eight obese and 20 slim, male Caucasian adults with OSA, confirmed by polysomnography.
METHOD: Upright lateral cephalometric radiographs taken at end-expiration were traced and digitised. Twenty angular, linear, area and proportional variables were calculated, comprising skeletal, oral and pharyngeal parameters. All measurements were corrected for magnification. Differences between slim and obese subjects were calculated and any significance examined using the Mann-Whitney *U* test.
RESULTS: Slim subjects exhibited significantly more retrusive maxillae ($P < 0.05$), smaller mandibles, shorter lower face heights ($P < 0.01$) and more upright incisors ($P < 0.05$) than obese individuals. The distance between the lower incisor and the posterior pharyngeal wall was reduced by 10 per cent ($P < 0.01$). Obese subjects had significantly longer, larger soft palates and tongues and both the hyoid and the cervical vertebrae were more posteriorly placed. Tongue (but not soft palate) dimensions in the slim group appeared normal. There were no differences in pharyngeal airway dimensions between the groups but both post-palatal and retro-glossal airways were markedly reduced in comparison with control individuals.
CONCLUSIONS: (1) All OSA subjects exhibit some anatomical basis for their condition and regardless of weight, are clearly distinguishable from control individuals. (2) In the obese the condition is compounded by the larger soft palate and tongue. (3) The longer lower face and more dorsally positioned hyoid and cervical spine may be due to the excessive soft tissue in this group.

13 SKELETAL TREATMENT EFFECTS IN CLASS II MALOCCLUSIONS

M Bendeus[1], B Nelson[1], K Hansen[2], A B M Rabie[1], U Hägg[1], [1]Faculty of Dentistry, University of Hong Kong, SAR China and [2]Cranio Facial Growth Centre, Malmö Hospital, Sweden

AIM: To investigate sagittal skeletal treatment changes in mild to moderate Class II division 1 subjects treated with headgear activator (HGA), Herbst (H) and fixed appliances with Class II elastics (CE), respectively.
SUBJECTS: Male Caucasian patients, 18–17 in each group, all treated non-extraction.

METHODS: Lateral cephalograms were obtained at the start and after 12 months of treatment. For the H group the 12 months period comprised 6 months of treatment and 6 months follow-up. For the HGA group cephalograms were taken 6 months prior to treatment and, by extrapolation, 12-month values for normal growth were established. Treatment effect equals changes during 12 months of treatment minus 12 months normal growth. The measurements of the maxillary and mandibular bases were made parallel to the initial occlusal plane to a perpendicular through Sella (Pancherz, 1982).
RESULTS: (1) Forward maxillary growth was restricted in the HGA and H groups but less in the CE group; (2) Mandibular sagittal growth was not affected in the HGA and H groups, but was negative in the CE group and (3) The jaw relationship was improved in the HGA and H groups, and unchanged in the CE group.
CONCLUSION: The improvement of the skeletal Class II relationship with headgear activator and Herbst is due to restraining growth of the maxilla and normal forward growth of the mandible. With Class II elastics the jaw relationship was unchanged but there was restraint of maxillary growth in combination with a 'negative' forward growth of the mandible.

14 AN EPIDEMIOLOGICAL INVESTIGATION OF DENTO-SKELETAL PATHOLOGIES IN PRIMARY SCHOOL CHILDREN

E R Benvenuto, G Laganà, R Chiaretti, C Chimenti,
Department of Surgical Sciences, University of L'Aquila, Italy

AIM: To determine the prevalence of dento-skeletal pathologies in primary school children.
SUBJECTS: An epidemiological investigation of 860 8 to 11 year old children living L'Aquila. The investigation had two aims: the evaluation of caries and malocclusion prevalence, and analysis of the dental parameters responsible for the alterations in occlusal pathology.
METHODS: The following variables were examined: caries, severe malocclusions, dental classes, coincident or non-coincident midline, upper and lower crowding.
RESULTS: The percentage of children with at least one deciduous or permanent carious tooth was 67.3 per cent. In the permanent dentition, caries prevalence was nearly 40.0 per cent and in deciduous dentition, 55.4 per cent. The percentage of children with severe malocclusions was 55.0 per cent, with a decreasing trend according to age. From the analysis of the trends of malocclusion in some cases there was a significant relationship.
CONCLUSION: The results provide information concerning the links existing among various malocclusion factors and suggest the possibility of setting up diagnostic protocols specific for various orthodontic patients.

15 EXPERIMENTAL SCANNING ELECTRON MICROSCOPIC EVALUATION OF THE ENAMEL-COMPOSITE INTERFACE OF FIVE ORTHODONTIC CEMENTS

G P Bertelè, A Urbani, F Stella, M Mercanti,
Clinica Odontoiatrica, Università di Verona, Italy

AIM: A comparative scanning electron microscopy (SEM) evaluation of the penetration inside enamel prisms of five orthodontic cements, four composites and one glass-ionomer, for direct bonding of orthodontic brackets *in vitro*.
MATERIAL: Eighty human molars extracted and stored in 10 per cent formalin, 30 polycarbonate orthodontics brackets, four composite resins and one glass-ionomer cement.
METHODS: Five brackets were cemented on the etched enamel of each tooth using the direct bonding technique, following the manufacturers' instructions. The teeth were then embedded in transparent methyl-methacrylate resin to be microtomized into 0.8 mm thick sections. Each section was SEM examined to evaluate and measure the enamel-cement interface.
RESULTS: Significant differences in the tested materials were found: a near to zero gap for one composite and from 0.24 to 0.58 μm for the other three. For the glass-ionomer cement a higher (3.70 μm on average) value in the interface with the enamel surface was found.
CONCLUSIONS: Three different bonding patterns have been identified: a chemical-mechanical type in the first case, primarily chemical in the second and exclusively chemical in the third with consequent differences in the degrees of tensile strength. At the same shearing and traction tests, differences in enamel loss during debonding and polishing procedures were observed.

16 FACIAL AND INTRA-ORAL VASCULAR ANOMALIES—ASSESSMENT OF ORAL STRUCTURES

J L Berten[1], C Baethge[1], P Brachvoge1[2], C Mauck[1],
C Fokas[2], Departments of [1]Orthodontics and [2]Oral and Maxillofacial Surgery, Medical School Hannover, Germany

AIM: To analyse the influence of haemangioma and lymphangioma on dentofacial growth.
SUBJECTS: Twenty patients aged 9 to 35 years with facial and/or intra-oral vascular anomalies.
METHODS: After clinical examination, cephalometric and cast analysis was performed to assess vascular anomaly-associated deformities.
RESULTS: Patients suffering from anomalies of the tongue and/or the mandibular alveolar processes generally exhibited a crossbite on the affected side and backward rotation of the mandible. In addition, all of these patients demonstrated an anterior open bite except one, in which dentoalveolar compensation occurred. Cephalometric analysis of the patients with vascular anomalies of their cheeks and/or the maxillary alveolar processes revealed a reduced NL-NSL angle, the more cranial the anomaly was located.

A physiological overbite existed. All patients exhibited a reduced arch width on the affected side. Additionally, vertical excess of the alveolar process was observed in all patients except one. This patient showed reduced vertical development because of soft tissue impingement.
CONCLUSION: Vascular anomalies interfere with physiologic development of oral structures. The orthodontic treatment of patients with vascular anomalies of the tongue should be similar to that of high angle subjects. In patients with anomalies of the cheeks, the soft tissue impingement should be prevented. After completion of facial growth, a bimaxillary osteotomy has to be performed to adapt the occlusal plane to the bipupillary line and the line of lip closure.

17 A NEW APPLIANCE FOR DISTAL BODILY MOVEMENT OF MAXILLARY MOLARS

L Bondemark, Department of Orthodontics,
Malmö University, Sweden

AIM: To evaluate cephalometrically the dental and skeletal treatment effects of a new lingual intra-arch Ni-Ti coil appliance for molar distalization and to compare the treatment effects with those of an established intra-arch appliance that uses repelling magnets for distal molar movement.
SUBJECTS: Two groups of 21 adolescents, all girls, participated in this retrospective study.
METHODS: One group was treated with the new lingual Ni-Ti coil appliance for 6.5 months and the other with the magnetic appliance for 5.8 months. The treatment effects were analysed by measurements on lateral head radiographs at the start of treatment and after the molar distalization was completed.
RESULTS: The mean amount of distal molar movement was 2.5 mm (SD 0.69) in the lingual coil group and 2.6 mm (SD 0.5 1) in the magnet group. A significantly higher degree of distal molar tipping was found in the magnet group, 8.8 degrees, compared with 2.2 degrees for the lingual coil group. Due to anchorage loss, the maxillary incisors moved forwards and the overjet was increased by an average of 1.2 mm in the lingual coil group and 1.7 mm in the magnet group.
CONCLUSIONS: The results indicate that the new lingual Ni-Ti coil appliance was a better choice than the magnet appliance for distal bodily movement of maxillary molars. The benefits of the new Ni-Ti appliance were due to the design, which prevented molar tipping, and its single activation.

18 COMPARISON OF TWO DIFFERENT FORCE SYSTEMS ON MAXILLARY ORTHOPAEDIC PROTRACTION

E Cetinkaya Tokmak, A Keles, N Erverdi, Department of Orthodontics, Marmara University, Istanbul, Turkey

AIM: Maxillary protraction is a common procedure used in the treatment of subjects with maxillary retrognathia. Whilst several methods have been described, counter-clockwise rotation of the maxilla during protraction procedure was unavoidable. In this study the aims were to compare the effects of different points of force application in the spatial movement of the maxilla.
SUBJECTS: Twenty-three individuals (13 girls, 10 boys) whose age ranged between 7.2 and 9.8 years, average 8.8 years, with maxillary retrognathia were divided into two groups. The first group comprised 12 subjects and the second group 11 subjects.
METHODS: An acrylic cap splint type expansion device was cemented on the maxillary dentition and rapid palatal expansion was performed for seven days. Following this, in the first group, elastics generating a unilateral force of 450 g were applied from the premolar area to a facemask at a downward angle of 15–20 degrees to the occlusal plane. In the second group, the point of force application was carried 2 cm upwards from the occlusal plane with a specially designed facebow. The same amount of force was applied as in the first group but it was orientated parallel to the occlusal plane. The patients were recommended to use their facemasks 16 hours/day.
RESULTS: Maxillary protraction was achieved in both groups. In the first group, counter-clockwise rotation and in the second group clockwise rotation of maxilla was observed. The anterior movement of the maxilla was greater in the first group compared with the second group.
CONCLUSION: Carrying the point of force application above the centre of resistance of the maxilla can be a useful procedure to control counter-clockwise rotation during maxillary protraction.

19 MANDIBULAR CHANGE AND DISPLACEMENT WITH A FUNCTIONAL APPLIANCE IN CLASS II DIVISION 1 PATIENTS

J Chalipa, M Hashemi, Department of Orthodontics,
Tehran University, Iran

AIM: To evaluate mandibular skeletal and dental changes and displacement following the use of a functional appliance in subjects with a Class II division 1 malocclusion.
SUBJECTS AND METHOD: Fifteen subjects, 10 girls (average age 9.5 years) and 5 boys (average age 10 years) all with Class II division 1 malocclusions were studied. The average study time was 7.5 months for boys and 8.8 months for girls. Lateral cephalograms were obtained at the beginning and end of the study with the functional appliance in place (intra-oral). The cephalograms were traced and analyzed with a combination method. An additional analysis for exact determination of the Go-Gn plane was used. Twenty-four parameters were used for angular and linear measurements in the cephalometric analysis. Statistical analysis was performed with a paired *t*-test.
RESULTS: Average changes for skeletal parameters: body length, saddle angle, articular angle and ANB were statistically significant. Average changes for dental parameters: IMPA to NB, 1 to SN and FMIA were statistically significant.

Average changes of gonial angle, ramus height, SNA, GoGnSN, Y-axis, 1 to NA, 1 to FH and inter-incisal angle were not statistically significant.
CONCLUSION: Comparison of radiographic and statistical results demonstrated relapse of treatment with a backward-downward movement of the mandible (clockwise rotation), due to masticatory muscle pull on the mandibular skeletal base. Dental movements may camouflage this skeletal relapse in some subjects. This effect is documented in cephalometric analysis of tooth position during treatment. Since most functional appliances are tooth-borne they cannot hold the position of the mandibular skeletal base for permanent changes to occur.

20 NEOVASCULARIZATION OF COMPOSITE DEMINERALIZED INTRAMEMBRANOUS AND ENDOCHONDRAL BONE GRAFTS

S H Chay[1], M C Chow[2], A B M Rabie[2], Orthodontics, [1]National University of Singapore and [2]University of Hong Kong, SAR China

AIM: To investigate the correlation between neovascularization and the enhanced bone induction ability of composite intramembranous bone grafts (IM-DBM_{IM}) and composite endochondral bone grafts (EC-DBM_{IM}).
MATERIAL AND METHODS: Forty-eight rabbits with 48 defects were used in this experiment. Sixteen defects were grafted with composite IM-DBM_{IM} and another 16 defects with composite EC-DBM_{IM}. In the control group 8 defects were left empty (passive control) and the other 8 defects were filled with skin collagen (active control). Tissues were retrieved on days 1, 2, 3, 4, 5, 6, 7 and 14 for immunohistochemical staining for angiogenesis related endothelial cells (EN 7/44). Qualitative and quantitative analyses were performed.
RESULTS: Immunohistochemical evaluation revealed a positive staining for angiogenesis related endothelial cells by day 1 post-grafting for IM-DBM_{IM} and day 3 post-grafting for EC-DBM_{IM}. Budding of micro-vessels from host tissues was seen by day 2 for IM-DBM_{IM} and day 3 for EC-DBM_{IM}. The appearance of small blood vessels into the newly formed matrix was seen at days 4 and 5, respectively. Chondroblasts were detected in EC-DBM_{IM} but not in IM-DBM_{IM}.
CONCLUSION: Composite IM-DBM_{IM} bone grafts demonstrated earlier as well as more vascularization compared with EC-DBM_{IM}, which had to pass through an intermediate cartilage stage. The enhanced vascularization could be a contributing factor to the enhanced osteogenic ability of the composite IM-DBM_{IM}.

21 THE CORRELATION BETWEEN CLINICAL AND CEPHALOMETRIC DATA IN CLASS II DIVISION 2 MALOCCLUSIONS

E Cocarla, Orthodontic Department of Medicine University, Cluj-Napoca, Romania

AIM: To establish the correlation between clinical and cephalometric data in subjects with Class II division 2 anomalies as well therapeutic difficulties estimated by the analysis of facial type.
SUBJECTS: One hundred and eighteen patients between 9–16 years of age, with Class II division 2 dental relationships.
METHOD: Clinical and functional examinations (freeway space, mandibular propulsion test in phonetics, and the effect of this in profile), photostatic, study model and cephalometric analysis were carried out using Sassouni's method. Determination of the value of the FMA-angle and the degree of treatment difficulty resulted in a group of 52 subjects (21 boys, 31 girls) 10–12 years of age with skeletal and alveolar Class II malocclusions.
RESULTS: Clinical and cast analysis showed a Class II occlusal relationship, dental retroversion and increased overbite. The profile was convex due to a retrognathic chin with a facial profile greater than 10 degrees. Cephalometric analysis showed skeletal and alveolar Class II in 57 per cent of the subjects, skeletal Class I in 32 per cent and 11 per cent skeletal Class III associated with alveolar Class I or II. The presence of a Class III malocclusion was due to over-development of the chin area. According to the FMA values, 43 per cent of the patients were normodivergent (48 per cent boys, 38 per cent girls) 27.5 per cent (24 per cent boys, 31 per cent girls) were hypodivergent and 29.5 per cent were of hyperdivergent facial type (28 per cent boys, 31 per cent girls).
CONCLUSION: These data determine the treatment when using functional appliances in the mixed dentition. Mandibular propulsion is appropriate in subjects with convex profiles, skeletal Class II and hypodivergent facial types, after treatment of maxillary dental retroversion. In skeletal Class I or III mandibular propulsion is not indicated. Normal occlusion will occur by moving the teeth.

22 FORCES AND MOMENTS OF PALATAL ROOT TORQUING MECHANICS

A G Crismani, J W Freudenthaler, H-P Bantleon, Department of Orthodontics, University of Vienna, Austria

AIM: To study the activation and deactivation force systems of palatal root torquing devices.
METHODS: Due to the force system tested, attachments and cantilevers were placed in the measuring device simulating the clinical situation. The forces and moments delivered by the activated force systems were measured in a computer-based strain-gauge system initially at full activation and during stepwise deactivation. The environmental temperature was a constant 37°C. Each measurement was repeated five times. Cantilevers fabricated from 0.032″ stainless steel were bonded to the palatal surface of the incisors. A superelastic coil spring (50 g) stretched to the palatal sheaths of the molar bands. Additionally a base arch was activated for intrusion (0.017 × 0.025″ TMA).

RESULT: The mean values of forces and moments delivered by a black NiTi coil spring for palatal root torque of incisors were:

	vertical	horizontal	moment
initial	0.46 N	0.56 N	16.3 Nmm
5° deactivation	0.45 N	0.56 N	15.8 Nmm
10° deactivation	0.27 N	0.36 N	10.2 Nmm

CONCLUSIONS: The clinical use of advanced segmented mechanics, such as palatal cantilevers, has improved the prediction of orthodontic tooth movement. As the force magnitude and the force constancy are no longer unknown, the requirements of an ideal force system are met.

23 SLEEP APNOEA AND ORAL APPLIANCES: A CEPHALOMETRIC AND POLYSOMNOGRAPHIC STUDY

M David, S Bou Saba, G Liistro, D Rodenstein, H De Clerck, Department of Orthodontics, Catholic University of Louvain, Belgium

AIM: To determine the effects of oral appliances on snoring in patients with obstructive sleep apnoea syndrome: correlation between cephalometry with and without an oral appliance (OA) in place.
SUBJECTS: Fifteen patients were treated with three types of OA: Herbst, tooth positioner and QuietKnight.
METHODS: All patients underwent a full-night's diagnostic polysomnography. They were asked to use their OA each night during one month. All the subjects then underwent a second polysomnography with the OA in place. Standard cephalometric analysis was undertaken for each patient with and without the OA in place.
RESULTS: Although the average apnoea-hypopnoea index decreased significantly, snoring was not affected by the OA. Only in seven patients was a reduction observed. There was a strong correlation between the change in snoring index during sleep and two cephalometric variables: ANB angle without, and overjet with the OA in place. No change in quality of sleep was observed.
CONCLUSION: OAs are effective in decreasing the number of obstructive apnoeas and hypopnoeas, without affecting the quality of sleep. Snoring reduction with OA may be predicted by cephalometry.

24 PREVALENCE AND CHARACTERISTICS OF MALOCCLUSIONS IN A BELGIAN ORTHODONTIC POPULATION

I De Bruyne[1], G Willems[1], C Carels[1], S Fieuws[2], [1]Department of Orthodontics and [2]Centre of Biostatistics, K.U. Leuven, Belgium

AIM: To provide quantitative information regarding the prevalence of dentofacial characteristics of malocclusions in a Belgian orthodontic population.
MATERIAL: Data were acquired from the files of 1477 patients who attended the Department of Orthodontics.
METHODS: Dental casts, intra- and extra-oral photographs, and radiographs were examined. An analysis of each case was completed by answering several questions concerning the sex of the patient, the age, treatment time, malocclusions following Angle's classification, skeletal relations, space conditions, transversal and vertical relationships, tooth anomalies and treatment factors.
RESULTS: The prevalence of Class I, Class II division 1, Class II division 2 and Class III was 30.9, 52.1, 11.5 and 5.5 per cent, respectively. There was no significant difference in the prevalence of Angle Classes between males and females. There were more traumatised teeth and more severe crowding in males. The following characteristics were significantly different between the Angle Classes: skeletal relationship, segmental crossbite, crossbite of one tooth, facial asymmetry, protrusive and lateral shift, anterior and posterior open bite, horizontal growth pattern, impacted teeth, treatment time.
CONCLUSION: There were only a few differences between males and females, but many between the Angle Classes. Correlations between the examined dentofacial characteristics were found.

25 APICAL ROOT RESORPTION IN ORTHODONTICS: A RISK TO BE CONSIDERED?

L Del Monaco, M Ravara, G Masotto, F A Miotti, Department of Orthodontics, University of Padova, Italy

AIM: To investigate the prevalence and extent of apical root resorption and the risk factors during orthodontic treatment to try to predict, prevent or reduce its occurrence.
SUBJECTS AND METHODS: Forty patients, mean age 13.7 years, 15 males, 25 females, treated in the Department of Orthodontics, University of Padova were examined. Criteria for inclusion in the study were the presence of a Class I or II malocclusion according to Angle's classification, the need for four first premolar extractions and full fixed appliance treatment (Straightwire technique according to Roth prescription), and no maxillo-facial surgery included in the treatment plan. Variables such as gender, age, molar occlusion, treatment length, the use of extra-oral or Class II traction were examined. Orthopantomograms at T1 and T2 (beginning and end of treatment) were examined. The length of each tooth at T1-T2 was measured with a viewer and a metric ruler from the occlusal margin to the apex of the root and the difference was calculated. Plaster casts were examined in all cases to exclude any possible shortening of the tooth crown due to fracture or abrasion.
RESULTS: All the parameters examined appeared to be somehow related to apical root resorption, even though the only really significant statistical correlation was observed with the presence of previous dental trauma and root morphology ($P = 0.05$). Resorption was most frequent in the upper second incisors, with a mean length loss of 9 per cent.

CONCLUSIONS: Root resorption is difficult to predict, as biological and genetic individual reaction to orthodontic forces might vary. The orthodontist must however identify known risk factors such as a history of trauma or root shape anomalies, and carefully monitor each single case during treatment to prevent damage to the patient. Discontinuing treatment might be necessary to allow for tissue repair.

26 FLUORIDE-RELEASING ELASTOMERICS ASSESSED WITH THE *IN SITU* CARIES MODEL

U Doherty, P E Benson, S M Higham, Department of Clinical Dental Sciences, University of Liverpool, England

AIM: To carry out a longitudinal, prospective, randomised, crossover clinical trial to examine the clinical benefit of fluoride-releasing elastomeric ligatures using an *in situ* caries model.
SUBJECTS: Fourteen individuals starting orthodontic treatment with fixed appliances.
METHODS: Three *in situ* enamel samples, with preformed subsurface lesions, were prepared for each patient, from human premolars. Two were placed in customised holders (Benson *et al.*, 1999) and one was retained as a control specimen. A crossover design was used so 11 patients had two experimental periods of six weeks with either fluoridated or non-fluoridated elastomerics and a washout between. Elastomerics were randomly allocated at the first visit and one enamel specimen was placed at the beginning and collected at the end of each experimental period. The specimens were sectioned and ground to 100 μm and transverse microradiography was carried out. They were analysed using dedicated computer software. The parameters of the preformed carious lesion, expressed as mineral loss (ΔZ), lesion depth (I_d), lesion width (I_w) and ratio ($\Delta Z/I_d$) were compared.
RESULTS: Mean mineral loss (vol per cent μm) for the control specimen was 576.3 ± 160.0, compared with 621.3 ± 266.9 for the non-fluoridated ligatures and 693.3 ± 286.6 for the fluoridated ligatures. A one-factor within subjects ANOVA showed no statistical difference between the groups ($P = 0.506$).
CONCLUSION: Using the *in situ* model, fluoridated elastomeric ligatures showed no benefits over non-fluoridated ligatures in remineralising an enamel specimen with a preformed carious lesion. This may be due to the short-term nature of the fluoride release from these ligatures. Fluoridated ligatures may affect the local environment surrounding the bracket.

27 RADIOGRAPHIC EVALUATION OF THE CONDYLAR POSITION IN RETRUSIVE CLASS II DIVISION 1 GROWING PATIENTS

C Dominguez-Rodriguez, C Morea, C Hirschheimer, J W Vigorito, Department of Orthodontics, University of São Paulo, Brazil

AIM: To determine the position of the condyle in the glenoid fossa before starting orthodontic treatment in Class II division 1 patients is important for complete evaluation of the components of the malocclusion. Studies that evaluate the influence of Class II malocclusion on the condylar position vary and have shown the condyle in a central, anterior and posterior position in the glenoid fossa. Bearing in mind that the condyle surface is irregular, a method to analyse the condylar position was developed.
MATERIAL AND METHODS: Lateral temporomandibular joint tomograms from 19 Class II division 1 patients, with a mean age of 10 years 7 months, were analysed by means of two different methods: firstly the anterior, superior and posterior joint spaces and secondly the position of the geometric centre of the condyle in the glenoid fossa.
RESULTS: The results showed a mean values for the posterior, superior and anterior joint spaces of 3.37 ± 1.4 mm, 4.2 ± 1.2 mm and 2.22 ± 0.7 mm, respectively on the right side and 2.93 ± 1.1 mm, 3.81 ± 1.2 mm and 2.05 ± 0.4 mm on the left side. The geometric condylar centre showed mean values for the posterior, superior and anterior distances respectively of 8.07 ± 1.86 mm, 8.31 ± 1.5 mm, and 7.33 ± 1.2 mm on the right side, and 7.83 ± 1.4 mm, 8.18 ± 1.4 mm and 7.25 ± 1.1 mm on the left side.
CONCLUSION: In this group of patients the centre of the condyle was located in the centre of the glenoid fossa and the position was bilaterally symmetrical. The articular spaces showed an antero-inferior condylar position and asymmetry between the right and the left sides.

28 THE EFFECTS OF MAXILLARY SPLINT THERAPY ON THE TREATMENT OF CLASS II DIVISION 1 MALOCCLUSIONS

E Erbay, Department of Orthodontics, University of Istanbul, Turkey

AIM: To evaluate cephalometrically the effects of a maxillary splint with a lower lingual shield and an acrylic cap covering the lower incisors on the treatment of Class II division 1 malocclusions.
SUBJECTS: Twenty subjects (8 females, 12 males) with a Class II division 1 malocclusion with mandibular skeletal retrusion and maxillary dentoalveolar protrusion. Ten subjects (4 females, 6 males) who had not undergone treatment served as the control group, whereas 10 subjects (4 females, 6 males) were treated with the maxillary splint. Chronological mean decimal age at the initial period of the investigation was 12.75 years in the treated group, and 12.84 years in the control group.
METHODS: The maxillary splint with the lower lingual shield and an acrylic cap covering the lower incisors was worn 24 hours/day, even while eating by each of the patients in the treated group. The mean research period was 1.63 years for the treatment group and 1 year for the control group. Investigation was carried out on lateral cephalograms taken before and after the study period. Cephalometric analysis comprised skeletal, dental and soft tissue measurements. Statistical analysis of the data included

descriptive statistics, Wilcoxon test for paired groups, Mann-Whitney *U*-test for independent groups.
RESULTS: All subjects in the treated group were treated to a Class I occlusal relationship. Comparison of change observed in the treated and control groups showed that SNA, ANB, 1/ANS-PNS angles, overjet and overbite were decreased, whereas SNB, SN/GoMe, NAPg, GISnPg' were increased significantly in the treated group.
CONCLUSION: The results suggest that a maxillary splint with a lower lingual shield and an acrylic cap covering the lower incisors is effective in the treatment of Class II division 1 malocclusions with mandibular skeletal retrusion and maxillary dentoalveolar protrusion by means of the stimulation of mandibular growth and retrusion of the upper incisors, without significant protrusion of the lower incisors.

29 EFFECTS OF CHLORHEXIDINE ON BACTERAEMIA FOLLOWING ORTHODONTIC DEBANDING AND DEBONDING

N Erverdi, A Acar, B İşgüden, T Kadir, Departments of Orthodontics and Microbiology, Marmara University, Istanbul, Turkey

AIM: To investigate the effects of chlorhexidine mouthwash on the incidence of bacteraemia following orthodontic treatment.
SUBJECTS: Thirty-six patients (11 males, 25 females) whose ages ranged from 13 to 27 years (average 18.5 years). All the patients were treated using the edgewise technique and had fixed appliances in both arches. Any subject who had taken antibiotics within the previous 30 days was excluded.
METHOD: Blood samples were obtained from the antecubital vein before the removal of bands and brackets. After rinsing their mouths for 60 seconds with 0.2 per cent chlorhexidine gluconate mouthwash, debanding and debonding procedures were completed and blood samples obtained for the second time. Ten millilitres of blood was aseptically inoculated into two blood culture bottles that were then connected with a growth indicator device and incubated at 37°C for 14 days. Cultures were taken from positive bottles and bacterial colonies were identified by several microbiologic testing techniques.
RESULTS: Bacteraemia was detected in one of the pre-operative blood samples (2.7 per cent) and one of the post-operative blood samples (2.7 per cent). *Staphylococcus aureus* (0 CFU/ml) was identified in the pre-operative blood sample and *Streptococcus sanguis* 1–2 (2 CFU/ml) in the post-operative blood sample.
CONCLUSION: The 2.7 per cent bacteraemia incidence detected in the present study is smaller than the incidence (6.6 per cent) found in a previous investigation in which no chlorhexidine mouthwash was used prior to debanding. Further research is needed in order to achieve more effective applications of chlorhexidine mouthwash for the prevention of bacteraemia.

30 OCCLUSAL VARIATION IN CHILDREN FROM EASTERN AND WESTERN FINLAND

R Eskeli, M T Laine-Alava, R H Pahkala, Departments of Orthodontics, University of Oulu and Kuopio University Hospital, Finland, and Department of Orthodontics, University of North Carolina at Chapel Hill, NC, USA

AIM: To examine differences in occlusal variation and expression of malocclusion between two population groups of the same ethnicity but slightly different origins living in various parts of Finland but under similar environmental circumstances.
SUBJECTS: All age cohorts from 5 to 15 years from two rural communities where most of the population has lived for many generations, including 571 children from Western Finland (WG) and 1008 children from Eastern Finland (EG).
METHODS: Occlusal traits were recorded using the method of Björk *et al.* (1964) as applied by Laine (1984).
RESULTS: The differences in occurrence of occlusal traits or in dimensions between WG and EG were assessed using logistic regression models and analyses of covariance, respectively, considering the effects of gender and age. Occurrences of several malocclusion traits, namely sagittal distal occlusion (Class II in 24 per cent), vertical anterior (3 per cent) and lateral open bite (3 per cent), and transversal lingual crossbite (8 per cent) were equally common in both groups and did not vary significantly with gender or age. Frequency of buccal crossbite increased clearly with age as did mesial occlusion (Class III), which was also more common among boys than girls, confirming the earlier results of the effects of a Y-chromosome (Laine and Alvesalo, 1992) on this occlusal trait. Although Class III was more common ($P = 0.0029$) in WG compared to EG, its low frequency does not warrant further conclusions. Overjet (mm) and overbite (mm) were smaller, and maxillary and mandibular crowding more common in WG than EG, while spacing of the dentition was more frequent in EG than in WG.
CONCLUSION: The results show no difference in variation with regard to occlusal features except for those related to dimensions. Therefore there is no difference in treatment need, if determined based on morphology, between children in Western and Eastern Finland.

31 CHARACTERIZATON OF BOVINE ENAMEL SURFACES USING ELECTRON MICROSCOPY AND SPECTROSCOPY STUDIES

M Es-Souni, H Fischer-Brandies, Department of Orthodontics, Christian-Albrechts-University, Kiel, Germany

AIM: To contribute to the understanding of the chemical nature of the interaction between conditioning agents such as benzoic acid dissolved in acetone and enamel.
MATERIALS AND METHODS: The crowns of freshly extracted bovine mandibular incisors with intact enamel stored in 0.9 per cent NaCl were used for scanning electron microscopy (SEM) and X-ray photoelectron spectroscopic

(XPS) studies. The labial tooth surface was cut parallel to the enamel surface using a diamond saw with water cooling, leading to slice thicknesses of 2–3 mm and an enamel surface of approximately 7 cm^2. For SEM investigations the slabs were additionally divided into four thin sections. Parts of these surfaces were ground on 1200-grade SiC waterproof paper. The cleaned and dried surfaces were exposed for 2 minutes to the action of acetone or a 3 per cent (by weight) solution of benzoic acid in acetone (BAA).
RESULTS: SEM investigations: Conditioning of bovine enamel surfaces with acetone or BAA does not lead to any visible etching effects either on polished or ground reference surfaces. XPS investigations: Surface treatment with acetone or BAA leads to increased intensities of Ca, P and O with respect to the polished reference surface. Acetone increased the area of the Ca peak by 20 per cent, whereas enrichment of about 60 per cent was achieved with BAA. The relative intensity of the P peak increased on the BAA treated surface by approximately 20 per cent.
CONCLUSIONS: The improved adhesive strength of GIC to enamel observed for BAA conditioned surfaces is believed to be due to better wetability and to an increased number of binding sites on the surface via surface enrichment in Ca and P.

32 EFFECT OF PALATAL EXPANSION ON MAXILLARY ARCH PERIMETER

G Eslami Amirabadi[1], M Biria[2], M Vahid Golpayegani[2], Department of [1]Orthodontics, and [2]Pedodontics, Shahid Beheshti University, Tehran, Iran

AIM: To examine the relationship between palatal expansion and maxillary arch perimeter.
SUBJECTS: Twelve skeletal Class I children aged 8–10 years, with posterior dentoalveolar crossbites.
METHODS: A removable palatal expander was used to correct the posterior crossbite. Changes in the intermolar widths of both the maxillary second primary and first permanent molars were compared with changes in arch perimeter at the end of treatment.
RESULTS: Comparison using a paired *t*-test revealed that by increasing the arch width, the increase of arch perimeter was significant ($P < 0.001$). Regression analysis showed that by increasing intermolar width (second primary molar), arch perimeter also increased, but this correlation was not statistically significant and there was no linear relationship between these two parameters. On the other hand, the same analysis showed that a significant correlation existed between changes in intermolar width (first permanent molar) and changes in arch perimeter ($P = 0.027$) There was a linear relationship between these two parameters.
CONCLUSION: A 1 mm increase in intermolar width (maxillary first permanent molar) will cause a mean increase of 0.96 + 0.31 mm in arch perimeter. This change in arch perimeter must be considered in space analysis in patients with posterior crossbite.

33 OVERBITE CORRECTION IN CLASS II DIVISION 2 TREATMENT: IS IT POSSIBLE? HOW?

K Faltin Jr., M A A Almeida, P Q Quaglia, R M Faltin, Department of Orthodontics, University Paulista, São Paulo, Brazil

AIM: The 'bite' or 'denture' height is one of the most important aspects to be considered in the treatment of Class II division 2 patients, especially in brachyfacial types. This retrospective study was performed to evaluate the changes in bite height during Bionator therapy of Class II division 2 brachyfacial patients.
SUBJECTS: Thirty Class II division 2 consecutively treated patients in the late mixed or young permanent dentition.
MATERIALS: Cephalometric lateral films using the same equipment were taken immediately before (T1) and after Bionator therapy (T2).
METHODS: To evaluate the vertical bite height, Ricketts, Schwarz and Sergl analyses were used. The *t*-test was used to statistically evaluate the results.
RESULTS: The values of the measured parameters at T1 and T2 indicated a considerable increase in bite height with this type of therapy. Ricketts' dentition height increased 2.43 degrees, $P < 0.05$; Sergl's bite height increased 4.18 mm, $P < 0.01$. Concerning the difference between T2 and T1, the value of NL-MP angle (Schwarz analysis) of 0.85 degrees was not significant. This value is very stable in spite of the significant bite height increase found using Ricketts and Sergl analyses.
CONCLUSION: The accurate observation of the results, as well as the clinical evaluation of treatment outcome, lead to the conclusion that the increase in bite height in the treatment of brachyfacial Class II division 2 patients with the Balters' Bionator, is a significant factor to be considered in therapy and stability.

34 PROPERTIES OF SOME COMMERCIAL SMA ARCH WIRES

H Fischer-Brandies[1], M Es-Souni[2], N Kock[1], O Bock[1], M Ermert[1], K Raetzke[3], [1]Department of Orthodontics and [2]Materials Science DPT, Christian-Albrechts-University and [3]Materials Testing & Joining, University of Applied Sciences, Kiel, Germany

AIM: To investigate the properties, including the bending properties, as a function of temperature, of some widely used SMA orthodontic archwires.
MATERIAL AND METHODS: Five commercial orthodontic arch wires: Neosentalloy (GAC). TH NiTi (G + H Wire Company), Thermo active Copper 35°C (Ormco/A-Company), Rematitan Lite (Dentaurum) and NTC (RMO) were investigated. Surface topography and chemical analysis as well as microanalysis were conducted using an analytical scanning electron microscope (Philips XL30 + EDAX SUTW). The transformation behaviour, i.e. the transition temperatures, was investigated by means of differential

scanning calorimetry, DSC (Perkin-Elmer Pyris 1). The mechanical properties were determined using 3-point bending tests with a beam length of 12 mm at 22, 37 and 60°C.
RESULTS: The results showed that the chemical compositions of the binary alloys were very similar. The surface topography may however differ depending on the finishing conditions, e.g. the surface can be smooth and free from inclusions or rough and containing oxide inclusions. The DSC results show three main groups depending on the processing history i.e. martensitic (at room temperature), martensitic-austenitic and fully austenitic (austenite stable below –80°C). The mechanical properties show that martensitic archwires have an overall lower strength than austenitic ones and that the strength drastically increases with increasing testing temperature, with a more or less loss in superelasticity. In this respect the copper NiTi arch wire seems to be characterized by superior properties.
CONCLUSION: The properties of SMA archwires are determined by their processing routes; the plateau bending moments may differ drastically depending on whether the wire is in the martensitic or austenitic state. Temperature has also a marked effect on the bending moments and superelastic response. A meaningful selection of the appropriate arch wire has therefore to take these factors into account.

35 THREE-DIMENSIONAL CHARACTERISTICS OF DENTAL ARCH FORMS EXPRESSED BY FA POINTS

K Fujita, Department of Orthodontics, Osaka University, Japan

AIM: To determine mathematical characteristics of dental arch forms expressed by a set of FA points in space in Japanese females with normal occlusion.
MATERIAL: Dental casts taken from 45 Japanese women with complete dentitions, Class I molar and canine relationships, tight intercuspation and no crowding of teeth were selected for study.
METHOD: Dental casts were digitized by a three-dimensional (3D) laser-scanning system based on a non-contact principle. Positions in space of a series of FA points as conceptually defined by Andrews (1972) for all permanent teeth except the third molars were measured on the digitized data set of the casts to determine dental arch forms by means of polynomial curve fitting.
RESULTS: The dental arches in the occlusal view were classified into U-, V- and square-shaped forms. Proportions of the U-, V- and square-shaped forms were 35.6, 46.7, and 17.8 per cent respectively, in the upper dental arch, and 57.8, 17.8 and 24.4 per cent respectively, in the lower arch. The V-shaped arches were best fitted with 2nd order polynomials while the U- and square-shaped arches were best fitted with 4th order polynomials. In the sagittal view, the FA points exhibited a curve-of-Spee-like distribution. Spatial variation of FA points in the vertical direction provided the maximum of 5.13 mm in the upper, and 5.31 mm in the lower arch.
CONCLUSIONS: The occlusal view of dental arch forms was classified into three types, U-, V- and squared-shaped. In the sagittal view, the curve-of-Spee-like distribution of FA points was observed, although there was a large variation in the positions of the FA points in the vertical direction.

36 THE ORTHODONTIST'S ROLE IN THE EARLY DIAGNOSIS AND MANAGEMENT OF AXENFELD-RIEGER SYNDROME

U Garagiola[1], V Ghiglione[1], C Maspero[1], K Nishiyama[2], Departments of Orthodontics, [1]University of Milan, Italy and [2]University of Tokyo, Japan

AIM: To focus on the clinical features, inheritance patterns, pathogenesis, diagnosis and management of Axenfeld-Rieger Syndrome (ARS). This is a rare genetic disorder characterized by a spectrum of dental, craniofacial, ocular, and others systemic anomalies.
SUBJECTS: Thirteen ARS patients, 5 to 21 years of age, (4 females, 9 males) who had undergone multidisciplinary treatment. Common oral manifestations included oligodontia (in both the deciduous and permanent dentitions, with maxillary incisors and canines especially and premolars occasionally missing), anodontia, hypodontia, microdontia, enamel hypoplasia, conical-shaped teeth, delayed eruption, taurodontia, misshapen teeth, shortened roots, hyperplastic fraena. Maxillary hypoplasia with flattening of the midface, receding upper lip and a prominent lower lip promotes a mild prognathic profile and a characteristic face displaying an old appearance. Other clinical features are hypertelorism, telecanthus, a broad flat nose, short stature, a characteristic redundant periumbilical skin, a bilateral developmental disorder of the eyes, and a high incidence of secondary glaucoma, typically difficult to control, often leading to significant optic nerve damage.
RESULTS: Multidisciplinary therapy achieved optimal results for aesthetics, neuromuscular and psychological aspects. Early ARS was diagnosed by orthodontists in five patients (5 to 9 years of age). The subjects were immediately referred to an ophthalmologist to prevent loss of sight.
CONCLUSION: Orthodontists might be able to aid in the early recognition of this hereditary disease and in the prevention of progressive visual loss. This genetic birth defect needs a multidisciplinary approach that permits the synergism of each discipline's specialised expertise and skill into a comprehensive therapy that consistently delivers optimal patient care.

37 HISTOLOGICAL CHANGES IN THE TEMPOROMANDIBULAR JOINT AND MUSCLES IN RESPONSE TO SAGITTAL ADVANCEMENT OF THE MANDIBLE

T Gedrange, I Tetzlaff, B Walter[1], W Harzer, R Bauer[1], H Schubert, Department of Orthodontics, Technical University Dresden and [1]Institute of Pathophysiology, Friedrich Schiller University, Jena, Germany

AIM: Sagittal advancement of the lower jaw leads to adaptive growth stimulation of the condylar cartilage of the

temporomandibular joint (TMJ), a change that is closely related to muscular reconstruction. Using stress intensity, which leads to activated joint reorganisation, the morphological changes which occur simultaneously in the muscles of mastication were studied.
MATERIAL AND METHODS: Fourteen 10-week-old pigs were divided into two groups of seven each. Treatment with build-ups lasted 4 weeks. Fluorescent pigments were injected weekly through a catheter and samples of different muscles of mastication and of the TMJ were obtained at the end of the investigation.
RESULTS: Sagittal advancement of the lower jaw caused a strong increase in proliferation in the posterior area of the condyle, a low increase in the superior area but no increase in the anterior area. Changes were observed with treatment in the anterior part of the masseter and the distal part of the temporalis muscles.
CONCLUSION: Growth of muscles and the TMJ depend on genetic factors that are connected to functional influences. Changes in muscle stress results in reorganisation of fibre types and the new equilibrium of force to changes in the development of the TMJ. Treatment of Class II malocclusions lead to further development of the muscles of mastication resulting in improved muscular energy exploitation (with increased force). The new muscular construction shows a better adaptation to treatment than the TMJ.

38 BILAMINAR ZONE REACTION TO ACTIVATOR TREATMENT

B Geers, S Ruf, H Pancherz, Departments of Orthodontics, University of Giessen, Germany

AIM: To examine the reaction of the bilaminar zone of the temporomandibular joint (TMJ) during activator treatment.
SUBJECTS: Twenty-eight subjects with Class II division 1 malocclusions (9 female and 19 male) treated with an activator were analyzed. The average pre-treatment age was 11 years and 5 months.
METHODS: Possible clinical and subclinical soft tissue lesions of the bilaminar zone were assessed by passive joint loading of the TMJ both in a retrusive and laterotrusive position of the mandible. The examination was performed before, after 6 months and after 1 year of activator treatment.
RESULTS: Before treatment a capsulitis of the inferior stratum of the bilaminar zone (= intracapsular inflammation) was found in 7 per cent of the joints. After 6 months and 1 year of treatment 36 and 32 per cent respectively, of the joints showed a capsulitis. At all examinations the lateral segments of the inferior stratum showed a higher prevalence of capsulitis than the central. During the entire observation period all findings were exclusively subclinical.
CONCLUSION: Activator treatment resulted in an inflammatory reaction of the bilaminar zone, which might be due to its expansion induced by the anterior mandibular positioning.

39 RELIABILITY OF LINEAR AND ANGULAR CEPHALOMETRIC MEASUREMENTS

B Genderski[1], A Heymer[1], U Hirschfelder[1], M Radespiel-Tröger[2], Departments of [1]Orthodontics and Dentofacial Orthopedics and [2]Medical Informatics, Biometry and Epidemiology, University of Erlangen-Nuremberg, Germany

AIM: To investigate the reliability of cephalometric measurements and to compare the accuracy of cephalometric measurements at two time points.
SUBJECTS: Twenty-four patients examined twice, first (T1) at the age of 9.6 years (SD ± 1.5 years) and second (T2) at the age of 16.4 years (SD ± 3.0 years).
METHODS: Lateral cephalograms at T1 and T2 were independently analyzed by three investigators at T1 and T2. Within the scope of the statistical evaluation the mean value, the inter-subject standard deviation and the repeatability ($\alpha = 5$ per cent) for each of the 16 cephalometric angular and linear measurements were determined. The subject standard deviation and the mean value for each of the 24 single measurements of the 16 cephalometric angular and linear measurements were also carried out by the three investigators.
RESULTS: Compared with the literature, the measurements showed a high level of reliability. At T1 the SNA angle (SNB angle) for example showed a mean value of 79.42 degrees (79.24 degrees), an inter-subject standard deviation of 0.790 degrees (0.75 degrees) and a repeatability of 2.20 degrees (2.08 degrees). At T2 the mean value of the SNA angle (SNB angle) was 80.43 degrees (80.89 degrees). The inter-subject deviation was 0.86 degrees (1.22 degrees) and the repeatability was 2.38 degrees (3.38 degrees). The inter-subject standard deviation of the mean value of the inclination of the lower central incisor against the mandibular plane decreased from 3.69 degrees at T1 (mean value: 86.73 degrees) to 1.44 degrees at T2 (mean value: 88.02 degrees).
CONCLUSION: Cephalometric measurements can distinguish slight changes in craniofacial morphology even if several experienced examiners perform the measurements.

40 THE DURATION AND SEQUENCING OF SURGICAL-ORTHODONTIC TREATMENT

S A Giles, R T Lee, Department of Orthodontics, The Royal London Hospital, England

AIM: To assess whether there was any difference in the total treatment duration, patient satisfaction, and treatment outcome between two units with different treatment philosophies regarding their sequencing of the combined surgical-orthodontic approach.
SUBJECTS AND METHOD: Ninety-four patients who had undergone combined-surgical orthodontic treatment between 1994–1996 were included in the retrospective

clinical study: 61 at a dental teaching hospital and 33 at a regional hospital. The orthodontic records were studied with respect to duration of treatment and visits to the individual departments. All patients were sent a self-assessment questionnaire and the PAR system was used to assess the pre- and post-treatment occlusion.
RESULTS: A statistically significant difference ($P < 0.05$) was seen in the 'early' surgery group corresponding to a reduction of the total treatment duration. There was no significant difference when the total number of visits to the hospital departments were analyzed, although the patients within the 'early' treatment group tended to have fewer visits. There was a wide range of total treatment duration observed in both groups. The questionnaires revealed a high level of satisfaction with the result (95.65 per cent) in both groups. Treatment duration was longer than expected in both groups. Shorter treatment duration led to greater patient satisfaction. The mean PAR score reduction was similar (86.7 per cent) in both groups, with the patients being treated to a high standard in both units.
CONCLUSIONS: 'Early' surgery led to shorter total treatment duration but with a wide individual variation regardless of the treatment approach. All aspects of a combined approach should be explained to patients verbally and in writing, before treatment commences.

41 UPPER AND LOWER ARCH POSITION IN THE DECIDUOUS DENTITION IN SUBJECTS WITH CLASS II DIVISION 2 MALOCCLUSIONS

B Glišić, N Jakšić, I Šćepan, Clinic of Orthodontics, University of Belgrade, Yugoslavia

AIM: To evaluate the craniofacial morphology of patients with Class II division 2 malocclusions in the deciduous dentition.
MATERIAL AND METHODS: Lateral cephalometric radiographs of 32 patients with Class II division 2 malocclusions, as well as 99 patients with normal deciduous dentitions, 4–6 years of age (mean age 5.6 years) were studied. The following angular variables were measured: SNA, SNB, ANB, NS/SpP, NS/MP and SpP/MP. The results obtained in each group were compared using the Student's *t*-test.
RESULTS: No statistically significant differences in the sagittal position of the maxilla or the mandible were found in either group. ANB angle was greater in subjects with Class II division 2 malocclusions ($P < 0.05$). The vertical jaw positions showed significant differences between the groups. Inclination of the upper jaw in the malocclusion group increased ($P < 0.05$), while that of the lower arch decreased ($P < 0.001$).
CONCLUSION: Class II division 2 malocclusions have a significant influence on the vertical jaw relationship in the period of the deciduous dentition.

42 DO THE ACTUAL DIMENSIONS OF SQUARE WIRES AGREE WITH THE MANUFACTURERS' DATA?

A Godt, H Fischer-Brandies, W Orthuber, Department of Orthodontics, Christian-Albrechts-University Kiel, Germany

AIM: The square wire is a tool that belongs to the orthodontist's daily routine. The literature contains many investigations on the physical and chemical properties of the wires but few reports dealing with the accuracy of the dimensions.
METHODS: In this study, a digital micrometer gauge was used to check the accuracy of cross-sectional dimensions of square wires. Ten square wires from each of a batch of products from different companies and materials (steel, chrome-cobalt-nickel, titanium) with the dimensions $0.016 \times 0.016''$, $0.016 \times 0.022''$ and $0.017 \times 0.025''$ were used. The height and width of each wire was measured 35 times at 1 cm intervals (30,800 individual measurements).
RESULTS: The means of the batches for the individual wires deviated from the stated value by up to 18 μm. The means of the individual wires differed within one batch by up to 16 μm. The dimensional constancy over the course of the wire also differed markedly between the wires. The mean absolute deviation of cross-sectional dimensions, related to the mean of the respective wire, ranged from 0.57 to 4.12 μm,
CONCLUSION: These results support the demand for precise information from the manufacturers concerning the compliance of offered orthodontic square wires with the standards.

43 EMINENCE STEEPNESS AND CONDYLE-DISC MOVEMENT IN TEMPOROMANDIBULAR JOINT DERANGEMENTS ON MAGNETIC RESONANCE IMAGES

H Gökalp, H Türkkahraman, N Bzeizi, Department of Orthodontics, University of Ankara, Turkey

AIM: To evaluate the rotational movement characteristics of the disc-condyle assembly and their relationships with steepness of eminence in disc displacement with reduction (DDR) and disc displacement without reduction (DDWR).
MATERIAL: Sagittal-oblique temporomandibular joint (TMJ) magnetic resonance images (MRIs) of 39 joints (26 DDR, 13 DDWR). The sagittal-oblique and coronal TMJ MRIs were taken in maximum intercuspation and opened position. Coronal MRIs were used to diagnose rotational disc displacement. TMJs with rotational disc displacement were not included in this study.
METHOD: The degree of the condyle and disc rotation within the glenoid fossa, the inclination of the condyle path, the amount of condyle translation and the steepness of the eminence were measured on sagittal-oblique MRIs. A Student's *t*-test was performed and correlation coefficient was calculated.

RESULTS: The disc rotated backwards in DDR more than in DDWR ($P < 0.01$). Disc rotation was significantly related to condyle rotation ($P < 0.05$, r = 0.44) and related significantly negative with condyle translation ($P < 0.05$, r = –0.44) in DDR. Condyle translation related significantly positive with eminence steepness in DDWR ($P < 0.01$, r = 0.74). It was found that the degree of disc rotation, inclination of the condyle path and condyle translation was statistically different between the DDR and DDWR groups ($P < 0.01$).
CONCLUSION: There is no relationship between the disc-condyle assembly movement and steepness of the eminence in DDR, whereas there is a relationship between condyle movement and steepness of eminence in DDWR.

44 STABILITY OF LOWER INTERCANINE DISTANCE FOLLOWING ORTHODONTIC TREATMENT

H Graf, S Kopp, G Glockmann, Department of Orthodontics, Friedrich-Schiller-University Jena, Germany

AIM: To determine the post-orthodontic intercanine distance with special reference to morphological and functional findings.
SUBJECTS: Thirty patients aged 9 to 17 years with lower arch crowding treated at the Department of Orthodontics.
METHOD: All patients were clinically examined. Study casts of both upper and lower arches were made and mounted arbitrarily in a Girbacch-Reference articulator. Panoramic radiographs and lateral headfilms were taken. The following parameters were measured: depth and length of dental arches, intercanine width, irregularity index according to Little, overjet and overbite, occlusion, cephalometric findings as angulation of incisors, base angle and Wits' appraisal.
RESULTS: Intercanine width measured at the end of treatment (end of retention) narrowed during recall intervals. There was also a relationship to the narrowing in the upper arch. Relapse of crowding was found in approximately 50 per cent of all subjects. Long-term, 30 per cent of the orthodontic treatment remained stable.
CONCLUSIONS: Changing intercanine distance is not a valuable method to treat lower arch crowding because relapse is found in many subjects. Relapse of intercanine width and lower arch dimensions often causes relapse of lower arch crowding.

45 SHEAR BOND STRENGTHS OF ALTERNATIVE ORTHODONTIC BONDING SYSTEMS

I Graf, B E Jacobi, C W Schwarze, Department of Orthodontics, University of Cologne, Germany

AIM: To compare bond strengths and bracket failure location of three different adhesives and three enamel conditioners, to find alternative bonding methods that minimize enamel surface damage while maintaining clinically useful bond strength.
MATERIALS: Fifty freshly extracted human teeth, stainless steel orthodontic brackets (Ultra-minitrim, Dentaurum), Enlight LV (Ormco), Etch&Prime 3.0 (Degussa), Prompt-L-Pop (Espe), Nova Bond/No-etch (Bona Dent), Fuji Ortho LC (GC America), 37 per cent H_3PO_4 (Ormco).
METHOD: The brackets were attached to the enamel surface by one of five protocols:
1. Enlight and phosphoric acid,
2. Enlight and Etch&Prime,
3. Enlight and Prompt-L-Pop,
4. Nova Bond/No-etch,
5. Fuji Ortho without etching under wet conditions.

The specimens were stored in deionized water for 72 hours. A Zwick universal testing machine was used to determine shear bond strengths (SBS). The residual adhesive on the enamel surface was evaluated with a modified Adhesive Remnant Index (ARI). ANOVA, Duncan's, and Chi-square tests were performed to compare the four groups at a rejection level of $P = 0.05$.
RESULTS: The mean SBS and SD in MPa were: Group 1 = 11.7 (3.6), Group 2 = 9.0 (2.5), Group 3 = 10.6 (2.6), Group 4 = 12.8 (3.6), Group 5 = 15.6 (2.1). Statistical analysis showed significant differences ($P < 0.001$) in bond strength (between Groups 2 and 5) and in ARI scores. The alternative conditioners showed more adhesive failure at the enamel interface without surface damage, whereas the phosphoric acid and Nova Bond group demonstrated more failures at the bracket adhesive interface.
CONCLUSION: All bonding methods in this *in vitro* study appeared to present clinically acceptable bond strengths. Alternative conditioning additionally revealed clean separation from the enamel after debonding.

46 EFFECTS OF A 2 × 4 APPLIANCE AND REVERSE HEADGEAR IN THE CORRECTION OF ANTERIOR CROSSBITES

Y Gu[1], A B M Rabie[2], U Hägg[2], M Bendeus[2], T C Wong[2], [1]School of Stomatology, Beijing Medical University, China and [2]Faculty of Dentistry, The University of Hong Kong, SAR China

AIM: To compare the skeletal and dental changes contributing to the correction of Class III malocclusions using a 2 × 4 appliance and reverse headgear.
SUBJECTS: Seventeen consecutive patients with Class III incisor relationship at centric occlusion and with mandibular displacement and straight or concave facial profiles were treated with a simple fixed appliance in the mixed dentition. Another 20 consecutive patients with a Class III incisor relationship and straight or concave facial profiles were treated with reverse headgear in the mixed dentition.
METHODS: Lateral cephalometric films taken at the beginning, end of treatment and one year after active treatment, were analyzed using the method of Pancherz (1992).

RESULTS: After active treatment, overjet correction, 5.2 and 6.5 mm, respectively, were achieved using the 2×4 and reverse headgear. The overjet correction with the 2×4 appliance was due to dental changes only. In the reverse headgear group, 60 per cent of the overjet correction was due to dental changes and 40 per cent to skeletal changes. During the 12-month follow-up period the overjet was unchanged in the 2×4 group (0.4 mm) and decreased (1.2 mm) in the reverse headgear group, the difference being statistically significant ($P < 0.05$). The decrease in overjet correction in the headgear group was mainly due to forward growth of the mandible and proclination of the lower incisor. The overjet in the 2×4 group was unchanged due to dental compensation (1.6 mm).
CONCLUSION: Overjet correction by the simple fixed appliance was achieved as a result of dental changes whereas in the reverse headgear group, it was produced by both dental and skeletal changes.
Grant 10117.06020810.00000.08003.340.01 from the University of Hong Kong.

47 FAILURE RATES OF FOUR DIFFERENT ORTHODONTIC BONDING SYSTEMS

M Gustafsson, R Lindman, Clinic of Orthodontics, Malmö, Sweden

AIM: To evaluate the clinical reliability of a new type of bonding agent, ethyl cyanoacrylate, (Smart-Bond®), and a resin modified glass ionomer (Fuji Ortho LC®) in relation to two traditional composite bonding systems: one light-cured (Transbond®) and one chemically-cured (Right-On®) composite resins.
SUBJECTS: Three hundred consecutive patients accepted for treatment with fixed appliance.
METHODS: A split mouth technique was used to compare Transbond and Fuji Ortho LC in 100 patients. In 50 subjects Fuji was used with etching and in the other 50 without any etching. To gain clinical experience of Smart-Bond 100 patients were bonded in one or two arches before starting Part II, where again the split mouth technique was used. In 100 patients Right-On and Smart-Bond were compared. The data were collected after the first six months of treatment
RESULTS: A total of 2,857 bonded brackets were evaluated. Two hundred and thirteen (7.9 per cent) failures occurred. The lowest failure rate was recorded for Fuji Ortho LC with etching in the upper arch (2.8 per cent) and the highest for Fuji Ortho LC without etching in the lower arch (20.6 per cent). Between the light-cured materials there was no significant difference in failure rate except in relation to etching ($P = 0.01$ and $P = 0.03$, respectively). There was a small but significant difference in failure rate between the chemically-cured materials, Smart-Bond and Right-On, ($P = 0.047$ upper and $P = 0.045$ lower jaw), with Right-On showing the lower failure rate.
CONCLUSION: The clinical reliability of bonding materials can only be evaluated in large *in vivo* tests. The most significant finding in this study was the importance of etching when using glass ionomer cements for orthodontic bonding.

48 OSTEOGENESIS IN THE GLENOID FOSSA IN RESPONSE TO MANDIBULAR ADVANCEMENT

U Hägg[1], Z H Zhao[2], A B M Rabie[1], [1]Faculty of Dentistry, University of Hong Kong, SAR China and [2]College of Dentistry, West China University, Chengdu, China

AIM: To quantify the amount of bone formation and to identify the temporal sequence of cellular changes in the glenoid fossa of the temporal bone in response to mandibular advancement.
MATERIAL AND METHODS: One hundred female 35-day-old Sprague Dawley rats were randomly divided into five experimental groups (15 rats each) and 5 control groups (5 rats each). In the experimental groups functional appliances kept the mandible in a continuous forward position. The rats were sacrificed after 3, 7, 14, 21 and 30 days. Sections were cut through the glenoid fossa at the sagittal plane and stained with PAS for evaluation of bone formation and haematoxylin and eosin for observation of cellular response.
RESULTS: In the controls, bone formation was initially higher in the posterior and middle regions compared with the anterior region. Thereafter, levels of bone formation became lower in all regions. In the experimental group bone formation significantly increased from day 7 to day 30 compared with the controls. The difference in bone formation being most marked at day 21 in the middle (+184 per cent) and posterior regions (+300 per cent). In the anterior region there was a consistent difference from day 7 to day 21 (+189, +104 and +143 per cent, respectively).
CONCLUSIONS: Mandibular protrusion in rats resulted in a marked significant increase of bone formation in the anterior, middle and posterior regions in the glenoid fossa. The amount of bone formation was highest in the posterior region and at its maximum at puberty.
Grants 10201953.15633.08003.301.01 and 10201960.22311.08003.301.01

49 LONG-TERM STABILITY OF THE MAXILLA ADVANCED BY OSTEOGENIC DISTRACTION

J Hammond, G Lello, Orthodontic Department, Edinburgh Dental Institute, Scotland

AIM: To assess the long-term stability of dentoalveolar and skeletal base changes induced by maxillary protraction achieved using an osteogenic distraction technique.
SUBJECTS: Six patients with congenital clefts of the plate who had undergone maxillary protraction in their mid teens (14.8 years) and who were a minimum of 5 years post-distraction (mean 7.6 years).

METHOD: Cephalometric radiographs taken prior to distraction, on completion of distraction and a minimum of five years post-distraction were analysed using the Pitchfork analysis.
RESULTS: The maxilla was advanced on average 7 mm with a range of 4–9 mm. Following distraction the mean overjet was + 3 mm (ranging from +1 to +5 mm). A reduction in post-distraction overjet was noted in all but one subject. In only one patient was a negative overjet re-established. Dentoalveolar compensation was observed.

50 NON-SURGICAL RAPID MAXILLARY EXPANSION IN ADULTS

C S Handelman, E A BeGole, Department of Orthodontics, University of Illinois, Chicago, USA

AIM: Non-surgical rapid maxillary expansion (RME) in the adult is thought to be an unreliable procedure with adverse side-effects. This presentation will substantiate or refute the efficacy and stability of adult non-surgical RME, and determine the incidence of the supposed complications such as pain and tissue swelling, tipping of molars, opening rotation of the mandible and gingival recession.
SUBJECTS: Three groups were studied: 47 adults and 47 children whose palates were expanded with a Haas tooth- and tissue-borne expander and 52 adults not requiring RME.
METHODS: Transarch widths were measured pre-treatment, following retention and after discontinuance of retainers for an average of 5.9 years. Measurement of cephalometric radiographs and buccal attachment loss were also performed. Scheffe's test for variance determined significance of differences between time periods and groups.
RESULTS: The mean transarch width increase was similar in adults and children who had RME, 4.6 ± 2.8 compared with 5.7 ± 1.4 mm for the molars, and 5.5 ± 2.4 compared with 5.7 ± 2.5 mm for the second premolars. In adults, transarch expansion as well as the correction of the posterior crossbite was stable following discontinuance of retainers. The procedure is well tolerated provided that the expander is properly fabricated and turned, at most, once per day. RME in adults flared the molars buccally only 3 degrees per side. Female subjects had buccal attachment loss that was 0.5 mm greater than the adult controls. This resulted in longer clinical crowns, but rarely caused exposure of buccal root cementum.
CONCLUSION: Non-surgical RME in the adult is a clinically effective and stable method for correcting transverse maxillary arch deficiency and the complications often cited are infrequent or clinically acceptable.

51 JAW DEVIATION IN SKELETAL CLASS III PATIENTS

S Haraguchi, K Takada, Department of Orthodontics, Osaka University, Japan

AIM: To investigate the frequency and laterality of maxillary and mandibular asymmetries in Japanese patients with gross skeletal Class III malocclusions.
SUBJECTS: One hundred and seventy consecutive patients with skeletal Class III malocclusions who attended the university dental hospital during 1981–1993, and were diagnosed as requiring orthognathic surgery.
METHODS: Postero-anterior (PA) and lateral cephalograms collected for each patient were used. Perpendicular distances to the midline from four reference points, i.e. ANS, U1 (upper incisal midpoint), L1 (lower incisal midpoint) and Me were measured on the PA cephalograms.
RESULTS: The frequency of asymmetry was 25.3 per cent (ANS), 41.8 per cent (U1), 62.9 per cent (L1) and 76.5 per cent (Me), respectively. Asymmetry of ANS and U1 were least, then the magnitude of deviation was significantly larger in the order of L1 ($P < 0.001$) and Me ($P < 0.001$). In the asymmetry group, ANS ($P = 0.046$), L1 ($P = 0.018$) and Me ($P = 0.001$) were significantly deviated to the left side.
CONCLUSIONS: Asymmetry of the maxilla and the mandible was found at least in 25 per cent (ANS), and at most in 76.5 per cent (Me) of the sample studied. The lower the landmark was positioned the more the subjects showed asymmetry. Thus, patients having a gross skeletal Class III malocclusion and facial asymmetry are likely to show deviation of the lower jaw to the left side.

52 PRENORMAL CANINE RELATIONSHIP IN PREMATURELY BORN CHILDREN

V Harila-Kaera[1], M Grön[1], T Heikkinen[1], L Alvesalo[1], R Osborne[2], [1]Department of Oral Development and Orthodontics, University of Oulu, Finland and [2]Department of Anthropology, University of Wisconsin, USA

AIM: To examine the effect of pre-term birth on arch dimensions and occlusal development.
MATERIAL: The data consisted of 339 prematurely born white (40 per cent) and black (60 per cent) children and 1,804 control children, who participated in the cross-sectional study of the Collaborative Perinatal Project (USA) in the early 1960s and 1970s.
METHODS: Medical background data were obtained from the first registration (1st to 2nd trimester) of the pregnancy up to 7 years of age and dental examinations including dental casts and photographs were performed at the age of 6–12 years. The pre-term and comparison groups were divided by sex and race. The limit for prematurity was placed at 36 gestational weeks in whites and 35 weeks in blacks to maintain equal relationship of pre-term/control children in statistical comparisons.
RESULTS: A significantly greater prevalence of pre-normal canine relationships (pre-normal, normal, cusp/cusp, post-normal) was found in pre-term group compared with the controls. This difference appeared as a 10–14 per cent greater proportion of pre-normal canine relationship when all pre-term infants were compared with all controls ($P < 0.007$). When the study groups were divided by sex and race, the same trends existed in all four groups (white boys, white girls, black boys and black girls) on both sides of the

dentition and these were statistically significant for black girls on the left side ($P < 0.05$) according to statistical analysis (chi-square).
CONCLUSION: These results suggest that premature birth and the exceptional early adaptation from the intra- to extra-uterine nutrition may influence the development of occlusion. This focuses the importance of early functional activity as well the largely unknown early maturational factors (catch-up growth, natural selection, need of medical care in pre-term infants etc.) in the variability of occlusion.

53 EVALUATION OF SKELETAL MATURATION AND MAXIMUM PUBERTAL GROWTH HEIGHT IN IRANIAN PATIENTS

Z Hedayati, Department of Orthodontics, Shiraz Medical Sciences University, Iran

AIM: To determine the mean age of skeletal maturity indicators appearance and body growth spurt range (PHV lies within this range), to determine the appropriate age for beginning orthodontic treatment in Iranian growing subjects.
SUBJECTS: Five hundred and seventy eight patients (292 females and 286 males) aged 8–17 years.
METHODS: Hand-wrist radiographs were taken and other information, consisting of sex, chronological age (year and month) and body height were collected. Age intervals for evaluation of skeletal maturity indicators were six months, and for height one year. On each radiograph the following was studied: pisiform and sesamoid bone, and fusion in the first, second and third phalanges of the third finger.
RESULTS: Height incremental curves showed a range of 11–13 years in girls and 13–15 years in boys for maximum height growth. Appearance of sesamoid was observed in females aged 9–13 years (average 11.6) and in males aged 12–16 years (average 14.3). The age for formation of pisiform was more variable. Fusion of the phalanges occurred in 100 per cent of 15.5–16 year old girls and 17-year-old boys.
CONCLUSION: The best age range for orthodontic treatment in Iranian patients has been identified.

54 THREE-DIMENSIONAL MEASUREMENT OF CURVATURES OF HUMAN ANTERIOR TOOTH SURFACES

H Hisaki, K Fujita, K Takada, Department of Orthodontics, Osaka University, Japan

AIM: To measure quantitatively curvatures of labial surfaces of human anterior teeth in the vertical and horizontal directions in order to obtain a rationale basis for designing appropriate base forms for orthodontic attachments.
MATERIAL: Dental casts collected from a sample of 80 human adults with complete permanent dentitions and acceptable occlusions were used.
METHOD: Surface morphology of dental casts were laser scanned with a stereotaxic device, and transferred to a graphic workstation for subsequent analysis. Radii of curvatures of the labial tooth surface in the vertical and horizontal directions at FA points as defined by Andrews (1972) were calculated for each anterior tooth with customized software.
RESULTS: Tooth surface curvatures in the vertical or horizontal direction did not differ significantly between the right and left sides or for male and female subjects for any tooth. The vertical curvature for the upper central incisors (median 26.6 mm) was significantly longer ($P < 0.01$) than that for the upper laterals (median 20.5 mm). The lower central and lateral incisors, as well as the upper and lower canines, showed similar radii of curvature. In an horizontal direction, the curvature of the upper canine (median 3.8 mm) was shorter ($P < 0.01$) than that of its antagonist (median 4.2 mm); the upper and lower incisor curvatures, however, both exhibited bimodal distribution patterns, showing a mixture of convex and concave labial type surfaces.
CONCLUSIONS: The labial surface curvatures determined at the FA points did not differ between the right and left sides or for male and female subjects for any anterior tooth, or between the lower central and lateral incisors in the same arch. The upper central incisors were flatter than the upper laterals in the vertical direction. The lower central and lateral incisors had similar labial surface contour curves.

55 BOND FAILURE INCIDENCE: WIDE VERSUS CONVENTIONAL BASED PREMOLAR BRACKETS

T M Hodge, Department of Oral and Maxillo-Facial Surgery and Orthodontics, Doncaster Royal Infirmary, England

AIM: To compare the incidence of bond failure of wide-based (gingivally offset) versus conventional based premolar brackets.
SUBJECTS: Sixty-three consecutive patients (excluding those with buccal crossbites or whose medical history would suggest a risk from a potential bacteraemia if wide-based brackets extended sub-gingivally) receiving full-arch straight-wire appliance orthodontic treatment.
METHODS: A prospective controlled clinical trial was undertaken bonding paired samples of the brackets to contralateral premolars in opposing arches. All premolars in any one quadrant received the same bracket base. Both brackets were from the same manufacturer and had the same surface fit. The sides of the wide based brackets were placed in alternate positions between consecutive patients. The same protocol for bracket placement was followed, all brackets being placed with the same chemically-cured composite. Records were kept of those premolar brackets that failed within the first 100 days of placement, all patients having worn the appliances for not less than 100 days.
RESULTS: Conventional based premolar brackets were lost twice as frequently as wide-based premolar brackets (20 conventional brackets out of 141 placed; 11 wide-based brackets out of 143 placed). An increased incidence of

premolar bracket failure was noted in the maxillary arch (23 maxillary brackets out of 164 placed; 8 mandibular brackets out of 120 placed).
CONCLUSION: The incidence of bond failure was greater in conventional based premolar brackets than in wide-based, gingivally offset premolar brackets.

56 INFLUENCE OF EXTRACTION AND A PALATAL BAR ON THREE-DIMENSIONAL TOOTH MOVEMENT

H Horn[1], G Göz[1], R Göttle[1], I Kretschmer-Schneider[1], D Axmann-Krcmar[2], Departments of [1]Orthodontics and [2]Prosthetic Dentistry, Eberhard-Karls-Universität, Tübingen, Germany

AIM: Tooth movement during fixed appliance therapy is influenced by multiple factors. The C3D-reflex microscope allows investigation of three-dimensional (3D) tooth movement in correlation with extraction site and different kinds of anchorage control.
SUBJECTS AND METHOD: Thirty-seven patients treated with fixed appliances in combination with headgear were analysed. They were divided into four groups: extraction with/without palatal bar, non-extraction with/without palatal bar. The plaster models before and after treatment were analysed with the C3D-reflex microscope and 3D movements of all teeth were evaluated.
RESULTS: After extraction the second premolars and first molars moved with respect to the midsagittal plane. Non-extraction cases showed lateral movement. The palatal bar had a positive effect on this movement. The extent of mesial movement was greater in extraction cases. The palatal bar could reduce this movement. In the vertical dimension, extraction resulted in extrusion of the premolars in comparison with intrusion in non-extraction cases. After extraction first premolars showed a distal and vertical movement, while non-extraction cases showed mesial movement. Anterior tooth extraction resulted in intrusion in contrast to extrusion without extraction. Total movement of anterior teeth was greater after extraction. No significant influence could be found for age at the beginning of treatment, duration of therapy, or Angle classification.
CONCLUSION: Extraction of teeth was the main influence on tooth movement. A significant influence of the palatal bar could be found only on the first molars.

57 THE INDEX OF ORTHODONTIC TREATMENT NEED AS A TOOL FOR TREATMENT PLANNING AND QUALITY CONTROL

H Horn[1], G Göz[1], M. Waßermann[1], C Neuscheler[1], D Aeschelmann[1], D Axmann-Krcmar[2], Departments of [1]Orthodontics and [2]Prosthetic Dentistry, Eberhard-Karls-Universität, Tübingen, Germany

AIM: To evaluate treatment need it is necessary to use an objective parameter for the irregularities of teeth and occlusion. The Index of Orthodontic Treatment Need (IOTN) allows the evaluation of treatment need and success of orthodontic treatment.
SUBJECTS AND METHOD: One hundred and fifty two (72 male, 80 female) starting orthodontic treatment at the age of 4–48 years (median 13.6 years) were analysed. The treatment was carried out with either removable or fixed appliances or with a combination of both. The IOTN-index was determined at the beginning and end of treatment.
RESULTS: By analysing the Aesthetic Component (AC) 73 per cent of the patients showed no treatment need at the beginning whereas the Dental Health Component (DHC) showed no treatment need for only 11 per cent. Using the AC treatment need was found for 5 per cent compared with 44 per cent using the DHC. After treatment the highest increase in the DHC could be found in the no treatment group (63 per cent) whereas the highest reduction after treatment was in the group with treatment need (40 per cent). Analysing the main effects in the different groups of the AC, 19.7 per cent changed from grade 3 to 2 and 14.5 per cent from 4 to 2. Concerning the DHC, 22.4 per cent changed from 3 to 2 and 16.4 per cent from 4 to 2. Starting from group 2 or 3 more improvement could be found in both components by using fixed appliances in comparison with other methods. Pre- and post-treatment comparison showed typical combinations of subgroups of the DHC
CONCLUSION: The IOTN serves as a tool for evaluating the treatment need as well as for assessment of the treatment results with regard to quality control. The DHC seems to be more accurate.

58 THE USE OF LASER CURING FOR COMPOSITE ORTHODONTIC ADHESIVES

L Huck, H Korbmacher, A Klocke, B Kahl-Nieke, Department of Orthodontics, University of Hamburg, Germany

AIM: To evaluate the *in vitro* shear bond strength of orthodontic brackets bonded with light-cured composite adhesive using a dental laser and reduced curing time.
MATERIAL AND METHOD: One hundred and eighty extracted human teeth were randomly divided into four experimental and two control groups of 30 teeth each (15 incisors, 15 premolars). Lateral incisor and first premolar brackets (Orthos, Ormco, USA, 100 gauge mesh) were bonded with Transbond XT (Unitek, USA) and Enlight (Ormco) composite adhesive. Light curing was performed following the manufacturers' recommendations with a regular curing light (Elipar Highlight, Espe, Germany) and with a curing laser (AccuCure 3000, Lasermed, USA) and reduced curing times (5 and 10 seconds). After 48 hours storage, shear bond strength was measured with a testing machine (Zwicki Z2.5, Zwick, Germany). An analysis of variance was performed.

	Curing laser				Regular curing light	
	5 s curing		10 s curing		20 s curing	30 s curing
	Transbond	Enlight	Transbond	Enlight	Transbond	Enlight
Incisor (n = l5)	83.61 ±46.91 N	59.04 ±21.85 N	114.37 ±56.98 N	49.80 ±45.56 N	139.48 ±42.88 N	115.31 ±52.68 N
Premolar (n =15)	90.70 ±28.80 N	64.79 ±10.83 N	121.18 ±31.63 N	50.13 ±20.68 N	134.07 ±37.24 N	79.49 ±32.45 N

RESULTS: Means and standard deviations are shown above.
CONCLUSION: Utilization of a dental laser with reduced curing time can only be recommended for the Transbond XT adhesive. Laser curing for 10 seconds provided bond strengths comparable to those with a regular light unit and standard curing time.

59 AN EPIDEMIOLOGICAL STUDY OF ORTHODONTIC PATIENTS IN KOREA

M Hwang, Y Yoon, K Kim, Department of Orthodontics, Chosun University, Kwangju, Korea

AIM: To examine the records collected from patients who had undergone orthodontic diagnosis and treatment.
SUBJECTS: Three thousand and seventy orthodontic patients (1334 males, 1736 females) with well-conserved records chosen from the total number of patients being treated in the Department of Orthodontics at Chosun University Dental Hospital between 1990 and 1999.
METHODS: The patients' treatment records, cephalometric and panoramic radiographs, intraoral and facial photographs, and diagnostic models were used for examination. Patients were excluded if they had none of the above records. Data was entered into the Microsoft Access program and SPSS was used for analysis.
RESULTS: The 7–12 year-old group was the largest (37.9 per cent) in age distribution, followed by 13–18 (32.0 per cent) and 19–24 (19.6 per cent). The percentage of more than 25 and 0–6 year-old group was 7.1 and 3.4 per cent, respectively. The distribution of malocclusion, according to Angle's classification, was Class I (38.9 per cent), Class III (38.4 per cent). Class II divisions 1 and 2 were 20.7 and 2.0 per cent, respectively. Anterior crossbite was the chief complaint (22.7 per cent), followed by anterior crowding (18.0 per cent), mandibular prognathism (12.6 per cent) and prognathism of maxillary teeth (12.2 per cent).
CONCLUSION: This study has provided an epidemiological description that can be useful for diagnosis and treatment planning, and to further establish treatment of malocclusions.

60 MECHANICAL PROPERTIES OF AESTHETIC FIBRE REINFORCED PLASTIC RECTANGULAR ARCHWIRE

T Imai[1], H Toyoizumi[1], S Yamagata[1], K Nagayma[1], T Yamamoto[1], J Iida[1], S Nakamura[1], F Watari[2], M Kobayaishi[3], Departments of [1]Orthodontics and [2]Dental Materials and Engineering, Hokkaido University, Sapporo and [3]Department of Industrial Chemistry, Chiba Institute of Technology, Japan.

AIM: To investigate the flexural and torsional properties of 0.0170 × 0.0254-inch transparent fibre reinforced plastic (FRP) rectangular archwire.
MATERIALS: The FRP wires were composed of 20 μm diameter CPSA glass fibres and three resins, UDMA, Epic-flo (CR-E) and Clearfil Photo SC (CR-P), for the matrix. The wires were fabricated by the light-curing method. Three types of FRP wires, FRP (CPSA/UDMA), FRP (CPSA/CR-E) and FRP (CPSA/CR-P), were made for the specimens.
METHODS: The surfaces of the glass fibres were treated with a coupling agent. After the fibre-resin complex was inserted into a metallic mould it was polymerized with light radiation. The fibres were orientated parallel to the longitudinal direction of the FRP wire. Three-point flexural and torsional tests were carried out using a universal testing machine (Instron Corp., Canton, MA).
RESULTS: Flexural loads at a deflection of 0.5 mm with a volume fraction of 37 per cent were 1.57 ± 0.07 N for FRP (CPSA/UDMA), 1.91 ± 0.10 N for FRP (CPSA/CR-E), and 2.33 ± 0.08 N for FRP (CPSA/CR-P). The wires showed sufficient flexural strength for use in orthodontic treatment. Torsional loads at a torsional angle of 14 degrees were 0.06 ± 0.01 N for FRP (CPSA/UDMA), 0.13 ± 0.01 N for FRP (CPSA/CR-E), and 0.24 ± 0.01 N for FRP (CPSA/CR-P). The torsional load of FRP wire using composite resin for the matrix was four times higher than that of FRP wire using UDMA.
CONCLUSION: Transparent rectangular FRP wires with a multiple fibre structure can be fabricated by the light-curing method. The flexural strength of these wires is sufficient for clinical use, but the torsional strength is still insufficient compared with that of conventional metal wires. A possibility exists for improving the torsional properties with the use of transparent stiff materials for the matrix.

61 A RADIOGRAPHIC STUDY OF GROWTH OF THE ZYGOMATIC ARCH

H Inoue, N Inoue, S Hokari, N Takahashi, Y Okumura, Department of Dental Radiology, Meikai University, Saitama, Japan

AIM: To investigate, by roentgenographic analysis, the relationship between growth of the zygomatic arch and Hellman's dental stage.
MATERIAL: Ten dried skulls for each Hellman's dental stage were selected, and a total of 100 skulls were studied.
METHODS: Parameters of the inner side of the zygomatic arch were measured on computer tomographic (CT) images using a CT scanner-TCT700S. The images were loaded into a CCDTV camera for computer image analysis. Pre-treatment of shadowing correction was followed by binary correction. The area of the cross-section, peripheral length, and length inner side of zygomatic arch and ODL and ODS were measured according to dental age.
RESULTS: Marked growth of the cross-section area of the inner side of zygomatic arch, peripheral length, length of inner side of zygomatic arch, and ODL were observed from stages IA to IIA. Marked growth of the ODS was also observed from stages IA to IIC.
CONCLUSION: Growth of the cross-section area of the zygomatic arch was closest to growth of the neural type according to the growth curves of Harris and Scammon. These results suggest that the difference in magnitude of growth is probably greatly affected by the developmental stage of the occlusion and growth of masticatory muscles

62 BLOOD VOLUME MEASUREMENT IN THE PERIODONTAL LIGAMENT USING NEAR-INFRARED SPECTROSCOPY

H Ishikawa, I Matsuyama, Department of Orthodontics, Hokkaido University, Sapporo, Japan

AIM: To measure blood volume changes in the human periodontal ligament (PDL) induced by loading on teeth, using near-infrared spectroscopy (NIRS).
SUBJECTS: Two young female adults who underwent fixed appliance treatment with four first premolar extractions.
METHODS: Blood volume changes in the PDL of the upper canine due to compression of the PDL were measured by a NIRS device after completion of levelling. The probe was placed on the gingival surface of the upper canine so that the NIR light was received by a photodetector through the distal-cervical area of the PDL. By applying forces of 50 to 500 g distally for 30 seconds, changes in relative blood volume were measured. The measurements were also performed during the canine retraction phase. The amount of distal movement for one month was measured on dental models of the four upper canines.
RESULTS: The relative blood volume in the PDL on the compressive side decreased by the loading on the teeth. With a force of 300 g, the relative blood volume reduced from –0.015 at the baseline stable state to –0.007. For each canine the changes became greater according to the magnitude of force. The amount of distal movement of the four canines was 0.5, 1.4 1.6 and 1.7 mm, respectively. For three canines with a movement of more than 1.4 mm the relative blood volume changes under a load of 300 g were almost constant during one month of canine retraction, whereas for 0.6 mm canine movement the changes significantly reduced during a period from 3 to 10 days after the start of the retraction.
CONCLUSION: Blood volume changes in the PDL due to compression were detected by NIRS. The reduction in blood volume seems to result from poorer circulation due, to a large extent, to degenerated tissue in the PDL.

63 THREE-DIMENSIONAL EFFECTS OF EXTRACTION/NON-EXTRACTION TREATMENT ON THE FACE

S F H Ismail, J P Moss, R Hennessey, Department of Orthodontics, Royal London Hospital, England

AIM: To assess the changes that occurred to the soft tissues of the face with orthodontic treatment. The assessment was in all three-dimensions of space and aimed to record these changes both in terms of metric dimensional and surface shape changes.
SUBJECTS AND METHOD: Patients were accepted if they were Skeletal Class I with normal maxillary-mandibular planes angles. Eighteen extraction and 16 non-extraction subjects were included in the study. An optical surface scanner was used to record the patients' faces prior to and after nine months of treatment. A computer software package was used to superimpose the scans and illustrate the changes that occurred with treatment.
RESULTS: Subnasale and the philtrum showed no difference between the two groups with treatment. The upper lip advanced 1–3 mm more in the non-extraction group, while the lower lip showed no difference. The labiomental fold region advanced 3–5 mm more in the non-extraction group with treatment. With regard to surface shape changes, despite showing no difference in metric measurements, the lower lip in the non-extraction group became more convex with treatment while it remained the same in the extraction group. The concavity of the labiomental fold region decreased to a greater extent in the non-extraction group with treatment.
CONCLUSIONS: Optical surface scanning allows information from the whole of the face to be assessed when comparing these forms of treatment, and surface shape analysis allows subtle changes to be observed that may not be recorded metrically.

64 PERIODONTAL TISSUE RESPONSE FOLLOWING FIXED RETAINERS IN YOUNG ADULT DOGS

M Jo, Y J Yoon, K W Kim, Department of Orthodontics, Chosun University, Korea

AIM: To evaluate fixed retainer material which allows physiological tooth movement and remodelling of the periodontium.

SUBJECTS: Four young adult dogs with early complete dentitions were divided into three groups. Group 1 contained the right side maxillary third incisors and canines, experimental, group 2 the contralateral teeth of same animals and group 3, which served as the control, contained the mandibular premolars.
METHODS: Orthodontic force was applied in groups 1 and 2 for a period of 7 days and four different types of fixed retainers were used in group 1 for 21 days. All the experimental animals were sacrificed three weeks after orthodontic tooth movement and specimens were obtained. The specimens were stained with haematoxylin and eosin and Masson's trichrome to observe the histologic changes in the periodontal tissue.
RESULT: There was decreased infiltration of giant cells and increased osteoid tissue in the 6-stranded 0.0195″ group than in the 3-strand 0.018″, 0.020″, and resin splinted groups.
CONCLUSION: The results show that 6-strand wire is the most useful material for allowing early periodontal tissue remodelling.

65 CRANIOFACIAL SKELETAL AND SOFT TISSUE MORPHOLOGY IN ICELANDIC ADULTS

B Johannsdottir, A Thordarson, T E Magnusson, Faculty of Odontology, University of Iceland, Reykjavik, Iceland

AIM: To describe the craniofacial skeletal and soft tissue morphology of Icelandic adults and to estimate the difference between the sexes and compare the results with closely related ethnic groups.
SUBJECTS: Three hundred and twenty four Icelandic adults, 155 (47.8 per cent) men and 169 (52.5 per cent) women. The mean age of the men was 35.5 years and 34.2 years for the women. Edentulous individuals, those with extensive tooth loss, subjects of foreign origin and those who had received orthodontic treatment were excluded from the study.
METHODS: Twenty-two skeletal reference points and 11 soft-tissue points were digitized and processed by standard methods with the Dentofacial Planner® computer software program. Forty-five angular and linear variables were calculated. Two sample *t*-tests were used to study the difference between sexes.
RESULTS: Men showed consistently larger values for linear dimensional variables, including anterior and posterior face heights, mandibular and ramus lengths, cranial base dimensions and nasal bone length. Mandibular prognathism was significantly greater in males ($P < 0.001$). On the other hand the inclination of the mandible both in relation to the cranial base ($P < 0.001$) and the nasal plane ($P < 0.05$) was significantly greater in women. The basal sagittal jaw relationship (ANB angle) was different between the sexes, with women, on average, showing higher values ($P < 0.05$). The lips were less protrusive in men but the thickness was greater compared with women. The nose was significantly more protrusive in men. When the Icelandic sample was compared to closely related ethnic groups, such as Swedes and Danes, it is interesting to note that Icelanders seem to be more like Swedes.

66 CORROSION SUSCEPTIBILITY OF LINGUAL WIRE EXTENSIONS IN REMOVABLE ORTHODONTIC APPLIANCES

I E Jonas[1], L C Fitjer[1], H F Kappert[2], Departments of [1]Orthodontics and [2]Experimental Dentistry, University of Freiburg i.Br., Germany

AIM: To evaluate the *in vitro* behaviour of orthodontic wire extensions incorporated in acrylic under severe corroding conditions.
METHODS: Identical test specimens were formed where part of the wire was free-running and the other half was embedded in self-curing acrylic. All samples were placed into a container with an aqueous solution comprising 0.1 mol/l NACl and 0.1 mol/l lactic acid. The examination included a deflection of the free wire ending using an electrical drive (dynamic loading in intervals). All tests were performed at 37°C for 7 days. Eight different orthodontic wires (20 specimens per wire) were examined with and without dynamic loading. The surface topography of the tested samples was qualitatively analyzed by stereoscopic and scanning electron microscopy.
RESULTS: After testing, the wire surfaces embedded in acrylic displayed the following alterations: 1. Crevice corrosion with extensive surface lesions and opaque discolouration; 2. Localised pitting corrosion; 3. Mild erosion with translucent discolouration. The type of corrosion and the degree of susceptibility varied among the investigated wires. Nickel-reduced products showed the greatest stability. There were no differences between static and dynamic loaded samples.
CONCLUSION: Acrylic discolouration of removable appliances is caused by corrosion processes of the embedded wire endings. This phenomenon seems unavoidable as long as crevice formation between the acrylic and wire surface cannot be prevented. The results show that the metal-acrylic interface in removable orthodontic appliance fabrication must be improved.

67 THE USE OF THE ICON SYSTEM TO ESTIMATE THE RESULTS OF TWO TREATMENT METHODS OF ANGLE CLASS II DIVISION 1 MALOCCLUSIONS

M Kalavritinos, Ennepetal, Germany and Athens, Greece

AIM: To examine the effectiveness of the ICON system by evaluating the results of two treatment methods of Angle Class II division 1 malocclusions.
SUBJECTS: Two patient groups (16 each) with an average age at the beginning of treatment of 11.2 years and at the end 14.3 years. The first group was treated with a combination of bionator and fixed appliances and the second with a Jasper-Jumper and fixed appliances.

METHODS: The model casts of the two groups were evaluated with the ICON system in order to identify differences or similarities of the two methods of treatment. All subjects were successfully treated. The pre-treatment need, the complexity, the improved grade and the treatment acceptability of each case was evaluated. Tables of descriptive statistical parameters and/or contingency tables were constructed for each treatment group separately. Continuous variables were compared between the groups with the non-parametric Wilcoxon rank sum test. The level of significance was fixed at $\alpha = 0.05$. *P*-values were derived from two-sided tests. The method error was tested by evaluating another patient group with the ICON system from two researchers. No significant difference was found.
RESULTS: No statistically significant differences were detected between the two groups according to complexity ($P = 0.15$), improvement grade ($P = 0.38$), pre-treatment need ($P = 0.73$) and end of treatment acceptability ($P = 0.37$).
CONCLUSION: The ICON system proved to be a reliable method to evaluate the results of two different treatment modalities of Angle Class II division 1 malocclusions.

68 JUVENILE TEMPOROMANDIBULAR JOINT DYSFUNCTION IN THE NORTHERN DISTRICT OF JAPAN

T Kamegai, T Tatsuki, H Mitsuhashi, H Nagano, S Matsushima, Department of Orthodontics, Iwate Medical College and Aomori Dental Association, Japan

AIM: To investigate the distribution of temporomandibular joint dysfunction (TMD) among the younger generation in Japan, and to clarify the relationship between TMD and occlusion.
SUBJECTS: Primary school (4–6 grade) and junior high school children (747 boys, 744 girls) in Northern Japan were examined.
METHODS: TMD symptoms were classified as joint noise, pain and dysfunction of jaw movement, according to palpation and inquiry.
RESULTS: In primary school children, the frequency of TMD symptoms was observed in only 7.1 per cent (7.1 per cent boys, 7.0 per cent girls), in junior high children, 12.1 per cent (10.5 per cent boys, 13.7 per cent girls). Joint noise was found in 79.2 per cent, pain in 17.4 per cent and jaw opening dysfunction in 3.5 per cent. The incidence of normal occlusion in subjects without TMD was 39.8 per cent, and 34.1 per cent in the TMD group. In TMD children with malocclusion, crowding was observed in 29.9 per cent. The tooth to denture base discrepancy in children with TMD was 64.5 per cent, and the difference in value between subjects with and without this discrepancy was significant ($P < 0.05$).
CONCLUSION: In the Japanese younger generation, TMD symptoms were registered in approximately 10 per cent at the developmental stage before completion of the masticatory system. In comparison with an earlier investigation in 1988 carried out near the Tokyo area, the frequency of children with TMD in the northern district showed an increasing tendency.

69 MAXILLOFACIAL MORPHOLOGY IN OPEN BITE SUBJECTS WITH A HISTORY OF TEMPOROMANDIBULAR DYSFUNCTION

T Kaneko, T Imai, T Okamoto, T Kusakabe, J Iida, Department of Orthodontics, Hokkaido University, Sapporo, Japan

AIM: To compare the morphological characteristics of maxillofacial and dentoalveolar structures in open bite patients with a history of temporomandibular joint disorders (TMD), such as restriction of movement of the TMJ and/or pain on movement, with open bite subjects without a history of TMD.
SUBJECTS: Forty-four female orthodontic patients 15 years of age or older (mean 23.2 years) with anterior open bite were included in this study. Subjects with congenital deformities such as a cleft palate were excluded.
METHODS: After examination, the subjects were divided into two groups; group A consisted of 23 patients with a history of restriction of movement of the TMJ and/or pain on movement and group B, 21 patients without a history of TMD symptoms. Lateral cephalograms taken before orthodontic treatment were used to investigate the maxillofacial and dentoalveolar morphological structures in both groups.
RESULTS: The characteristics of the maxillofacial structure in group A were as follows: (1) the mandible was positioned posteriorly, (2) the gonial angle was small, (3) the ramus inclined posteriorly, and (4) the palatal plane rotated inferiorly. The characteristics of the dentoalveolar structure in group A were as follows: (1) the upper incisors inclined lingually, (2) the lower incisors inclined labially, (3) the curve of Spee in the lower arch was reversed, and (4) the lower second premolar inclined mesially.
CONCLUSION: The results suggest that the maxillofacial morphology of patients with a history of TMD was a clockwise rotational facial type, with the upper and lower incisors showing a dentoalveolar compensatory inclination in comparison with those without a history of TMD.

70 A BIOCHEMICAL STUDY OF CELLULAR RESPONSE UNDER MECHANICAL STRESS

Z Kanno[1], K Ohya[2], K Soma[1], [1]First Department of Orthodontics and [2]Department of Dental Pharmacology, Tokyo Medical and Dental University, Japan

AIM: To investigate the mechanisms whereby bone cells detect mechanical stimuli and how the stimuli are translated into biochemical changes.
MATERIALS AND METHODS: Osteoblastic KUSA cells were loaded with fluorescent Ca^{2+}-sensitive fluo-3 AM dye, and exposed to fluid-shear stress in a flow chamber. Stimulus-induced changes in the fluorescence intensity were measured using confocal laser scanning microscopy.

RESULTS: Application of flow to the cells led to an increase in fluorescence, which declined when the flow was stopped. Blockading the mechanosensory stretch-activated channel with gadolinium reduced the magnitude of the calcium response and extended the latency of the reaction. Disruption of the actin filament by cytochalasin D did not show any inhibitory effect on the magnitude of the calcium response, but the latency was shortened.
CONCLUSION: These results indicate that the stretch-activated channel is involved in the fluid-induced intracellular calcium response in the osteoblastic cells, and that actin filaments modulate the sensitivity of the stretch-activated channel.

71 A CEPHALOMETRIC STUDY OF PATIENTS WITH SICKLE CELL ANAEMIA IN GREECE

S Kavadia, E Marcovitsi, G Kolokithas, S Sidiropoulou, O Kolokitha, A Nasiopoulos, E Chasapopoulou, I Christakis, Department of Orthodontics, Aristotle University of Thessaloniki, Greece

AIM: The cephalometric evaluation of adult Greek patients with sickle cell anaemia.
MATERIAL AND METHODS: Forty-six lateral cephalometric radiographs of patients with sickle cell anaemia and 215 healthy adult Greeks as a control group were obtained. Thirty variables were used referring to: (1) the vertical facial pattern of the patients, (2) the internal structure of the skull, (3) the position of the mandible, (4) the mandibular size, (5) the maxillary position and size, (6) the dental and the dentoskeletal relationships, as well as (7) facial aesthetics. Mean, minimum and maximum values, range and standard deviation of the 30 variables were calculated. Multiple regression analysis, ANOVA, for parametric variables and Mann-Whitney tests were used for comparison of the mean values (Significance level 0.05.)
CONCLUSIONS: Patients with sickle cell anaemia present a dolichofacial pattern, a convex face and increased overjet.

72 A NEW APPROACH IN MAXILLARY MOLAR DISTALIZATION: THE INTRA-ORAL BODILY MOLAR DISTALIZER

A Keles, K Sayinsu, Department of Orthodontics, Marmara University, Istanbul, Turkey

AIMS: To achieve bodily molar distalization, avoid distal tipping of molars and minimise patient co-operation.
SUBJECTS: Five male and 10 females, with a mean age of 13.53 years. All the patients presented a Class II division 1 or 2 relationship with a Class II molar relationship on both sides. The patients were in the permanent dentition, second molars were erupted and the lower dental arch was well aligned. They showed a normal or sagittally directed growth pattern. Lateral cephalograms and cast models were taken and analyzed before and after molar distalization.
METHOD: In order to achieve maxillary molar distalization a new intra-oral appliance the intra-oral bodily molar distalizer (IBMD) was developed. This comprised two parts, an anchorage and a distalizing unit. The anchorage unit was a wide Nance button, while the active unit consisted of distalizing springs. The springs had two components: the distalizer section of the spring applied a crown tipping force, while the uprighting section of the spring applied a root uprighting force on the first molars. A distalizing force of 230 g was utilized on both sides.
RESULTS: After distal movement of the first molars, the cephalometric analysis was as follows: The maxillary first molars were moved distally by an average of 5.23 mm ($P < 0.001$), without tipping or extrusion. The maxillary first premolars were moved 4.33 mm mesially ($P < 0.001$), tipped 2.73 degrees distally ($P < 0.05$) and extruded by 3.33 mm ($P < 0.001$). The maxillary central incisors were proclined an average of 4.7 mm ($P < 0.001$) and tipped 6.73 degrees labially ($P < 0.01$). Model analysis showed that the maxillary first molars were not rotated and inter-molar distance did not change after distal movement of the molars.
CONCLUSION: Unlike other molar distalization mechanics, this newly developed device achieved bodily distal movement of maxillary molars that did not depend on patient co-operation and did not require headgear wear for molar root uprighting.

73 TEMPOROMANDIBULAR JOINT SYMPTOMS IN ORTHODONTICALLY TREATED AND UNTREATED YOUNG FINNISH ADULTS

H M Kerosuo, E N J Kerosuo, Faculty of Dentistry, Kuwait University, Kuwait

AIM: To study the frequency of objective and subjective temporomandibular joint (TMJ) symptoms in relation to the history of orthodontic treatment, RP-IP discrepancy and overjet and overbite in young Finnish adults.
SUBJECTS: A total of 281 18–19 year-old subjects, comprising 70 per cent of the sample, were randomly selected from the population register of the city of Vantaa, Finland.
METHODS: The clinical examination included assessment of treatment need using the Index of Orthodontic Treatment Need. TMJ clicking, RP-IP discrepancy and maximal mandibular opening were also assessed. The subjects were interviewed about subjective TMJ symptoms such as pain, locking or luxation, stiffness and tiredness in the jaws, sounds from the TMJ. Information of a history of orthodontic treatment and the type of appliance were based on the patients' records.
RESULTS: Forty-six per cent of the subjects (54 per cent females, 37 per cent males, $P < 0.05$) had received orthodontic treatment during adolescence. Interceptive orthodontics with headgear and quadhelix were widely used. Fixed appliances were used in 36 per cent of the treated cases. Clicking of TMJ was found in 15 per cent of the treated and in 10 per cent of the untreated subjects (not statistically

different). Regarding RP-IP discrepancy greater than 2 mm and the frequency of subjective TMJ symptoms, no difference was found between the treated and untreated subjects. Subjects with deep overbite showed significantly more often RP-IP discrepancy greater than 2 mm compared with those with normal overbite, 50 and 16 per cent, respectively.
CONCLUSION: Orthodontic treatment was not connected with TMJ symptoms among the young Finnish adults in this study.

74 PERIODONTAL STATUS FOLLOWING SURGICAL UNCOVERING AND ORTHODONTIC TREATMENT OF BUCCALLY IMPACTED CANINES

K H Kim, C W Baek, J Y Han, Department of Orthodontics, Yonsei University, Yongdong Severance Hospital, Seoul, Korea

AIM: To examine the effect of orthodontic treatment of surgically exposed impacted upper canines or ectopically erupted upper canines on the periodontal condition.
SUBJECTS: From a total of 23 patients with unilateral buccal upper canine impaction, 11 were treated by a closed eruption technique (group I), four by an apically positioned flap procedure (group II), and eight by traction through keratinised gingiva (group III).
METHODS: After completion of orthodontic treatment, keratinised gingival width, attached gingival width, probing depth and bone probing depth were measured and compared with the contralateral normally erupted canines.
RESULTS: In all three groups, the width of keratinised gingiva was preserved and showed no signs of detrimental periodontal conditions such as gingival recession. In all three groups, no significant difference in periodontal pocket depth from control was observed. The width of attached gingiva was significantly greater in patients treated with the apically positioned flap procedure (group II) than in the other groups.
CONCLUSION: The periodontal condition of buccally impacted canines treated with surgical uncovering can be maintained favourably by appropriate treatment selection.

75 EFFECT OF TREATMENT TIMING ON MAXILLARY PROTRACTION—A COMPARISON OF PREPUBERTAL AND PUBERTAL PATIENTS

K H Kim, J H Lee, S U Kim, Department of Orthodontics, Yonsei University, Yongdong Severance Hospital, Seoul, Korea

AIM: To compare maxillary protraction effects at prepubertal and pubertal age.
SUBJECTS: Forty patients at prepubertal age (SMI: 1–3) and 32 patients at pubertal age (SMI: 4–7).
METHODS: Hand and wrist radiographs were taken and the skeletal maturity indicator (SMI) was evaluated according to Fishman. Patients with SMI 1–3 were grouped into the prepubertal group and those with SMI 4–7 into the pubertal group. Pre- and post-treatment cephalometric radiographs were taken and analysed.
RESULTS: 1. After maxillary protraction, considerable maxillary advancement was achieved in both groups showing no significant difference in amount. 2. No significant difference was found considering the vertical change of the maxilla. 3. The final horizontal position of the mandible was more posterior in the prepubertal group. 4. No significant difference was found for the vertical change of the mandible. 5. Almost no significant dental changes were found between the groups.
CONCLUSION: Maxillary protraction results in considerable skeletal and dental effects. There was no significant difference among prepubertal and pubertal patients.

76 CEPHALOMETRIC EVALUATION OF SAGITTAL JAW RELATIONSHIPS IN CLASS II PATIENTS

S Kišić-Merlo, M Lapter, M Šlaj, S Rajić-Meštrović, Department of Orthodontics, University of Zagreb, Croatia

AIM: To determine the amount of maxillary prognathism, mandibular retrognathism and their combination in clinically diagnosed Class II patients.
MATERIAL: Lateral cephalograms of 71 patients with clinically diagnosed Class II malocclusions and a control group of 70 patients with ideal occlusion, between 13 and 16 years of age.
METHODS: Variables SNA, SNB, SNPg, NA-FH and NPg-FH were analysed in both groups. The subjects were grouped according to maxillary prognathic and mandibular retrognathic reference values. The relationship between diagnosis and indicators of maxillary prognathism and mandibular retrognathism was evaluated (Pearson's correlation, regression analysis).
RESULTS: The results revealed the presence of different skeletal maxillomandibular combinations. Bimaxillary retrognathism dominated in the sample 47.88 per cent (SNA-SNB) or 42.25 per cent (NA-FH—NPg-FH). The percentage of maxillary normognathism and mandibular retrognathism combination was 22.54 per cent (SNA-SNB) or 21.12 per cent (NA-FH—NPg-FH); maxillary prognathism and mandibular retrognathism 11.27 per cent (SNA-SNB) or 18.31 per cent (NAFH—NPg-FH); and maxillary prognathism—mandibular normognathism 11.27 per cent (SNA SNB) or 8.4 per cent (NA-FH—NPg-FH). Regression analysis revealed low correlation between sella-nasion and Frankfort horizontal based indicators (NA-FH and SNA $R^2 = 0.19$; NPg-FH and SNB $R^2 = 0.17$).
CONCLUSION: Similar results with respect to maxillary or mandibular positions were found when using sella-nasion or Frankfort horizontal as the baseline, but regression analysis revealed low relationship within changes in these two groups of variables. Sella-nasion showed higher stability than Frankfort horizontal when evaluating sagittal jaw relationships and should be used as a reference line.

77 THE DIAGNOSTIC SIGNIFICANCE OF THE INDICATOR LINE

Y Kitafusa, Kitafusa Orthodontic Clinic, Asahi City, Chiba Prefecture, Japan

AIM: To examine the relationship between facial patterns and occlusal patterns using the indicator line.
SUBJECTS: One hundred and fifty-six attending the orthodontic clinic in 1996–1997.
METHODS: The subjects' seven facial patterns were classified by cephalometric analyses. The indicator line was directly measured on the subject's face, and the differences between measured length and standard ideal length were calculated. The average ideal length was subtracted from the average length of the indicator line for all facial patterns. Bite force was taken using the Dental Prescale 9 Occluzer System from the subjects of the seven facial patterns. The data was analyzed by the occluzer to find the occlusal contact area, mean pressure on each occlusal contact area, and all occlusal forces.
RESULTS: From severe dolichofacial pattern to severe brachyfacial pattern, the indicator line values decreased gradually. The values were 4.98 mm mesiofacial, 5.85 mm dolichofacial and 3.33 mm brachyfacial. For occlusal contact area, brachyfacial type was larger than dolichofacial type. For average occlusal pressure, there were no significant differences for each facial pattern. The range was from 49.9 to 53.8 MPa. For occlusal force, brachyfacial type had more impact than dolichofacial pattern. It was related to the volume of the contact area.
CONCLUSION: Measuring values of the indicator line and the application of those values to diagnosis are considered very significant and valuable.

78 TOOTH ERUPTION IN NEWLY GENERATED BONE INDUCED BY rhBMP-2

A Kitamura, N Motohashi, T Kawamoto, M Ogawa, Y Baba, S Suzuki, T Kuroda, Maxillofacial Orthognathics, Graduate School, Tokyo Medical and Dental University, Japan

AIM: To observe the tooth eruption pattern in newly generated bone induced by rhBMP-2.
SUBJECTS: Three beagle dogs 12 weeks old were used in this experiment.
METHODS: The maxillary alveolar bone was resected with a dental electric engine together with extraction of the maxillary second incisor tooth germ. rhBMP-2 (5μg/100μl or 10μg/100μl) was implanted in the resected area. The non-implanted site after resection and the non-resected site were used as controls. Serial changes of the eruption pattern of the maxillary third incisor in the implanted area were observed radiologically. Oxytetracycline and calcein were employed as bone markers. Nine weeks after implantation, the animals were sacrificed. The samples were observed histologically and analyzed using peripheral quantitative computerized tomography to determine trabecular bone mineral density.
RESULTS: In the rhBMP-2 (5μg/100μl)-treated site, new bone generation was observed at the implanted area. Its density was higher than that in the non-implanted site and similar to the non-resected site. The maxillary third incisor erupted through the implanted area, and its eruption pattern showed no significant difference compared with the control site. In the rhBMP-2 (10μg/100μl)-treated site, considerable new bone generation was observed at the implanted area. Its density was higher than that in the other sites. The maxillary third incisor erupted mesially so as to avoid this implanted area.
CONCLUSION: These results show that newly generated bone induced by rhBMP-2 (5μg/100μl) could be adaptive for tooth eruption, suggesting the clinical possibility of new biomaterial in secondary bone grafting for alveolar cleft.

79 CRANIOFACIAL MORPHOLOGY AND DENTAL AGE IN CHILDREN WITH SILVER RUSSELL SYNDROME

H Kjellberg, A Bergman, K Albrektsson-Wikland, Department of Orthodontics, University of Göteborg, Sweden

AIM: To examine the craniofacial morphology, occlusion and dental age in children with Silver-Russell syndrome (SRS).
SUBJECTS: Twelve children, 7 boys and 5 girls, with a mean age of 9.6 and 9.3 years respectively, were examined.
METHODS: Facial morphology was measured on cephalograms and posteroanterior radiographs. Occlusion, tooth eruption and palatal height were measured on casts, and dental maturity on orthopantomograms. The statistical analysis used was paired and unpaired *t*-tests and *z*-scores.
RESULTS: Overall, smaller linear facial dimensions, asymmetries and deviations in the facial proportions such as a small retropositioned and a steeply inclined maxilla and mandible and a proportionally larger anterior face height in relation to posterior face height was found among SRS-children. The frequency of malocclusions was higher and the palatal height showed tendencies to be increased. Dental maturity was within normal limits while the time for tooth eruption was slightly delayed.
CONCLUSIONS: The deviating facial morphology described above is a part of the syndrome, which is characterized by short stature, growth hormone deficiency, and asymmetries of the body.

80 LASER CURING OF A GLASS IONOMER ORTHODONTIC ADHESIVE

A Klocke, L Huck, H Korbmacher, B Kahl-Nieke, Department of Orthodontics, University of Hamburg, Germany

AIM: To determine the influence of decreased curing time with a dental laser on *in vitro* shear bond strength of orthodontic brackets.
MATERIAL AND METHOD: One hundred and eighty extracted human teeth were randomly divided into four

	(1) Curing laser				(2) Regular curing light	
	10 s curing		20 s curing		40 s curing	
	No etching	Etching	No etching	Etching	No etching	Etching
Incisor (n = l5)	30.26 ±10.56 N	55.76 ±35.14 N	37.24 ±26.73 N	100.04 ±43.64 N	32.36 ±17.68 N	102.19 ±28.45 N
Premolar (n = 15)	46.07 ±21.99 N	118.57 ±30.70 N	50.36 ±43.31 N	120.88 ±65.59 N	55.15 ±28.97 N	99.36 ±40.49 N

experimental and two control groups of 30 teeth each (15 incisors, 15 premolars). Lateral incisor and first premolar brackets (100 gauge mesh) were used (Orthos, Ormco, USA). All teeth were bonded with glass ionomer cement (GC Fuji Ortho LC, GC Corporation, Tokyo, Japan) with and without prior etching (10 per cent polyacrylic acid, 20 seconds) of the tooth surface. Light curing was performed using (1) a dental curing laser (AccuCure 3000, La-sermed, USA) and reduced curing times (10 and 20 seconds) and (2) a regular light curing device (Elipar Highlight, Espe, Germany) for 40 seconds. After 48 hours storage shear bond strength was measured with a testing machine (Zwicki Z2.5, Zwick, Germany). An analysis of variance was performed.
RESULTS: Means and standard deviations are shown above.
CONCLUSION: In order to achieve sufficient bond strength, the tooth surface needs to be prepared by etching with polyacrylic acid prior to bonding with glass ionomer cement. The use of the laser with a reduced curing time of 20 seconds provided adequate bond strength and might be an economic alternative with improved patient comfort compared with the standard 40 second curing procedure with a regular dental light.

81 UTILIZATION OF A PLASMA-BASED CURING SOURCE WITH RESIN-REINFORCED GLASS IONOMER

A Komori, I Kojima, H Ishikawa, Department of Orthodontics, Nippon Dental University, Tokyo, Japan

AIM: To determine the bond strength of resin-reinforced glass ionomer cement (RGIC) when used to bond mesh-backed brackets to bovine teeth with a plasma-based curing source.
MATERIALS AND METHODS: Sixty bovine mandibular incisors were used in this study. Progressively finer polishing of the enamel surface was performed with 120 to 2400 grit waterproof abrasive paper. Two bonding agents were used: a light-cured RGIC (Fuji Ortho LC, GC Corp. Japan) and bis-GMA based composite resin (Light Bond, Reliance Orthodontic Products Inc., USA). All bonding mediums were handled according to the manufacturers' instructions. Each bracket was exposed for 3 seconds to the plasma-based curing source (Apollo 95E, DMD Systems, USA) at the incisal and gingival margins. After storage at 37°C for 24 hours and thermal cycling from 5 to 55°C 2,000 times, bond testing was performed. A universal testing machine (Shimadzu Co. Ltd., Japan) was used to measure the shear bond strength.
RESULTS: The bond strength of the light-cured RGIC and composite was 21.3 ± 7.9 MPa and 20.7 ± 8.6 MPa, respectively. There was no significant difference in bond strength between light-cured RGIC and light-cured composite resin. No significant differences were seen in bond strength between 24 hours and thermal cycling.
CONCLUSION: The light-cured RGIC was shown to have a retentive strength similar to light-cured composite resin. RGIC appears to be adequate for clinical use when used with a plasma-based curing source.

82 STATISTICAL INVESTIGATIONS IN THE REPRODUCIBILITY OF A PHOTOGRAMMETRIC MEASUREMENT SYSTEM

S Kopp[1], F Ifert[2], N P Schumann[1,3], D Wangemann[1], S Richter[1], [1]Department of Orthodontics, [2]Private practice, Schewina, [3]Motor Research Group, Institute of Pathophysiology, Friedrich-Schiller-University Jena, Germany

AIM: To demonstrate the accuracy of the Pictran-Med® three-dimensional (3D) facial analysing system under conditions of everyday use in orthodontic practices.
SUBJECTS. Fifty subjects attending the Department of Orthodontics.
METHODS: Photographs were taken from five different views with a customized digital camera system (Fuji X DS-300) and the 3D photographic analysis was undertaken with and without markers. The measurements were carried out by different investigators multiply and repeated at different times. All calculations were performed by Pictran-Med® software (Schewe, Hausen, Germany) and interpreted by SPSS 7.5 (SPSS Inc., USA).

RESULTS: With markers, the accuracy of the 3D-point detection reached a 0.2 mm level, while measurements without markers showed results at the 0.5 mm level. A very good intra-rater reliability (kappa = 0.89) was found when using markers. Without markers kappa showed good results (0.68). The inter-rater reliability calculated in this investigation was 0.82 with markers and 0.59 without markers.
CONCLUSION: Measuring soft-tissue structures by Pictran-Med® is easy. At a 0.5 mm level of accuracy the system is recommended for gaining 3D-information of the face. The practicability in daily use is also proved by intra- and inter-rater reliability tests.

83 EVALUATION OF A NEW ONE-PHASE ORTHODONTIC ADHESIVE

H Korbmacher, A Klocke, L Huck, B Kahl-Nieke, Department of Orthodontics, University of Hamburg, Germany

AIM: To examine the *in vitro* shear bond strength of a new cyanoacrylate-based orthodontic adhesive.
MATERIAL AND METHOD: Extracted human teeth were divided into two experimental and five control groups of 30 teeth each (15 incisors, 15 premolars). Bonding in the two experimental groups was carried out using Smart-Bond (Gestenco, Sweden), while in the control groups teeth were bonded with glass ionomer cement (Fuji Ortho LC, GC, Japan) and composite (Transbond XT, Unitek, USA). Lateral incisor and first premolar brackets (100 gauge mesh, Orthos, Ormco, USA) were utilized. After etching with phosphoric acid for 20 seconds, in experimental group I bonding was performed in a wet field according to the manufacturers' specifications, while experimental group II comprised teeth contaminated with human saliva. After 48 hours storage, shear bond strength was measured with a testing machine (Zwicki Z2.5, Zwick, Germany).
RESULTS: Means and standard deviations are shown below.
CONCLUSION: Shear bond strength with the new cyanoacrylate-based adhesive in a wet field and for teeth contaminated with saliva was found to be at the lower limit of recommended bond strength for clinical use. Therefore, *in vivo* testing is needed as a follow-up on new material.

	Smart-Bond		Fuji				Transbond
	No saliva (I)	Saliva (II)	No saliva		Saliva		No saliva
	Etch	Etch	No etch	Etch	No etch	Etch	Etch
Incisor (n = l5)	59.62 ± 36.07 N	42.58 ± 20.72 N	32.36 ± 17.68 N	102.19 ± 28.45 N	52.30 ± 28.71 N	89.99 ± 40.37 N	139.48 ± 42.88 N
Premolar (n = 15)	68.25 ± 22.46 N	71.02 ± 34.41 N	55.15 ± 28.97 N	99.36 ± 40.49 N	45.59 ± 23.46 N	89.99 ± 40.37 N	134.07 ± 37.24 N

84 UPPER ARCH DIMENSIONS IN PATIENTS WITH UNILATERAL AND BILATERAL CLEFTS BEFORE AND AFTER PALATAL SURGERY

H Kratzsch, Ch Opitz, Department of Orthodontics and Dentofacial Orthopedics, Humboldt-University, Berlin, Germany

AIM: Examination of the transverse dimension of the upper arch and the positions of the incisal point and the segments in cleft patients compared with a control group without clefts.
MATERIAL AND METHOD: A three-dimensional examination was carried out on maxillary plaster models of patients with unilateral (44) and bilateral (28) cleft lip alveolus and palate (CLP) and without clefts (28). The angles between the canine point and the intertuberosity distance, as well as between the incisal point and the intertuberosity distance were investigated. The transverse changes were measured by the intercanine-distance and the intertuberosity-distance. All distances and angles in cleft patients have been measured previously (2½–3 years) and after (3½–4 years) palatal surgery and compared with a control group at the age of 3 to 4½ years.
RESULTS: Before palatal surgery: In UCLP the intercanine distance and in UCLP and BCLP the intertuberosity-distances were reduced compared with the control group. The incisal point in UCLP (86 degrees) and in BCLP (92 degrees) showed a displacement compared with the control group. The segments in BCLP (right 81.8 degrees; left 83.2 degrees) and the larger segment in UCLP (84.9 degrees) were rotated outward, compared with the control group (right 77.5 degrees; left 76.6 degrees). After palatal surgery: Compared with the control group both intercanine and intertuberosity distance in UCLP and BCLP showed normal proportions. In relation to the control group the incisal point was displaced in BCLP. The small segment in UCLP was rotated inwardly.

CONCLUSIONS: Before palatal surgery the dimensions in the upper jaw in UCLP as well as in BCLP subjects show considerable differences compared with the control group without clefts in the deciduous dentition. After palatal surgery a normalisation could be established of upper jaw dimensions in UCLP and BCLP.

85 RELATIONSHIP BETWEEN ALVEOLAR THICKNESS, MAXILLOFACIAL MORPHOLOGY, AND BITE FORCE

M Kubota, H Nakano, K Ogasawara, K Satoh, K Kubota, H Miura, Department of Orthodontics, Iwate Medical University, Morioka, Japan

AIM: To investigate the relationship between mandibular alveolar thickness, maxillofacial morphology, and maximal voluntary bite force and to compare the differences in mandibular alveolar thickness among facial types.
SUBJECTS: Thirty adult male volunteers (mean age: 24 years 10 months) with no history of orthodontic treatment and no missing teeth except third molars.
METHODS: Alveolar thickness at the first premolar region (P1) and first molar region (M1) of the mandible was measured using a CT scan of a horizontal section. Conventional roentgenographic cephalometry was performed on a lateral radiograph. Maximal voluntary biting force (MBF) was investigated by pressure-sensitive film. The data were initially analyzed using simple regression analysis to obtain correlation coefficients. Subsequently, subjects were classified into three groups according to facial type: brachy, meso and dolichofacial types. Differences in Pl and Ml were compared among facial types using one-way factorial ANOVA and *post hoc* test.
RESULTS: P1 and Ml were positively correlated with ramus height ($P < 0.05$) and MBF ($P < 0.001$), and negatively with mandibular plane angle and gonial angle ($P < 0.05$). P1 and MI in the brachyfacial type group were significantly thicker than those of the dolichofacial type ($P < 0.05$).
CONCLUSION: Brachyfacial individuals have greater alveolar thickness at the first premolar and first molar region of the mandible than dolichofacial individuals.

86 ADDITIONAL SPACE GAINING WITH A MODIFIED SUPERCABLE

S Küffers, M Hahn, W Hahn, Private Practice, Homburg, Germany

AIM: To correct severe anterior crowding by minimizing the treatment time and less wire changes during the levelling phase.
SUBJECTS AND METHOD: Twenty-four patients with severe anterior crowding were selected and divided into two groups of 12 patients each: Twelve patients were initially treated with Supercable™ (0.016-inch round 7-strand super elastic nickel titanium archwire). Two tubes were crimped onto the archwire as stops mesial of the canines with a surplus of archwire length (up to 5 mm in the intercanine arch length). The control group were treated with stainless steel (0.016-inch round 5-loop) archwire. The patients were examined weekly. Photographs and impressions for plaster casts were taken to demonstrate the treatment progress. For analysis, Little's irregularity index was used before and after each archwire change. Panoramic radiographs were taken after removal of the appliance.
RESULTS: In comparison with the control groups in all patients treated with Supercable™ and stops mesial of the canines it was possible to correct severe anterior crowding within 4–6 weeks without intermediate adjustments and less than 30 per cent treatment time. A few subjects showed slight uncontrolled protrusion of the incisors. Neither group showed signs of root resorption or recession.
CONCLUSION: Stainless steel looped arches may allow alignment of mild to moderate anterior crowding in a similar time, but severe crowding needs more frequent activations and longer treatment time. In comparison with multilooped arches, space gaining with the Supercable™ modification seems a more convenient way to align the anteriors. Moreover, by avoiding loops it is possible to reduce adjustments and soft tissue alteration, as well as additional plaque accumulation.

87 DEVELOPMENT OF THE CURVE OF SPEE DURING AND AFTER ORTHODONTIC TREATMENT

R B Kuitert, B Prahl-Andersen, Department of Orthodontics, ACTA, Amsterdam, The Netherlands

AIM: To investigate the changes and prediction of form and depth of the curve of Spee during and after orthodontic treatment.
SUBJECTS: One hundred and fifteen subjects were selected with full sets of records and good treatment results. The mean pre-treatment age was 12.4 years, and the mean age at follow-up was 31.4 years.
METHODS: Standardized photographs of the plaster models before treatment (T1), at the end of active treatment (T2) and post-treatment (T3) were used. The curve was described by the depth, the localization of the deepest point and three angles. To analyze correlations, changes and differences, MANOVA and multiple regression analyses were applied.
RESULTS: There were significant changes for most measurements between T1 and T2 and between T2 and T3. There was a significant correlation between the depth of the curve and the localization of the deepest point. During treatment 72 per cent of deep curves were corrected to normal curves. Of the subjects that had a normal curve at T2, 10 per cent changed, mostly to a deep curve. Of the patients showing an abnormal curve at T2, 50 per cent changed to a normal curve at T3. At T3, 26 per cent of those with a deep curve at T1 and 22 per cent of those with a normal curve at T1 showed a deep curve. Prediction of the post-treatment change of the curve was only possible using the angle

between the occlusal plane and the curve of Spee. If this angle is large at T1 and/or enlarges between T1 and T2 the chance for a deep curve at T3 increases.
CONCLUSION: The original depth of the curve is not predictive for the post-retention depth. After treatment many changes are possible. Fifty per cent of the abnormal curves improve, 25 per cent of the normal curves deteriorate.

88 ENHANCED MAGNETIC RESONANCE IMAGING OF THE TEMPOROMANDIBULAR JOINT IN CHILDREN WITH JUVENILE CHRONIC ARTHRITIS

A Küseler[1], T K Pedersen[1], J Gelinek[2], T Herlin[3], Departments of [1]Orthodontics and [2]Radiology and [3]Pediatric Rheumatology Clinic, University of Aarhus, Denmark

AIM: In order to estimate the prevalence of temporomandibular joint (TMJ) involvement and quantitate the progression of the disease in children, a group of newly diagnosed patients with juvenile chronic arthritis (JCA) was followed employing extensive clinical examinations and magnetic resonance imaging (MRI) of the TMJ for a period of 2 years.
SUBJECTS AND METHODS: Fifteen children (30 TMJs) (mean age 12.7 years) with diagnosed JCA within the previous three years were examined clinically and with MRI—four times at intervals of 6–8 month. The MRI was carried out using a 1.0 T magnet, T1-weighted images were performed before and after i.v. injection of gadolinium-DTPA (Schering) 0.2 ml/kg. Post-contrast examinations consisted of oblique sagittal T1-weighted images with fat-suppression and coronal T1-weighted images, MRIs were scored for each joint and compared with a clinical examination score.
RESULTS: Only one child (two joints) remained without any clinical or MRI signs of inflammatory activity in the TMJs during the 2-year observation period. In the group of children there was a significant increase in the enhancement score as well as the total MRI score from the first to the second examination, but this did not increase further at times 3 and 4. From a total of 56 MRIs, 38 clinical examinations showed mild or severe signs of TMJ involvement, and all of them had clear pathological signs on the MRI. Eighteen clinical examinations had a low score.
CONCLUSION: TMJ involvement determined by pathological changes on the MRI were observed as a very common phenomenon since 93 per cent of the children had inflammatory signs demonstrated as Gd-DTPA enhancement on MRI. Not all of the patients without clinical signs on examination were without pathological changes on the MRI. On the other hand, patients showing mild to severe signs in the clinical examination also had a high MRI score. The clinical examination can be used as a 'filter' where children showing one or no clinical signs are selected for enhanced MRI. MRI of the TMJ may be a helpful tool in detecting the onset of inflammatory changes.

89 COMPONENTS OF ANGLE CLASS II DIVISION 2 MALOCCLUSIONS IN THE MIXED DENTITION

G Laganà, P Cozza, C Chimenti, Department of Orthodontics, University of Rome 'Tor Vergata', Italy

AIM: To analyse the nature and frequency of the occurrence of specific components that can contribute to a Class II division 2 malocclusion in the mixed dentition.
MATERIAL: Lateral cephalograms of 80 patients of Caucasian origin with skeletal Class II division 2 malocclusions selected from the files of the Department of Orthodontics, University of Rome 'Tor Vergata' were used in the study.
METHOD: The linear and angular cephalometric measurements used were: maxillary skeletal and dental position (SNA, A to N Perp., Inc.Sup.^FH angle); mandibular skeletal and dental position (SNPG, Pg to N Perp., IMPA angle, interincisal angle); vertical dimension (SN to ANS-PNS, SN to Mand. Plane, ANS-PNS to Mand. Plane, FMA angle, P.Occl. to FH angle; gonial angle (Ar-Go-Me); cranial base angle (N-S-Ba). Each cephalogram was traced and measured by one author (GL). All measurements were repeated twice, after a period of 7 days and the mean value of the two measurements was used. Graphical and statistical methods were used to characterize each measurement. Descriptive statistics included mean and standard deviation.
RESULTS: 1. The horizontal facial plane was more parallel; 2. Gonial angle was small; 3. All measurements used in this study indicated retrusion of the mandibular skeletal position.
CONCLUSION: The clinical implications of the study suggest that skeletal Class II division 2 malocclusions result from numerous combinations of skeletal and dental components.

90 APPLICATION OF 180-DEGREE TORQUE GENERATED BY RECTANGULAR NICKEL TITANIUM WIRES

Y Lai, M Chu, T V Vijayaraghavan, Department of Orthodontics, University College of Dentistry, New York City, USA

AIM: Utilizing the 180-degree torsional force of super elastic nickel titanium wires to upright buccally or lingually tipped molars.
SUBJECTS: Sixty-eight patients (l2–40 years of age) with buccally or lingually tipped molars (total 116) were treated.
METHODS: In the laboratory, a typodont with 0.022″ slot brackets was set up with a digital torque gauge to measure different levels of force using different sizes of NeoSentalloy wires (0.018 × 0.025″; 0.0215 × 0.028″; force levels 100–300 gm-cm). Since the wires supplied by GAC were thermo-sensitive, a hot water bath was used to keep the temperature of the wires close to intra-oral temperature (37°C). The wire was inserted into the gauge and twisted 180-degrees. The torsional forces were measured. Clinically, the same technique was applied to correct the following problems: buccal crossbites and buccally tipped maxillary

molars; lingually tipped mandibular molars. The 180-degree torsional force was applied to these molars for 3–16 weeks depending on the severity of the case.
RESULTS: With 0.018 × 0.025″ NeoSentalloy wires the average torsional force generated was 40 gm-cm (F100); 47 gm-cm (F200); and 55 gm-cm (F300) in distance of 35 mm, In 0.0215 × 0.028″ wires the average force measured was 55 gm-cm (F100); 62 gm-cm (F200); and 70 gm-cm (F300), Clinically, the buccally or lingually tipped molars were uprighted without any serious side-effects such as occlusal cants, root resorption, root perforating through lingual or buccal plates, or extrusion or intrusion of the molar and adjacent teeth.
CONCLUSION: The force measured in laboratory and the results produced in clinical trials show that the 180-degree torsional force generated by Neo Sentalloy wires is suitable to upright buccally or lingually tipped molars from mild to severe cases. There were no undesirable side-effects if the wire activation is within four months.

91 MEDIUM TERM STABILITY IN DEEP OVERBITE CORRECTION

A Laino, D Pizzoni, G Fiorelli, P Fulcoli, Cattedra di Ortodonzia e Gnatologia, Università degli Studi di Napoli 'Federico II', Italy

AIM: To evaluate treatment stability after two years of deep bite correction carried out using Burstone's segmented arch technique.
SUBJECTS: Twenty young adults with a deep bite treated with the segmented arch technique.
METHODS: Lateral cephalograms, before treatment (T0), at the end of treatment (T1) and two years post-treatment (T2) were analyzed. Seventeen variables were assessed and related with a Student's *t*-test.
RESULTS: Overbite reduction amounted, on average, to 4 mm. Treatment resulted in incisor intrusion of 1.31 mm in the upper ($P < 0.001$) and 1.33 mm in the lower arch ($P < 0.001$) and in a labial tipping (9.91 degrees, $P < 0.001$) of the lower incisors. No substantial molar extrusion was found and, consequently, no posterior mandibular rotation. Predictable relapse, two years post-treatment was not considerable (0.96 mm), but significant ($P < 0.001$).
CONCLUSION: With regard to craniofacial morphology and rotational growth patterns, overbite correction appeared to be stable.

92 THE ROLE OF CYTOKINES AND IL-1 RECEPTOR ANTAGONIST IN ORTHODONTIC TOOTH MOVEMENT

A Lala, O Jureyda, C B Preston, Department of Orthodontics, State University of New York, Buffalo, USA

AIM: To determine the role of cytokine IL-1β and IL-1 receptor antagonist (IL-ra) in orthodontic tooth movement.
MATERIAL AND METHODS: Gingival crevicular fluid (GCF) was collected from each patient using paperstrips (Periopaper, USA) that were inserted 1 mm into the gingival crevice and allowed to remain there for 30 seconds. GCF collection from the same site was repeated in 1 minute. The sample from the periopaper was eluted using PBS (pH 7.2) and the contents of IL-1β and IL-1ra in the samples were measured using ELISA kits (R & D Systems, USA).
RESULTS: The preliminary results showed that the concentration of IL-1β in the GCF correlated with orthodontic tooth movement. The concentration of IL-1 ra was detectable in all the samples. These results provide information regarding the correlation of IL-1ra concentration in the samples with orthodontic tooth movement.
CONCLUSION: Proinflammatory cytokines induce cellular production of lipid mediators, prostaglandins, proteases, and free radicals, all of which modulate the immune system during tooth movement. IL-1β, a proinflammatory cytokine, is recognized as exerting inducing effects on osteoblast/osteoclast interaction and activating them to induce immunomodulatory cytokines such as IL-6 all of which actively participate in bone remodelling. On the other hand, mechanisms for inhibiting inflammation involve the IL-1 receptor antagonist (IL-1 ra) (released by macrophages), which, in some conditions, specifically suppress the effects of IL-1 and TNF-alpha (another mediator). This study shows that cytokine IL-1β and IL-1 ra both contribute in the bone dynamics during orthodontic tooth movement. Since the proinflammatory cytokine IL-1β has been suggested to initiate bone resorption, it is logical to infer that inhibitor IL-1 ra may play a crucial role as an inhibitor of resorption in bone physiology.

93 CLEFT PALATE TREATMENT FOR IMPROVED MAXILLARY GROWTH: EARLY RESULTS

R A Latham, M S Lacey, E M Latham, Graduate Orthodontics, University of Western Ontario and Division of Plastic Surgery, London Health Sciences Centre, London, Canada

AIM: To evaluate maxillary growth in terms of dental occlusal development after a new method of hard palate repair that causes less trauma and after a delay in definitive lip muscle repair until after incisor eruption at about 18 months.
SUBJECTS: Eight consecutive children born with bilateral clefts of the lip and palate between 1996 and 1999. Ten consecutive patients treated prior to the change of treatment plan were used as the control group. The alveolar segments of all subjects were well aligned at the time of primary surgery.
METHODS: Primary incisor, canine and first molar occlusion was recorded as assessed by clinical observation.
RESULTS: Of the children in the control group a crossbite of primary incisors, canine and first molars was present in seven subjects. All of the children in the study group had an incisor overjet ranging from –4.0 to –2.0 mm. Four patients with primary first molars erupted, had a normal cusp and

fossa occlusion. The canines erupted in two patients had a good lateral relationship. There was a striking consistency in the presence of incisor overjet with well-developed maxillary arches in all eight subjects.
CONCLUSION: Two basic changes have produced dental arches with improved occlusion and maxillary support for the upper lip. Palatal surgery with less trauma and a delay in the timing of lip muscle repair appear to reduce many of the negative effects of the earlier primary treatment plan.

94 CRANIOFACIAL MORPHOLOGY AND PHYSIOTHERAPEUTIC DATA

C Lippold, U Ehmer, Department of Orthodontics, Westphalian Wilhelms-University, Münster, Germany

AIM: To examine the relationship between craniofacial morphology and physiotherapeutic data.
SUBJECT: Fifty patients, 4 to 55 years of age, were examined during an interdisciplinary orthodontic and physiotherapeutic consultation.
METHODS: Physiotherapeutic data concerning body posture, functional disorders of the vertebral column, and palpation of the head and neck muscles was registered. The results were related to craniofacial morphology (Angle Class I, II, III and asymmetries) with Fisher's exact test. A questionnaire was given to the patients evaluating personal and social data, the physiotherapeutic examination and the number of following physiotherapeutic treatments.
RESULTS: Functional disorders of the cervical spine were found in all craniofacial groups. The cervical spine was the part of the vertebral column with the most functional impairments. The anterior position of the head was related to the hyperkyphosis of the thoracic spine ($P = 0.002$) and to the oblique pelvis ($P = 0.046$) with statistical significance. The oblique pelvis was related to scoliosis of the cervical spine ($P = 0.032$). Craniofacial asymmetry was related to the oblique pelvis ($P = 0.015$) and different leg length ($P = 0.009$). Ninety per cent of the patients who answered the questionnaire underwent more than five sessions of subsequent physiotherapy.
CONCLUSION: Patients with craniofacial asymmetry have statistically significantly more asymmetric morphologies in other parts of the body. Before commencing orthodontic or combined surgical orthodontic treatment, these patients should be examined by a physiotherapist for extended diagnosis and treatment to prevent negative influences of the body on the stomatognathic system.

95 *IN VITRO* TESTING OF ELASTOMERIC CHAINS

M Lucci, S Angeloni, M G Di Giuseppe, Department of Surgical Sciences, University of L'Aquila, Italy

AIM: To evaluate elastomeric chain behaviour in different environmental conditions and at different time intervals.
MATERIAL: Two hundred and fifty lengths of transparent narrow chains (K6465-13, Leone S.p.A).
METHODS: Elastomeric chains were stretched on plexiglass supports at a distance equal to twice the initial length and tested in four different environments: 1. Air ambient temperature 2. Water ambient temperature 3. Water 37°C and 4. Artificial saliva 37°C. They were observed at seven different time intervals: 1, 3, 24, 96, 168, 360 and 720 hours. For each chain the following measurements were obtained: initial force developed when the chain was stretched for measurement by an Instron machine; force developed 5 minutes after the stretching; initial length; length 1 minute after slackening; length 30 minutes after slackening.
RESULTS: Environmental conditions and time affected elastomeric chains properties. The highest percentage force decay was observed in artificial saliva and after 1 week (63 per cent decay). A high percentage of decay after 1 hour in each test environment was also observed. This force decay was accompanied by a progressive deformation of the chain.
CONCLUSIONS: As artificial saliva consistently produced better results, it is suggested that chains are prestretched outside the oral environment to reduce percentage force decay in the mouth and that the chains are changed frequently during therapy.

96 OCCLUSAL REHABILITATION IN ORTHODONTIC PATIENTS WITH TEMPOROMANDIBULAR JOINT DISEASE—DIAGNOSTIC AND THERAPEUTIC PROBLEMS

D Lupini[1], D Celli[2,1] Private Practice, Teramo and [2]School of Dentistry, University 'G. D'Annunzio', Chieti, Italy

AIM: To demonstrate how different diagnostic and therapeutic approaches to temporomandibular joint (TMJ) disease in orthodontic patients should have as the main and common target, the disappearance or at least improvement of signs and symptoms of temporomandibular dysfunction (TMD).
SUBJECTS: Twenty orthodontic patients, 16 to 40 years of age, with different TMD (disc displacement with reduction, disc displacement without reduction, closed lock).
METHODS: The diagnosis was formulated on the basis of anamnesis and clinical and radiographic examinations (MRI, TMJ correct tomography) taken with and without the bite plane, occlusal splint and improvement of the symptoms after splint therapy. Most patients underwent orthodontic finishing maintaining a therapeutic condyle position able to minimize the TMD signs and symptoms and guarantee an improvement of TMJ anatomy and function.
RESULTS: After splint therapy (lasting from 4 to 9 months according to the particular TMJ disease) all patients showed a clinical improvement with a significant reduction and, sometimes, complete disappearance of the signs and symptoms of the disease. The effect of the splint therapy was monitored radiographically. The finishing procedures (orthodontics with or without prosthodontics) led to a stable occlusal position and correct functional movement of the mandible.
CONCLUSIONS: Whatever diagnostic and therapeutic approach to TMJ diseases is chosen, the radiographic images

should be double-checked. During the finishing phase of treatment it is essential at all times that the mandible is maintained in the exact spatial position determined by the splint therapy. This should be confirmed radiographically after final rehabilitation of the patient.

97 LIP POSITION IN CHILDREN WITH AND WITHOUT CEREBRAL PALSY

F Luther, N Zamzam, Division of Child Dental Health, Leeds Dental Institute, England

AIM: To assess whether lip position changes in a similar manner with age in children with and without cerebral palsy (CP), and whether drooling affects this.
SUBJECTS: Sixty-four cerebral palsied and 60 unaffected children, excluding digit suckers and those with previous orthodontic treatment. Their age range was 5–19 years.
METHODS: Lip position and competence in children with CP (study group) and unaffected children (control group) were assessed using the Jackson lip classification both clinically and using remote video surveillance. Drooling, if present, was also noted. The groups were divided into three age bands (5–9; 10–13; 14–19 years) so that lip position, competence and drooling could be related to age (Kruskal-Wallis test for within group comparisons, corrected for ties; Mann-Whitney *U* test for between group comparisons).
RESULTS: No significant differences ($P > 0.05$) in lip position existed between age groups within study or control groups nor in lip position or competence with age within CP children who drooled (CPd). There was, however, a significant difference in lip competence with age within the study group ($H = 9.1$ with 2 d.f.; $P < 0.05$). When the study and control groups were compared, a significant difference was found in lower lip position ($z = 3.2$; $P < 0.01$). Analysis of the 10–13 year olds demonstrated a significant difference between study and control groups in lower lip position ($z = 3.0$; $P < 0.01$) and lip competence ($z = 2.2$; $P < 0.05$).
CONCLUSION: Neither lip position nor competence changed with age in unaffected children or in CPd. However, in 10–13 year-old CP children the lower lip covered the upper incisors less and lip incompetence was greater than in the controls. The reasons for such differences require further investigation but may have consequences for orthodontic treatment stability.

Jackson D 1962 Lip positions and incisor relationships. British Dental Journal 112: 147–155 Supported by Northern and Yorkshire NHS Executive (Ref.CCB/ACJ/LKJ/PCC3).

98 PROTRACTION FACEMASK RESPONSE WITH BANDED AND BONDED APPLIANCES

C Maspero, U Garagiola, V Ghiglione, Department of Orthodontics, University of Milan, Italy

AIM: To compare the skeletal responses of a maxillary protraction facemask in combination with either banded or bonded rapid palatal expansion appliances in Class III patients.
SUBJECTS AND METHODS: Forty patients (25 males, 15 females), mean age 8 years, with dental and skeletal Class III malocclusions were analysed. Twenty-two patients were treated with a banded appliance (group I) and 18 patients with a bonded appliance (group II). All were treated by the same orthodontist, using a facemask with protraction forces exerted by elastics for 14 to 18 hours a day. The expansion appliance screw was activated once a day. Standardized lateral cephalograms were obtained before treatment (T1), at the end of treatment (T2), and after an observation period of 1 year (T3). Skeletal and dental changes in the sagittal and vertical planes were calculated according to the Milan cephalometric system. Differences in growth direction in the observation periods were compared and the dependency of the original morphology was analyzed.
RESULTS: Significant forward movement of the maxilla was found with banded (3.2 ± 2.4 mm) and bonded (3.7 ± 2.0 mm) appliances. Correction of a Class III malocclusion was enhanced by downward and backward rotation of the mandible with an average increase in lower face height of 2.4 and 1 mm in the banded and bonded groups, respectively. Differences were found in eruption of the posterior molars between the two groups. Forward movement of the maxillary molars was found to be less in the bonded group (0.7 mm) compared with the banded group (2.1 mm).
CONCLUSIONS: Both types of appliances are equally effective in maxillary protraction. The use of a bonded appliance may provide improved anchorage control due to splinting of the posterior teeth. It also prevents vertical eruption of molars, provides improved control in the vertical dimension and seems to be more effective in high angle cases.

99 INFLUENCE OF BITE JUMPING APPLIANCE TREATMENT ON FACIAL GROWTH ON MAXILLARY INCLINATION

C Mauck, J L Berten, J Tränkmann, G Sieverding, C A Polzin, Department of Orthodontics, Medical School, Hannover, Germany

AIMS: Antero-posterior and vertical changes appear during functional orthopaedic treatment of Class II patients. The aim of the present investigation was to determine the different effects of the bite-jumping appliance in relation to the initial NL-NSL angle.
MATERIAL AND METHOD: Lateral cephalograms of 28 Class II division 1 patients (mean age 11.0 ± 1.9 years) were examined. All were treated with a bite-jumping appliance. They were divided into three groups: with reduced, physiological, and increased NL-NSL angle.
RESULTS: A significantly reduced SNA and increased NL-NSL angle was found after treatment of patients with a small or physiological NL-NSL angle ($P < 0.05$). In the first group a backward tipping of the upper incisors, a forward tipping of the lower ones, a decreased ANB angle and a backward rotation of the occlusal plane was measured

($P < 0.05$). The reduction of the SNA angle was larger in the small angle group whereas a larger backward rotation of the maxillary plane was found in the physiological group. No significant changes occurred in the open bite group. No mandibular anterior-posterior or vertical changes were found in these three groups. The ML-NL angle also showed no alteration.
CONCLUSION: Skeletal improvement cannot be achieved in patients with an increased NL-NSL angle. Anterior-posterior correction is more effective in patients with a low NL-NSL angle. Although backward rotation of the maxilla occurs, it is not as large as in the physiological group. One reason might be the force direction in relation to the centre of resistance of the maxilla.

100 AN EVALUATION OF OCCUPATIONAL STRESS FACTORS IN ORTHODONTIC PRACTICE

P McSherry, P Dowling, Department of Public and Child Dental Health, Trinity College, Dublin, Ireland

AIM: To examine the perceived stress levels, personality characteristics and stress outcomes in orthodontists in Ireland.
SUBJECTS: Forty-nine orthodontists working in orthodontic practice.
METHODS: The occupational stress indicator was distributed to 61 orthodontists. Forty-nine returned the questionnaire. The questionnaire is designed by psychologists and is widely used in business and industry. It consists of six main sections to examine aspects of perceived stress levels, Type A personality, locus of control, coping strategies used, satisfaction with work, and state of physical and mental health. Normative data for general medical practitioners and middle managers were available and used for comparative purposes. The differences between the groups were tested for statistical significance using Student's *t*-tests.
RESULTS: Compared with the normative groups it was found that the orthodontists were significantly more satisfied with their job ($P < 0.01$) and with their personal relationships in their work ($P < 0.05$). In relation to the control that the orthodontists had in their workplace, they had significantly more control over organizational forces and management processes than the normative groups ($P < 0.01$). Sources of stress within the job were not significantly different to the normative groups ($P > 0.05$). Orthodontists used logic, time management ($P < 0.01$) and social support ($P < 0.05$) as coping strategies significantly more than the normative groups.
CONCLUSION: Orthodontists receive greater job satisfaction than general medical practitioners and middle managers in business.

101 A RANDOMISED, PLACEBO-CONTROLLED TRIAL OF A MANDIBULAR ADVANCEMENT SPLINT IN OBSTRUCTIVE SLEEP APNOEA

A Mehta[1,2], A Faniran[1], J Qian[1], M A Darendeliler[2], P A Cistulli[2], [1]Centre for Sleep Disorders and Respiratory Failure, St George Hospital and [2]Discipline of Orthodontics, United Dental Hospital, New South Wales, Australia

AIM: To evaluate the effectiveness of a newly designed mandibular advancement splint (MAS) in patients with obstructive sleep apnoea (OSA).
SUBJECTS AND METHOD: A randomised, placebo-controlled, ABB/BAA crossover design. Placebo (A) consisted of a dental plate that had no effect on mandibular position. A MAS (B) was issued for wearing during sleep and the mandible was incrementally advanced until symptoms resolved or the maximum comfortable limit was reached during an acclimatisation period of 4–6 weeks. After a washout period of two weeks, the patients were randomised to undergo three polysomnographs one week apart, in either the ABB or BAA sequence. Outcome measures were subjective response measured by questionnaire and standard polysomnographic variables, including respiratory disturbance index (RDI), minimum oxygen saturation ($MinSaO_2$) and arousal index (AI). Complete treatment success was defined as a resolution of symptoms and a reduction of RDI to <5/hr. Partial success was defined as a >50 per cent reduction in RDI but remaining ≥5/hour.
RESULTS: The baseline characteristics (mean ± SEM) of the 24 patients (19 males, 5 females) studied were: age 48 ± 2 years (35–73), BMI 29.4 ± 1.0 kg/m^2 (24.8–36.3), RDI 27 ± 3/hour (10–68) and $MinSaO_2$ 85 ± 2 per cent (61–96). Subjective improvements in snoring, sleep quality and daytime hypersomnolence were reported by 96 per cent of patients. The MAS resulted in a significant reduction in RDI (30 ± 2 versus 14 ± 2/hour) and AI (41 ± 2 versus 28 ± 2/hour) and an improvement in $MinSaO_2$ (87 ± 1 versus 91 ± 1 per cent) compared with placebo ($P < 0.001$). Complete success was achieved in 38 per cent of patients and partial success in 25 per cent.
CONCLUSION: The MAS is a viable treatment alternative for some patients with OSA.
Supported by NHMRC of Australia.

102 THE CURVE OF SPEE IN RELATION TO MORPHOLOGY—A STEPWISE MULTIPLE REGRESSION ANALYSIS

A Michelotti, M Farella, P Venuti, R Martina, Department of Orthodontics, University of Naples 'Federico II', Italy

AIM: To investigate the relationship between the mandibular curve of Spee and several craniofacial features.
MATERIAL: Dental casts and lateral cephalograms were obtained from 60 orthodontic patients randomly selected among those referred to the dental clinic of the University of Naples 'Federico II'. The mean age (±SD) of the sample was 20 years (± 4.7 years).
METHODS: The amount of the curve of Spee was calculated by a second-order quadratic interpolation of buccal cusp tips obtained from lateral digital photographs of the teeth. Cephalometric analysis aimed to evaluate the sagittal and vertical jaw relationship (SNB, SN-Go-Me,

PFH-AFH, ATFH-ALFH), the inclination of the occlusal plane (SN-OP), and the position of the mandibular condyle with respect to the occlusal plane (Osborn, 1993). Stepwise multiple regression was used for statistical analysis.
RESULTS: The cephalometric variables included in the regression model could explain only 28 per cent of the total variance of the curve of Spee. The amount of the curvature was significantly related to the horizontal position of the condyle with respect to the dentition (R; P=0.01), and to the inclination of occlusal plane with respect to the anterior cranial base (SN-OP; P=0.02). No significant relationship was found between the curve of Spee and the other cephalometric variables (SNB, SN-Go-Me, PFH/AFH, ATFH/ALFH; $P > 0.05$).
CONCLUSIONS: The curve of Spee does not appear to be related to vertical and sagittal jaw relationship.

103 CLASS II DIVISION 2 MALOCCLUSIONS: FREQUENCY AND UPPER INCISOR ASPECTS

L L Mierut, Department of Orthodontics, University of Medicine, Cluj-Napoca, Romania

AIM: To determine the frequency of Class II division 2 malocclusions over a two-year period (1996–1998) and individual clinic aspects of the upper incisors.
SUBJECTS: Seven hundred and two children from 8 to 14 years of age with different malocclusions.
METHODS: The number of patients with Class II division 2 malocclusions and also their mean age was determined from the total examined. The study casts of the patients with Class II division 2 disorders were analysed to determine malpositions of the upper incisors.
RESULTS: Seventy-one subjects (10.11 per cent) had Class II division 2 anomalies. Their average age was 11 years 7 months. Forty-two children (59.15 per cent) had retroclination of the upper central incisors, the upper lateral incisors being proclined, mesially inclined and mesiolabially rotated. Twenty-four children (33.80 per cent) had well aligned upper incisors and six children (8.45 per cent) presented with complex malpositions of the entire upper incisor group.
CONCLUSIONS: The results of this study are closely related to the findings of other authors. Most of the patients with Class II division 2 malocclusions had retroclined upper central incisors and proclined, mesially inclined, mesiolabially rotated upper lateral incisors.

104 DAMPING CAPACITY OF SUPER-ELASTIC Ti-Ni ALLOY ORTHODONTIC WIRE

H Miura, K Otsubo, K Soma, First Department of Orthodontics, Tokyo Medical and Dental University, Japan

AIM: Titanium-nickel alloy (Ti-Ni alloy) is known to possess superelasticity and shape memory properties, and the recent focus has also produced a high damping alloy. This study investigated the damping capacity of the super-elastic Ti-Ni alloy wire in comparison with traditional stainless steel wire.
MATERIAL: Experiments were performed with both 0.016×0.022 and 0.018×0.025-inch orthodontic stainless steel wires and various super-elastic Ti-Ni alloy wires.
METHODS: A predetermined impact was imposed on experimental orthodontic wire with an aluminium rod, and the damping capacity phases of the wire were recorded by laser strain sensor. In the meantime, a loading force of 500 or 1000 g was added to the wire.
RESULTS: The damping curve of the Ti-Ni alloy wire was found to decrease abruptly, while that of the stainless steel wire gradually decreased. It was especially shown from the specific damping capacity (SDC) that the superelastic Ti-Ni alloy wire possessed elevated damping capacity compared with stainless steel wire. SDC for stainless steel wire was 83–86 per cent, while for super-elastic Ti-Ni alloy it was 90–98 per cent.
CONCLUSION: Super-elastic Ti-Ni alloy wire has a high damping capacity according to its damping curve and SDC. It is also suggested that damping capacity plays a role in modulating the transmission of external forces, such as occlusal forces, to other teeth during orthodontic treatment.

105 EVALUATION OF ANCHORAGE LOSS DURING PHASE 1 OF THE PREADJUSTED EDGEWISE TECHNIQUE

A Mohajer, Orthodontic Department, Tehran University, Iran

AIM: To examine anchorage loss during phase 1 (levelling and aligning) of the preadjusted edgewise technique (MBT prescription).
SUBJECTS: Fourteen subjects (4 boys, 10 girls) with an average age of 13.7 years, a skeletal Class I malocclusion, no functional disorders or severe vertical problems and moderate crowding were selected.
METHODS: The primary lateral cephalograms and casts were analyzed. Extraction of four first premolars was included in the treatment plan. An additional lateral cephalogram with band and brackets in position and a special metal indicator (for exact linear and angular measurement of tooth positions) was taken. Two months after treatment with 0.016-inch NiTi archwire and canine lacebacks, another cephalogram with the same metal indicator was obtained. Exact tooth movement (anchorage loss) was measured on the casts and cephalograms.
RESULTS: Forward movement of the posterior teeth (anchor unit) was significantly greater in the study group in comparison with posterior teeth without lacebacks. However the anterior teeth moved backward, instead of anteriorly (which usually occurs due to tipping of anterior brackets).
CONCLUSION: Although anchorage loss (forward movement) of posterior teeth is greater in phase 1 (levelling and aligning) with the preadjusted edgewise technique with

canine lacebacks, it is clinically insignificant when considering the amount of retraction during this phase.

106 PAEDIATRIC BRUXISM: WHAT ARE THE CAUSES?

A Monaco, N M Ciamella, M C Marci, E Pucci, Odontostomatological Department, University of L'Aquila, Italy

AIM: To assess the relationship between bruxism with sleep disorders and psychological aspects.
SUBJECTS: Twenty-five children with bruxism represented the study group and 25 children, non-bruxers, the control group.
METHODS: Psychological aspects were registered through parental interviews. Sleep disorders were registered by the presence of snoring, apnoea, nocturnal enuresis and somnambulism. Dental wear was measured on a graduated scale from 0 to 3.
RESULTS: No significant differences were found with respect to sleep disorders between the two groups, while anxiety was significantly related to bruxism.
CONCLUSION: In children, as well as adults, anxiety was the key factor for the occurrence of parafunctional activity.

107 THE AESTHETIC COMPONENT OF THE INDEX OF ORTHODONTIC TREATMENT NEED IN THE ASSESSMENT OF OCCLUSAL APPEARANCE IN YOUNG ADULTS

A Monaco, M C Marci, M Boccuni, G Mosca, P Franceschini, Odontostomatological Department, University of L'Aquila, Italy

AIM: To assess the agreement between self-evaluation of acceptable occlusal appearance of young Italian adults and professional evaluation of the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN).
SUBJECTS: One hundred and thirty two Italian students aged 17–20 years from the town of L'Aquila. The study was performed only on individuals who were neither undergoing or had completed orthodontic treatment.
METHODS: The subjects were assessed by orthodontists who scored their occlusal view by using the 10 pictures of the AC of the IOTN (1–4 no/slight need, 5–7 borderline need, 8–10 need for orthodontic treatment). The subjects were asked to give their own views on their dental appearance on a scale of 1–10 by means of picture 1 of the AC (most attractive) and picture 10 (least attractive).
RESULTS: In the self-evaluation, 86 per cent of subjects categorised themselves in grade 1–4, 11 per cent as grades 5–6 and 3 per cent as grades 8–10. According to the orthodontists' evaluation, 79 per cent of the students did not need treatment for aesthetic reasons, 17 per cent were in borderline need and 4 per cent in need of orthodontic treatment.
CONCLUSION: There was good agreement between orthodontists and self-evaluation and the difference was very low. The subjects, especially in the age group extremely sensitive to aesthetic problems, were more indulgent than the operators in considering the characteristic of their occlusion. These results show how the operators' parameters often do not give the right relevance to social aspects to which the need/demand for orthodontic treatment is linked.

108 ENAMEL DEMINERALISATION AROUND ORTHODONTIC BRACKETS BONDED WITH AN IONOMER RESIN

S Moopen, M Collins, E Lynch, M Goodveld, Department of Orthodontics, Royal London Hospital, England

AIM: To compare enamel demineralisation and bond failure of a fluoride releasing resin ionomer (Ariston pHc) with a fluoride-releasing composite bonding agent (Phase II).
SUBJECTS: Twenty patients treated with straightwire appliance and 100 subjects without a history of orthodontic treatment.
METHODS: A split mouth technique was used for bonding of the brackets (one side of the mouth had brackets bonded with Ariston pHc and the other side with Phase II). Demineralisation around orthodontic brackets after debonding was evaluated by visual examination using a scoring method. The bond failure study was restricted to recording bond failure, which was first time or primary failure. The assessment of bond failure was recorded until 0.019×0.025 inch stainless steel wire was placed. The enamel demineralisation in pre-orthodontic subjects was also recorded using the same scoring system.
RESULTS: Statistical analysis indicated significant differences in the degree of demineralisation with Phase II > Ariston pHc > pre-orthodontic subjects. Bond failure showed no significant difference between the two materials.
CONCLUSION: Ariston pHc (a single paste light-cured resin ionomer restorative material that releases OH^-, F^-, Ca^{2+} ions and buffer acids) considerably reduced enamel demineralisation adjacent to brackets bonded with this material. Bracket failure with this material was comparable with that of a conventional bonding agent.

109 CRANIOFACIAL DEVELOPMENT IN CHILDREN WITH UNILATERAL CLEFT LIP AND PALATE

D O Morris[1], G Semb[2], D P Roberts-Harry[1], D R Bearn[2], N L Price[1], [1]Department of Child Dental Health, Leeds Dental Institute and [2]Department of Oral Health and Development, University Dental Hospital of Manchester, England

AIM: To compare the craniofacial form and soft tissue profile of two groups of 10-year old children born between 1983 and 1987 with complete unilateral clefts of the lip and palate (UCLP).
SUBJECTS: Twenty two consecutive UCLP children (15 male, 7 female) from West Yorkshire, who were closely

matched for age at record, sex, cleft laterality and presence of Simonart's bands against 22 children (15 male, 7 female) from the Oslo CLP growth archive.
METHOD: Lateral cephalograms were obtained within 12 months of the child's 10th birthday and digitized using the Dentofacial Planner™ Plus software. Twenty hard and 20 soft tissue variables were measured and corrected for radiographic enlargement. Parametric Student's *t*-tests for independent samples were performed to identify significant differences between the two groups at the $P < 0.05$ level.
RESULTS: Significant differences in maxillary growth and soft tissue profile were found, with the West Yorkshire group having a more retruded mid-face and mandible. The Oslo group demonstrated a more protrusive lip and facial profile with a positive dental overjet ($P < 0.001$).
CONCLUSIONS: The West Yorkshire UCLP children have a less favourable treatment outcome compared with the matched Oslo group. The Oslo UCLP children exhibited a significantly more protrusive mid-face region and dentition at 10 years of age. A contributing factor to account for the significant treatment outcome differences found in this study is likely to be the varied cleft treatment regimes of the West Yorkshire sample.

110 A PROSPECTIVE STUDY OF THE TWIN BLOCK AND SILENSOR APPLIANCES

S D Muniandy, J M Battagel, J P Moss, Department of Orthodontics, The Royal London Hospital, England

AIMS: To compare the treatment changes produced by the Twin Block and the Silensor appliance with those resulting from normal growth alone and to evaluate the effectiveness of the Silensor as a functional appliance.
SUBJECTS: Sixty-five patients with Class II division 1 malocclusions, between 8–15 years of age, were randomly allocated to the Twin Block and Silensor groups. Forty patients, 19 males and 21 females, completed the study over a mean treatment time of 1.1 years and were compared with untreated controls matched for age and sex.
METHODS: Twenty-five patients were treated with Twin Block and 15 with the Silensor. Treatment with the Silensor was preceded by upper arch expansion where necessary. Pre- and post-treatment cephalograms and laser scans were assessed for facial hard and soft tissue changes.
RESULTS: Both treatment groups produced significant hard and soft tissue changes when compared with the controls; with a more pronounced change occurring in the Twin Block group. The Twin Block males and females had an increase in mandibular length (Art to Pog) of 5.8 and 4.1 mm, respectively, whereas the Silensor males and females had an increase of 3.1 mm. The Twin Block also produced greater dentoalveolar effects than the Silensor. Hence, the overjet reduction with the Twin Block was almost twice as much as with the Silensor. The soft tissue changes reflected the hard tissue changes in some areas, with the laser scans showing evidence of masseteric enlargement in the treatment groups.
CONCLUSIONS: Both the Twin Block and the Silensor produced favourable treatment changes when compared with the controls. The Silensor can be used as a functional appliance with the bilateral connectors providing an effective mechanism for posturing the mandible forward.

111 A COMPARISON OF MANUAL TRACING, DIGITISING AND COMPUTER CEPHALOMETRIC ANALYSIS

F B Naini, M Otasevic, N S Vasir, J Battagel, Central Middlesex Hospital NHS Trust and The Royal London Hospital, England

AIMS: The value of accurate cephalometric analysis in orthognathic surgery is well established. It was therefore intended to assess the relative merits of manual tracing, digitising and the more recently introduced computer generated cephalometric analysis (OTP by OrthoVision).
METHOD: Thirty lateral cephalometric radiographs were assessed using each of the three methods. Intra- and inter-examiner reproducibility was assessed by re-analysing all radiographs after one month.
RESULTS: There were significant differences between the three methods, in particular regarding the time taken to enter data, ability to enhance and enlarge portions of the image (aiding landmark identification), and the ease of producing customised analyses and superimpositions.
CONCLUSIONS: It is evident that the introduction of computer software packages has changed cephalometric analysis in orthognathic surgery. Recent technological advances have allowed the use of image capturing systems, and manipulation of the image. However, it is anticipated that manual tracing will remain popular, as it is less costly and easily accessible.

112 DENTAL ARCH WIDTH CHANGES BEFORE AND AFTER SURGICAL-ORTHODONTIC TREATMENT

R Nakahara, S Kobayashi, Y Ebata, N Gotoh, Jaw Deformities Project Team, The Nippon Dental University, Tokyo, Japan

AIM: To assess the dental arch width after orthodontic-surgical treatment.
MATERIAL: Dental arch plaster models before and after the treatment of 42 male and female patients with skeletal mandibular protrusion undergoing sagittal split ramus osteotomy (SSRO). Two upper premolars were extracted to finish with an Angle Class II molar relationship.

METHODS: Dental arch widths (8 maxillary fossae and 8 mandibular buccal cusp tips) were measured with digital callipers to determine the difference in the width before and after treatment.
RESULTS: Treatment resulted in the following changes in the dental arch width: (1) Maxilla: the width was reduced by 2.90 mm at the second premolar (mesial fossae), by 2.42 to 1.90 mm at the first molar (mesial, central, and distal fossae) and by 2.62 to 2.30 mm at the second molar (mesial and distal fossae), while that of the canine cusp alone increased by 1.18 mm. (2) Mandible: the width was increased by 1.65 to 2.00 mm at the first and second premolars (buccal cusp tips), by 2.00 to 2.39 mm at the second molar (mesial and distal buccal cusp tips), and 0.50 to 0.59 mm at the canine cusp and first molar (mesial and distal buccal cusp tips and distal cusp tips).
CONCLUSION: The treatment reduced the dental arch width in the maxilla and increased that in the mandible. The mean change in width when the maxilla and mandible were combined was 4.90, 4.66, and 2.66 mm for the second premolar, second molar, and first molar, respectively.

113 DEVELOPMENT OF A HIGH ACCURACY THREE-DIMENSIONAL OPTICAL MEASUREMENT SYSTEM FOR DENTAL CASTS

H Nakano[1], M Yagi[1], Y Seino[1], N Suzuki[1], H Miura[1], M Shozushima[2], K Sakamaki[2], K Otsuka[3], R Komatsubara[4], Departments of [1]Orthodontics and [2]Dental Radiology, Iwate Medical University, [3]J Osawa & Co. Ltd. and [4]Techno Arts Laboratory, Japan

AIM: To establish a very precise and efficient measurement system for plaster dental casts by application of a three-dimensional (3D) grid pattern projection measurement method.
MATERIAL AND METHODS: Dental casts were measured by a 3D grid pattern projection measurement method. The range of determination was limited to 15 mm^2, as the measurements were performed with precision and at a high density. The total calculation was divided into 20 projections for a whole cast. Each dental cast was mounted on a 5-axis motor-operated platform to rotate and tilt automatically, thereby reducing the undercut as much as possible. Using processing software, the dental casts were measured by conventional callipers with computer graphics.
RESULTS: It was not possible to measure casts with a precision of less than 0.1 per cent of the size of the measured region (less than 0.1 mm of the actual measurement). Calculation of the palatal vault volume, which cannot be performed by existing methods, and setting of the 3D reference plane on the dental arch could be obtained.
CONCLUSIONS: A new 3D grid pattern projection measurement system for dental casts has been developed. With this method, 3D co-ordinates of the superficial configuration of the dental casts, including the undercut, can be obtained automatically and accurately. Moreover, the precision is as high as when using callipers.

114 CEPHALOMETRIC LANDMARK REPRODUCIBILITY UTILIZING CONVENTIONAL AND TWO DIGITAL SCANNING TECHNIQUES

T Niegel, S Mayes, U Ehmer, Department of Orthodontics, Westphalian Wilhelms-University, Münster, Germany

AIM: To compare the reproducibility of specific landmarks in lateral headfilms obtained utilizing conventional radiographs and two different digital scanning techniques with storage phosphor plates.
MATERIAL AND METHOD: A standardized dry skull with metal markers to ensure secure superimposition of the images was positioned in a cephalostat. Lateral headfilms were obtained at different exposure settings using conventional films (method: Co) and twice using storage phosphor plates. One of the storage plates (Digital 1: Di1) was read by the high-resolution scanner of the University of Münster (Digiscan 2H Plus®, Siemens). The other storage plate (Digital 2: Di2) was read by a scanner developed for use in the dental practice (DenOptix Combo®, Gendex). Seven representative landmarks (N, P, Po, LoIa, Ba, Pt, A) were traced independently four times by one experienced and one less experienced clinician. The distances between the marks from all four tracings were analyzed for every landmark and compared using descriptive statistics (mean and standard deviation). The differences between the varying techniques were compared by the Bland-Altman test.
RESULTS: Good reproducibility of the landmarks was found using the Co images and those obtained with Di1. A statistically significant difference was not found between these techniques. Partially reduced landmark reproducibility was found for the digital images obtained with Di2.
CONCLUSION: Sufficient relevance of the results necessary for clinical use can be achieved, also using the second digital technique, with digital enhancement techniques (Di2).

115 EVALUATION OF CEPHALOMETRIC VERTICAL CHANGES DURING PHASE 1 OF THE PREADJUSTED EDGEWISE TECHNIQUE

M Noori, Department of Orthodontics, Tehran University, Iran

AIM: To evaluate radiographic vertical measurements during phase 1 (levelling and aligning) of the preadjusted edgewise technique (MBT prescription).
SUBJECTS: Fourteen subjects (4 boys, 10 girls), average age 13.7 years, with skeletal Class I malocclusions, no functional disorders or severe vertical problems and moderate crowding were selected. Extraction of four first premolars was included in the treatment plan.

METHODS: Pre-treatment lateral cephalograms and casts were analyzed. An additional lateral cephalogram with bands and brackets in position with a special metal indicator (for exact linear and angular measurement of tooth position) was taken. After two months of treatment with 0.016-inch NiTi archwire and lacebacks a second cephalogram with the same metal indicator was obtained. The exact tooth movement (anchorage loss) was measured on casts and cephalograms. Three cephalometric parameters were used to evaluate vertical changes.
RESULTS: GoGN-SN angle, Y-axis and N-Me distance increased significantly.
CONCLUSION: Although first premolar extraction and anchorage loss (due to canine lacebacks) indicate a decrease of vertical measurements, a slight increase in vertical parameters was found. It seems occlusal interference causes backward and downward rotation of the mandible with increased vertical dimension during levelling and aligning.

116 GENETICALLY DETERMINED DISTURBANCES OF TOOTH DEVELOPMENT IN PATIENTS WITH CLEFT LIP AND PALATE

F Nötzel, R Grabowski, M Hartung, Department of Orthodontics, University of Rostock, Germany

AIM: To investigate the occurrence of genetically determined disturbances of tooth development in patients with cleft lip and palate (CLP) and to compare them with non-cleft subjects.
MATERIAL: Panoramic and intraoral radiographs, study models and dental photographs of 263 children with CLP and 4,208 non-cleft-children.
METHODS: The records were examined to assess the occurrence of a disturbed development in the dentition according to Hoffmeister. The disturbances were listed as gender- and cleft-specific and cleft width.
RESULTS: Two hundred and fifty seven patients (97.7 per cent) presented with at least one disturbance affecting all cleft groups. Most frequently, 2 (30 per cent) and 3 (21.7 per cent) disturbances occurred. One symptom occurred in only 18.6 per cent of all patients. A maximum of eight symptoms were found. There was no significant difference with regard to severity when unilateral and bilateral clefts as well as right and left unilateral clefts were compared. The same was true for the gender-specific difference. However, more disturbances occurred in subjects with bilateral clefts and in females. Ten of the most frequent symptoms in non-cleft-patients were compared with those in the cleft group. Nine out of 10 occurred significantly more often in cleft patients. Partly, the symptoms occurred several times more often than in non-cleft patients, including those outside the cleft area.
CONCLUSIONS: The accumulated occurrence of these findings in a family could represent an additional risk criterion for a latent tendency of cleft development.

117 FACIAL GROWTH BASED ON CEPHALOMETRIC MEAN VALUES

N Ntountoulas, E Kleemola-Kujala, Department of Pedodontics and Orthodontics, University of Helsinki, Finland

AIM: To present, in a visual form, the growth of a British sample of Caucasian origin and to compare the growth of males with that of females and also the facial form of the British sample with a Swedish sample.
MATERIAL AND METHODS: This study was conducted using the template method. For the British sample the templates were created in a personal computer according to mean cephalometric values based on longitudinal cephalometric data (Bhatia and Leighton, 1994). Thirty templates were created, 15 for males and 15 for females, one for each age from 6 to 20 years. For the Swedish sample the templates used were published by Persson and Thilander (1987) and were based on cross-sectional cephalometric data published by the same authors. The templates were superimposed on the S-N reference line for different ages to show the growth pattern of males and females separately, for males and females of the same age to reveal differences in their facial form, and for British and Swedish males and females of the same age to determine differences in the facial form of the two ethnic groups.
RESULTS AND CONCLUSIONS: There was a forward growth direction for both males and females. Males grew more and for a longer period. Until the female growth spurt, the facial dimensions were slightly bigger in males whereas the facial geometry was essentially the same in males and females. At the end of the female growth spurt period their growth had essentially ceased, whereas males continued to grow in a forward growth direction resulting in significantly larger facial dimensions and more closing facial geometry. The British sample was found to be more retrognathic in relation to the Swedish sample.

118 INFLUENCE OF A COLLAPSED PALATE ON CRANIOFACIAL GROWTH IN CLEFT PATIENTS

A Nunota, N Motohashi, T Kuroda, Maxillofacial Orthognathics, Graduate School, Tokyo Medical and Dental University, Japan

AIM: To clarify the interrelationships between craniofacial dysmorphology and collapsed palate in unilateral cleft lip and palate (UCLP) patients.
MATERIAL: Twenty-seven sets of gnathostatic dental models, lateral and frontal cephalograms of Japanese male UCLP patients taken at the first examination (mean age 9 years) were used for this study.
METHODS: The cephalometric measurements to represent the characteristic craniofacial dysmorphology were first distilled by comparison with normative non-cleft data. The correlation between these cephalometric and model measurements were then analyzed by the non-contact

three-dimensional dental model analyzer (UNISN 250R) and evaluated at the significance levels of 1 and 5 per cent, respectively.
RESULTS: Comparative cephalometric analysis revealed characteristic craniofacial dysmorphology in both sagittal and frontal dimensions. Sagittal: upper arch area and length, palatal surface area and maxillary intramolar width showed a significant correlation with midfacial retrusion, decreased maxillary anterior basal height, lingual tipping of the upper central incisor, increased mandibular length and mandibular rotation. Frontal: upper arch area, palatal volume and maxillary intramolar width showed a significant correlation with a narrowed nasal width and mandibular midline deviation to the facial midline.
CONCLUSION: The collapsed palatal vault after surgical repair of cleft lip and palate influenced the following growth of the craniofacial structure resulting in a characteristic distorted facial harmony.

119 OPEN SURGICAL EXPOSURE AND ORTHODONTIC ALIGNMENT OF PALATALLY IMPACTED MAXILLARY CANINES

C Ödman Bresin, K Hansen, G Andersson, B Nelson, Department of Orthodontics and Oral Surgery, Malmö University, Orthodontic Clinic, Public Dental Health Service and Department of Maxillo-Facial Surgery and Jaw Orthopedics, University Hospital, Malmö, Sweden

AIM: To evaluate the clinical results of surgical exposure and orthodontic alignment, with an open eruption technique, of palatally impacted maxillary canines.
SUBJECTS: Fourteen patients, 10 with unilateral and 4 with bilateral impacted canines, were included in the study. The 10 normally erupted canines in the unilateral cases were used as control teeth.
METHODS: Records were collected before and after treatment and at follow-up. Registrations were made on apical and panoramic radiographs, study casts and the patients' orthodontic and oral surgery records. A clinical examination was performed at the follow-up visit.
RESULTS: The impacted teeth were fully visible during the entire orthodontic treatment period and no further surgical intervention was needed even if the bonded attachment loosened from the tooth. All impacted teeth were aligned in the dental arch. No marginal bone breakdown was found on either previously impacted or controls or any neighbouring teeth. No tooth was found to be non-vital after treatment, nor had any of the canines any noteworthy root resorption or colour changes. There was no statistically significant difference in the height of the attached gingiva and the only statistically significant difference in pocket depth was at the mesio-buccal surface of the canine. However, the mean difference was less than 0.5 mm.
CONCLUSIONS: The open eruption technique was favourable for the patients. Surgical intervention was needed in only one patient. The technique allowed visual control over the tooth and attachment position during treatment. The clinical results regarding periodontal conditions, tooth colour, tooth vitality and root resorption were good.

120 RELATIONSHIP OF GROWTH PATTERN WITH JAW BASE EFFECTIVE LENGTH, TONGUE POSTURE AND LOWER ARCH SPACE

M Ordobazari, Tehran, Iran

AIM: Evaluation of the relationship between average, horizontal and vertical growth patterns with maxillary and mandibular length, tongue posture and space discrepancy in the lower arch in an Iranian population.
SUBJECTS: Eighty-three individuals between 9–11 years (38 boys, 45 girls) with a Class 1 occlusion, normal maxillary position and inclination, with a complete dentition who had not undergone orthodontic or orthognathic surgery treatment were divided into three groups: 1. A control group consisting of 27 subjects with an average growth pattern (13 boys, 14 girls). 2. An experimental group of 26 individuals with a horizontal growth pattern (12 boys, 14 girls). 3. An experimental group of 30 subjects with a vertical growth pattern (14 boys, 16 girls).
METHOD: Lateral cephalograms and study models were obtained. The following parameters were measured on the radiographs: Y-axis, inclination angle, SNA, ANB, Jarabak index, effective jaw base length. Tongue posture and space analysis were also calculated for all groups. The correlation between growth pattern, effective jaw base length, tongue posture and space was calculated. All findings were analyzed according to gender and growth pattern using SPSS, and various group comparison with ANOVA analysis and Tukey test.
RESULTS: Mandibular and maxillary effective length, and tongue posture in the subjects with horizontal and vertical growth patterns were significantly different. In those with a horizontal growth pattern, space deficiency was greater compared with subjects with a vertical growth pattern.
CONCLUSIONS: 1. Maxillary effective length was smaller in vertical growth pattern subjects compared with those with a horizontal growth pattern. 2. Mandibular effective length in the horizontal growth pattern group was more than in the vertical group. 3. In subjects with a horizontal growth pattern, the height of the tongue was less than in those with a vertical growth pattern. 4. Protrusion of the lower incisor and significant space deficiency was prevalent in the horizontal growth pattern group.

121 CATHEPSINS mRNA EXPRESSION DURING DEVELOPMENT OF THE RAT MANDIBULAR CONDYLE

T Ohba, Y Ohba, K Moriyama, Department of Orthodontics, University of Tokushima, Japan

AIM: To investigate cathepsins L and K mRNA expression in the growing rat mandibular condylar cartilage.

MATERIALS AND METHODS: The mandibular condylar cartilage and the long bone cartilage of Sprague Dawley rats at 15 and 17-days post-coitum (pc), and at 1, 7, 14 and 28-days post-natum (pn) were used. Sections were prepared and analyzed by *in situ* hybridization with rat cRNA probes for cathepsins L and K. Total RNA was extracted from the tissues, and cathepsins L and K mRNA expression was detected by RT-PCR.
RESULTS: Cathepsin L mRNA was widely expressed in chondrocytes in the maturative and hypertrophic zones of the condylar cartilage at 17-days pc and 1-day pn. The expression was gradually restricted in the maturative and upper hypertrophic zones at 7-days pn, and then eventually disappeared at 28-days pn. In contrast, the long bone cartilage showed no cathepsin L mRNA expression at any stage. Cathepsin K mRNA expression was undetectable in chondrocytes, but was found in osteoclasts, consistently in the condyle and the long bone. Equivalent mRNA expression patterns of cathepsins L and K were also recognized in both tissues by RT-PCR.
CONCLUSION: These data strongly suggest that cathepsin L mRNA expression might be an important event for the physiological degradation of the extracellular matrix in the growing condylar cartilage.

122 EXPRESSION OF CATHEPSIN K mRNA DURING EXPERIMENTAL TOOTH MOVEMENT IN RATS

Y Ohba, T Ohba, K Terai, K Moriyama, Department of Orthodontics, University of Tokushima, Japan

AIM: Cathepsin K is a novel cysteine proteinase, which is specifically expressed in osteoclasts and plays an important role in osteoclastic bone resorption. The mechanism of alveolar bone remodelling during orthodontic tooth movement, based on the examination of the alteration of cathepsin K mRNA expression by *in situ* hybridization histochemistry was investigated.
MATERIALS AND METHODS: Orthodontic elastics were inserted into the interproximal space between the maxillary first and second molars of 7-week old male Sprague Dawley rats according to Waldo's method and the tissues were obtained after varying lengths of time. The samples were fixed with phosphate buffered 4 per cent paraformaldehyde and decalcified with 19 per cent EDTA. Decalcified tissues were dehydrated and embedded in paraffin. Sections of the maxillary dentoalveolar unit were analyzed by *in situ* hybridization with rat cathepsin K cRNA probe.
RESULTS: Cathepsin K mRNA expression was detected in mono- and multi-nucleate osteoclasts on the pressure side of the alveolar bone 12 hours after orthodontic force application, and the distribution and the number of cathepsin K mRNA-positive osteoclasts increased time-dependently on the pressure side. At 3–4 days, an increase in cathepsin K mRNA-positive osteoclasts was markedly found not only on the pressure side but also on the tension side of the alveolar bone in response to tooth movement. At 7–12 days, the cathepsin K mRNA-positive osteoclasts on both sides had disappeared.
CONCLUSION: These findings suggest that the recruitment of osteoclasts on the pressure side begins during the initial stage of orthodontic tooth movement and the site-specific early induction of cathepsin K mRNA may cause an imbalance in the relative resorption activities on the pressure and tension side incident to orthodontic tooth movement.

123 A NEW SUPERIOR Ti-Ni CLOSED COIL SPRING MINIMALLY AFFECTED BY THE ORAL ENVIRONMENT

K Otsubo, Y Tobiume, K Soma, First Department of Orthodontics, Tokyo Medical and Dental University, Japan

AIM: To develop an orthodontic Ti-Ni closed coil spring delivering an exceptional constant force in the oral environment and to investigate the effectiveness of this new coil spring in clinical application.
METHODS: 1. The influence of oral temperature on the orthodontic force of the original super-elastic Ti-Ni alloy coil springs was investigated. The load was measured with a tensile tester with a temperature control system. 2. During the new process of heat treatment (two-step heat treatment) performed with the original spring in a bath of nitrate, stress hysterisis and load were measured. 3. The newly developed coil spring was finally applied in some clinical cases.
RESULTS: The loads of the original coil spring measured at several displacement positions were markedly increased as the temperature changed during both martensitic (loading) and reverse (unloading) transformation. After two-step heat treatment, the stress hysterisis of the new coil springs was reduced to 47–60 per cent of the original. Therefore, the amount of the increased loads during temperature change was less than 12 per cent of the respective original loads. The duration of treatment was remarkably shortened with almost no damage to the periodontal tissues when using this new coil spring.
CONCLUSION: These results indicate that the super-elastic Ti-Ni alloy coil spring made by the two-step heat treatment possesses appropriate properties in the oral environment. The usefulness of this new coil spring has been clinically confirmed.

124 PATHOGENESIS OF MALFORMATIONS OF THE MAXILLARY ANTERIOR TEETH

H-D Otto[1], Ch Opitz[2], [1]Hospitel Friedrichshain and [2]Department of Orthodontics and Dentofacial Orthopedics, University Clinic Charité, Humboldt-University, Berlin, Germany

AIM: To determine the pathogenetic mechanism of all malformations of maxillary anterior teeth with the method of theoretical embryology.

MATERIAL: Casts, radiographs and photographs of 500 patients with and 800 patients without cleft lip and palate were examined for malformations of their maxillary teeth. On this basis the following hypothesis was developed.
HYPOTHESIS: The two globulo-maxillary epithelial walls (Hochstetter) are preserved. Each of them consists of a nasal and oral double-sheeted epithelium (nasal and oral connecting lamina). Between them there is a differentiation boundary. The still invisible odontogenic areas of the deciduous and permanent anterior teeth (i_1 , I_1 // i_2, I_2, c, C) are already localised in the globulary and the maxillary epithelium sheet of the oral connecting lamina by a genetically determined localisation pattern.
After epithelial separation (1) between the nasal and the oral connecting lamina along the differentiation boundary, the vertical shift of the oral connecting lamina with their odontogenic areas is introduced and the mesenchymal fusion of the primary palate can start. Near the palatal sulcus the globulary and maxillary epithelial sheets were separated from each other (epithelial separation 2) and were shifted horizontally into the epithelium of the oral cavity. Interepithel adhesions between some or all cells of the odontogenic areas in both the globulary and maxillary sheet may arise. They cause different scatterings of dental germs from the globulary to the maxillary sheet. In the wrong location the displaced cells may survive (dystrophia, supernumerary teeth, germinations, inversion) or perish (aplasia, invagination). Local causes influence the scattered cells and the resulting malformation as well as their different frequencies in the deciduous and permanent teeth.

125 EFFECT OF A PULSED ELECTROMAGNETIC FIELD ON THE MANDIBULAR CONDYLES OF GUINEA PIGS

E Özdiler, M O Akçam, B Özel, H Türkkahraman, E Başpınar, Departments of Orthodontics and Biostatistics and Genetics, Ankara University, Turkey

AIM: To evaluate the effects of a pulsed electromagnetic field (PEMF) on growing guinea pig mandibular condyles.
SUBJECTS: Twenty-four growing guinea pigs divided into two groups, PEMF and a control group.
METHODS: A generator was developed for the purpose of applying the PEMF on 16 guinea pigs simultaneously. The guinea pigs were then placed in the device and lateral radiographs of 12 control and 12 PEMF groups were taken at the end of a 10-day experimental period. Condylar measurements were held on the radiographs and statistically evaluated.
RESULTS: Initial and final condylar measurements showed that there was a slight increase in growth rate in the PEMF group when compared with the control group.
CONCLUSION: PEMF affects mandibular condylar growth rate. Further studies, for the purpose of reducing functional orthodontic treatment time, are planned.

126 EVALUATION OF DENTOFACIAL AND NASOPHARYNGEAL STRUCTURES IN CLASS III AND CLASS III OPEN BITE CASES

Y Öztürk, H İşeri, Department of Orthodontics, University of Ankara, Turkey

AIM: To evaluate the differences in morphology and nasopharyngeal airway in skeletal Class III and Class III open bite subjects.
MATERIAL AND METHODS: Lateral cephalometrics and hand-wrist films of 141 Class III subjects with an open bite and 173 Class III without open bites. Dentofacial, nasopharyngeal, tongue and hyoid bone measurements were performed. The differences between the groups were statistically analysed by factorial variance analysis. The interaction between gender and skeletal maturation in terms of groups was taken into consideration.
RESULTS: During the pubertal growth period, the angle between the maxillary and mandibular planes (NL/ML) was decreased in the Class III group, while slightly increased in the Class III open bite group. The downward and backward rotation of the mandible resulted in a more retrognathic mandible in the Class III open bite group, compared with the Class III group. The upper posterior dentoalveolar height (ms-NL) was higher in the Class III open bite group. The skeletal structures surrounding the nasopharyngeal airway were found to be narrower in the Class III open bite group, compared with the Class III group. The height and length of the tongue was found to be increased in the Class III open bite group in the post pubertal period. The vertical airway length was statistically longer in the Class III open bite group, compared with the Class III group.
CONCLUSION: Treatment planning strategies of skeletal Class III and Class III open bite patients should include not only changes in morphology, but also elimination of dysfunctions for more stable results.

127 EFFICIENCY OF ROOT TORQUING AUXILIARIES IN THE TIP-EDGE TECHNIQUE

H Pancherz, A Löffler, C Obijou, Department of Orthodontics, University of Giessen, Germany

AIM: To experimentally examine the efficiency of different torquing auxiliaries used in the Tip-Edge technique.
MATERIAL: Together with a Tip-Edge bracket system and a 0.022-inch archwire, six torquing wires were tested: (1) Two-spur/long wire, (2) Two-spur/short wire, (3) Four spur, (4) Reciprocal lateral torque, (5) Torque bar 20 degrees, and (6) Torque bar 30 degrees.
METHOD: A typodont set-up simulating the third stage of the Tip-Edge technique. The effect of the six torquing auxiliaries on the upper four incisors was repeatedly (three times) assessed using the method of laser reflection. The testing time was 60 and 600 minutes.

RESULTS: (1) The two-spur wires showed good torque effects on the central incisors. The long wire was more efficient than the short wire. (2) The four-spur wire acting on all four incisors was less efficient than the two-spur wires. (3) The reciprocal lateral torque wire showed good palatal root torque on the central incisors and labial root torque on the lateral incisors. (4) The torque bars (20 and 30 degrees) exhibited only small torque effects on the central and lateral incisors.
CONCLUSION: In the Tip-Edge technique the two-spur/long wire torquing auxiliary should be the wire of choice for efficient palatal root torque of the upper central incisors.

128 DENTAL ANOMALIES IN CHILDREN IRRADIATED *IN UTERO*

N V Pankratova, L S Persin, A V Sevbitov, E A Skatova, Department of Orthodontics and Children's Prosthetics, State Medicostomatology University of Moscow, Russia

AIM: To determine the frequency of dental abnormalities among children living in radiation polluted areas of Chernobyl, who were irradiated *in utero* and who have been monitored annually since 1986.
SUBJECTS AND METHODS: One hundred and thirty four children born in 1987 were clinically examined. All lived in towns with soil polluted by Cs-137: Donskoi, Tula (0–5 Ku/km^2; R-I); Uzlovaya, Tula, (5–15 Ku/ km^2; R-II); Novozybkov, Bryansk (15–45 Ku/km^2; R-III).
RESULTS: Clinical examination showed that 89.6 per cent of children living in the area with a pollution level of 5–45 Ku/km^2 had dental abnormalities connected with the radiation grade of the polluted soil. When there was an increase in the radiation grade the frequency and structure of abnormalities also increased ×1.5–2, whereas the normal status of the dentition corresponding to the age standard was not found. Thus 100 per cent of children in Novozybkov, Bryansk, where the soil pollution was 15–45 Ku/km^2; R-III had dental abnormalities.
CONCLUSION: Children born in 1987 living in radiation-polluted areas, who were irradiated *in utero*, have an 89.6–100 per cent incidence of dental anomalies.

129 THE FUNCTIONAL CONDITION OF THE FACIAL MUSCLES IN PATIENTS WITH MESIAL MALOCCLUSION

N V Pankratova, L S Persin, V A Kukushkin, A A Nedbai, A A Ayvazian, Department of Orthodontics and Children's Prosthetics, State Medicostomatology University of Moscow, Russia

AIM: To study facial muscle function in subjects with mesial occlusion to determine the time and amplitude values on which muscle co-ordination is based.
MATERIALS AND METHODS: Electromyographic (EMG) investigation of the temporalis, masseter and hypoglossus muscles of 46 patients with mesial occlusion.
RESULTS: The temporalis and masseter muscle EMG amplitude decreased 76.55–90.5 per cent and the hypoglossus muscle amplitude was increased 123.8 per cent in comparison with normal. There was also a large difference in the time indices. The active period for the temporalis and masseter muscles decreased 9.4–14 per cent and the period of hypoglossus muscle activity increased 12.5 per cent. The relaxation period for all muscles increased: temporalis and masseteric 17.2–22.2 per cent, hypoglossus 43.5 per cent. Such EMG differences led to an increased chewing period of 79 per cent. Also, due to the decrease in temporalis and masseteric biopotential and relative increase in hypoglossus muscle biopotential, the muscle co-ordination coefficient rises increased by 16.4 per cent.
CONCLUSIONS: 1. The facial muscle functional condition is essentially changed. The temporalis and masseteric amplitude indices decrease and the hypoglossus increases. 2. EMG period indices also change—the relaxation period increases and the active period decreases. 3. As a result of the latter index changes, the chewing period and muscle co-ordination coefficient in the chewing period increase.

130 RECYCLING OF METALLIC ORTHODONTIC BRACKETS: EFFECTS ON MORPHOLOGICAL CHARACTERISTICS

M A Papadopoulos, T Eliades, O Morfaki, A E Athanasiou, Department of Orthodontics, Aristotle University of Thessaloniki, and Research Center for Biomaterials, Athens, Greece

AIM: To identify material surface alterations following recycling of metallic orthodontic brackets.
MATERIALS: Forty metallic brackets, 10 upper and lower incisor brackets from two brands [Mini Diamond (Ormco Corporation) and Master Series (American Orthodontics)] at two conditions (as-received and following recycling).
METHODS: The recycling process used was the Ortho-Cycle Co., method. Scanning electron microscopy was employed to assess the morphological appearance of the surfaces of metallic brackets. For this purpose specimens were vacuum coated with a thin layer of conductive carbon and examined under an electron probe microanalyzer (JXA 733 Superprobe, Jeol Ltd., Tokyo, Japan). Secondary electron images were recorded at 20 kV accelerating voltage, 8 nA probe current and 5 nA specimen current.
RESULTS: Recycled brackets presented severe problems such as material loss, increased roughness, porosity and material deterioration.
CONCLUSION: Clinicians must be aware that recycled metallic brackets are characterized by altered material surfaces. Decisions to integrate them into clinical practice should be based a careful examination of the brackets and after obtaining the patient's informed consent.

131 INTER-EXAMINER RELIABILITY OF A CLINICAL TEST FOR EVALUATION OF LEG-LENGTH INEQUALITY

G Pellegrino, A Michelotti, P Manzo, M Farella, A Del Prete, E Cuevas, Department of Orthodontics, University of Naples 'Federico II', Italy

AIM: A cause-effect relationship between leg-length inequality and occlusal disturbances has been suggested (Meerssman, 1989). Several diagnostic tests have been developed in order to investigate this relationship. The aim of the present study was to evaluate the inter-examiner reliability of a simple clinical test to identify leg-length inequality.
SUBJECTS: Forty-one subjects (23 males, 18 females) with a mean age of 24 years (range 21–34 years) participated.
METHODS: Three different examiners were selected: (1) an expert chiropractor; (2) a dentist who was also extensively trained in chiropractics; (3) a dentist without chiropractic training. Leg-length inequality was assessed at the medial malleolus with a standardised procedure. The subjects were examined in a one-day session by each examiner who was unaware of the diagnosis of the other examiners. Inter-examiner reliability was calculated by kappa statistics.
RESULTS: According to the chiropractitioner 26 out of 41 (63 per cent) subjects had leg-length inequality. The percentage agreement between the different examiners ranged from 56 to 63 per cent, however, the corresponding kappa values were generally low ($\kappa < 0.3$), indicating poor reliability between examiners.
CONCLUSION: The assessment of leg-length inequality based on a simple clinical test alone should be interpreted with caution.

132 DEMINERALISATION ASSESSED BY PHOTOGRAPHS AND QUANTITATIVE LIGHT-INDUCED FLUORESCENCE

N Pender[1], P E Benson[1], E de Josselin de Jong[2], S M Higham[1], [1]Clinical Dental Sciences, University of Liverpool, England and [2]Inspektor Research Systems, Amsterdam, The Netherlands

AIM: To test the detection of demineralisation after orthodontic debonding using quantitative light-induced fluorescence (QLF).
SUBJECTS: Twenty-three fixed appliance patients at debond.
METHODS: With ethical approval, patients were consented prior to debond and debridement after which a QLF image (Inspektor Research, Amsterdam) and a ring flash clinical photograph (Dental Eye II, Yashica, Japan) were obtained of a randomly chosen upper incisor tooth. The QLF image was analysed blindly from a coded image using dedicated software. Clinical photographs of all upper incisor teeth were blindly and randomly assessed by two specialist orthodontists and one cariologist for buccal demineralisation.
RESULTS: Two patients were excluded because the QLF images were not clearly in focus. In 9 patients there was complete agreement between assessors and QLF on the presence (3) and absence (6) of demineralisation. In 10 patients, demineralisation found by QLF was either seen by no assessor (5) or one assessor (5). In four of the latter, another QLF image captured one month later also showed demineralisation. Patterns of demineralisation were mainly gingival. The cariologist saw most demineralisation on the photographs and showed moderate agreement with QLF ($\kappa = 0.46$); the clinicians had poor agreement with QLF ($\kappa = 0.20$ and 0.11).
CONCLUSION: This preliminary study shows that QLF can detect demineralisation not apparent on clinical photographs. Clinicians may be more subjective in their evaluation of clinical photographs when assessing early lesions.

133 GINGIVAL CLEFTS FOLLOWING ORTHODONTIC CLOSURE OF PREMOLAR EXTRACTION SITES

M Persson, U Folkesson, Departments of Orthodontics and Periodontology, Umeå University, Sweden

AIM: To primarily study the prevalence of gingival clefts (duplicated gingival papillae) with an attempt at classification, and, secondly, to test for a relationship between the occurrence of cleft and a reduction in marginal bone height.
SUBJECTS AND METHODS: Thirty-six subjects (22 females, 14 males) were studied following fullbond orthodontic treatment and space closure, after premolar extractions, at a mean age of 13.5 years. In total 139 extraction sites, 60 first premolar and eight second premolar sites in the maxilla, and 60 first and 11 second premolar sites in the mandible were examined and classified with regard to cleft depth at the start of the adjustment phase, and at follow-up 1.2 years later. Bitewing radiographs were taken for the recording of marginal bone height, to be tested for a difference between non-cleft and cleft sites.
PRELIMINARY RESULTS: Gingival clefts to some degree were found buccally or interdentally at 66 out of 139 examined sites, with a mean depth of 0.8 mm. Severe clefts (cleft depth > 2 mm) were found in 23 per cent of the sites. The majority, 85 per cent of severe clefts, were located at mandibular extraction sites. At follow-up examination clefts were often still present as a cleft depth of 1.5 mm or more in 13 per cent of examined sites. Treating orthodontists surprisingly often overlooked clefts, as clefting was often first revealed following a thorough examination. Although several severe clefts co-existed with a marked reduction in marginal bone height, correlation test did not demonstrate any direct relationship between cleft depth and marginal bone height (distance to the cemento-enamel junction).
CONCLUSION: Gingival clefting, following space closure of premolar extraction sites, is common, and often overlooked. No direct relationship between clefting and marginal bone height appears to exist. The results highlight the need

to develop a sensitive classification of clefts for further evaluation of the significance of gingival clefting.

134 CHANGES IN OVERBITE OF CLEFT LIP AND PALATE PATIENTS

D Pfalzgraf[1], S Scherer[1], J A Lisson[1], J Tränkmann[1], C Kuettner[2], Departments of [1]Orthodontics and [2]Maxillofacial Surgery, Hannover Medical School, Germany

AIM: To evaluate the necessity for orthodontic treatment of deep overbite in children with unilateral or bilateral cleft lip and palate.
SUBJECTS AND METHODS: Ten subjects with an untreated unilateral deep overbite > 4 mm (group I), 10 with bilateral cleft lip and palate (group II) and 10 with skeletal and dental Angle's Class I relationship (control) were randomly selected. The casts of each patient were examined and the vertical dimension was measured annually from 9 to 17 years of age. The significance of the differences between the groups concerning overbite was calculated by using a two-tailed *t*-test for unpaired values. $P < 0.05$ was considered significant.
RESULTS: At the beginning of the observation, the extent of vertical overbite between the groups was distributed in an almost identical manner ($P < 0.05$). In groups I and II there was a greater decrease of overbite compared with the control group at 17 years of age ($P < 0.01$). Between groups I and II there were no significant differences in the reduction of overbite ($P > 0.05$).
CONCLUSION: In children with unilateral and bilateral cleft lip and palate there appears to be a greater reduction of overbite during adolescence compared with a non-cleft control. The orthodontic treatment of overbite during craniofacial growth in cleft patients is indicated only in severe cases.

135 PERCEIVED TREATMENT NEED AND INDEX OF ORTHODONTIC TREATMENT ASSESSMENT AMONG TREATED AND UNTREATED ADOLESCENTS

T Pietilä[1], I Pietilä[1], A-L Svedström-Oristo[2], P Alanen[2], J Varrela[2], [1]Pori Health Centre and [2]Institute of Dentistry, University of Turku, Finland

AIM: To analyse orthodontic awareness and perceived treatment need in a group of treated and untreated adolescents and compare their views with a professional assessment based on the Index of Orthodontic Treatment Need (IOTN).
SUBJECTS AND METHODS: One hundred and seventy five adolescents (mean age 16.6 years) from the town of Savonlinna, Eastern Finland, 47 per cent of whom had a previous treatment history and had completed a questionnaire on perceived treatment need and satisfaction with their own dental appearance. The subjects were then assessed by two calibrated orthodontists using the Dental Health Component (DHC) and Aesthetic Component (AC) of IOTN.
RESULTS: Eight per cent of subjects felt they were in need of orthodontic treatment, and all of them were in moderate or definite need for treatment when assessed with the DHC. Treatment need was perceived by 12 per cent of subjects with a treatment history, and 4 per cent with no treatment history. Sixty-three per cent of subjects felt they were not in need of treatment, but half were in moderate or definite need of treatment according to professional assessment. Five per cent of subjects gave themselves an AC score of 5 or more, indicating treatment need, while score 5 or more was given by the orthodontists to 16 per cent. Sixty-eight per cent of the subjects with a treatment history were satisfied or very satisfied and 6 per cent dissatisfied with their dental appearance, while respective proportions among the non-treated adolescents were 75 and 2 per cent. The most common reason for dissatisfaction was crowding of the lower anterior teeth.
CONCLUSIONS: Professionals seem to be more critical than adolescents about the acceptability of dental arrangement. The adolescents with a previous treatment history tended to be more aware of their dental appearance than those with no treatment history. However, an unsatisfactory dental appearance was not the only factor explaining perceived treatment need.

136 NATURAL ASYMMETRY IN PROTEOGLYCAN CONTENT BETWEEN THE RIGHT AND LEFT MANDIBULAR CONDYLAR CARTILAGE

K Pietilä, P Pirttiniemi, T Kantomaa, A Poikela, Department of Orthodontics, University of Oulu, Finland

AIM: Natural asymmetry is well documented in macroscopic mandibular dimensions. The aim of this study was to investigate if there is any asymmetry at cellular level in proteoglycan and collagen contents of the left and right mandibular condylar cartilages.
SUBJECTS: Nineteen New Zealand rabbits. Nine rabbits were killed at 25 days of age and 10 at 35 days of age. Right and left mandibular condylar cartilages were dissected out.
METHODS: Cartilage samples from the same side were pooled and subjected to biochemical analysis. The amount of proteoglycan was measured using dimethyl-methylene blue staining (Blyscan®) and the amount of collagen by measuring the level of hydroxyproline. The aggregating properties of proteoglycans were also determined in the samples.
RESULTS: Chondroitin sulphate concentration, which indicates the amount of proteoglycans, was considerably greater (30 per cent) in the condylar cartilage of the right side in 25-day-old rabbits. In 35 day old rabbits chondroitin sulphate concentration was also higher in the right side but to a lesser degree (10 per cent). The quantity of the aggregated proteoglycans was higher in the right condylar

cartilage both in 25 and 35 day old rabbits. The total collagen content of the right and left condylar cartilages was at the same level in 25 day old rabbits and only slightly lower on the left side in 35 day old rabbits.
CONCLUSION: Clear difference in proteoglycan content was found between the right and left mandibular condylar cartilages. Proteoglycans are of primary importance for the growth of the cartilage tissue and thus this difference could be associated with the differences in the amount of growth resulting in asymmetry between right and left side mandibular dimensions.

137 ABNORMAL HABITS IN THE AETIOPATHOGENESIS OF DENTOMAXILLARY DISTURBANCES

A Podariu, D Jumanca, A Glucan, Department of Preventive and Community Dentistry, University of Medicine and Pharmacy Timioara, Romania

AIM: To demonstrate that correcting abnormal habits and treatment of dentomaxillary disturbances must be performed as early as possible, by well conducted functional therapy, using other means of interceptive orthodontics as well as those applied by the orthodontist and dental nurse in co-operation with the family.
SUBJECTS: The relationship between abnormal habits and dentomaxillary disturbances were studied for a period of four years in a group of 1,850 children aged between 2 and 16 years. From these subjects, 632 had dentomaxillary disturbances: 216 sucked a finger (34.17 per cent); 44 bit writing instruments (6.96 per cent); 96 used comforters (15.18 per cent); 35 sucked their lower lip (5.53 per cent); 41 sucked their cheek (6.48 per cent). Four hundred and thirty two (68.32 per cent) had oral habits. In the children without dentomaxillary abnormalities, 4.58 per cent had abnormal habits.
METHODS: The following interceptive methods were used during the temporary dentition: Soulet-Bescombes appliances which allowed the correction of anterior inverted bite at 2–3 years of age (3 patients); activators or removable devices (palatal or lingual) for correction of crossbite (21 subjects); space maintainers in subjects with early dental loss (19); extraction of retained deciduous incisors (7); elimination of abnormal habits in 19 subjects between 2 and 5 years of age by psycho-educational means which led to normalization of the dentomaxillary apparatus; functional re-education concerning atypical dentition and abnormal lingual behaviour (3 subjects); neuromuscular re-education aiming at reflex images (4).
CONCLUSIONS: Orthodontically, all three sections are affected, but the most disturbed is the sagittal one. If bad habits are corrected up to the age of 5, the abnormality is spontaneously healed. Not all those with abnormal habits also have dentomaxillary disturbances. The use of orthodontic devices does not exclude psychological methods and each child must be individually assessed in their psycho-emotional environment. Conceptual orientation continues to be crucial in the diagnosis and treatment of deviated behaviours.

138 THE PENDULUM APPLIANCE—A NON-COMPLIANCE THERAPY FOR CLASS II CORRECTION

H-J Pönitz[1], U Reiß-Pönitz[2], G Aktan[1], [2]Private practice, Heidenheim and [1]Department of Orthodontics, Julius-Maximilians-University, Würzburg, Germany

AIM: To assess the efficiency of the Pendulum appliance (PA).
SUBJECTS: Twenty-five Class II patients (16 males, 9 females) with an average age of 10.24 years.
METHODS: The PA consisted of a modified Nance button with an expansion screw and two extending coil springs (TMA 0.032-inch). The springs were recurved at the end where they fit into the lingual sheath. Using four auxiliary wires, the PA was fixed to the maxillary premolars. The springs were activated to 45 degrees, with an initial force of 150 g. The patients attended every 3 weeks for control. The PA was worn until a Class I relationship was obtained. Photographs were taken at the beginning, middle and end of treatment. The average treatment time was 114 days.
RESULTS: Distal movement of the molars was within the range of 2 to 4.5 mm.
CONCLUSION: The PA is an effective method for distalization of maxillary molars. The major advantages are that it is easy to produce and requires minimal patient compliance.

139 CONDYLAR POSITION IN CLASS III MALOCCLUSION TREATMENT WITH AN ORTHOPAEDIC FACEMASK

D Proietti[1], E Barbato[1], C Malagola[2], [1]Department of Orthodontics, University of Roma 'La Sapienza', [2]Department of Dentistry, University of Catanzaro 'Magna Graecia', Italy

AIM: To evaluate condylar position changes in Class III patients treated with an orthopaedic facemask.
SUBJECTS AND METHOD: Fifteen subjects (8 males, 7 females), 7 to 10 years of age, with dental and skeletal Class III malocclusions, treated with an orthopaedic facemask until a Class I molar relationship was obtained. The extraoral elastic force was 450 g per side. Active treatment time averaged 13.4 months. Pre- (T0) and post-treatment (T1) individualized (corrected) sagittal tomograms of the temporomandibular joints (TMJ) were taken and the following variables were measured according to Athanasiou: superior joint space (SJS), posterior joint space (PJS) and anterior joint space (AJS). A Student's *t*-test for paired comparison was used to assess any significant change for each variable.
RESULTS: No statistically significant differences were found between T0 and T2 tomograms with respect to SJS,

PJS and AJS. Mean variation of articular spaces ranged from –0.32 mm to 0.22 mm.
CONCLUSIONS: The orthopaedic facemask is commonly used in the treatment of skeletal Class III malocclusions. It has been suggested that stresses exerted on the chin might lead to posterior and superior condylar displacement, which may be a predisposing factor for TMJ disorders. This study shows no evidence that the orthopaedic force exerted by a facemask modifies the condylar position and drives the condyle distally; furthermore, all of the patients were free from TMJ signs or symptoms at the end of treatment.

140 MECHANICAL AND STRUCTURAL PARAMETERS OF BONE MATURATION

E Rose[1], C Bültmann[1], M Hagenmüller[1], B A Rahn[2], I E Jonas[1], [1]Department of Orthodontics, University of Freiburg i. Br., Germany and [2]AO/ASIF Research Institute, Davos, Switzerland

AIM: To assess mechanical and structural age-related changes of the growing mandible to quantify bone maturation.
MATERIAL AND METHODS: Mandibles of pigs were taken from the slaughterhouse and prepared immediately after the animals had been killed. The pigs were selected according to age and the total sample was subdivided into three groups (A = young, <2 months, weight: 30–40 kg, B = young adult 4–6 months, weight: ca. 110 kg, C = adult, 2> × >5 years, <200 kg). The horizontal cortical bone of 10 mandibles in each group was studied. The following parameters were measured: architectural organisation by speed of sound (SOS), bone mineral density by qualitative computer tomography (CT), cortical surface hardness by Vickers (HV), elastic modulus (EM) in a three-point bending test, and water content of the bone. The data and the group differences were statistically analyzed using an ANCOVA-test.
RESULTS: While SOS, BMD, surface hardness and EM increased ($P < 0.001$), the water content of the bone decreased significantly ($P < 0.001$). There was no statistical correlation between the amount of change and the different methods used.
CONCLUSION: Age-related changes of bone maturation can be monitored with the methods used. Maturation of the mandible implies changes in the architectural organisation, in the material composition, and in the mechanical properties of cortical bone.

141 CROSSBITE IN THE MIXED DENTITION: MANDIBULAR SHIFT CORRECTION

L Rosignoli, M Lucci, P Cozza, Department of Orthodontics, University of Rome 'Tor Vergata', Italy

AIM: To investigate the effects of a modified anterior quadhelix in the treatment of subjects with functional posterior crossbites and anterior open bites.
SUBJECTS: Fifteen Italian children with a mean age of 7 years were included in the study. All were in the early mixed dentition and showed a persistent thumb-sucking habit. Clinical examination revealed an anterior open bite and a unilateral posterior crossbite that produced a functional shift of the mandible and facial asymmetry.
METHOD: To correct thumb-sucking and transverse constriction, interceptive functional-orthodontic treatment was planned using a modified anterior quadhelix. The modified quadhelix was made of 0.036-inch stainless steel round wire soldered to bands adapted to the first permanent molars. The lingual arms of the appliance extended to the deciduous canines. Three segments of 0.032-inch stainless steel round wire were soldered to the anterior bridge of the quadhelix. The segments were lingually inclined to avoid impinging on the sublingual mucosa.
RESULTS: The treatment resulted in correction of the open bites and posterior crossbites, normalisation of the constricted maxillary arch and improvement of the dental midline and facial asymmetry. A normal occlusion was established.
CONCLUSION: Skeletal unilateral functional posterior crossbites with a mandibular shift and anterior open bites can be successfully treated in the mixed dentition with a modified anterior quadhelix.

142 EVALUATION OF POST-TREATMENT CHANGES IN TRANSVERSE DENTAL DIMENSIONS

M Rübendüz, S Altunay, Department of Orthodontics, Ankara University, Turkey

AIM: To comparatively evaluate post-treatment changes in intercanine and intermolar dimensions and ratios in dento-skeletal Class I extraction and non-extraction subjects.
MATERIAL AND METHOD: Pre- and post-treatment orthodontic models and cephalometric films of 24 dento-skeletal Class I females aged 12 years or over with moderate crowding. The first group consisted of 12 patients treated with four first premolar extractions and the second group 12 females treated non-extraction. The selection criteria was: ANB 0–4 degrees, GoGn-SN 28–36 degrees, overbite 0–4 mm, overjet 0–4 mm. Eight linear, two proportional intramaxillary and two proportional intermaxillary measurements for each upper and lower arch were evaluated.
RESULTS: The maxillary intercanine dimensions decreased while the mandibular intercanine dimensions increased in both groups. Maxillary and mandibular intermolar dimensions increased in the non-extraction group but decreased in the extraction group.
CONCLUSION: Similar changes in maxillary and mandibular intercanine dimensions were seen in both the extraction and non-extraction groups. However the maxillary and mandibular intermolar linear changes were different. These dimensions were increased only in the non-extraction group.

143 THE EFFECT OF HERBST APPLIANCE TREATMENT ON TEMPOROMANDIBULAR JOINT SOFT TISSUES

S Ruf, H. Pancherz, Departments of Orthodontics, University of Giessen, Germany

AIM: To assess the reaction of the temporomandibular joint (TMJ) soft tissues and the masticatory musculature with Herbst appliance treatment.
SUBJECTS: Sixty-two consecutive Class II malocclusion patients treated with the Herbst appliance for an average period of 7.2 months. In all subjects the Herbst treatment resulted in a Class I or overcorrected Class I dental arch relationship.
METHODS: The condition of the TMJ soft tissues and the masticatory musculature was assessed by means of a manual functional analysis, including active and passive joint movements as well as isometric contractions. The examination was performed before treatment, after one, six and 12 weeks of Herbst treatment, after removal of the Herbst appliance, as well as six and 12 months thereafter.
RESULTS: No signs of muscular TMJ dysfunction could be found at any time during the observation period. The only affected joint structure was the inferior stratum of the posterior attachment. Before treatment 24 per cent of the joints exhibited a capsulitis of the inferior stratum. The prevalence of capsulitis increased to 100 per cent of the joints after 6 weeks of Herbst treatment but thereafter continuously decreased to 7 per cent of the joints one year after Herbst treatment.
CONCLUSION: Bite jumping with the Herbst appliance did not result in any muscular TMD and reduced the prevalence of capsulitis existing before treatment.

144 CONDYLAR MOVEMENT AND CRANIOFACIAL MORPHOLOGY

M R Sadat Khonsari, B Kahl-Nieke, C Fenske[1], I Kirsch, Departments of Orthodontics and [1]Prosthodontics, University of Hamburg, Germany

AIM: To analyse the relationship between craniofacial morphology and condylar translation plus rotation during mouth opening in healthy human.
SUBJECTS: Thirty individuals (19 females, 11 males) without any past history or present signs of dysfunction were examined.
METHODS: The condylar pathway was recorded with a computer aided axiographic tracing system (Cadiax, Gamma GmbH, Klosterneuburg, Austria) during mouth opening. Data based on this measurement were related with morphology of the skeleton on lateral cephalometric radiographs.
RESULTS: A significant correlation with both parameters SNB and S-Ar-Go-angle ($r = 0.57$, $P = 0.007$) was shown for the anterior translation as well as for the ratio between the opening angle and translation. In most individuals condylar movement was characterised by a linear relationship between rotation and translation except for the initial and final phase of opening where there was a more pronounced rotational component.
CONCLUSION: The special morphology of the skeleton has an influence on the translation and rotation capacity of the condyle. For this reason the evaluation of maximum opening of the mandible should take the craniofacial configuration into consideration.

145 MESIODISTAL WIDTH OF THE UPPER ANTERIOR TEETH IN PATIENTS WITH CLEFTS

M Sasic, Z Stamenkovic, Department of Orthodontics, University School of Dental Medicine, Belgrade, Yugoslavia

AIM: To determine the mesiodistal width of the six upper anterior teeth in patients with clefts and in a control group.
MATERIAL: Casts of 50 patients with bilateral cleft lip and palate (BCLP) and a control group consisting of 50 patients without clefts.
METHODS: The mesiodistal width of all anterior teeth was measured. All patients had upper permanent anterior teeth.
RESULTS: The teeth on the cleft side were smaller compared with the same teeth in patients without clefts. This difference was statistically significant ($P < 0.001$) for the upper lateral incisor. This tooth had an extremely small mesiodistal size in patients with clefts. The central incisor and upper canine were smaller in patients with clefts, but this difference was not statistically significant ($P > 0.05$).
CONCLUSION: The mesiodistal size of the teeth is influenced by many factors, one of which is the existence of a cleft. Patients with BCLP have smaller mesiodistal widths of all six permanent upper anterior teeth. In the control group these values were significantly larger. The upper lateral incisor has the smallest mesiodistal width because this tooth is the nearest to the cleft line.

146 EVALUATION OF GROWTH TYPE IN PATIENTS WITH CLASS II DIVISION 2 MALOCCLUSIONS

M Sasic, S Milosevic, Department of Orthodontics, University School of Dental Medicine, Belgrade, Yugoslavia

AIM: To evaluate the linear and angular parameters for growth type in patients with Class II division 2 malocclusions.
SUBJECTS: The experimental group consisted of 30 patients (mean age 11.3 years) with skeletal Class II division 2 malocclusions, and a control group of 41 subjects with an ideal Class I occlusion. The growth types were compared in both groups.
METHODS: In the experimental group the posterior occlusion was Class II, and the anterior teeth were in a typical position. Profile teleroentgenographs were taken for all subjects and the following variables considered: Sella (NSAr), articular (SArGo) and gonial (ArGoMe) angles,

the sum of these angles, percentage ratio between the posterior and anterior facial height (S-Go: N-Me), the angle between the anterior cranial base and the most anterior inferior point of the bony chin (gnathion) in the centre of sella [Y (NSGn)—Y-axis]. The dimensions of the jaw bases were assessed in relation to the N-Se distance in the form of a proportional as described by Steward.
RESULTS AND CONCLUSIONS: In children with skeletal Class II division 2 malocclusions forward rotation was the most frequent. The sella angle was larger but the articular angle was smaller in the experimental group. The gonial angle and Y-axis was significantly larger in subjects with Class II division 2 malocclusions. The maxilla was smaller in these subjects but not significantly. There were smaller linear values for the mandibular corpus but significantly larger values for ramus length in the experimental group.

147 PROFILE PREFERENCE IN JAPANESE MALE LAYPERSONS

Y Sato, T Imai, T Yamamoto, J Iida, Department of Orthodontics, Hokkaido University, Sapporo, Japan

AIM: To investigate the relationship between profile preferences judged by Japanese male adults and the morphology of their own profiles.
MATERIAL AND METHODS: The Japanese normal female profile was selected as the original profile silhouette. The position of the lower lip was 1.0 mm before the E-line. Seven silhouettes were made based on the original. In six silhouettes, the lip areas were altered in 2.0 mm stages perpendicular to the E-line from retrusive to protrusive from the original, and in the other one, the lower lip was bounded on its outline by the E-line. Forty-three Japanese male laypersons were asked to judge one of the eight silhouettes, as the most preferred using a questionnaire. Lateral facial photographs were then taken of their profiles and these were divided into two groups according to the morphology. In group A the lower lip was positioned ahead of the E-line and in group B behind the E-line.
RESULT: The mean value of the distance between the lower lip and the E-line was –1.6 mm in group A and –2.9 mm in group B. The subjects in group B had a strong tendency to choose the retrusive silhouette as the preferred profile compared with those in group A.
CONCLUSION: Male laypersons with a retruded lip position against the E-line tend to prefer the retrusive profile silhouette.

148 BENDING PROPERTIES OF NICKEL-TITANIUM ORTHODONTIC WIRES

K Satoh[1], H Nakano[1], M Ishigame[1], T Jin[1], H Miura[1], H Katsura[2], Departments of [1]Orthodontics and [2]Dental Technology, Iwate Medical University, Japan

AIM: By clarifying the bending properties of nickel-titanium wires, one objective of this study was to provide a reliable reference from which clinicians can evaluate archwires based on consistent testing conditions rather than on manufacturers' claims.
MATERIALS: Forty-four commercially available brands of wires from 10 manufacturers. These samples included 20 brands of 0.016″ round wire and 24 brands of 0.016 × 0.022″ rectangular wire.
METHODS: To examine the relationships between the deflection and load during bending, a three-point bending test using the universal testing machine (Autograph DSS-5000, Shimazu Co., Tokyo) was conducted at 37°C.
RESULTS AND CONCLUSIONS: (1) 0.016″ wire: the load exerted at 1.5 mm of activation varied from 17 g for copper Ni-Ti and from 35 to 153 g for Aline. (2) 0.016″ wire: the load difference between 1.5 and 0.5 mm of activation varied from 17 g for copper Ni-Ti, and 35 to 100 g for Aline and Titanal. (3) 0.016 × 0.022″: the load exerted at 1.5 mm of activation varied from 3 g for copper Ni-Ti and from 40 to 340 g for Aline. (4) 0.016 × 0.022″: the load difference between 1.5 and 0.5 mm of activation varied from 3 g for copper Ni-Ti and from 40 to 200 g for Aline. (5) The majority of the samples with a smaller load difference between deflections of 0.5 and 1.5 mm in the unloading process were found among super elastic wires, while samples with a larger load difference were predominantly found among work-hardened wires.

149 HEREDITY OF CLASS II DIVISION 2 MALOCCLUSIONS: A PEDIGREE ANALYSIS

I Šćepan, B Glišić, L Vukosavljević, Clinic of Orthodontics, University of Belgrade, Yugoslavia

AIM: To demonstrate similarities of craniofacial morphology among 11 family members with Class II division 2 malocclusions covering three consecutive generations.
MATERIALS AND METHODS: A series of lateral cephalometric radiographs of 11 members of a consecutive three-generation family, including direct descendants and adjoining family members (spouses), exhibiting both clinical and cephalometric Class II division 2 malocclusions were analysed. The family consisted of one female in the first generation (grandmother), and her two female offspring (daughters) who, with their respective spouses, were the second generation. The third generation included four siblings (two females, two males), who had 'textbook' examples of Class II division 2 malocclusions, offspring of the first daughter, and a male who had very expressed characteristics of a Class II division 2 malocclusion, also two female dizygotic twin siblings (who exhibited a less expressed malocclusion), offspring of the second daughter and a male who lacked any of the characteristics of the malocclusion studied. Tracings of the lateral cephalometric radiographs were superimposed to compare parents and offspring, as well as respective sibling groups.
RESULTS: Analysis of superimposed tracings of cephalometric radiographs showed great similarities for craniofacial

morphology. This was especially true for the shape of the mandible, inclination of the maxilla, and incisor inclination. The similarities of morphology were more striking in the branch of the family in which both parents had the anomaly.
CONCLUSION: Pedigree analysis and striking similarities of craniofacial morphology confirmed the heritability of Class II division 2 malocclusions.

150 AXIAL POSITION OF CLEFT ADJACENT TEETH AFTER MULTIBRACKET APPLIANCE TREATMENT

M Schmechel, Ch Opitz, A Bartels, Department of Orthodontics and Dentofacial Orthopedics, Humboldt-University, Berlin, Germany

AIM: To study the relationship between the axial position of cleft adjacent teeth and the method of space closure after secondary osteoplastic surgery and multibracket appliance treatment.
MATERIAL AND METHOD: Model analysis and orthopantomographic evaluation of 70 patients with unilateral or bilateral cleft lip and palate (CLP) after eruption of cleft adjacent canines before and after multibracket appliance treatment in comparison with 20 patients with maxillary lateral incisor aplasia. Model analysis: determination of the distance between the central incisor and canine in the occlusal plane with reflex microscopy. Orthopantomographic: determination of the angle formed by the axial position of central incisor and canine.
RESULTS: The interaxial angle of cleft adjacent teeth was significantly larger after orthodontic space closure than after prosthodontic space closure. The extent of mesial movement also correlated with the degree of the interaxial angle. Patients with lateral incisor aplasia showed a smaller interaxial angle than CLP subjects after orthodontic space closure.
CONCLUSION: The orthoaxial positioning of cleft adjacent teeth into the osseous transplant is not fully accomplished by multibracket appliance treatment. While orthoaxial positioning of cleft adjacent teeth is possible with prosthodontic space closure, a less favourable result has to be taken into account when using orthodontics for space closure

151 THE CLINICAL PERFORMANCE OF REMOVABLE PROSTHESES IN THE DECIDUOUS DENTITION

M Schoch[1], U Hirschfelder[1], M Wuttig[1], S Rügheimer[2], N Krämer[2], Department of [1]Orthodontics and Dentofacial Orthopedics and [2]Operative Dentistry and Periodontology, University of Erlangen-Nuremberg, Germany

AIM: To evaluate the acceptance, function and efficiency of removable children's prostheses.
SUBJECTS: Twenty-three children (11 male, 12 female), 2¼–6 years of age, with premature loss of the deciduous dentition.
METHODS: The removable prostheses, with wire clasps, were manufactured according to the requirements of prosthetic dentistry, including, among other procedures, gnathologic registrations, wax model dentures, and fitting. At baseline and at the recall appointments every three months, the patients were examined by calibrated investigators concerning the criteria described in the results and regarding the necessity of repair or denture relining.
RESULTS: The reason for the premature loss of deciduous teeth was caries in 20 patients ('nursing-bottle-syndrome' in nine of these children), trauma in two subjects, and enamel hypoplasia in one child. At least two incisors in the maxilla had to be replaced in all children, while in five subjects the deciduous molars were additionally affected. At baseline two children did not accept the removable prosthesis and new dentures were made. The percentages (average of all investigation appointments) of children/prostheses with clinically sufficient conditions concerning the following criteria were: bite and masticatory function 96 per cent; articulation 92 per cent; fit 98 per cent; retention 98 per cent; tongue posture and habits 98 per cent; mucosal condition 89 per cent. The period after which the prostheses had to be modified, relined or remanufactured ranged between two weeks and three years with an average of eight months. The average entire period of treatment was 1.76 years. There were no statistically significant differences concerning those criteria between any recall (Wilcoxon-Rank-Test, $P > 0.05$).
CONCLUSION: Within the limits of the present study, the application of removable prostheses in the deciduous dentition was clinically successful.

152 INTRAMUSCULAR STRATEGIES OF MOTOR CONTROL

H Ch Scholle[1], N P Schumann[1,2], F Biedermann[3], R Graßme[1], B U Kleine[1], D F Stegeman[4], S Kopp[1], [1]Motor Research Group, Institute of Pathophysiology, Departments of [2]Orthodontics and [3]Otolaryngology, Friedrich-Schiller-University Jena, Germany and [4]Department of Clinical Neurophysiology, University of Nijmegen, The Netherlands

AIM: To demonstrate that activation of skeletal muscles is not homogeneous, but selective depending on the motor task, the actual load situation, etc, and to prove by spatio-temporal analysis of muscle activation patterns that morphological and/or functional compartmentalisation of muscles is essential.
SUBJECT: Sixty healthy volunteers; 30 patients with central motor disorders; 10 rats (*Rattus norvegicus*).
METHODS: Spatio-temporal analysis of muscle activation by surface electromyographic (EMG) mapping (16, 32 or more channels). Humans: biceps brachii, masseter, trapezium, quadriceps femoris muscles during defined motor tasks. Rats: triceps brachii muscle 16-electrode matrix (12*15 mm), high speed videography during treadmill locomotion.

RESULTS: Depending on the motor tasks and actual load situations the muscles showed differentiated activation patterns. Such selective activation could be found at the level of motor units, muscle compartments, and muscle heads. In rats differences in EMG activity patterns of the long and lateral triceps brachii heads during the stance and swing phase of locomotion corresponded to histological/histochemical characteristics.
CONCLUSIONS: The results show evidence for selective muscle activation processes on the level of motor units, muscle compartments and muscle heads that partly correlated to morpho-functional muscle properties. On this basis it might be possible to create more focused diagnostic therapeutic strategies for orthodontic and prosthetic problems.

153 PERIODONTAL CONDITIONS AND TOOTH MOBILITY WITH FIXED ORTHODONTIC RETAINERS

W Schröder, W Hahn, M Hahn, Private Practice, Hamburg, Germany

AIM: To identify possible side-effects, especially on the periodontal supporting tissues and mobility of teeth, of permanent orthodontic retainers. The evaluation concerned the lower anterior segments with fixed retention as well as their upper antagonists.
SUBJECTS: Ten patients with and 10 without fixed retainers (control group) were examined 1, 2 and 5 years after band-bracket removal.
METHODS: The individual adapted retainers were fabricated of multistrand wires and bonded between the lower canines and incisors. The following parameters were examined and the data compared with the non-retainer group: 1. Development of dental calculus; 2. Periodontal attachment (from cemento-enamel junction); 3. Probing depth; 4. Mobility of the teeth with special regard to the antagonists. The periodontal measurements (attachment and probing depth) were made with a calibrated periodontal probe while tooth mobility was evaluated additionally by means of periotest. Radiographs completed the 5 year-follow-up examinations.
RESULTS: Comparison of the above parameters between the retainer patients and the control group without fixed retainers did not reveal obvious differences. Neither marked mobility nor a reduction of periodontal support or gingival recessions was found.
CONCLUSION: The findings suggest that periodontal conditions remain well maintained. The bonded retainers seem not to induce periodontal deterioration.

154 DYNAMIC INTRAMUSCULAR ACTIVATION PROCESSES DURING CYCLIC MOVEMENTS

N P Schumann[1], F Biedermann[3], B U Kleine[1] S Kopp[2], H Ch Scholle[1], [1]Motor Research Group, Institute of Pathophysiology and Departments of [2]Orthodontics and [3]Otolaryngology, Friedrich-Schiller-University Jena, Germany

AIM: To register the intramuscular activation pattern during cyclic movements such as chewing in man as well as locomotion in rats by means of multi-channel surface electromyography (EMG) and to show the variation of topographical EMG distribution in different phases of cyclic movement.
SUBJECTS: Five healthy volunteers, 10 Hannover rats.
METHOD: Humans: 16-channel surface EMG was recorded from the masseter and temporal muscles during chewing (bread, carrots, chewing gum). Rats: the triceps brachii was investigated with surgically implanted suprarmuscular 16-channel-matrix-electrodes (12*15 mm) and high-speed videography during treadmill locomotion. Selected by cinematic information, the EMG (root mean square) of artefact-free steps was time normalised.
RESULTS: The masseter and the temporal muscles showed different activation patterns within the time-course of the chewing cycle. The main activated region of the masseter was in the lower muscle third. In the temporal muscle the highest EMG activity was demonstrated in the upper anterior region. In rats the EMG activity patterns were different between stance and swing phase.
CONCLUSIONS: The results confirm the hypothesis of functionally different compartments within the investigated muscles. Further investigations are required to determine whether dynamic muscle activation patterns are altered by functional disorders of the cranio-mandibular systems as well as by orthodontic and prosthetic therapy.

155 EFFECT OF THE PALATAL SHAPE OF ORTHODONTIC REMOVABLE APPLIANCES ON SPEECH

G Schuster, M Scharfenberger, Policlinic for Orthodontics, Dental University, Frankfurt and Clinic for ENT, Medical University, Würzburg, Germany

AIM: To clinically test the influence of different palatal shapes on speech.
SUBJECTS: Ten students with normal articulation and occlusion.
METHOD: Four palatal forms were designed according to orthodontic treatment indications (thin acrylic body versus anterior bite plate) and with slight modifications (integrated rugae palatinae, roughened surface). Without allowing time to adapt to the different plates, specific test words with dental and palatal fricatives (s, ch, sch, st, l) were recorded three times in a row with each plate as well as without a plate. Using formant analysis (TFR, Avaaz®) the frequency, amplitude and band width for the recorded fricatives were measured and evaluated.
RESULTS: Compared with normal speech, all plates reduced the maximum intensity of high frequencies to lower

ones. The duration of the test words was not changed, but the surrounding vocals were stressed and the fricatives shortened. Although the difference between the different plates was not significant, the anterior bite plate changed the fricatives most, whereas the modifications facilitated clearer articulation.
CONCLUSION: With spectral analysis an objective measurement of the influence of different shapes of dentures or orthodontic removable plates is possible. This helps the orthodontist support the articulation by small modifications so improving patient compliance.

156 THE EFFECT OF PROSTAGLANDIN E_2 AND CALCIUM GLUCONATE ON ROOT RESORPTION DURING TOOTH MOVEMENT IN RATS

M Seifi, E Ziaie Matin, Department of Orthodontics, Shahid Beheshti University, Tehran, Iran

AIM: To quantify the amount of root resorption in a control group without orthodontic tooth movement (OTM), after injection of PGE_2 alone and with calcium gluconate during OTM.
MATERIALS AND METHOD: Twenty-four, 8-week-old male Wistar rats were randomly divided into three groups. The orthodontic appliance consisted of a closed coil spring ligated to the upper right first molar and the incisor on the same side, applying a force of 60 g. The control group had localized injections of a neutral fluid on the buccal gingiva of the upper right first molar. In the first experimental group, 0.1 ml of 1 μm/ml PGE_2 was injected at the same place, in addition to the force. The other group received IP injections of 200 mg/kg calcium gluconate beside the PGE_2 and force. All the injections were performed on day 0 and 7. The animals were killed on day 21. Both sides of the palatal halves of the control group (right control, left normal) and the right palatal halves of the other groups were removed for histological processing. Root resorption was calculated on the mesial surface of the right molar root by the sum of the resorptive surfaces, multiplying the deepest depth and the largest length of the resorptive surfaces. The data were analyzed by Kruskal-Wallis and multiple range tests.
RESULTS: There were no statistical differences between the groups, except for the normal group and the PGE_2 group ($P < 0.05$). PGE_2 as a mediator of OTM enhanced root resorption following the remodelling process, in the teeth that were not moved orthodontically. Following the calcium content injections, there was a decrease in root resorption in comparison with the PGE_2 group.
CONCLUSION: Since the calcium gluconate dose did not significantly decrease root resorption, further studies should be undertaken to investigate whether different doses may play a significant role in decreasing root resorption. The judicious use of local and systemic biochemical agents that alter remodelling of periodontal tissues, in conjunction with orthodontic treatment, appear to induce fewer side-effects during treatment.

157 A COMPARISON OF ELECTROMYOGRAPHIC MUSCLE ACTIVITY IN ADULTS WITH NORMAL OCCLUSION AND CLASS II DIVISION 2 MALOCCLUSIONS

M Seifi, P Jahanshahi, Department of Orthodontics, Shahid Beheshti University, Tehran, Iran

AIM: To compare the electromyographic (EMG) muscle activity in adults with normal occlusion and those with Class II division 2 malocclusions.
SUBJECTS: Ten young adults with normal occlusion and 10 with Class II division 2 malocclusions.
METHODS: EMG activity of the masseter, anterior temporal, mentalis, and orbicularis oris muscles was recorded using a computer-based system with surface bipolar electrodes during rest, swallowing, maximum intercuspation, and clenching. A total of 44 recordings were made for each subject and the mean values for each muscle in each function were calculated and compared between the two groups (Student's *t*-test, Mann-Whitney).
RESULTS: Data analysis revealed no significant difference between the two groups. Variable differences were found between the muscle activities of the two groups in each function. The orbicularis oris muscle activity/amplitude was higher in the Class II division 2 subjects than in the normal occlusion subjects at rest, maximum intercuspation and during swallowing, but the differences were not statistically significant.
CONCLUSION: With respect to the significant differences reported between orofacial muscle EMG activity of Class II division 2 and normal occlusion in children, these findings suggest an adaptation between form and function in the dentofacial neuromuscular system in the growing child. Precise evaluation of this adaptation may be of clinical importance.

158 MANDIBULAR GROWTH PREDICTION IN CLASS II ANOMALIES

A Serbanescu, Orthodontic Department, University of Medicine, Cluj-Napoca, Romania

AIM: Comparison of mandibular growth in the two Class II sub-divisions.
SUBJECTS: Fifty Class II division 1 and 50 Class II division 2 malocclusion patients in the mixed and incipient permanent dentition were compared with 50 subjects with normal occlusion.
METHOD: Facial type analyses on cephalograms using Björk's method and the mandibular growth prediction of Ricketts.
RESULTS: A mesiofacial type occurred in 60 per cent of Class II division 1 and 70 per cent of Class II division 2 subjects compared with 72 per cent with normal occlusion. The value of the facial axis angle in 72 per cent of subjects with Class II division 1 was less than in 52 per cent in Class II division 2 patients.

CONCLUSIONS: These results could be important in the treatment of Class II anomalies. The alternative treatment plans include repositioning the mandible or moving the teeth to obtain a normal occlusion

159 TOOTH TRANSPOSITION: TREATMENT OPTIONS AND OUTCOMES

Y Shapira, M M Kuftinec, Departments of Orthodontics, Tel Aviv University, Israel and New York College of Dentistry, USA

AIM: To determine the distribution of transposed teeth and to propose various treatment options for different types of transposition.
SUBJECTS: Eighty-six subjects with transposed teeth, 55 (64 per cent) females and 31 (36 per cent) males, aged 9 to 25 years.
METHODS: Full pre- and post-treatment records were examined for the severity of the anomaly and the treatment results were evaluated. All of these individuals received orthodontic treatment by qualified clinicians.
RESULTS: Over 70 per cent of all subjects had a maxillary transposition, a significant majority of which involved the canine and the first premolar and the rest the canine and the lateral incisor. Thirteen per cent were bilateral. Of the unilateral ones, involvement of the left side was 50 per cent higher than of the right side. All mandibular transpositions (25 cases) involved the canine and lateral incisor. Bilateral anomalies were present in four subjects. Of the unilateral ones the right side was seen substantially more often than the left (2.5:1 ratio). The sample comprised more females, presumably because the anomaly affects them twice as often as males.
CONCLUSIONS: Two basic approaches were evident in studying treatment outcomes. One involves tooth alignment in the transposed condition. The other, extraction of the tooth transposed with the canine and alignment of the remaining teeth in their normal position within the dental arch. Both approaches provide good aesthetic and functional results.

160 MECHANICAL PROPERTIES OF SCAR TISSUE FROM RAT PALATAL MUCOSA

T Shibusawa[1], C Shinohara[1], Y Shibasaski[1], K Segawa[2], R Taskiguchi[2], Departments of [1]Orthodontics and [2]Oral Anatomy, Showa University School of Dentistry, Tokyo, Japan

AIM: To investigate the differences in fibre structure and mechanical properties between scar tissue and normal palatal mucosa of rats
MATERIALS: Fourteen 5-week-old male Wistar rats (weighing 149.6 ± 4.3 g) were used for the experiments.
METHODS: Strips of mucoperiosteum (adjacent to right teeth) were excised from each palate. The left palatal mucosa was used as the control in each rat. One rat was sacrificed at 0, 1, 3, 7, 14 and 30 days after operation for morphological observation. Tensile tests were carried out on the specimens obtained from the palatal mucosa which had been operated on prior to 30 days.
RESULTS: The fibre structure of the normal palatal mucosa exhibited a meshwork structure. In the scar tissue of the palatal mucosa, thick fibre bundles were observed to be converging from the edge to the centre of the wound. Mechanical properties were significant differences of the tensile strength ($P < 0.01$), the strain at failure ($P < 0.05$) and the tangent modulus ($P < 0.05$) between the control and scar tissues.
CONCLUSION: The ultrastructure and mechanical properties of scar tissues and normal tissues are different in the palatal mucosa of rats.

161 BONE MINERAL CONTENT TO BITE FORCE AND OCCLUSAL CONTACT AREA

M Shozushima[1], H Nakano[2], H Miura[2], M Izumisawa[1], H Moriguchi[1], K Sakamaki[1], Departments of [1]Dental Radiology and [2]Orthodontics, Iwate Medical University, Japan

AIM: There are some reports that the growing craniofacial skeleton affects activity in the masticatory system. It was speculated that biting efficiency affects not only cephalometric data but also mandibular bone mineral content (BMC). In this study, the relationship between mandibular BMC and maximum bite force or occlusal contact area as a parameter of biting efficiency was evaluated.
SUBJECTS: Forty six adults, with a mean age of 23 years 7 months without a history of orthodontic treatment, defects in the anterior teeth, defects in two or more molars.
METHODS: Mandibular BMC was measured by photodensitometry using dental radiographs. The subject contrast of the mandible was used as a parameter of BMC. Bite force and occlusal contact area were measured using pressure sensitive sheets.
RESULTS: A negative correlation was observed between subject contrast and bite force and between subject contrast and occlusal contact area, with correlation coefficients of –0.378 ($P < 0.01$) and –0.401 ($P < 0.01$), respectively. Thus, BMC increased with maximum bite force and occlusal contact area.
CONCLUSION: Masticatory activity appears to affect not only cephalometric data, as previously reported, but also bone strength.

162 THE PREVALENCE OF TEMPOROMANDIBULAR DISORDERS IN GREEK PATIENTS REFERRED FOR ORTHODONTIC TREATMENT

S Sidiropoulou, S Kavvadia, M A Papadopoulos, A Karamouzos, G Kolokithas, Department of Orthodontics, Aristotle University of Thessaloniki, Greece

AIM: To evaluate the prevalence of temporomandibular dysfunction (TMD) signs in a group of patients referred for

orthodontic treatment and to describe the associations between malocclusion traits and signs of TMD.
SUBJECTS: One hundred and thirty four patients (56 M, 78 F), aged 7 to 22 years, referred for orthodontic treatment at the orthodontic clinic of the Aristotle University.
METHODS: Malocclusion traits and signs of TMD were recorded before the commencement of orthodontic treatment, by two operators simultaneously. The clinical examination protocol comprised a registration of mandibular mobility and an evaluation of temporomandibular joints (TMJs) with regard to tenderness and clicking or other sounds. The masticatory muscles were examined for tenderness by palpation. All patients were classified according to the clinical dysfunction index (Helkimo, 1974). The information collected was entered on a database for analysis. All variables were analyzed by means of Student's *t*-tests to evaluate possible statistically significant differences between them.
RESULTS: Seventy per cent of the sample had at least one sign of TMD, but the percentage of patients with moderate or severe clinical signs declined to 8.2 per cent. Joint sounds were the most common TMD sign (38.81 per cent). TMJ and muscle tenderness on palpation was experienced by 25.7 and 22.9 per cent of patients, respectively. Pain or limitation of mandibular movement in terms of maximal opening, protrusion and lateral movements, were less frequent findings. No significant differences were found between males and females. Statistically reduced mandibular opening was present in the younger group of patients (<12 years). Clinical signs of TMD were significantly associated with extreme maxillary overjet, deep bite, unilateral posterior crossbite and large occlusal slides (>2 mm).
CONCLUSIONS: There appears to be a high prevalence of TMD problems in patients referred for orthodontic treatment. Some specific types of malocclusion were significantly associated with the occurrence of TMD signs.

163 THE SQUAMO-TYMPANIC FISSURE IN HUMAN CRANIA

N M Skoumpourdis, S Anagnostopoulou, N D Spyropoulos, Department of Anatomy, University of Athens, Greece

AIM: To study the squamo-tympanic fissure and determine its position in each part of the cranium.
MATERIAL: Sixty dry crania from the Anatomy Department.
METHODS: The distance from the squamo-tympanic fissure to (a) articular tubercle, (b) styloid process and (c) the deepest point of the glenoid fossa were measured using a boley gauge and a pair of compasses.
RESULTS: The squamo-tympanic fissure had an asymmetrical relationship with (a) articular tubercle on both sides ($t = 1.2$ $P = 0.234$) and (b) glenoid fossa ($t = 1.26$ $P = 0.21$). The squamo-tympanic fissure has asymmetrical relationship with the styloid process ($t = 2.56$ $P = 0.013$).
CONCLUSION: The distance between the squamo-tympanic fissure and articular tubercle and the deepest point of the glenoid fossa is symmetrical on both sides of the cranium, while the distance of the fissure from the styloid process is characteristically asymmetric.

164 METHODS TO DETERMINE THE DIMENSIONS OF THE DENTITION DEPENDING ON THE SIZE OF THE LOWER INCISORS

A Slabkovskaia, N Pankratova, Department of Orthodontics and Children's Prosthetics, State Medicostomatology University of Moscow, Russia

AIM: An anthropometric investigation of dental study models.
MATERIALS AND METHODS: The models of 60 patients 7–12 years of age with normal occlusion were studied. The models of 29 subjects with anterior crowding and 20 patients with anterior crowding and vestibular canine position were also investigated.
RESULTS: It was found that the width of the dentition in the canine area in subjects with a physiologic occlusion had a maximum number of correlations with other parameters. This served as the basis for studying the canine width area while characterising the transverse dimensions of the dentition. It was found that the sum of the mesiodistal sizes of the four lower incisors correlated with a large number of parameters of the dentition and the sum of the width of the four upper incisors. This made it possible to presume that the sum of mesiodistal sizes of the four upper incisors is rather variable due to instability of their size and form. It is therefore recommended to use the sum of the mesiodistal sizes of the four lower incisors as the basic parameter for analysing the size of the dentition.
The size of the teeth and dentition was also examined in patients with anterior crowding (group I) and subjects with vestibular canines (group II) using both generally accepted methods and those proposed. The width of the dentition was correlated with the mesiodistal size of the four upper and lower incisors. There was no significant difference in the width of the dentition in the premolar and molar area in groups I or II, while the distance between the incisors varied considerably.
CONCLUSIONS: The data make it possible to recommend measuring the width of the dentition in the incisor area and is dependent on the mesiodistal size of the four lower incisors, expressed by index 0.69.

165 MANDIBULAR CONDYLE MOVEMENT IN ANGLE CLASS II TREATMENT WITH FUNCTIONAL APPLIANCES

G S Smiech-Slomkowska, M Mikolajczyk, Department of Orthodontics, Medical Academy of Lodz, Poland

AIM: Assessment of the influence of Angle Class II treatment with functional appliances on the angle between the condyle trajectory and the Camper plane.

SUBJECTS: Thirty-seven patients, 13 to 16 years of age, with Angle Class II malocclusions treated using functional appliances for a period of 18 months.
METHODS: The construction bite was made according to Klammt. A Gerber arch was used to register the condyle trajectory. Measurements were undertaken before and after treatment. The documentation consisted of diagnostic models and condyle trajectory plots.
RESULTS: Treatment to an Angle Class I molar occlusion with the edge of the mandibular incisors in contact with the lower part of tuberculum dentale, and a smooth bite plane was considered as an indicator of a positive result. On average, treatment resulted in a 1.7 mm reduction in overbite and a 2.3 mm decrease in overjet. The average reduction of the angle between the condyle trajectory and the Camper plane was 5.20 degrees (right joint) and 5.90 degrees (left joint). Differences between measurements were statistically significant at $\alpha = 0.01$ level.
CONCLUSION: Treatment of Angle Class II subjects leads to a decrease in the angle between the condyle trajectory and Camper plane.

166 THE EFFECTIVENESS OF MANDIBULAR ADVANCEMENT SPLINTS IN SUBJECTS WHO SNORE

A M Smith, J M Battagel, Department of Orthodontics, The Royal London Hospital Dental Institute, London, England

AIM To subjectively and objectively assess the effectiveness of mandibular advancement splints (MAS), and to determine the effect of altered posture and mandibular protrusion on the radiographic pharyngeal airway.
SUBJECTS: Thirty-five adults with proven non-apnoeic snoring were fitted with an adjustable MAS. Questionnaires determined changes in snoring incidence and daytime tiredness, and any side-effects and their duration. Eleven subjects completed overnight domiciliary sleep recordings before and after fitting the device. Lateral skull radiographs were traced and digitised to assess changes in pharyngeal morphology with alteration of posture from upright to supine position and with mandibular protrusion in the supine position.
RESULTS: The questionnaires and sleep recordings suggest the MAS significantly reduces snoring incidence ($P < 0.05$) and brings sleep quality to within normal limits. Daytime tiredness was significantly reduced, as assessed by the Epworth Sleepiness Scale ($P < 0.001$). The side-effects of muscular and temporomandibular joint discomfort mostly resolved after one month. Radiographic pharyngeal dimensions were changed with altered posture resulting in significant reductions in the minimum post-palatal ($P < 0.01$) and post-lingual ($P < 0.05$) measurements; mandibular protrusion produced increases in the minimum post-palatal (0.5 mm) and post-lingual (1 mm) dimensions and reductions in the tongue proportion ($P < 0.01$).
CONCLUSION: MAS produce complex changes in the morphology and function of the pharyngeal airway that appear to positively influence the airway, reducing snoring incidence and improving sleep quality. Radiographic pharyngeal dimensions are significantly affected by alteration of posture and mandibular protrusion.

167 MULTIFACTORIAL INFLUENCES ON BITE FORCE IN CHILDREN AND ADOLESCENTS

M Stephan, M Wuttig, M Schoch, U Hirschfelder, Department of Orthodontics and Orofacial Orthopedics, Friedrich-Alexander-University, Erlangen-Nuremberg, Germany

AIM: To analyse multifactorial influences on bite force.
SUBJECTS: One hundred patients (47 males, 53 females) without a history of orthodontic treatment, mean age 12.1 years (min. 8.4 years; max. 17.9 years).
METHODS: Masseter muscle thickness was measured during relaxation and contraction by ultrasonography. The bite force on the first molars was registered with a measurement device based on pressure-sensor technology. Chronological and skeletal age and body height were registered. These functional parameters were matched using multiple linear regression analysis.
RESULTS AND CONCLUSIONS: The mean thickness of the contracted and relaxed muscle in males was 12.1 and 8.6 mm, respectively, and for females 11.4 and 8.3 mm, respectively. The average bite force in males was 390 N and in females 316 N. Simple linear regression analysis showed larger correlations in skeletal than in chronological age. Chronological age, skeletal age, masseter muscle thickness, sex, and individual body height influenced bite force. Highly significant correlations ($0.49 < r < 0.5$ $P < 0.001$) were determined using multiple linear regression analysis.

168 THREE DIMENSIONAL EVALUATION OF CASTS TAKEN FROM CLEFT PALATE PATIENTS

I Storr, C Michl, A Mehl, I Rudzki-Janson, Departments of Orthodontics and Restorative Dentistry and Periodontology, Ludwig-Maximilians-University, Munich, Germany

AIM: To evaluate maxillary changes in cleft palate babies as a result of growth and surgical treatment.
MATERIAL: Maxillary casts of 65 babies with unilateral cleft palate were taken and evaluated at birth and one year of age.
METHODS: All 130 casts were measured by means of the Laserscan 3D Pro. Five separate scans were taken from each individual cast and then combined by the Match 3D-program. Measurements were made on each cast according to reliable landmarks defined by Kriens.
RESULTS: Laser scanning allowed 3D-visualisation and reliable measurement of casts. Changes caused by growth

and surgical treatment could be detected and simulated by superimposing the areas in the various 3D pictures.
CONCLUSION: An optimal diagnosis combined with an exact evaluation of growth changes is crucial for a successful individualised treatment of cleft palate patients.

169 ASSOCIATION BETWEEN OCCLUSAL CHARACTERISTICS AND SYMPTOMS OF TEMPOROMANDIBULAR JOINT DYSFUNCTION IN ORTHODONTICALLY TREATED AND UNTREATED ADOLESCENTS

A-L Svedström-Oristo[1], T Pietilä[2], I Pietilä[2], P Alanen[1], J Varrela[1], [1]Institute of Dentistry, University of Turku and [2]Pori Health Centre, Finland

AIM: To analyse the associations between functional and morphological characteristics of occlusion and self-perceived symptoms of temporomandibular joint dysfunction (TMD) in a group of orthodontically treated and untreated adolescents.
SUBJECTS AND METHODS: One hundred and seventy five subjects, aged between 15 and 18 years, from the town of Savonlinna. Eighty-two (47 per cent) had been treated orthodontically while 93 (53 per cent) were untreated. The mean age in both groups was 16.6 years. The subjects were clinically examined. Six morphological and six functional traits of the occlusion were recorded. The self-perceived symptoms of TMD were assessed by a questionnaire.
RESULTS: Seventy one per cent of the treated and 76 per cent of the untreated subjects met the given functional criteria of acceptable occlusion while only 43 per cent of the treated and 41 per cent of the untreated subjects had a morphologically acceptable occlusion. TMD symptoms were reported by 18 per cent of treated and 12 per cent of untreated subjects. In both groups, the symptoms were most frequently observed when the canine relationship was not Class I. Self-perceived symptoms were also reported by 22 per cent of the treated and 9 per cent of the untreated subjects with functionally and morphologically acceptable occlusions.
CONCLUSIONS: From a morphological and functional point of view, no large differences existed between the groups. These results suggest that the canine relationship may have a role in the development of TMD symptoms.

170 SKELETAL AND DENTOALVEOLAR STABILITY OF SURGICALLY CORRECTED ANTERIOR OPEN BITES

K Swinnen, C Politis, G Willems, C Carels, S Fieuws, Department of Orthodontics, K.U. Leuven, Belgium

AIM: To determine maxillary skeletal stability and dentoalveolar changes after surgical correction of anterior skeletal open bites treated by maxillary intrusion (group A) or extrusion (group B).
SUBJECTS: Forty-nine patients with anterior open bites, all treated by the same maxillofacial surgeon. Group A (n = 38) underwent Le Fort I intrusion and group B (n = 11) a Le Fort I extrusion osteotomy. A bimaxillary operation was performed in 31 and 6 patients, respectively. Rigid internal fixation was standard. Forty-five of the 49 patients received orthodontic treatment.
METHODS: Lateral cephalograms obtained at the start of orthodontic treatment (T1), before surgery (T2), immediately after surgery (T3), early post-operatively (T4) and one-year post-operatively (T5) were manually traced by one author.
RESULTS: The overall increase of overbite (A: 2.4 mm, B: 2.7 mm) and the reduction of open bite (A: 3.9 mm, B: 7.7 mm), which occurred during surgery, remained stable one year post-operatively. The increase of SNA (T2–T3) showed a high tendency for relapse and the clockwise rotation of the palatal plane (1.7 degrees) relapsed completely within the first year. A reduction of anterior facial height (A: 5.5 mm; B: –0.8 mm) occurred at the time of surgery.
CONCLUSION: Good skeletal maxillary stability was present one year post-surgery. However the canting of the palatal plane relapsed within the first year.

171 THE VISUAL JUDGMENT OF HUMAN FACIAL HEIGHT

Ka Takada, Ke Takada, N Kitai, Department of Orthodontics, Osaka University, Japan

AIM: To investigate whether there are any critical zones in the lower facial height to distinguish visually short, normal and long faces.
SUBJECTS: Seventeen orthodontists (8 male, 9 female) whose clinical experience was greater than 4 years and who had been confirmed to have high intra-observer consistency participated in the study.
METHOD: A frontal view of a Japanese woman, 27 years of age, was photographed and digitized into a computer to generate a normative face which had a proportion of 1:1.35 for facial width and height (72 × 102 mm in printed size) and equal proportions between the upper, middle and lower facial heights. A series of digitized facial images was then developed by increasing/decreasing the lower facial height every 5 per cent to a maximum of 30 per cent of its entire length. Each orthodontist made an independent visual classification of the computer-generated facial images that were provided in a random order into short, normal and long faces.
RESULTS: The mean critical height of the lower face that separated the short face from the normal face was found to be 13.7 per cent (S.D. 4.8 per cent) short (less than) of the normative lower facial height, while the long face was separated from the normal face with an augmentation proportion of 16.8 per cent (S.D. 7.2 per cent). The critical value for distinguishing the normal face from the long face showed similar inter-observer variation ($P = 0.159$) to that for separating the normal and short

faces. The critical heights did not differ between male and female judges.
CONCLUSIONS: Experienced orthodontists found differences in vertical proportions. These differences were an increase/decrease of about 15 per cent of the standard lower face height.

172 DO MULTIBRACKET APPLIANCES CHANGE EATING HABITS?

S Talesnik[1], P-G Jost-Brinkmann[1], T Schneller[2], [1]Abteilung für Kieferorthopädie und Orthodontie, Humboldt-Universität zu Berlin and [2]Medizinische Hochschule Hannover, Germany

AIM: To investigate whether wearing multibracket appliances correlates with changes in eating habits that increase the risk of developing caries.
SUBJECTS: One hundred and two patients aged 10 to 20 years during their first six months of orthodontic therapy with fixed appliances.
METHOD: The subjects were interviewed about their eating habits on three separate occasions during the study through a standardised questionnaire: one week before bracket placement; 5 to 10 days after changing the first wire and 4 to 6 months later. The subjects were asked 34 questions including, what they had eaten the previous day, their preference for meals and snacks between meals, what they had eaten at school, and questions regarding their dental hygiene. The subjects were also asked how they felt about wearing braces, and finally they were questioned about their socio-economic status.
RESULTS: Sixty two per cent of the patients answered in the second interview that their habits had changed with the braces. After 4 to 6 months only 51 per cent of the subjects could again eat everything. Before the start of treatment 35 per cent of males preferred softer food; in the second interview it was 56 per cent; and 4–6 six months later 46 per cent. Before treatment 53 per cent of the subjects ate many sweets; this number rose in the second interview to 62 per cent, and stood at 57 per cent during the third interview.
CONCLUSION: Patients must be taught not only how to clean their braces and protect them from breakage by avoiding hard food, but also correct and conscientious eating habits in order to prevent caries.

173 DENTO-CRANIOFACIAL MORPHOLOGY OF CLEFT LIP AND PALATE SUBJECTS REQUIRING ORTHODONTIC-SURGICAL TREATMENT

C Tateishi[1, 2], K Moriyama[1], T Takano-Yamamoto[3], Departments of Orthodontics, [1]University of Tokushima and [3]Okayama University and [2]Department of Maxillofacial Surgery, Kobe University, Japan

AIM: To clarify the dento-craniofacial morphology of cleft lip and palate (CLP) patients with severe Class III malocclusions at the pre-treatment stage of surgical-orthodontic treatment.
SUBJECTS: Twelve Japanese males with repaired unilateral CLP (surgical CLP group mean age 21.2 years). Two sets of non-CLP subjects with Class III malocclusions consisting of 19 patients treated surgically and orthodontically (surgical Class III group; mean age 23.4 years) and 14 subjects treated only orthodontically (non-surgical Class III group; mean age 18.7 years).
METHODS: Analyses were performed using lateral and postero-anterior (PA) cephalograms. Sixteen angular and 16 linear measurements for the lateral cephalograms, and four angular and 15 linear measurements for the PA cephalograms were employed for morphological evaluation.
RESULTS: In the lateral views, the surgical CLP group showed significantly smaller values for overjet ($P < 0.001$), SNA angle ($P < 0.01$) and inclination of the maxillary incisor ($P < 0.001$) compared with the surgical and non-surgical Class III groups. The values of SNB angle ($P < 0.05$), mandibular effective length ($P < 0.001$) and ramus height ($P < 0.001$) in the surgical CLP group were significantly smaller than those of the surgical Class III group, but were rather similar to those of the non-surgical Class III group. On frontal views, the mandible and the upper and lower dental arches tended to laterally deviate toward the cleft side. The amount of mandibular displacement was correlated with that of the maxilla.
CONCLUSION: These CLP patients who underwent surgical orthodontic treatment had a characteristic dento-craniofacial morphology as compared with the non-CLP patients with a skeletal Class III malocclusion.

174 ORTHOPANTOMOGRAPHIC ANALYSIS OF DENTAL AND CHRONOLOGICAL AGE

S S Tolpalovic, N L Nedeljkovic, P V Nikolic, Clinic of Orthodontics, University of Belgrade, Yugoslavia

AIM: To estimate dental age and to compare it with chronological age using orthopantomographic analysis.
MATERIAL AND METHOD: Sixty orthopanoramic radiographs of children 6 to 12 years of age (30 girls, 30 boys) attending the Clinic of Orthodontics, Faculty of Stomatology, Belgrade. The calculation was made using the point evaluation system of Nola (1960) and Demirijan (1973). The mineralisation stage of teeth 1–7 in the lower left quadrant were examined. The sum of the individual points gives the developmental value, which can be transferred into dental age with the aid of standard tables for males and females separately. Dental age was compared with chronological age using the *t*-test.
RESULTS: For boys: 109.3 ± 15.94 (chronological age) and 110.04 15.43 (dental age). For girls: 110.98 + 16.53 (chronological age) and 1 4.09 18.99 (dental age).
CONCLUSION: Dental age is greater than chronological in both sexes. Comparing the dental age of boys to girls it was found that girls were older. There was no significant difference between males and females for chronological age.

175 RELIABILITY OF COMPUTER GENERATED DIGITIZING

H Türkkahraman, H İşeri, Department of Orthodontics, University of Ankara, Turkey

AIM: To evaluate the accuracy of cephalometric analysis generated by the Quick Ceph Image Pro (QCIP) software.
MATERIAL AND METHOD: Twenty lateral cephalometric radiographs of various malocclusions were selected. Thirty skeletal, dentoalveolar and soft tissue reference points were marked on acetate on each radiograph. The acetates were first digitized directly using the Pordios software. The same acetates were then scanned and the marked landmarks were digitized on screen using the QCIP software. Finally, the acetates were removed and all the lateral cephalometric radiographs were scanned and digitized on screen again using QCIP software. One month later, the same practitioner marked and digitized all of the reference points again using the above procedures. Cranial base, maxillary, mandibular, dentoalveolar and soft tissue measurements were made according to the different types of digitizing techniques and the results were statistically analyzed by variance analysis.
RESULTS AND CONCLUSION: No significant differences were found between skeletal, dentoalveolar and soft tissue measurements made by the Pordios and QCIP systems. The findings of this study indicate that direct and on-screen digitizing techniques can be used in the analysis of cephalometric radiographs.

176 EFFECT OF RAPID MAXILLARY EXPANSION ON NOCTURNAL ENURESIS

S Üşümez, H İşeri, M Orhan, F A Başçiftçi, Departments of Orthodontics, Universities of Ankara and Selçuk, Turkey

AIM: One effects of rapid maxillary expansion (RME) has been shown to be a reduction in night time bed-wetting in children with varying degrees of nocturnal enuresis (Timms, 1990; Kurol *et al.,* 1998). These studies mentioned a possible relationship between nocturnal enuresis and disturbed sleep patterns due to upper airway obstruction. The aim of this prospective investigation was to analyse the effect of RME treatment in cases of primary nocturnal enuresis.
SUBJECTS: Eight children (6 boys, 2 girls) who had not responded to different conventional medical treatments. The subjects were residents of the Government dormitory and were aged 8–11 years (mean 9 years 5 months). All of the children wet the bed once or twice every night and all had tried conventional treatment, such as a wetness alarm in bed, ADH substitute, etc. An ENT specialist examined the mode of breathing before the RME treatment. No breathing problems were found in 6 of the children.
RESULTS AND CONCLUSIONS: In 7 children a remarkable improvement was observed after 4–5 mm RME. At the end of the 10-week observation period, the improvement in the 7 successful subjects ranged between 56–90 per cent (mean of 73.7 per cent). The unsuccessful case was one of the two cases where symptoms of upper airway obstruction existed at the beginning of RME. Compared with the spontaneous recovery rate of 15 per cent per year, the results are promising.

177 UNRAVELLING THE MYSTERY OF ODONTOGENESIS

H Vastardis, Divisions of Growth and Development (Orthodontics) and Basic Sciences, New York University College of Dentistry, USA

AIMS: An arginine to proline substitution at position 31 (R31P) within the homeodomain of the *MSX1* gene as the cause of an autosomal dominant form of tooth agenesis in one family has previously been identified. In an effort to understand how *MSX1* and particularly Arginine 31 of the homeodomain accomplishes its important developmental role on teeth, the biochemical and biological activities of the wild type and mutant Msx1 were studied.
METHODS: Since Msx1 is a transcription factor implicated in DNA binding through specific target sequence recognition, multimerization and/or transcription regulation, the assays used included the following: DNA binding, glutathione-S-transferase (GST) interaction, transient transfection and retroviral infection.
RESULTS: The biochemical properties of the mutant Msx1, [Msx1(R31P)], are severely impaired since it exhibits little or no ability *in vitro* to interact with target DNA or other partner proteins, or to function in transcriptional repression. It was also shown that Msx1(R31P) is unable to produce any of the effects of the ectopic expression of wild type Msx1 in a developing organ such as the limb, suggesting that the mutant Msx1 is inactive *in vivo*. Furthermore, Msx1(R31P) does not antagonize the activity of wild type Msx1. Taken together, Msx1(R31P) appears inactive both *in vitro* and *in vivo*, does not perturb the actions of wild type Msx1, and demonstrates no novel activities.
CONCLUSIONS: It is, therefore, proposed that the phenotype in affected individuals with selective tooth agenesis is due to reduced dose of MSX1 (haploinsufficiency). Understanding the mechanism by which tooth agenesis is created can be very useful towards advancing diagnosis, treatment prognosis and eventually therapeutics of dental anomalies.

178 STABILITY OF OUTCOME IN 'BORDERLINE' CLASS III ORTHODONTIC OR ORTHODONTIC-SURGICAL TREATMENT

V E Viitanen[1], P Pirttiniemi[1], T Peltomaki[2], Departments of Orthodontics, [1]University of Oulu and [2]University of Turku, Finland

AIM: To examine the amount of relapse after orthodontic-surgical or orthodontic treatment at least 3 years out of retention.

SUBJECTS: Fifteen Class III adult patients (1 male, 14 females) with anterior crossbite treated orthodontically (mean angle ANB –3.3; range –0.1, –5.0) and 15 (4 men, 11 women) treated orthodontic-surgically (mean angle ANB –5.0; range –0.3, –8.2).
METHODS: Standard cephalograms before and after treatment and at least 3 years out of retention were digitised and analysed (both hard and soft tissue) with the Dentofacial Planner programme.
RESULTS: In surgically treated patients there was small but significant sagittal relapse in mandible position (lower molar, point B and Pogonion). The relapse after orthodontic treatment was small and not statistically significant. Only a small amount of soft tissue relapse was seen in both groups.
CONCLUSION: The stability of treatment was fairly good with both methods. The large amount of incisor movement in the orthodontically treated subjects was stable but these patients benefit if the occlusal forces are loaded on as large a dental area as possible.

179 INSULIN-LIKE GROWTH FACTOR-I RECEPTOR EXPRESSION IN DIFFERENT REGIONS OF THE TEMPOROMANDIBULAR JOINT

V Visnapuu, T Peltomaki, O Rönning, Institute of Dentistry, University of Turku, Finland

AIM: Insulin-like growth factor-I (IGF-I) has a local effect on longitudinal bone growth, and IGF-I receptors have been demonstrated in the epiphyseal cartilages of long bones. However, no such information is available regarding the mandibular condylar cartilage. The aim of this investigation was to examine the distribution of IGF-I receptors in the temporomandibular joint (TMJ).
MATERIAL AND METHODS: Long-Evans/Turku rats, three in each of six age groups, ranging from one to 21 days. The animals were killed with an overdose of carbon dioxide and decapitated. The heads were fixed in picric acid-formaldehyde, decalcified in 12.5 per cent EDTA and cut sagittally into two halves. After freezing in iso-pentane the specimens were sectioned sagittally at 9 μm. In order to detect IGF-I receptors the sections were fixed in acetone and treated with 3 per cent H_2O_2/methanol, and IGF-I receptor monoclonal antibody (ICN Biomedicals, Inc., Aurora) was then applied. The reaction product was visualized using the vectastain JABC Elite Kit (Vector Laboratories, Burlingham, CA, USA) with DAB as the substrate. Negative controls without the primary antibody were also prepared. The sections were counterstained with haematoxylin. The staining intensity was assessed by grading, the reaction in different regions of the TMJ on a scale from no (–) to intense (+++) staining.
RESULTS: Examination of the sections revealed that IGF-I receptors were located in the fibrous articular surface, and in the undifferentiated, proliferative and upper chondrocenic cell layers of the condylar cartilage. Distinct enhancement of IGF-I receptor antibody was observed particularly at the superior and postero-superior areas of the condylar cartilage as a function of age. In addition, staining reaction was noted in the bone of the glenoid fossa, in the articular disc, and surrounding muscles in all age groups. Negative controls did not show any reactions.
CONCLUSION: IGF-I receptors are found in most regions of the immature rat TMJ, including the condylar cartilage. Since active receptors are a prerequisite for the function of any growth factor, it is proposed that the early postnatal growth and development of the mandibular condylar cartilage is IGF-I dependent.

180 FREQUENCY OF CRANIOMANDIBULAR AND CRANIOCERVICAL DYSFUNCTION IN PATIENTS WITH ORTHODONTIC TREATMENT NEED

D Wangemann[1,2], F Ifert[1,2], S Kopp[2], [1]Private Practice, Schweina, [2]Department of Orthodontics, Friedrich-Schiller-University Jena, Germany

AIM: To demonstrate the high rate of craniomandibular (CMD) and craniocervical (CCD) dysfunction in patients with orthodontic treatment need.
SUBJECTS: One hundred children aged 6 to 9 years, and juvenile patients 10 to 15 years of age with malocclusion were examined.
METHODS: The spine, shoulders, legs and temporomandibular joints were examined and the results compared with age and malocclusion. The occurrence of headache and pain in the muscles of mastication was also recorded.
RESULTS: A high rate of dysfunction (more than 80 per cent in children and 85 per cent in juvenile patients) was present in this group of patients with malocclusions. A link between malocclusion and speech problems also was obvious in some patients, especially in patients with KISS-syndrome.
CONCLUSION: The occurrence of CMD and CCD must be examined before orthodontic treatment is started. Functional related findings must be recognized and treated as soon as possible because they influence the orthodontic treatment planning itself.

181 A NEW METHOD TO EVALUATE ORTHOPANTOMOGRAPHIC FINDINGS INCLUDING THE DYSFUNCTION-INDEX

D Wangemann[1,2], S Kopp[2], F Ifert[1,2], [1]Private Practice, Schweina, [2]Department of Orthodontics, Friedrich-Schiller-University Jena, Germany

AIM: To present a method evaluating morphological findings on panoramic radiographs with morphological and functional findings in clinical examination with special reference to interdisciplinary co-operation.

SUBJECTS: Two thousand patients who had completed orthodontic treatment (age 6–19 years). The results from clinical and manual examinations, findings from radiographs, and the dysfunction index were studied.
METHOD: A comparison between the clinical examination results and the information obtained from the orthopantomograms was carried out. Special attention was given to determine the dysfunction index. The morphological changes of the condyles were also registered.
RESULTS: The dysfunction index, as an indicator for craniocervical (CCD) and craniomandibular (CMD) dysfunction, showed a different range of positive results, depending on the malocclusion. A statistically significant difference also existed in the occurrence of morphological changes of the condyles ($P < 0.05$).
CONCLUSION: The dysfunction index is helpful in selecting patients with a higher risk of developing CMD and CCD. Individual aspects in treatment planning can be considered.

182 BONE INDUCTION USING AUTOGENOUS BONE VERSUS DEMINERALIZED BONE MATRIX

A M K Wong, A B M Rabie, Orthodontics, The University of Hong Kong, SAR China

AIM: To compare the bone induction ability of autogenous bone grafts with that of demineralized bone matrices of the same origin.
MATERIALS: Forty-eight critical size defects were created on the parietal bone of 26 adult New Zealand white rabbits. Forty defects, in sets of 10, were grafted with intramembranous (IM) autogenous bone, endochondral (EC) autogenous bone, demineralized bone matrix prepared from rabbit intramembranous bone (DBM_{IM}) and demineralized bone matrix prepared from rabbit endochondral bone (DBM_{EC}). The remaining eight defects were used as controls where four defects were left empty as a passive control and the other four were grafted with rabbit skin collagen as positive controls.
METHOD: Tissues were harvested for histological and ultrastructural identification on days 7 and 14. The amount of new bone formation was quantified by image analysis on day 14.
RESULTS: In IM graft and DBM_{IM}, no cartilage cells were identified; whereas both osteoblasts and chondroblasts coexisted in EC graft and DBM_{EC}. Quantitative analysis showed that the DBM_{IM} group formed 69 per cent more new bone than the IM graft ($P < 0.001$), and that the DBM_{EC} group formed 64 per cent more new bone than the EC graft ($P < 0.001$).
CONCLUSION: Demineralized bone matrices are osteoinductive and produce considerably more bone than the autogenous bone.

183 GENETIC ANALYSIS OF VAN DER WOUDE SYNDROME IN FINNISH FAMILIES

F K Wong, Department of Orthodontics, Karolinska Institutes, Huddinge, Sweden

AIM: To examine linkage of Finnish families with van der Woude syndrome (VWS) to the VWS region at 1q32–4l and a proposed modifying locus for cleft palate at 17p11.2–11.1.
SUBJECTS: Five Finnish families affected with VWS. In total, 55 individuals (24 affected) were genotyped.
METHODS: Peripheral blood samples were collected from the participating individuals and DNA purified. Polymerase chain reaction was performed using nine polymorphic microsatellite markers from the VWS region and 5 markers from 17p11.2–11.1. Electrophoresis was carried out on an ABI 377 automatic sequencer. Linkage analysis was performed with the Genehunter computer program.
RESULTS: Ninety per cent of the Finnish VWS patients were affected with cleft palate or submucous cleft palate and 22.5 per cent with lip pits. Linkage analysis at 1q32–41 revealed three linked families with cumulative LOD scores higher than 3.8. Two families were found to be unlinked (LOD <–2. In a linked family, a recombination between DlS2136 and D1S3753 was observed in an unaffected individual, which tentatively refined the VWS locus to a region between D1S491 and D1S3753 (<200 kb). Linkage analysis at 17p11.2–11.1 excluded four families (both linked and unlinked to 1q32–41) with cumulative LOD scores of less than –2 for a 20 cM region.
CONCLUSIONS: Genetic heterogeneity in VWS was demonstrated for the first time in the Finnish families and the VWS locus was tentatively refined to less than 200 kb. The proposed major modifying locus for cleft palate in VWS at 17p1.2–11.1 was excluded.

184 EFFECT OF A PASSIVE LINGUAL ARCH ON LOWER INCISOR POSITION

M Wong, C D Stephens, The North Hampshire Hospital, Basingstoke, England

AIM: To determine if a passive lingual arch disturbs the labio-lingual position of the lower labial segment following premolar extractions.
SUBJECTS: Thirty-one patients with Class II division 1 malocclusions were studied. Ethical approval was obtained and lingual arches fitted. The average age of the patients was 12 years. No active orthodontic treatment was carried out during the first six months.
METHODS: A passive lower lingual arch was placed in all patients prior to the extraction of the upper and lower first premolars. It was left in place for six month with no other treatment in either arch. Lateral cephalometric radiographs were taken immediately before the extraction of the first premolars and again before the start of active orthodontic

treatment. Both angular and linear measurements were used to determine changes in molar and incisor inclination, as described by Miotti (1984).
RESULTS: The method error fell within acceptable limits. There were no changes to suggest that the molar or the incisors moved significantly labially during this period. No significant changes were found between the inclination of the lower incisors before or after the six-month period, LI/Mp: T = 2.371 ($P = 0.05$), L6/Mp: T = 1.632 (NS), I-R line T = –0.417 (NS), L-R: T = –0.489 (NS), L6C-R line: T = –1.235 (NS), L6R-R line: T = –0.489 (NS), I-L6C T = 1.718 (NS).
CONCLUSION: Passive lingual arches appear to be effective in maintaining the position of the lower labial segment following premolar extractions.

185 APPLIANCE BREAKAGE IN PRACTICE AND HOSPITAL ORTHODONTIC UNITS

M Wong, S Power, The North Hampshire Hospital, Basingstoke, England

AIM: To determine the number of extra visits required for the repair of orthodontic breakages in hospital and specialist practice. Penketh (1995) has suggested that breakage appointments should not exceed 5 per cent of booked appointments. This has been used as the 'gold standard' in orthodontic audit (Tyrell, 1998) and was adopted for this study.
SUBJECTS: Fifteen hospital orthodontists and five specialist practitioners took part. Data was collected over a three-month period. Standard breakage forms were sent to each clinician and every patient presenting for orthodontic appliance repair was recorded. The time taken to repair the breakage and type of breakage was also recorded.
RESULTS: Fifteen hospital practitioners and five specialist practitioners returned information for data analysis. Two clinicians had to be excluded due to incomplete data. The successful return rate was 90 per cent. The time spent on the repair of orthodontic appliances during this three-month period in the units studied was equivalent to four 'man' weeks, based on a seven-hour day. The extra visits as a percentage of the booked appointments ranged from 0.39–9.64 per cent in the hospital and from 4.06–8.36 per cent in specialist practice. The three major causes of extra attendance were debonded brackets, removable appliance breakages and wire problems. The results in hospital and specialist practice were similar.
CONCLUSION: Fifty three per cent of hospital units and 60 per cent of specialist practices were within the gold standard. The results reflect a need to examine current practice and identify methods of reducing the incidence of orthodontic breakages. It appears that a small percentage of patients tend to have continual breakages and this will be investigated.

186 COMPARISON OF THE EFFECT OF RETENTION DEVICES AFTER HERBST TREATMENT

D Xi[1], U Hägg[2], A B M Rabie[2], M Bendeus[2], D Leung[2], [1]College of Dentistry, West China University, Chengdu, China and [2]Faculty of Dentistry, University of Hong Kong, SAR China

AIM: To compare the effect of two retention devices after Herbst treatment.
SUBJECTS: Twenty-nine Chinese patients treated with a splinted Herbst appliance for 12–14 months, of whom 11 (mean age 14.1 years) had an activator *ad modum* Andresen and 18 (mean age 14.3 years) had a headgear activator *ad modum* Van Beek for 6 months.
METHODS: Lateral cephalograms taken at the start of the retention period and after 6 months were analyzed according to Pancherz (1982).
RESULTS: There was no difference in the effect on the maxillary base. The mandible came forwards 1.6 mm in the headgear activator group and –1.0 mm in the Andresen activator group, the difference being statistically significant ($P < 0.05$). The maxillary plane was unchanged in both groups. The lower facial height was unchanged and the mandibular plane angle closed (–0.5 degrees) in the headgear activator group. In the Andresen activator group lower facial height increased 1.8 mm ($P < 0.01$) and the mandibular plane angle opened 0.5 degrees.
CONCLUSION: The headgear activator maintained a positive sagittal growth pattern and vertical control. The Andresen activator had a negative effect in both the sagittal and vertical planes on the treatment results achieved by the Herbst appliance.

187 MAXILLARY CHANGES: HERBST VERSUS HEADGEAR HERBST

D Xi[1], U Hägg[2], D Leung[2], A B M Rabie[2], M Bendeus[2], M Boisson[2], [1]College of Dentistry, West China University, Chengdu, China and [2]Faculty of Dentistry, University of Hong Kong, SAR China

AIM: To compare the maxillary changes by conventional Herbst versus headgear Herbst.
SUBJECTS: Fourteen consecutive patients (12.9 ± 1.7 years) treated with a silversplint (conventional) Herbst appliance and 22 consecutive patients (13.2 ± 1.4 years) treated with a silversplint headgear Herbst appliance.
METHOD: Lateral cephalograms were obtained at start of treatment, after six months and at end of treatment (13–14 months). Analysis was made according to Pancherz (1982).
RESULTS: The sagittal maxillary change was 0.6 mm ($P < 0.05$) and 2.0 mm ($P < 0.01$) larger after 6 and 12 months, respectively, with the headgear Herbst compared with the conventional Herbst. There was no difference in the changes of lower facial height, maxillary plane or mandibular plane

CONCLUSION: The headgear Herbst had a significantly more restraining effect on sagittal maxillary growth than the conventional Herbst. The difference became significantly greater with longer treatment.

188 A BIOCOMPATIBLE GLASS CLOTH FOR REINFORCEMENT OF POLYMER RETAINERS

S Yamagata[1], T Imai[1], J Iida[1], M Kobayashi[2], [1]Department of Orthodontics, Hokkaido University, Sapporo and [2]Department of Industrial Chemistry, Chiba Institute of Technology, Japan

AIM: To determine the effect of the glass-cloth on the flexural strength of polymer for retainers.
MATERIALS: All test specimens were formed into a $2 \times 15 \times 40$ mm shape. A biocompatible glass cloth composed of fibres 16 μm in diameter and silanated before fabrication was used as the reinforcing material. Each of them was placed into the neutral zone during polymerization. Specimens without reinforcement were used as the control.
METHODS: A three-point flexural test was carried out with an Instron testing machine (Instron Corp., Canton, MA) with a span of 20 mm and a crosshead speed of 2 mm/min. Each test was continued until the specimens failed.
RESULTS. It was anticipated that the elastic modulus of composite samples would be the same as the intrinsic property of the resin because the glass-cloths had been orientated in the neutral area. It was also found the flexural strength of FRP (107.5 MPa) made in the routine manner could have become 1.3 times larger than the original property (85.07 MPa).
CONCLUSIONS: Adequate improvement in transverse strength of polymer was accomplished simply by placing the glass cloths into them. Glass-cloth may prevent retainer breakage.

189 DNA ANALYSIS IN MANDIBULAR MORPHOLOGY IN COL2A1 AND IL-1β GENES

T Yamaguchi[1], K Maki[1], M Takeda[2], Y Shibasaki[2], Departments of [1]Orthodontics and [2]Biochemistry, Showa University, Tokyo, Japan

AIM: To estimate the relationship between candidate genes and mandibular morphology, and to evaluate whether genetic markers are useful predictors of mandibular growth.
SUBJECTS: Fifty unrelated Japanese men and 100 women without any bone disease were recruited.
METHODS: The genomic DNA was isolated from whole blood. The genotype of the COL2A1 (type II collagen α1) gene and the IL-1β (Interleukin-1β) gene were determined by PCR-RFLP (polymerase restriction fragment length polymorphism). Mandibular morphology from lateral cephalograms and body height was compared between the genotypes using ANOVA and Fisher's protected least significant difference test.
RESULTS: The mean data of each genotype was shown to be significantly different ($P < 0.05$). The IL-1β BsoFI genotype was associated with ramus length (Cd-Go), and the COL2A1 PvuII genotype with mandibular length (Gn-Cd and Pog'-Go).
CONCLUSION: This data suggests that the COL2A1 genotype and IL-1ß are possible predictors of mandibular growth.

190 TONGUE MOVEMENTS DURING ARTICULATION OF VOWELS IN CLASS III SUBJECTS

T Yamamoto, T Imai, K Umeda, T Yamazaki, G Fujii, T Furuya, S Nakamura, J Iida, Department of Orthodontics, Hokkaido University, Sapporo, Japan

AIM: To compare tongue movements during articulation of the five Japanese vowels in normal and skeletal Class III subjects and to acoustically analyse the vowels.
SUBJECTS AND METHODS: Three normal subjects without impairments in hearing or articulation and three skeletal Class III subjects. The newly developed three-dimensional tongue movement measuring device, employing an electromagnetic sensing system, was used to measure tongue movements during articulation and at rest. Speech was quantified at 10-kHz sampling frequency with 12-bit accuracy, and analyzed by the FFT cepstrum method. The first and then the second formant of the vowels were picked up from the spectrum wave form and the frequency of each formant was calculated.
RESULTS: 1) The distance between two vowels in the skeletal Class III subjects was greater in the antero-posterior direction but smaller in the vertical direction compared with normal subjects. 2) The distance between the vowel and rest position in the skeletal Class III subjects was greater than in normal subjects. 3) The frequency distribution of the first and second formants of five vowels in the skeletal Class III subjects was narrower than in normal subjects.
CONCLUSION: The range of tongue movement during speech production in skeletal Class III patients is smaller in the vertical direction and larger in the antero-posterior direction compared with normal subjects. The areas of the point of articulation of the five vowels in the skeletal Class III patients is thought to be narrower than those in normal people in the vertical and antero-posterior direction.

191 SKELETAL CHANGES AFTER ORTHOGNATHIC SURGERY—PLANNING AND SURGICAL RESULTS

W Zenk, S Kopp, Departments of Oro-Maxillofacial Surgery/Plastic Surgery and Orthodontics, Friedrich-Schiller-University Jena, Germany

AIM: To demonstrate differences between three-dimensional (3D) planning on articulator mounted casts and cephalograms and post-operative cephalograms.
SUBJECTS: From a sample of 153 subjects, 6 patients undergoing surgical mandibular positioning were selected.

Only those where investigations and treatment was undertaken by the authors were included.
METHODS: Impressions were taken by pressureless methods. With centric recordings, axiographic measurements and individual facebows, the casts were mounted in the Girrbach Reference-i articulator, planned surgically by the 'Jena Protocol' and compared with the findings of cephalometric analysis pre- and post-operatively (statistical interpretation by Excel 97, Microsoft Corp., SPSS Inc.).
RESULTS: In most cases analysis of lateral cephalograms could not demonstrate the real amount of surgical positioning of the lower arch. Even when using frontal cephalograms for planning the ideal position of the occlusion, there were a number of errors. The results were compared with the real planning data in 'Jena Protocol'.
CONCLUSION: Cephalometrics are a useful tool in planning skeletal relationships in orthognathic surgery cases concerning direction and two-dimensional amount of total displacement. 3D planning in the articulator on mounted casts results in more detailed information such as rotation on the *x*- and *z*-axes and the real amount of displacement for both right and left sides.

192 MORPHOLOGICAL PARAMETERS AS PREDICTORS OF SUCCESSFUL CORRECTION OF CLASS III MALOCCLUSIONS

A Zentner, G M Doll, S Peylo, H G Sergl, Department of Orthodontics, University of Mainz, Germany

AIM: To assess pre-treatment skeletal and dentoalveolar parameters as predictors of successful correction of Class III malocclusions.
MATERIAL AND METHODS: Lateral cephalograms and study models of 78 completed Class III cases were examined to obtain 26 cephalometric parameters (CP) used in Schwarz and McNamara analyses, and to measure the size and spatial relationship of apical bases (ABR) using previously described methods (Sergl *et al*., 1996). Success of occlusal correction was evaluated as percentage changes of PAR scores (per centPAR) during treatment, which were used as dependent variables in correlation and regression analyses testing predictive values of CP and ABR measurements and patient's age.
RESULTS: Correlations between most CP and per centPAR were weak, and none of the CP describing sagittal jaw relationship or patient's age were associated with per centPAR. Among dentoalveolar parameters only ABR (R2 = 0.071, $P = 0.018$), and from vertical CP only Go angle ($R^2 = 0.066$, $P = 0.024$) were related to per centPAR. Among CP describing jaw size discrepancy only the relationship of mandibular length to ramus height ($R^2 = 0.052$, $P = 0.044$) was related to per centPAR. Multiple linear regression analysis showed that only ABR supported the ability to predict per centPAR ($R^2 = 0.148$, $P = 0.042$).
CONCLUSION: Cephalometric measurements of pre-treatment patterns of craniofacial morphology are poor predictors of successful correction of Class III malocclusions. Assessment of the size and spatial relationship of apical bases may serve as a valuable diagnostic addition in the prediction of successful treatment outcome.

Sergl H G, Kerr W J S, McColl J H 1996 A method of measuring the apical base. European Journal of Orthodontics 18: 479–483

193 CRANIOFACIAL HARMONY IN CLASS II MALOCCLUSIONS

I N Zetu, V, Dorobat, M Pacurar, C Raomanec, G Chirakis, Departments of Orthodontic, Universities of Iasi and Tg. Mures, Romania

AIM: To examine the treatment related changes of craniofacial harmony following functional orthopaedic and fixed appliance treatment in subjects with Class II malocclusions.
MATERIAL AND METHODS: Cephalometric lateral films obtained before and after therapy, of 52 subjects (23 males, 29 females) with a Class II malocclusion. Two cephalometric analyses were undertaken for each subject: the classic one using Coben's analysis with the Frankfort plane as a reference, and a modified one, using the SN plane for orientation. The angular variation between Frankfort plane and SN plane, as well as the average for the whole sample, was calculated.
RESULTS: In the study of the facial depth, the divergences between the two analyses were significant for the segments: BAS, BaA, GoPo, BaPo, the facial depth being more important when referring to the SN line. The participation of ArPo was less. The participation of the different segments at the facial depth on the segmental diagrams was better: an increase for BaS (7.9 per cent SN, 5.2 per cent Frankfort); a decrease for SPtm (3.4 per cent SN, 4.6 per cent Frankfort); and an increase for BaAr.
CONCLUSION: For estimating the facial aesthetics pre- and post-orthodontically in subjects with Class II malocclusions, Gracia's analysis as well as Coben's modified analysis seems to be extremely illustrative.