ABSTRACTS

OF POSTERS

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1 ASSESSMENT OF THE RELATIONSHIP OF POINTS A AND B TO THE FRANKFORT HORIZONTAL PLANE

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AIMS: To derive the formula to modify SNA, SNB by Frankfort Horizontal (FH) to SN angle and to investigate the relationship of points A and B to the FH plane.
SUBJECTS AND METHOD: One hundred and eighteen adult Japanese (61 males, 57 females) with a normal occlusion. Lateral cephalograms were traced and the cephalometric data were calculated. Regression analysis was carried out, with the differences of SNA, SNB from the mean values as dependent variables, and the difference of FH to SN from the mean value as the independent variable. Po-N′-A, Po-N′-B angles (N′ is a projection from N on FH plane) were measured. The relationship between Po-N′-A, Po-N′-B and SNA, SNB was investigated with regression analysis.
RESULTS: 1. Correlation coefficients for SNA modification formulas were –0.70 (male), –0.53 (female), and for SNB modification –0.52 (male), and –0.50 (female). R (multiple correlation) was from 0.41 to 0.54. 2. Means and standard deviations of Po-N′-A, Po-N′-B in normal subjects were 89.40, 5.39 and 85.46, 4.29 for males, and 89.72, 5.16, 85.74 and 3.70 for females, respectively. 3. Po-N′-A was represented by SNA, FH to SN and facial height (N-Me), and Po-N′-B with SNB, FH to SN and facial height (N-Me). R was from 0.92 to 0.98.
CONCLUSIONS: 1. Modification formulas for SNA and SNB by FH to SN were obtained, but R was relatively low. 2. Po-N′-A and Po-N′-B were introduced as indices to assess the relationship of points A and B to the FH plane. These angles were estimated by SNA, SNB, FH to SN, facial height (N-Me), with a high degree of accuracy.

2 BIOMECHANICAL ANALYSIS OF MANDIBULAR OSTEODISTRACTION USING A THREE-DIMENSIONAL FINITE ELEMENT METHOD

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AIM: To show the possibilities a three-dimensional (3D) model of a human mandible obtained using finite element (FE) modelling offers in the analysis of biomechanical effects of mandibular distraction.
MATERIAL AND METHODS: The mathematical mandibular model was obtained from laser digitization performed at the Centre of Innovation and Services (Galicia, Spain), with a final mesh of 22,042 nodes and 108,200 3D-elements in which each tooth can be individualized. This 3D-model was used in a preliminary study simulating real conditions of distraction forces for mandibular widening with a separation of 4 mm to both sides of the midsymphyseal zone. The norm of displacement and the average stress values accumulated in the different mandibular areas were analysed.
RESULTS: Compressed zones in the external surface of the symphysis, the medial surface of the neck of the condyle and the lateral edge of the condyle were observed. Negative values indicated stretched zones in the internal surface of the symphyseal region and the medial pole of the condyle.
CONCLUSIONS: This 3D-FE model of the human mandible shows the possibility of performing, with mathematical accuracy, mandibular behaviour when different forces are applied. Therapeutic procedures such as mandibular distraction osteogenesis can be simulated satisfactorily by means of these computerized systems.

3 INVESTIGATION INTO THE EFFECTS OF MECHANICAL DEFORMATION AND OESTROGEN ON BONE REMODELLING

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AIMS: Investigations into the production of IL-1β by human osteogenic sarcoma cells (Saos-2) *in vitro*, as a consequence of mechanical deformation, including the expression of RANKL in an *in vivo* ovariectomized (OXV) mouse model using *in situ* hybridization and immunolocalization techniques.
MATERIALS AND METHODS: In the first part of the study an *in vitro* Petri dish model of mechanical stimulation was used to investigate the production of IL-1β by Saos-2 cells in response to stress over varying time periods (0, 3, 6, 12, 24, 36 and 48 hours). In the second part indirect *in situ* hybridisation was used to detect the cellular induction of RANKL mRNA, and indirect immunolocalization of RANKL protein in OVX and sham-operated (SHAM) mouse distal femoral head.
RESULTS: The production of IL-1β was found to be enhanced by mechanical stimulation, with increasing amounts produced over time. A Student's *t*-test demonstrated no statistical significance between the stimulated and control samples. Immunolocalization of RANKL protein in the mouse distal femoral head was shown to be consistent with the mRNA expression seen in the *in situ* hybridization study for both OVX and SHAM operated samples. This is the first report of RANKL immunolocalization using commercial antibodies.
CONCLUSION: Both mechanical stimulation and oestrogen deprivation have an influence on the process of bone remodelling. Current studies suggest that both oestrogen and mechanical strain stimulate osteoblast proliferation through the oestrogen receptor. With an increasing level of orthodontic provision in the adult female population there is a possibility that in post-menopausal female patients the rate of tooth movement may be affected by the absence of oestrogen.

4 VERTICAL AND SAGITTAL DIMENSION CORRECTIONS WITH FUNCTIONAL APPLIANCE THERAPY IN GROWING PATIENTS

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AIM: To analyze the clinical efficacy of the monobloc appliance in mandibular skeletal Class II deep bite therapy.
SUBJECTS AND METHOD: Thirty-five young patients with mandibular Class II features (SNB 76.8°). The diagnosis was performed using Jarabak and Pancherz's latero-lateral cephalometric analyses. The appliance was constructed and clinically managed in the same way during treatment, starting from the growth peak, for an average period of 1 year 8 months.
RESULTS: At the end of therapy, clinical and cephalometric studies showed a statistically significant increase in SNB angle with condylar growth, and also in Go-Me and SNA-Me distances.

5 BILATERAL MAXILLARY MOLAR DISTALIZATION WITH MODIFIED SLIDER

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AIM: To move upper first molars in a distal direction without distal tipping and with minimum anchorage loss.
SUBJECTS AND METHOD: Five female and two males patients with a mean age of 13.39 ± 1.53 years. All subjects were without crowding in their lower arches and with a dentally Class II molar relationship on both sides. They had a normal or low vertical growth pattern. No anterior bite plane was used and the diameter of the stainless steel wire, used as a guide for maxillary molar sliding, was increased to 1.2 mm as a modification of the molar slider appliance. The purpose of this increase in diameter was to prevent molar tipping and rotation during distalization. An 11 mm long Ni-Ti open coil spring that gave

150 g of force to slide the molars distally was used. Lateral cephalograms and cast models were analysed before and after the molar distalization. A non-parametric Wilcoxon signed rank test was used for statistical evaluation.
RESULTS: The maxillary first molars were distalized an average of 3.13 ± 1.19 mm without any tipping or extrusion. The maxillary first premolars were mesialized an average of 1.31 ± 1.05 mm and extruded an average of 2.25 ± 0.93 mm. The maxillary central incisors were proclined on average by 1 mm and tipped labially on average 2.12 degrees. Model analysis showed an average increase of 0.87 ± 0.95 mm in the transverse distance between the upper first molars. There was no change in skeletal vertical parameters.
CONCLUSION: Parallel upper first molar distalization with minimum anterior anchorage loss was achieved with this modified Keles slider appliance.

6 CEPHALOMETRIC EVALUATION OF A MODIFIED MAXILLARY PROTRACTION FACEMASK

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AIM: To evaluate the clinical effects of a modified maxillary protraction facemask through the application of a specially designed facebow that carries the point of force application from the centre of resistance (CR) of the maxillary dentition.
SUBJECTS AND METHODS: Twelve patients with a mean age of 12.42 years. A Hyrax expansion screw with a full coverage acrylic cap splint was constructed and rapid palatal expansion was performed for 7 days. On the 7th day, protraction therapy using a combination of a specially designed facebow and a Petit type facemask was started. The facebow was bent upwards to raise the point of force application to pass through the CR of the maxilla, and to have parallel application of the elastic force on both sides. A unilateral 500 g force was applied and the patients were instructed to wear the facemask for 16 hours a day. The average treatment time was 7.5 months. Lateral cephalometric films were taken before and immediately after removal of the appliance.
RESULTS: The appliance was effective in protracting the maxilla where point A moved anteriorly by 2.41 mm. Anterior translation of the maxilla without counterclockwise rotation was achieved. The maxillary occlusal plane showed significant clockwise rotation. The maxillary incisors were extruded and retroclined because of clockwise rotation of the maxillary dentition. The mandible displaced downward and backward.
CONCLUSION: Using this new facebow design, which was modified from that introduced by Nanda (1980), the maxilla can be protracted bodily and at the same time have a more effective force system where the whole protractive force is utilized in protracting the maxilla.

7 INTERLEUKIN-1β LEVELS IN GINGIVAL CREVICULAR FLUID DURING RAPID AND SLOW MAXILLARY EXPANSION

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AIM: To evaluate and compare interleukin-1β (IL-1β) levels in gingival crevicular fluid (GCF) collected from maxillary molars during rapid (RME) and slow (SME) maxillary expansion.
SUBJECTS AND METHOD: Eighteen patients with a bilateral crossbite were selected (9 patients for RME, 9 patients for SME). After oral hygiene instruction, a modified Hyrax appliance was inserted. In the RME group the jackscrew was activated four times during the first day and then twice daily until the appropriate expansion was achieved. In the SME group the jackscrew was activated once every three days. GCF samples were collected with perio paper from the buccal and palatal aspects of the left and right maxillary first molars at 11 different observation periods. The samples were analyzed using ELISA. For statistical analysis, intragroup differences were compared with a Wilcoxon test and intergroup differences with a Mann Whitney *U*-test.
RESULTS: There were statistically significant differences from baseline to the end of the study in the RME and SME groups. IL-1β levels were increased during the activation period compared with baseline in both groups palatally and buccally. There was no significant difference between either group at the buccal or palatal sites.
CONCLUSION: Although different activation procedures were used in the RME and SME groups, the change in IL-1β levels in GCF indicated similar patterns in both groups.

8 COMPARISON OF THREE-DIMENSIONAL BIMETRIC MAXILLARY DISTALIZING ARCHES WITH CERVICAL HEADGEAR: DENTOFACIAL EFFECTS

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AIM: To evaluate and compare the effects of three-dimensional bimetric maxillary distalizing arches (3D-BMDA) and cervical headgear on dentofacial structures of subjects with an Angle Class II molar relationship, skeletal Class I or II malocclusion.
SUBJECTS AND METHOD: Twenty-one individuals treated with 3D-BMDA and 18 with cervical headgear. As the treatment period was longer in the cervical headgear group, the results of this group were compared with a control group of 17 individuals with similar dental, skeletal and growth characteristics. In order to define the similarities and differences between the effects of a 3D-BMDA and cervical headgear, 12 angular, 32 linear and two proportional parameters related to the skeletal and dentoalveolar structures and soft tissue profile were measured on the lateral cephalometric radiographs.
RESULTS: The period for moving the molars from a Class II to a Class I relationship for the 3D-BMDA and cervical headgear groups was 3.4 and 10.2 months, respectively. A significant amount of maxillary molar distalization was achieved with both techniques. A Class I molar relationship was achieved with pure upper first molar distalization in the cervical headgear group, while it was achieved with both upper first molar distalization and lower first molar mesialization in the 3D-BMDA group. In the 3D-BMDA group the mandibular incisors were protruded significantly by the effect of Class II elastics used with a fully bonded mandibular arch. Although no change was observed in the 3D-BMDA group, a significant increase was observed in the mandibular plane angle in the cervical headgear group. Cervical headgear created a retrusive effect on sagittal growth of the maxilla although it was only used for molar distalization. The most significant finding was the significant effect of 3D-BMDA on sagittal growth of the mandible.
This study was supported by Ankara University Research Fund as Project No: 980200003.

9 FEEDING, SUCKING AND MALOCCLUSIONS IN 3-YEAR OLDS

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AIM: To register sucking and feeding habits and dental development in 3-year-old Norwegian girls.
SUBJECTS AND METHODS: Sixty randomly selected 3-year-old Norwegian girls belonging to two health and welfare districts in Oslo.

The girls were examined intraorally by one author (EMA). The escorting parent was interviewed. The following parameters were recorded: breast-feeding; start, duration and age of weaning; sucking habits; type, onset and duration; malocclusion; open bite, uni/bilateral crossbite, crowding, forced bite and cusp-to-cusp relationship.
RESULTS: Ninety-six per cent of the girls were breast-fed, the mean breast-feeding time being 10 months. Eighty-six per cent were breast-fed for more than half a year. Sixty-two per cent developed an initial artificial sucking habit (42% became pacifier-suckers and 20% digit-suckers). Five girls did not start an artificial sucking habit until weaning at the age of 12–36 months. The mean duration of breast-feeding was longer for the girls who did not develop an initial artificial sucking habit (14 months) than for the pacifier-sucking girls (8 months) and for the digit-suckers (10 months). At the age of 3 years, six of the 29 pacifier-sucking girls had stopped their habit. None of the digit-suckers had stopped. Thirty-five girls (58%) were registered as having a malocclusion. Of those, 63 per cent were pacifier-suckers and 28 per cent digit-suckers. Of the 23 girls who still were pacifier-suckers at 3 years of age, seven (24%) had developed a posterior crossbite.
CONCLUSIONS: Girls who are breast-fed for a longer period are less prone to develop an artificial sucking habit than those who are not breast-fed or only fed for a short time. Especially pacifier-sucking, but even digit-sucking, in early childhood is associated with a high degree of malocclusion.

10 PERIORAL FORCES OF MANDIBULAR PROGNATHISM ON THE INCISORS AND MOLARS

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AIM: Dental arch form and tooth position are said to be influenced by perioral forces, especially those of the tongue, lip, and buccal. In this study, tongue, lip, and buccal pressure to the maxillary and mandibular incisors and molars was measured and compared in subjects with and without mandibular prognathism.
SUBJECTS AND METHOD: Eight subjects (4 males, 4 females, mean age: 23.9 years) with mandibular prognathism and eight normal subjects (4 males, 4 females, mean age: 27.4 years). The measuring points were on the maxillary and mandibular incisors and molars. These were at the edge and cervix of the lingual surface and at the centre of the labial or buccal surface of these teeth. Tongue, lip, and buccal pressure were measured during rest and swallowing.
RESULT: There was no significant difference in tongue rest period between subjects with and without mandibular prognathism. During swallowing, the tongue pressure was largest at the cervix of the mandibular incisor and molar ($P < 0.05$) and smallest at the lingual surface of the maxillary incisor ($P < 0.05$).
CONCLUSION: The tongue position in subjects with mandibular prognathism is lower than in those without mandibular prognathism.

11 DIFFERENTIAL DIAGNOSIS OF SKELETAL CLASS III

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AIM: To reveal the differential diagnosis of a skeletal Class III pattern in the pre-pubertal period.
MATERIAL AND METHODS: Lateral cephalograms and hand wrist films of 74 individuals with skeletal Class III malocclusions. The growth period was limited between Pisi, H1, R and S, H2 hand-wrist stages. The mean age of the patients was 10 years 2 months (SD: 1.8) and all were in the mixed dentition period. Inter-jaw relationships were determined by McNamara's analysis.
RESULTS: The subjects in the first group demonstrated maxillary retrusion with a normally positioned mandible ($n = 36$, 48.6%), the second group had a normal maxillary position with mandibular protrusion ($n = 10$, 13.5%) and the third group included a retrusive maxilla with a protrusive mandible ($n = 28$, 37.8%). Regarding this classification, the distribution of the individuals within each group and the differences between the groups were statistically assessed.
CONCLUSION: One of the leading aspects for comprehensive treatment planning, hence, successful treatment results, is the differential diagnosis of Class III malocclusions.

12 PROFILE CHANGES ASSOCIATED WITH DIFFERENT ORTHOPAEDIC TREATMENT APPROACHES IN CLASS III SUBJECTS

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AIM: To evaluate and compare the soft tissue effects of a chin cup (CC), chin cup plus bite plate (CC+P) and reverse headgear (RH) therapies with each other and an untreated control group.
MATERIAL AND METHOD: Lateral cephalometric and hand-wrist films obtained from 59 Class III patients and 20 non-treated control subjects. Thirty-one patients were treated with a CC, 14 with CC+P and 14 with RH and a Class I relationship was achieved. The mean pre-treatment chronological ages were approximately 11 years and the observation period was 1 year for all groups. The cephalometric films were analyzed according to the structural superimposition method of Björk. All tracings were double-digitized and the measurements calculated by a computer program (Pordios). *t*-tests were performed to evaluate changes within the groups, and the differences between the groups were analyzed using ANOVA and Duncan tests.
RESULTS: Forward positioning of the maxilla was more significant in the RH group, whereas the mandible was positioned significantly backward in all treatment groups ($P < 0.001$). Posterior rotation of the mandible was more pronounced in the CC+P and RH groups. In all treatment groups the overjet increased and the overbite decreased significantly. Forward movement of soft tissue A and upper lip was significant in all groups, but more pronounced with CC+P and RH. The soft tissue chin was positioned significantly backward and retrusion of the lower lip was significant in the CC and CC+P groups ($P < 0.001$).
CONCLUSION: Improvements in dentofacial profile were achieved with all orthopaedic treatment modalities. Soft tissue changes in the mandibular region were significant in the CC and CC+P groups, whereas in the maxillary region more significant and similar improvements were obtained with CC+P and RH. Long-term studies are required in order to confirm the stability of these changes.

13 ORTHODONTIC TREATMENT OF PATIENTS WITH MICROGNATHIA AFTER COMPRESSION-DISTRACTION OSTEOSYNTHESIS

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AIM: To determine age-dependent orthodontic treatment after compression-distraction osteosynthesis (CDO) for achievement of optimal results.
SUBJECTS: Seventy-seven patients, aged 1 to 18 years, with congenital and acquired mandibular defects and deformities in whom CDO was carried out during the last four years.
METHODS AND RESULTS: After CDO the majority of patients had a poor occlusion that required orthodontic treatment after removal of the compression-distraction devices (CDD). The algorithm stage of orthodontic treatment of patients after CDO was determined. In the period of the primary and mixed dentition before removing the CDD,

removable retention bimaxillary appliances, which stabilized the position of mandible achieved during surgery, were constructed and fitted. The use of this type of appliances for 6–12 months preserved the the size of new bone up to its complete mineralization, and normalized muscle function in the new mandibular position. For children under 12 years of age functional appliances were used to optimize maxillary growth with respect to the mandible. For children over 12 years of age in the permanent dentition, fixed appliances were used. CDO was performed simultaneously with incomplete maxillary osteotomy and intermaxillary immobilization using the straightwire technique. In the process of CDO simultaneous lengthening of the upper and lower jaws took place, which corrected the occlusal plane.
RESULTS: In 90 per cent of subjects good results were achieved, in 6 per cent these were satisfactory, and in 4 per cent unsatisfactory.

14 TEMPOROMANDIBULAR JOINT INVOLVEMENT IN PATIENTS WITH EARLY STAGE JUVENILE IDIOPATHIC ARTHRITIS

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AIM: To study the prevalence of temporomandibular joint (TMJ) involvement and signs and symptoms of temporomandibular dysfunction (TMD) in children with newly diagnosed juvenile idiopathic arthritis (JIA).
SUBJECTS AND METHODS: Children with onset of chronic arthritis fulfilling ILAR classification criteria during the period August 1998–July 2000 in Helsinki University Central Hospital district were invited for the study. Eighty-nine children (59 girls, 30 boys) with a mean age of 7.5 years (range 1.8–15.9 years) participated. Clinical examination included orthodontic evaluation and recording of signs and symptoms of TMD. Ten of the patients were too young for radiographic examination, which included panoramic and TMJ radiographs.
RESULTS: The children were examined 7–13 months after the first symptoms of JIA. At interview, six of the children (7%) reported pain during mouth opening and three (3%) impaired mandibular mobility. On clinical examination, however, many signs and symptoms of TMD were found. Ten per cent of the children complained of pain or palpatory tenderness in the condyles or muscles, seven (7%) had deviation in jaw opening and five (6%) showed a reduced opening capacity. Clicking or crepitation of the TMJ was recorded in eight (9%) of the patients. Fourteen children (16%) showed mandibular asymmetry. Radiographic condylar changes were seen in 23 (29%) of the patients.
CONCLUSIONS: TMJ involvement in JIA is common even in the early stage of the disease. Nearly one-third of the patients had condylar lesions, with many signs of TMD seen at clinical examination.

15 GROWTH CHANGES FOLLOWING ADENOIDECTOMY PERFORMED AT DIFFERENT GROWTH PERIODS

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AIM: To retrospectively and cross-sectionally compare the vertical growth component of the craniofacial structure of subjects with early and late adenoid removal and controls.
MATERIALS AND METHOD: Ninety-three lateral cephalometric radiographs of 42 boys and 51 girls, with various malocclusions. The adenoidectomy patients were referred for surgical procedures for their obstructed nasal breathing. The control group had no history of nasal obstruction, nasorespiratory allergy, or recurrent otitis media. None of the patients had undergone orthodontic treatment. For assessment of vertical growth direction, SNGoMe, PPGoMe, gonial angle, gonial ratio, sum of the internal cranial angles, ANSMe/NMe, and Jarabak's ratio were measured. Linear nasopharyngeal and oropharyngeal airway measurements were investigated by PNS-ad1, PNS-ad2, OAW1, OAW2, and OAW3 as defined by earlier research.
RESULTS: The Mann-Whitney *U* test from the SPSS program was used for analysis. The data obtained from the two adenoidectomy groups were compared and since no statistically significant difference was found except for ANSMe/Nme, the two groups were combined for subsequent analysis. Airway measurements showed that the upper airway in the adenoidectomy group was narrower in the sagittal plane than in the control group.
CONCLUSION: There were no differences in the vertical growth pattern except for one parameter, between the two groups of children who had an adenoidectomy before and after 4 years of age.

16 PRELIMINARY RESULTS OF THE BRACKET SCREW BONE ANCHORAGE SYSTEM IN BEAGLE DOGS

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AIM: To evaluate the bracket screw bone anchorage (BSBA) system, when loaded at different time intervals.
MATERIALS AND METHODS: BSBA consists of a titanium bracket (Orthos2T, Ormco, Orange, California) laser-welded on a titanium bone screw (diameter 1.7 mm, length 6 mm, Leibinger®, Freiburg). In five Beagle dogs, two BSBAs were placed on each side of the lower jaw, between the first and second and between the second and third premolar. On the left side, the BSBAs were loaded immediately with a nitinol closed coil spring exerting a continuous force of 200 cN. On the right side, the BSBAs were loaded after 6 weeks in two dogs, and after 3 months in one dog with 200 cN.
RESULTS: At baseline, 25 per cent of the BSBA revealed a lack of primary stability. At the 6 week evaluation, five of the 10 immediately loaded (50%) and three of the 10 (30%) unloaded BSBAs were lost. After 3 months, six of the 10 immediately loaded (60%) and one of the four (25%) BSBAs, loaded at 6 weeks, were lost. The losses were 100 per cent for the first two dogs and 12.5 per cent for the last two dogs, probably due to the learning curve for placing the BSBA.
CONCLUSIONS: No conclusions can be drawn so far concerning the ideal moment for loading the BSBA. Follow-up investigations are recommended in order to establish the ideal moment for loading. The failure rate decreases with increasing experience in placing the BSBAs.

17 LINGUAL RETAINERS BONDED WITH HYBRID AND FLOWABLE COMPOSITES—A CLINICAL COMPARATIVE STUDY

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AIM: To compare the survival rate of lingual retainers bonded with a flowable composite (Tetric Flow®, Vivadent, Liechtenstein) and a commonly used hybrid composite (Transbond LR®, Unitek, Monrovia).
SUBJECTS AND METHODS: One hundred consecutive orthodontic patients, treated in two private practices, for whom lingual retainers in the lower arch were indicated. The retainers were bonded using a split-mouth design: one side was bonded with Tetric Flow® and

the other side with Transbond LR®, or *vice versa*. In one practice, the enamel surfaces were conventionally scaled and pumiced prior to bonding while in the other, sandblasting (SiO_2, 50 μ) was added. The patients were followed during a 12-month period.
RESULTS: Overall 10 per cent of the retainers failed. There was no statistically significant difference in the percentage of failures between the two types of composite ($P > 0.05$). In 79 per cent bond failure occurred at the composite-enamel interface. The time of failure varied from 1.5 months to 1 year after placement. The survival rate was 100 per cent in the practice where the enamel was sandblasted and 80 per cent in the other practice.
CONCLUSIONS: A flowable composite can perform as well as a hybrid composite in bonding lingual retainers. Sandblasting prior to bonding might provide improved results. These findings might also indicate that the success rate is greatly practitioner-dependent.

18 CEPHALOMETRIC EVALUATION OF ANTERIOR OPEN BITE TREATMENT USING NiTi ARCHWIRES AND ANTERIOR ELASTICS IN ADOLESCENTS

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AIM: To evaluate the clinical effects of upper accentuated and lower reverse curve NiTi archwires and anterior elastics in anterior open bite (AOB) treatment in adolescents.
SUBJECTS AND METHODS: Ten patients (8 females, 2 males) with an age range of 12.2 to 14 years. All presented a high angle skeletal pattern and an AOB that ranged between 1 and 5 mm, average 2.33 mm. The skeletal relationship in the sagittal plane was Class I, and the dental relationship was Class I or mild Class II. After initial levelling, 0.016 × 0.022 inch upper accentuated and lower reverse curve archwires were placed, with elastics applied in the canine regions. Cephalometric assessment was carried out on lateral head films taken at the beginning of treatment and on average 3 months after open bite closure was obtained.
RESULTS: The upper and lower incisors and upper and lower first premolars were both significantly uprighted and extruded. The upper and lower first molars were uprighted significantly, and slightly extruded; however, this extrusion was not statistically significant. The functional occlusal plane rotated counterclockwise in relation to S–N and palatal planes. There was a significant increase in overbite due to extrusion of the upper and lower incisors, while the overjet was reduced as a result of uprighting of both upper and lower incisors.
CONCLUSION: The treatment of AOBs was effective in young adolescents. Further studies are required to investigate long-term stability.

19 EVALUATION OF THE FACIAL PROFILE OF PROGNATHIC PATIENTS

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AIM: To establish if there is dependence of soft tissue changes in the skeletal morphology of patients with prognathic profiles.
MATERIALS AND METHOD: Forty-five lateral cephalograms of patients with a prognathic profile; eight had a dentoalveolar and 37 a skeletal type anomaly; six were associated with an open bite and 39 with a deep bite. Steiner and Ricketts' methods were used to study the hard tissues and the analyses of Burstone and Holdaway for soft tissue evaluation.
RESULTS: In patients with increased skeletal measurements: S-N-Pg 11.6 degrees and N-A-Pog 13 degrees, the convexity of the soft tissue profile was elevated (G′-Sn′-Pog′ by 19º). The thickness of the mandibular soft tissues (B-B′, Pog-Pog′) was decreased 3 mm, the genio-labial angle was increased 26 degrees and the lower nasolabial angle decreased 8 degrees. Pogonion-labial angle (Ls-Pg-Li) was negative, on average 7.5 degrees.
CONCLUSIONS: Evaluation of the facial profile showed a difference between skeletal convexity and soft tissue convexity of 6 degrees. This can be explained by the increase in upper lip thickness, superior alveolar compensation, hyper strain and thinning of the mandibular soft tissues.

20 HYPERSENSITIVITY TO METALS IN ORTHODONTIC PATIENTS: COMPARISON AMONG MALES AND FEMALES

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AIM: To determine the frequency of metal hypersensitivity in orthodontic patients, since metals are routinely used in orthodontic treatment. The results were distinguished among male and female patients to investigate differences between the two sexes.
SUBJECTS AND METHOD: Forty patients (20 males, 20 females) aged 7 to 14 years. A questionnaire, subdivided into four different sections, was distributed. The questions concerned anamnesis and any personal allergic predisposition. All the patients underwent patch testing using some of the allergens from the Girdca® standard and Trolab® dental series. The patch tests were applied to the patient's back using Finn Chambers supports. The patch tests were removed and interpreted after 48 and 72 hours.
RESULTS: There were considerable differences between the sexes. The patch test showed a hypersensitivity to nickel in 10 per cent of the males and 30 per cent of the females. The reaction to chromium was: males 10 per cent, females 15 per cent, and to gold males 5 per cent, females 15 per cent. In addition several other percentuals in the two sexes were found for the remaining constituents.
CONCLUSION: The frequency of metal hypersensitivity in young people has recently increased, with nickel being the most common cause of contact allergy among European women. Epidemiological data indicate that metal allergy is more common in females, probably because of frequent contact with jewellery and ear piercing. The results show the prevalence of hypersensitivity to metals in the females compared with male patients.

21 CLASSIFICATION CRITERIA OF JUVENILE IDIOPATHIC ARTHRITIS AND TEMPOROMANDIBULAR JOINT INVOLVEMENT

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AIM: The definition juvenile idiopathic arthritis (JIA) is used to describe all forms of arthritis that occur before 16 years of age, which lasts more than 3 months and whose cause is unknown. On the basis of diagnostic criteria, modality of appearance and laboratory data, it has nevertheless been possible to distinguish three main forms of JIA: 1) Systemic; 2) Polyarticular (with two subgroups: F. polyarticular serum-positive and F. polyarticular serum-negative); and 3) Pauciarticular. The purpose of this study was to investigate the percentage of temporomandibular joint (TMJ) involvement related to the subsets of the rheumatic chronic disease and the incidence of unilateral or bilateral forms from 1992 until the present time
SUBJECTS AND METHOD: One hundred and two patients (80 females, 22 males) aged 6 to 16 years, with confirmed JIA. All had TMJ involvement, 45 per cent bilaterally, 55 per cent unilaterally. A diagnostic work-up was carried out involving tomograms of the TMJ and cephalometric analysis.

RESULTS: The results showed a M/F relationship of 1:3. In this sample, the TMJ was generally more affected in those children suffering from the pauciaticular form, followed by the polyarticular form. In 55 per cent TMJ involvement was unilateral with very difficult therapeutic implications. The importance of an early approach to prevent severe arthritic deterioration of the TMJ is confirmed.

22 HEADGEAR-ACTIVATOR WITH MAXIMAL JUMPING VERSUS HEADGEAR-SPLIT-ACTIVATOR STEP-BY-STEP JUMPING OF THE MANDIBLE

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AIM: To compare the treatment changes with different modes of mandibular advancement with a removable functional appliance.
SUBJECTS AND METHOD: Two groups of consecutive Chinese patients with skeletal Class II malocclusions treated with a headgear-activator, one group (n = 43; mean age 11.5 years) was treated with maximal advancement of the mandible (van Beek, 1982) and the other group (n = 10; mean age 12.3 years) by step-by-step advancement (4 mm at start of treatment; 4 mm every three months) of the mandible (Robinson *et al*., 2003). Data on condylar growth changes were obtained from the first group who were followed before active treatment. Full-mouth-open lateral cephalograms obtained at the start (T0) and after 6–8 (T1) and 12–14 (T2) months of treatment were analysed according to the method of Pancherz and Hägg (1985).
RESULTS: There was a significant and similar effect on both vertical and sagittal condylar growth during initial treatment (T0–T1) with both devices. During the late treatment period (T1–T2) there was no effect, the changes remained close to those of growth only for maximal jumping of the mandible, whereas for step-by-step advancement of the mandible the condylar growth in both dimensions continued to be enhanced and remained at the same level also during the late period of treatment (T1–T2).
CONCLUSION: The mode of bite-jumping affects condylar growth. Step-by-step advancement of the mandible continues to enhance mandibular growth throughout treatment, whereas maximal jumping of the mandible enhances condylar growth only during initial treatment.

23 HEADGEAR-ACTIVATOR—IS TREATMENT RESPONSE AFFECTED BY DIFFERENCES IN DENTO-FACIAL MORPHOLOGY?

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AIM: To compare the treatment changes in two ethnic groups with different dento-facial morphology treated with a headgear-activator.
SUBJECTS AND METHOD: Two groups of consecutive co-operative skeletal Class II patients treated with a headgear-activator (van Beek, 1982), one group of Chinese boys (n = 20; mean age, 11.5 years) and the other group Caucasian boys (n = 17; mean age, 11.7 years). The average overjet before treatment was 9.4 and 9.1 mm, respectively. Lateral cephalograms obtained before and after 12 months of treatment were analyzed using Pancherz's (1982) method.
RESULTS: Before treatment both the maxillary and mandibular dentitions were in a significantly more forward position on their respective jaw base in the Chinese versus the Caucasians, whereas the overbite was significantly deeper in the Caucasians. After 12 months of treatment the ethnic differences still remained.
CONCLUSION: There were significant dental differences in the dento-facial morphology of Chinese and Caucasian skeletal Class II patients. The ethnic dental features were affected by treatment to a similar extent in the two groups, i.e. there was seemingly still an ethnic difference in their dental appearance after active treatment.

24 MISSING TEETH IN CHILDREN AND ADOLESCENTS—A SCHEME FOR INTERDISCIPLINARY TREATMENT PLANNING

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AIM: Construction of a flowchart that meets the requirements for interdisciplinary treatment planning in children and adolescents with hypodontia and premature tooth loss.
SUBJECTS AND METHODS: For 40 patients suffering from hypodontia and premature tooth loss a list of treatment priorities and mechanics was collected strictly with respect to the occlusion and growth pattern. On the basis of that priority, a list was constructed concerning the treatment options—prosthodontics, autologous tooth transplantation or orthodontic space closure.
RESULTS: In subjects with missing premolars, crowding and an open bite growth pattern continue to be the essential criteria for orthodontic space closure. Some modification of this rule is needed if the upper lateral incisors are missing because crowding and an open bite growth pattern are far less influenced by orthodontic space closure in this area. Additionally, the problems involving orthodontic space closure in lateral upper incisors become more complex because a decision is required on compensatory extractions in non-affected quadrants. For missing upper centrals, problems are related to the fact that there are only two competing treatment options: prosthodontics or transplantation of lower first premolars. Conserving the alveolar bone is the most important advantage of autologous transplantation, but orthodontic space closure in the harvest area depends on the preconditions mentioned above. The same is true for missing first molars. With respect to anchorage demands and the need for compensatory extractions, the transplantation of wisdom teeth becomes a stringent treatment alternative.
CONCLUSIONS: On the basis of well-known criteria of crowding and growth pattern, a diagnostic and therapeutic scheme has been constituted to help decide whether the most desirable solution is orthodontic, surgical or prosthodontic in nature.

25 CHEMICALLY MODIFIED TETRACYCLINES STIMULATE MMP PRODUCTION BY HUMAN PERIODONTAL LIGAMENT CELLS

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AIM: To analyse the effects of several chemically modified tetracyclines (CMTs) on MMP production by human periodontal ligament (PDL) cells. CMTs are known as inhibitors of MMP activity but far less is known about their effect on MMP production. CMTs are studied for the prevention of tissue degradation in conditions such as periodontitis, rheumatoid arthritis and tumour metastases. The final goal of these studies is to investigate whether CMTs are suitable to prevent relapse after orthodontic tooth movement.
MATERIAL AND METHODS: PDL cells were cultured from PDL explants from extracted human third molars. CMTs (types 1, 3, 5, 7, 8) were added for 24 hours at several concentrations (0–500 μM) in serum-free medium. MMP 2 and 9 (gelatinases) were quantified in the culture medium by gelatin zymography. Vitality of the cells was assessed by a live/death assay. DNA was determined with the Picogreen method. The amount of MMPs per microgram of DNA was calculated.
RESULTS: At the highest dose (200–500 μM) all CMTs were toxic to the cells. CMT-1 induced a dose-dependent increase in production of both MMPs. For CMT-3 there was an optimum at about 100 μM. For CMTs 5 and 7 there was an optimum at about 50 μM. CMT-8 induced only a slight increase in MMP production at the highest concentrations.

CONCLUSION: Surprisingly, the CMTs stimulated the production of gelatinases by human PDL cells. This might be caused by a direct increase of MMP gene expression or by a positive feedback pathway induced by inhibition of MMP activity. Studies into the specific effects of these CMTs on the activity of MMP 2 and 9 are being undertaken.

26 BENIGN MASSETERIC HYPERTROPHY: CLINICAL AND INSTRUMENTAL INVESTIGATION AND MORPHO-FUNCTIONAL RELATIONSHIPS

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AIM: Benign masseteric hypertrophy is an uncommon affliction, usually asymptomatic, that could determine aesthetic modifications. The aim of this study was to elaborate a diagnostic protocol for unilateral and asymmetrical bilateral masseteric hypertrophy and to evaluate the relationship between facial asymmetry and dentoskeletal anomalies.
SUBJECTS AND METHOD: Seven consecutive patients (4 females, 3 males) with facial asymmetry due to suspected masseteric hypertrophy were analysed by clinical examination, dental pantomography (DPT), latero-lateral and postero-anterior (PA) teleradiography, bilateral ultrasonography (US) of the masseter, magnetic resonance imaging (MRI), electromyography (EMG) and kinesiography.
RESULTS: The patients were brachifacial (assessed by latero-lateral teleradiography) and four of these showed skeletal asymmetry (by PA cephalometry and depth of antegonial point to the mandibular plane on DPT). US underlined an evident uni- or bilateral increase of masseteric thickness (confirmed by MRI) and a broad iperechogenicity. EMG showed an increase in the electrical signal of the masseter and kinesiography an alteration of the mandibular cinematic.
CONCLUSIONS: Careful clinical examination allows diagnosis of masseteric hypertrophy; US enables more detailed assessment of the volumetric and echogenic anomalies of this muscle and to distinguish uni- and bilateral forms. DPT and PA teleradiography is useful to identify the presence of skeletal asymmetries but further research is needed to correlate morpho-functional relationships.

27 ASSESSMENT OF ADRENOMEDULLIN ON THE HUMAN OSTEOBLASTIC CELL LINE, SAOS-2

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AIM: Adrenomedullin, a 52-amino acid peptide, has been shown to play an active regulatory role in bone remodelling in rodents. The objective of this prospective laboratory based study was to determine whether a possible role for adrenomedullin also applies to human bone remodelling.
MATERIALS AND METHOD: Immunocytochemistry confirmed that adrenomedullin, and its receptor, are expressed in the human osteoblastic cell line, Saos-2. Reverse transcription-polymerase chain reaction showed that Saos-2 cells express mRNA encoding the genes for adrenomedullin and its receptor. Enzyme-linked immunosorbent assays were undertaken to determine whether 10^{-7}–10^{-11} mol concentrations of adrenomedullin over 1, 4, 8 and 24 hour intervals could stimulate Saos-2 cells to produce cytokines, including IL-1α, IL-1β, IL-6 and IL-18. Statistical analysis was performed using the Student's *t*-test.
RESULTS: An increase in production of all four cytokines was observed at increasing adrenomedullin concentrations over the longer intervals. IL-1β showed the most promising results, compared with the relatively modest production of the other cytokines.
CONCLUSION: Co-expression of adrenomedullin and its receptor in the human osteoblastic cell line, Saos-2, in conjunction with stimulation of these osteoblasts to produce cytokines, indicate that adrenomedullin may play an active role in the regulation of human bone remodelling and understanding of orthodontic tooth movement.

28 SIMULATION OF THE BIOMECHANICAL BEHAVIOUR OF MULTI-ROOTED TEETH UNDER ORTHODONTIC LOADING

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AIM: Until recently experimental and numerical studies of initial tooth mobility have focused mainly on single rooted teeth. Only a minor number of investigations have dealt with analysis of the biomechanical behaviour of multi-rooted teeth.
MATERIAL AND METHODS: In a combined experimental and numerical study, load/deflection curves of pig premolars were registered in a laser-optical set-up. The crowns of the teeth were loaded with forces of up to 15 N. Subsequently, the specimens were cut into histological sections, and, based on these sections, the geometry of the specimens were reconstructed to build finite element (FE) models of the teeth. In the simulations, the models were loaded with the same force system as in experimentation to check the validity of the mechanical assumptions and the material parameters of the periodontal ligament, determined previously. After this validation phase the FE models of the pig premolars as well as FE models of two rooted human molars and premolars were loaded with pure moments (couples of forces) to determine the centres of resistance (CR) in a mesio-distal and oro-vestibular direction. The calculations were performed using the FE packages COSMOS/M 2.6 and MSC-MARC/Mentat.
RESULTS AND CONCLUSIONS: Material parameters and model assumptions determined to simulate the behaviour of single rooted teeth in FE calculations can also be used for the simulation of multi-rooted teeth. In contrast to previously reported results, the position of the CR was not located in the region of the furcation. However, in accordance with the position of the CR of single rooted teeth it seems to be at a distance of one-third of the total root length down from the alveolar crest, as a superposition of the CRs of the two individual roots. There were clear differences between the mesio-distal and the oro-vestibular directions.
This study was supported by Deutsche Gesellschaft für Kieferorthopädie (DGKFO) and the Medical Faculty of the University of Bonn.

29 EVALUATION OF STRAIN DURING TORQUING MOVEMENT USING AN ORTHODONTIC-IMPLANT ANCHOR

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AIM: To identify strain patterns on a model during torquing movement of incisors while using orthodontic-implant anchorage.
MATERIALS AND METHOD: A polyester model with human teeth was developed. An ortho-implant (ITI, Straumann, Waldenburg, Switzerland) was placed midsagittally in the palate. A transpalatal arch (0.32 mm TMA®, Ormco, Orange, CA, USA) was fixed to the implant and connected to teeth 16 and 26. Edgewise brackets (0.22 inch) were placed. A passive 0.017 × 0.025 stainless steel archwire was inserted that bypassed the incisors incisally. A 0.017 × 0.025 TMA® (Ormco) torquing arch was ligated into the incisor brackets and hooked on to the base-arch mesial of elements 16 and 26. Activation-force on both sides was 50 cN. Seven TML® (Tokyo, Japan) strain gauges were placed. The strain was measured 10 times in three directions. Each measurement consisted of three periods: 1: passive torquing arch, 2: active torquing arch, 3: passive torquing arch. Each period took 60 seconds. The strain was measured every 0.1 seconds.

The average strain was calculated for each period and differences in strain between each period were calculated.
RESULTS: Significant differences in strain ($P < 0.05$) were found at the following points: tooth 26, tooth 21, ventral of the implant and apical of the incisors. Measurements on the contralateral points were not the same.
CONCLUSIONS: Significant differences in strain were measured on the right side of the model and at the implant, but further refinement of the set-up and the model is necessary.

30 APERT SYNDROME—TOOTH SIZE AND MORPHOLOGY

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AIM: Apert syndrome is a rare autosomal dominant disorder characterised by craniosynostosis, midface hypoplasia and symmetrical syndactyly of the hands and feet. The molecular genetic basis of Apert syndrome is unique among the craniofacial dysostosis syndromes, in that 98 per cent of cases are caused by point mutations in the gene encoding the fibroblast growth factor receptor 2 (FGFR2) gene. The FGFR2 gene has been found to be vital in the formation of mesenchymal condensates and in the epithelial development of the tooth. The aim of this study was to identify whether any differences exist in tooth size and morphology between a group of Apert syndrome patients and a control group, matched for sex and age.
MATERIALS AND METHOD: Study models were used to examine all first permanent molar teeth of the 25 Apert syndrome and 25 control patients. Linear and angular measurements were recorded using digital callipers and image analysis (ImageTool).
RESULTS: The overall dimensions of the teeth in the Apert group were generally smaller, in both the mesiodistal and buccolingual dimensions. The intercuspal distances were also found to be smaller, with the majority of the differences being statistically significant. The upper intercanine and intermolar distances were significantly smaller in the Apert group and the differences were highly statistically significant. The results of the angular measurements between the two groups showed a wide variation with no specific trends being identified.
CONCLUSION: Apert teeth were found to be smaller in size but they did not differ in morphology when compared with a control group, matched for sex and age.

31 ENAMEL SURFACE AFTER DIFFERENT STRIPPING TECHNIQUES

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AIM: The introduction of vibratory methods has improved clinical stripping techniques. The aims of this study were to evaluate interproximal stripping after carrying out different techniques of stripping with a prophylometer, to determine the superficial ruggedness (Ra); and to quantitatively with scanning electron microscopy (SEM), analyze the enamel surface. Once known, analysis can be undertaken on cavity risk and possible periodontal disease after stripping.
MATERIAL AND METHODS: Human premolars and incisors that had been stored in formol solution were placed on an acrylic base and prepared in a mouth simulator. They were divided into four groups in which different stripping techniques were carried out: (A) Manual with ribbons (B) Diamond discs; (C) Tungsten carbide burs; (D) Ortho-Strips® System Set Intensive. The later analysis was carried out with a linear prophylometer and SEM.
RESULTS: Of all stripping methods analyzed the one that presented the most refined end was the Ortho-Strips® System Set Intensive.
CONCLUSIONS: With vibratory stripping a refined and perfect finish is achieved, without the appearance of cavities or periodontal disease.

32 INTRA- AND INTER-RELIABILITY OF THE MANUAL FUNCTIONAL ANALYSIS TECHNIQUE FOR TEMPOROMANDIBULAR JOINT EVALUATION

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AIM: Conventionally, signs and symptoms of craniomandibular disorders have been diagnosed by palpation of the muscles and the temporomandibular joints (TMJ), checking on the occurrence of clicking sounds or crepitus during active movements. The intra- and inter-reliability of these conventional methods are usually low. The aim of this study was to obtain reliable data on specific TMJ examination techniques based on manual orthopaedic examination techniques.
SUBJECTS AND METHOD: Twenty-four subjects from 9.75 to 18.25 years of age were selected to determine intra-examiner reliability. They were investigated three times by one examiner at weekly intervals. In addition 24 subjects from 7.7 to 15.1 years of age were investigated by two examiners on the same day. Orthodontist A carried out the first examination in 50 per cent of the patients and in 50 per cent it was undertaken by orthodontist B. The intra- and inter-examiner reliability was tested with the Kappa (κ) coefficient according to Cohen, and the intraclass coefficient according to Lin.
RESULTS: All examination techniques of the manual functional analysis (MFA) showed either strong or complete agreement. The best agreement was found by testing the bilaminar zone with passive compressions and the lowest agreement for testing the end-feel on ventral translation ($\kappa = 0.9$) and for clicking sounds on medial and lateral translations ($\kappa = 0.83$ and 0.92, respectively).
CONCLUSION: All techniques of the MFA were very reliable. In contrast, commonly used techniques such as palpation demonstrated only low Kappa coefficients from 0.4 to 0.5 (weak agreement). Given the high reliability with the MFA, this method should be preferred for clinical TMJ evaluation.

33 IMAGING CONSIDERATIONS USING QUANTITATIVE LIGHT FLUORESCENCE TO QUANTIFY DEMINERALISATION ADJACENT TO ORTHODONTIC BRACKETS

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AIM: To elucidate factors affecting the analysis of quantitative light fluorescence (QLF) images; the presence or absence of an orthodontic component, angulation of the image, extent of demineralisation and the degree of tooth hydration, *in vitro*.
MATERIAL AND METHODS: One of three makes of orthodontic bracket were bonded to the buccal (Bc) surface of 30 premolar teeth. Each tooth was coated with a transparent varnish save for an area (±2 mm) surrounding the bracket, and on the lingual (Ln) surface an exposed enamel window (3 × 5 mm) of enamel was left. Baseline QLF images of both the Bc and Ln surfaces were taken. The teeth were exposed to 10 and 20 days of demineralisation using buffered lactic acid (pH 4.5). Each tooth was subsequently imaged using QLF on both Bc and Ln surfaces from a perpendicular and ±15 degree angle. The samples were imaged following moistening with saliva and drying with compressed air.
RESULTS: Each of the teeth exhibited demineralisation ($\Delta Q \uparrow 5.0$). The Ln surfaces were analysed reliably, irrespective of demineralisation severity; however, in more severe lesions the presence of the bracket confounded the analysis. Angled Bc views facilitated analysis,

although the whole area of the bracket could not be imaged. The presence of moisture resulted in inaccurate analysis, although this was restored following drying. Bracket type did not affect analysis.
CONCLUSIONS: When imaging bracketed teeth; a) angled shots should be employed for more severe demineralisation and b) teeth should be dehydrated. QLF is a promising technique for *in vivo* detection of orthodontic demineralisation.

34 THE PREVALENCE OF CONGENITAL TOOTH ANOMALIES IN A YOUNG POPULATION

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AIMS: To determine the type of congenital tooth anomalies among a young population and to examine whether a difference in these anomalies exists between groups of teeth and sexes.
SUBJECTS AND METHODS: This retrospective study included 618 patients (341 males, 277 females), with an average age of 14.3 years. The record data and panoramic radiographs of each patient were examined to determine the presence of congenital tooth anomalies (supernumerary or hypodontia). The collected data were stratified according to sex and affected groups of teeth. Third molars were not included in the study.
RESULTS. There were 72 (11.7%) patients with at least one congenitally missing tooth, while 15 (2.4%) patients exhibited at least one supernumerary tooth. The most frequently missing teeth were the lower second premolar (left 39, right 38), upper second premolar (left 20, right 19) and upper lateral and lower central incisor. The upper lateral incisor was the most frequent supernumerary tooth (left 5, right 3), which showed, in most cases, a typical shape. Chi-square tests demonstrated a statistically significant difference in the distribution of tooth agenesis between sexes, but not in the presence of supernumerary teeth.
CONCLUSION. Congenital tooth number anomalies are very frequent and have considerable importance for treatment planning. Hypodontia is more prevalent than supernumerary teeth and occurs statistically more often in females.

35 RELATIONSHIP OF DIASTEMAS TO TOOTH SIZE AND DENTAL ARCH DIMENSIONS IN THE PRIMARY DENTITION

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AIM: Tooth size and different arch parameters were studied for their influence on the presence or absence of diastemas in the primary dentition.
SUBJECTS AND METHOD: Two hundred and sixty seven children (153 males, 114 females) aged 2 to 8 years. All were white Caucasian, apparently healthy and lacking malformations with complete primary dentitions, and no erupted permanent teeth, and without existing dental malocclusions who had not undergone any type of orthodontic treatment. Study models were fabricated from impressions taken of all the children. The diastemas were registered on these models, as well as transverse diameters and arch perimeter, using a digital calliper.
RESULTS: The size of the dental crowns was not directly related to the presence or absence of a diastema. Upper or lower arches with diastemas of either type were wider at all levels, with more depth and perimeter than those without diastemas.
CONCLUSIONS: The presence of diastemas in the primary dentition is due above all to broader arches and not smaller teeth and, in the same way, the non-existence of diastemas must be related to smaller arches not to bigger teeth.

36 EFFECTS OF BONDED LINGUAL RETAINERS ON ORAL HYGIENE AND PERIODONTAL HEALTH

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AIM: To evaluate the effects of two different types of bonded orthodontic canine-to-canine lingual retainers on oral hygiene and periodontal health and to compare their ability to maintain incisor alignment.
SUBJECTS AND METHOD: Fifty-four young adult subjects, divided into two groups. The 27 subjects in the first group received retainers made of 0.0175 inch stainless steel twisted wire bonded to each tooth in the lower anterior segment, while the other 27 subjects received retainers made of 0.032 inch stainless steel plain wire bonded only to the lower canines. Clinical measurements were made just before debonding and 1, 3, and 6 months after retainer insertion. Plaque index, gingival index, gingival recessions, probing attachment, and calculus index were scored. Standardized periapical radiographs were taken at the same time periods to evaluate alveolar crestal bone levels. The irregularity index was measured on the plaster models made at the time of retainer insertion and 6 months later.
RESULTS: Significant intergroup differences were found only in the gingival index; the retainer made of twisted wire had a worse effect on gingival health. Calculus index scores were higher after 6 months in both groups. Incisor irregularity did not show any increments. No failures occurred.
CONCLUSION: The two different types of retainers had similar effects and did not have a striking negative influence on oral hygiene and adjacent tissues.

37 COMPUTED TOMOGRAPHY OF THE POSITION OF IMPACTED MAXILLARY CANINES

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AIM: To evaluate the position of impacted maxillary canines in the three planes of internal jaw space.
SUBJECTS AND METHODS: Fifty-three subjects (21 males, 32 females) with 66 impacted maxillary canines. The patients underwent clinical and radiographic examinations, which involved conventional radiographic methods and spiral computed tomography (CT).
RESULTS: A palatal position of the crown was observed in 60.6 per cent, impacted maxillary canines (buccal position) in 10.6 per cent, and in the line of the arch in 28.8 per cent. The root apex position related to the surrounding teeth was: vertically above the first premolar root (i.e. the most favourable position for orthodontic treatment) in 60.6 per cent, vertically above the interdental space between first and second premolars in 18.2 per cent, vertically above the second premolar root in 13.6 per cent and posterior to the second premolar root in 7.6 per cent. A buccal position of the root apex was found in 6.1 per cent, in line with the root apices of the surrounding teeth (i.e. favourable position for orthodontic treatment) in 59.1 per cent, palatal position in 18.2 per cent and highly palatal position (i.e. unfavourable position for orthodontic treatment) in 16.6 per cent. Inclination of the long axis of the impacted canine (in a direction from root apex to crown cusp) in the three planes of internal jaw space were: mesiopalatal in 33.3 per cent, mesial in 22.7 per cent, mesiobuccal in 21.3 per cent, horizontal in 13.7 per cent, palatal in 4.5 per cent and vertical in 4.5 per cent.
CONCLUSION: CT and three-dimensional CT improve the spatial orientation of impacted maxillary canines. CT was found to be the superior method for visualization of the internal jaw situation.

38 MAXILLARY INCISOR IMPACTION AND ITS RELATIONSHIP TO CANINE DISPLACEMENT

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AIM: To examine the eruption status of unerupted maxillary permanent canines in subjects with an impacted central incisor.
MATERIAL AND METHOD: Seventy-six unilateral cases of the incisor anomaly were retrospectively examined. The positions of the ipsilateral and contralateral canines and lateral incisors were assessed on the initial panoramic films, together with the timing (eruption progress) of the canines. The final position of the canines was evaluated from patient records and progress photographs. The data revealed a significant increase in prevalence and severity of displaced canines on the ipsilateral side (41.3%) compared with the contralateral (4.7%). Palatally displaced canines occurred in 9.5 per cent of the cases, buccally displaced canines (BDC) in 30.2 per cent, and canine-lateral incisor transposition in 1.6 per cent. Half of the BDC on the ipsilateral side were pseudotransposed with the adjacent lateral incisor
RESULTS: The eruption timing of ipsilateral canines was either similar or delayed, relative to the contralateral tooth, but never accelerated. The ipsilateral lateral incisor was strongly angulated because of a more distally located apex (5 mm) rather than a mesially tipped crown. The ipsilateral canine was relatively more superiorly positioned (under-erupted). The trauma-related cases displayed a significantly higher prevalence and severity of canine displacement and more distally displaced lateral incisor apices. Initial height of incisor impaction did not influence the results.
CONCLUSION: This data provides evidence of a significant environmental influence of the impaction of a maxillary central incisor in delaying and altering the eruption path of the ipsilateral maxillary canine tooth.

39 EFFECTS OF SURFACE TREATMENT AND AGEING ON BRACKET BOND STRENGTH TO PROVISIONAL MATERIALS

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AIM: To evaluate the effects of surface treatments (greenstone and sandblasting) and ageing (1 week and 1 month) on the bond strength of orthodontic brackets to materials (PMMA, temporary bridge resin, and bis-acryl composite resin, Protemp 3 Garant). The mode of failure of the materials was also compared.
MATERIAL AND METHOD: One hundred and twenty flat-surface discs of each material were fabricated and potted into acrylic moulds. After one week of storage in distilled water at 35°C, the specimens were pumiced and divided into three groups of 20 specimens each according to the surface treatment tested, 1) control, 2) greenstone and 3) sandblasted. They were then etched and primed before bonding of brackets using composite adhesive. After storing in distilled water at 35°C for 1 week and 1 month, respectively, the specimens were debonded with a shear-peel load by an Instron testing system with a crosshead speed of 0.5 mm/minute. The materials were subsequently examined under a light stereomicroscope to establish the amount of remaining composite resin and classified using the Adhesive Remnant Index.
RESULTS: The bond strength of brackets to bis-acryl composite resin for all three groups of surface treatment was clinically acceptable (9–12 MPa) compared with PMMA (3–5 MPa). Surface treatment was shown to have no effect on the bond strength of brackets to both bis-acryl composite resin and PMMA (except at 1 month). On the other hand, ageing does have an effect on the surface retention of the provisional materials to the brackets. This could be explained by the mode of failure, which was adhesive for PMMA and cohesive for bis-acryl composite resin.
CONCLUSION: The shear peel bond strength of orthodontic brackets to restorations is dependent on material and time, but not surface treatment.

40 EVALUATION OF THE STOMATOGNATHIC SYSTEM IN SUBJECTS WITH AN ANTERIOR OPEN BITE

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AIM: The relationship between malocclusion traits and signs and symptoms of temporomandibular dysfunction (TMD) has been extensively studied. TMD is generally considered to be one of the risks related to malocclusion, and an anterior open bite (AOB) is one of the malocclusions significantly associated with signs and symptoms of TMD. The aim of this study was to examine the functions of the stomatognathic system of adolescents with an AOB.
SUBJECTS AND METHODS: Twenty-one subjects (mean age 14.7 years) with an AOB. All were skeletally Class I. Lateral cephalograms and transcranial radiographs were obtained for each subject. Stomatognathic functions were evaluated by means of joint vibration analysis, electromyograms and jaw tracking. Skeletal and dental measurements were made on the lateral cephalograms, and joint spaces evaluated from transcranial radiographs. TMJ sounds were recorded and classified. Electromyographic data were collected during rest, swallowing and clenching for the temporalis anterior, masseter, anterior digastric and suprahyoid muscles. Jaw movements were recorded during opening and closing, chewing and phonation.
RESULTS: The subjects exhibited a vertical growth pattern with a mean ANB value of 2.56 degrees. The mean overbite was –2.57 mm. Non-concentricity and mild asymmetry of the condyle fossa relationship were commonly observed. EMG results showed that 85 per cent of the subjects had an abnormal swallowing pattern and 52 per cent an abnormal clenching pattern.
CONCLUSIONS: Since an AOB is a malocclusion that tends to display some of the signs and symptoms of TMD, this risk must be taken into consideration during orthodontic treatment.

41 THREE-DIMENSIONAL ANALYSIS OF FACIAL SOFT TISSUES IN HEALTHY CHILDREN AGED 3–7 YEARS

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AIM: To measure the age-related modifications in soft tissue facial dimensions in healthy non-patient children.
SUBJECTS AND METHODS: The three-dimensional (3D) co-ordinates of 22 soft tissue facial landmarks were obtained in 31 healthy children aged 3–7 years (12 girls, 19 boys), without dental or respiratory problems. Facial landmarks were digitized with a computerized 3D instrument and their co-ordinates used to derive a geometric model of the face. The facial volumes (upper, middle and lower third), nasal volume, mandibular width (go-go), face height (n-pg), and mandibular corpus length (pg-go) were measured. The dimensions were compared between sexes and ages by analyses of variance.
RESULTS: All three facial volumes, nasal volume, and facial height significantly increased as a function of age ($P < 0.05$). Significant sex differences (boys larger than girls) were found for all variables except mandibular width. Between 3 and 7 years of age, the volume of the upper facial third (forehead) increased 16 per cent in boys and 21 per cent in girls; facial middle third volume (maxilla) increased 20 per cent in boys and 15 per cent in girls; facial lower third volume (mandible) increased 20 per cent boys and 13 per cent in girls. The increment

for nasal volume was approximately 30 per cent in both sexes. Face height increased 10 mm in boys and 8 mm in girls; mandibular width increased approximately 5 mm in both sexes; in contrast, mandibular corpus length did not modify during the analyzed time span.
CONCLUSIONS: Between 3 and 7 years of age, most facial growth was found in the vertical plane. Mandibular dimensions in the horizontal and sagittal planes did not modify, and most of the increment in mandibular volume could be explained by the modification in the n-pg distance. Normal morphological modifications in the vertical plane should be considered when planning functional orthodontic treatment.

42 RAPID MAXILLARY EXPANSION IN THE MIXED DENTITION: PERMANENT MAXILLARY INCISOR BEHAVIOUR

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AIM: To evaluate the behaviour of the permanent incisor after rapid maxillary expansion (RME) performed in the mixed dentition using maxillary primary teeth as anchorage.
SUBJECTS AND METHOD: The experimental group (Group A) comprised 42 patients (21 females, 21 males), mean age 8.8 years at the end of the retention phase. The control group (Group B) were 38 patients (23 females, 15 males), mean age 9.2 years who had no previous orthodontic treatment. The groups were matched by malocclusion and age. The appliance used in the experimental group was a RME as described by Haas modified to be anchored on the maxillary primary dentition. After a mean appliance activation period of 18 days for 5–8 mm expansion, the appliance was stabilized and kept in place as retention for at least 10 months. Neither active nor passive retention was applied on the permanent dentition. Impressions of the dental arches were taken and models developed and the following measurements were performed: permanent maxillary interlateral incisor width, maxillary intercanine width and irregularity index.
RESULTS: The mean permanent maxillary interlateral width was 29.5 ± 2.6 mm in Group A and 26.3 ± 3.1 mm in Group B ($P < 0.01$); the mean intercanine width was 36.7 ± 2.3 mm. in Group A and 30.1 ± 3.0 mm in Group B ($P < 0.01$); the mean irregularity index was –1.6 ± 2.8 mm in Group A and +3.4 ± 3.1 mm in Group B ($P < 0.01$).
CONCLUSION: RME produces more space to allow for spontaneous alignment of the permanent maxillary incisors, therefore the permanent maxillary incisors in group A demonstrated, at the end of the retention phase, improved alignment compared with the untreated group.

43 USEFULNESS OF PRE-OPERATIVE LATERAL CEPHALOMETRIC FILMS FOR PLANNING ORTHODONTIC PALATAL IMPLANTS

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AIM: To determine the usefulness of lateral cephalometric films in evaluating the bone volume available pre-operatively for placing palatal implants.
MATERIALS AND METHODS: Cephalometric and histometric data of 20 partially edentulous human cadaver upper jaws were compared. Lateral cephalometric films of the specimens were recorded and the palatal complex was outlined by two orthodontists. In addition, low-dose dental computed tomographic (CT) scans were obtained for every specimen. Guided by the CT data, palatal implants (Orthosystem®, Straumann, Switzerland) were placed. Post-implantation another set of lateral cephalometric films was taken. The implant-bearing specimens were then processed with the cutting and grinding equipment described by Donath and Breuner (1982) and the pre-operative tracings were superimposed on the post-operative cephalometric films.
RESULTS: Of the implants placed, 12 were 4 mm and eight 6 mm long. The distance between the apical end of the implants and the nasal floor was between 0.32 and 9.31 mm. Perforation of the nasal floor was avoided by intra-operative probing. On histologic analysis of the specimens, two implants projected 1.03 and 1.31 mm, respectively, beyond the nasal floor. Analysis of the superimposed pre- and post-operative cephalometric films showed a total of five implants to project beyond the nasal floor (–0.25 to –2.75 mm). Histologically, only one of these projecting implants caused perforation of the palatal complex. Comparison between the histometric and cephalometric data showed that cephalometry imaged the palatal complex 0.80 mm below the actual anatomical site.
CONCLUSIONS: Cephalometry failed to provide precise pre-operative information on available bone volume, that intra-operative probing is of limited value and that perforations up to 1.31 mm need not necessarily result in frank perforation of the nasal mucosa.

44 ARE PRE-TREATMENT PSYCHOLOGICAL CHARACTERISTICS INFLUENCED BY PRE-SURGICAL ORTHODONTICS?

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AIM: This questionnaire-based study aimed to investigate whether psychological changes occurred during pre-surgical orthodontics and whether there is any justification for using the end of pre-surgical orthodontics as a baseline.
SUBJECTS AND METHOD: Sixty-five patients were recruited and, of these, 62 completed questionnaires prior to any treatment (T1) and at the end of pre-surgical orthodontic treatment (T2). The questionnaire looked at various aspects of an individual's psychological profile: state and trait anxiety, depression, self-esteem, body image and facial body image. The changes between T2 and T1 were calculated and the data analysed using the MLwiN programme for multivariate multiple regression analysis. This allowed the impact of the orthodontic intervention to be established whilst still considering the influence of demographic characteristics on the six outcome measures.
RESULTS: There was only one significant finding due to orthodontic intervention; body image showed a significant ($P = 0.05$) change between T1 and T2, although only after accounting for differences in patient-perceived severity of malocclusion. There were also a number of significant findings related to other explanatory variables, for example, increased state anxiety in older patients ($P < 0.001$) and increased trait anxiety in females ($P < 0.04$).
CONCLUSIONS: As pre-surgical orthodontic treatment has minimal effects on the chosen psychometric variables, it may be reasonable to use T2 as a baseline measure. When the multivariate results were compared with separate regression models, some differences were noted. The use of the multivariate technique is recommended for investigations of this type as the statistical power of the study is enhanced.

45 TREATMENT CONCEPT OF OPEN BITE AFTER COLLUM FRACTURE

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AIM: Dislocated collum fractures caused by trauma often result in an open bite. The conservative treatment is usually carried out

with functional orthodontic appliances. This study was conducted to analyse treatment outcome with the Karwetzky mandibular protrusion appliance (U-bow-activator) for functional treatment of dislocated collum fractures. In severe cases of open bite, a chin cap was additionally used.
SUBJECTS AND METHODS: Nineteen patients with dislocated uni- or bilateral collum fractures treated with a Karwetzky mandibular protrusion appliance. In six patients with anterior open bite (AOB) of more than 6 mm a chin cap with a vertical force direction (Hickham system) was additionally used. The treatment effects were measured using the following parameters: maximum mouth opening, protrusion, laterotrusion and settling of occlusion. Statistical analysis was carried out using SPSS 10.0 for Windows. Wilcoxon's test was used with a level of significance of $P < 0.05$.
RESULTS: A statistically significant difference between functional mandibular movement parameters at the start of treatment and after 4 months was found. In two patients with insufficient compliance the activator therapy had no significant effect. No significant difference was measured between uni- and bilateral collum fractures.
CONCLUSION: Activator therapy with the Karwetzky appliance for treatment of dislocated uni- or bilateral collum fractures provides good rehabilitation of mandibular movement. Nevertheless, good functional results do not mean morphological *restitutio ad integrum*. In subjects with an AOB of more than 6 mm, chin cap therapy in addition to the functional orthodontic appliance provides good support for closing the open bite. However, compliance remains an essential factor for treatment outcome.

46 MATERIAL CHARACTERISTICS OF DIFFERENT LIGHT CURING AND AUTOCURE RESINS FOR OCCLUSAL SPLINTS

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AIM: Treatment with occlusal splints represents an essential component of the interdisciplinary therapy of temporomandibular joint dysfunctions. They are also used for orthognathic surgery as temporary intermaxillary fixation, as well as a guide during surgery. The aim of this *in vitro* study was to examine different materials with regard to their suitability for manufacturing occlusal splints.
MATERIALS AND METHOD: Following light curing the following materials were used: Acrylight, Triad TranSheet Colorless, Triad TranSheet Pink and Primosplint. Polymerization was carried out with the curing units, Targis Power (400–500 nm) and Kulzer Unilux AC (320–400 nm) for 10 and 15 minutes. The results were compared with Palapress, as a representative of an autocure resin. The parameters measured were flexural strength, flexural modulus and Vickers hardness (0.5 HV). The examinations were carried out according to ISO-1567 and ISO-10477.
RESULTS: Flexural strength of the examined light curing resins was between 80.9–128.6 MPa. Flexural moduli were between 8.0–13.6 GPa. The results for Palapress were 86.9 and 9.6 GPa. For Acrylight the flexural strength and moduli could not be determined because of its great bend. Surface hardness was measured at 39.3 HV 0.5 (Triad TranSheet Pink) and 33.1 HV 0.5 (Triad TranSheet Colorless), Primosplint (29.2 HV 0.5) and Acrylight (10.9 HV 0.5). For Palapress the measurement was 27.5 HV 0.5.
CONCLUSIONS: Light cured resins can achieve or even exceed the material qualities of autocure materials with regard to flexural strength and modulus as well as surface hardness. Except for Acrylight, all light curing materials satisfied the criteria of ISO norms. It can be concluded that light cured resins are a suitable alternative for use as occlusal splint materials.

47 THE EFFECT OF FATIGUE ON THE SHEAR BOND STRENGTH OF THE BRACKET-ADHESIVE COMPLEX

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AIM: The shear bond strength of the bracket-adhesive complex is influenced by many factors such as material, bonding procedure, surface geometry, ageing and fatigue. The aim of this study was to determine the sole influence of fatigue on the shear bond strength of the bracket-adhesive-complex by choosing identical parameters for the other factors.
MATERIALS AND METHODS: Lower incisor brackets with laser-structured and foil mesh bases (Discovery, Ultra-Minitrim/Dentaurum), two- and four-component chemically-cured adhesive (No-Mix/Dentaurum, Concise/3M Unitek), stainless steel plates of 5 mm thickness, 50 mm in diameter, mechanical testing machine (Zwick 1445). The metal plates were prepared with the 'Rocatec' silane procedure; brackets were bonded to the plates. The four bracket-adhesive combinations were stored in distilled water at 37°C for 3 days. Each material combination was divided into two groups: the first was used as a control to determine the ultimate shear bond strength without fatigue. The brackets of the second group underwent 1,000 loading cycles to determine the shear fatigue limit according to the staircase method, i.e. the maximum stress applied in each succeeding test was increased or decreased, depending on whether the previous stress resulted in failure or success. Surviving specimens were subjected to ultimate tensile strength testing. Comparisons between the values for fatigued and non-fatigued specimens were made to extrapolate the effect of fatigue on the shear bond strength.
RESULTS AND CONCLUSIONS: 1. Shear fatigue of the bracket-adhesive-complex had no significant influence on its strength. 2. The fatigue limit of the bracket-adhesive-complex for 1,000 cycles was approximately 61 per cent relative to the ultimate shear bond strength. 3. The ultimate shear strength of the non-fatigued brackets with a laser-structured base was about 83 per cent higher than that of the foil mesh brackets. 4. Greater amounts of adhesive remained on the laser-structured bases than on the foil mesh bases.

48 TGFb1 AND FGF2 INHIBIT GROWTH OF FEMORAL HEADS BUT NOT MANDIBULAR CONDYLES

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AIM: To compare the effects of TGFb1 and FGF2 on the *in vitro* growth of femoral heads and mandibular condyles, which consist of primary and secondary cartilage, respectively.
MATERIALS AND METHOD: Cartilages were dissected from 4-day-old rats and cultured for up to two weeks. The culture medium contained either IGF-I (0, 5, 25, 100 ng/ml), TGFb1 (0, 0.1, 1, 10 ng/ml) or FGF2 (0, 1, 10, 100 ng/ml) alone, or a combination of TGFb1 or FGF2 with IGF-I (100 ng/ml). Controls contained no growth factors. The effects of these growth factors on DNA and glycosaminoglycan (GAG) synthesis were analyzed with radiolabelled precursors after five days. The effect of TGFb1 or FGF2 alone on growth was determined during a two-week experiment. Growth was determined from the total surface area of the cartilages on standardized pictures taken at regular intervals. Several samples were used for histological analyses.
RESULTS: IGF-I enhanced mainly the DNA synthesis of mandibular condyles, while it stimulated GAG synthesis of both. In both cartilages the growth factors antagonized the stimulation of GAG synthesis by IGF-I. In control mandibular condyles the total growth was 1.3 ± 0.3 mm^2; this was not significantly affected by the growth factors.

In contrast, total growth of femoral heads was 2.6 ± 0.3 mm^2, which was strongly reduced by both TGFb1 and FGF2. Histology showed that this was due to inhibition of the differentiation to hypertrophied cartilage.
CONCLUSION: No clear differences were found in the regulation of DNA and GAG synthesis between the two types of cartilage by TGFb1 and FGF2. However, IGF-I stimulated DNA synthesis of mandibular condyles only. In contrast, both TGFb1 and FGF2 inhibited growth of femoral heads. This supports the hypothesis that the growth of primary cartilage is more dependent on growth factors than that of secondary cartilage.

49 CONVENTIONAL OR PHOTOGRAPHED CASTS—DOES IT INFLUENCE ORTHODONTIC DECISIONS?

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AIM: To evaluate the consistency of orthodontic diagnosis and treatment planning by comparing the use of plaster casts with photographed casts.
SUBJECTS AND METHOD: Five clinicians were asked to evaluate five different cases and to formulate a detailed diagnosis and treatment plan for each of them. The sample consisted of dental school orthodontic patients. The following diagnostic records were used: study models or photographed study models, facial and dental photographs, a panoramic radiograph, a lateral cephalogram and its tracings. The orthodontists recorded their treatment decisions on four separate occasions: two double-determinations with the photographed models and two with the conventional plaster casts. To prevent bias between the double-determinations, there was a minimum time interval of two months.
RESULTS: In general the consistency of each orthodontist was high for treatment planning. There was no statistical difference in consistency between the judgement of the photographed models and plaster casts (Wilcoxon: $Z = 0.772$). Comparison of the diagnostic records showed: 1) The consistency in evaluating diagnostic records in the lower arch was perfect, 2) In the upper arch it was difficult to accurately evaluate diastemas, the curve of Spee and the size of the apical area, 3) Occlusal variables were scored more consistently on the photographs than on the plaster casts. In addition there was a small difference in the interpretation of the molar occlusion on plaster casts, indicating that photographs are easier to consistently evaluate molar occlusion, 4) There was no difference in treatment plan.
CONCLUSION: Photographed models are as useful as plaster casts for orthodontic treatment planning.

50 RELEASE OF EPIDERMAL GROWTH FACTOR IN HUMAN DENTAL PULP FOLLOWING ORTHODONTIC FORCE

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AIMS: To examine the release of angiogenic growth factor, human epidermal growth factor (EGF) in human dental pulp following orthodontic force application, by using neutralising growth factor antibody, anti-human epidermal growth factor (anti-hEGF), to block its effects.
MATERIALS AND METHODS: Following ethics committee approval, the dental pulps from 10 premolar teeth from 10 patients treated with straight-wire fixed appliances for two weeks were divided vertically, and each half pulp further sectioned horizontally, and co-cultured with a section of rat aorta in collagen surrounded by growth media. For each specimen, anti-hEGF was added to the media of the co-cultures from one half of each pulp. Sections of rat aorta alone were similarly cultured. All cultures were examined daily by light microscopy for angiogenic changes, and a count of microvessels was taken at days 5 and 10 of culture.
RESULTS: The addition of anti-hEGF to the growth media in the co-cultures resulted in a significant reduction in pulpal microvessels ($P < 0.005$ Wilcoxon signed rank test) and rat aorta microvessels ($P < 0.016$) when compared with those of the control co-cultures at days 5 and 10 of culture. There was individual variation both in the angiogenic response shown in the control co-cultures, and in the reduction of the angiogenic response with the addition of anti-hEGF to the co-cultures. Microvessel numbers in both rat aorta co-cultures with and without the addition of anti-hEGF were significantly greater ($P < 0.005$) than in the rat aorta alone cultures.
CONCLUSIONS: EGF is released following orthodontic force application, and plays a part in the angiogenic response of the pulp.

51 INTERCANINE DISTANCE IN HEALTHY CHILDREN AGED 3 TO 6 YEARS

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AIM: To assess the age-related modifications in intercanine distance in healthy non-patient children in a mixed cross-sectional and longitudinal investigation.
MATERIAL AND METHODS: The dental casts of 24 children aged 3 to 6 years, all with a complete primary dentition, and free from respiratory problems, were obtained every 6 months. Dental landmarks were digitized with a computerized three-dimensional instrument, and their co-ordinates used to obtain maxillary and mandibular intercanine distances and the height of the clinical crowns. Dimensions were compared between ages by analyses of variance.
RESULTS: No significant effects of age were found for all measured variables. Maxillary intercanine distance was 27.2 mm (SD 0.3) at 3 years of age, 28.8 mm (SD 1.8) at 6 years; mandibular intercanine distance was 21.1 mm (SD 1.6) at 3 years, 22.3 mm (SD 1.8) at 6 years. A large variability in intercanine discrepancy was found, without age-related patterns (range from 4.2 to 7.8 mm). Clinical crown height was approximately 5.2 mm in the upper arch, and 6.1 mm in the lower arch.
CONCLUSIONS: In children with a complete primary dentition, the lack of age-related modifications in intercanine widths as well as in their discrepancy imposes a need for careful consideration of treatment timing of patients with crossbite. Probably, a relatively reduced maxillary intercanine distance will not spontaneously correct with growth, recommending an interceptive treatment.

52 IMPACTED TEETH IN A PREHISTORIC POPULATION OF THE CANARY ISLANDS

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AIM: To establish the prevalence of impacted teeth in a prehistoric aboriginal population of the island of Tenerife (Canary Islands) and to compare the results with contemporary populations.
MATERIALS AND METHODS: The study was carried out on the collection of prehistoric human remains at the Archaeological Museum of Tenerife. This collection has been dated between III B.C. and XIII A.C. The subjects inhabited the island of Tenerife, presumably originating from North Africa (Berber). Eight hundred and fifty six adult individuals were analysed (296 maxillae, 560 mandibles). The diagnosis of impacted teeth was made by means of detailed observation of all specimens.
RESULTS: The frequency of impacted maxillary teeth was: canines 2.36 per cent, first premolars 0.33 per cent, second premolars 0.67 per cent, and third molars 3.19 per cent. Mandibular teeth: central incisors 0.44 per cent, lateral incisors 0.62 per cent, canines 2.05 per cent, first

premolars 0.26 per cent and third molars 1.43 per cent. No difference by gender was observed.
CONCLUSIONS: The teeth most frequently impacted in contemporary populations are the mandibular third molars followed by the maxillary canines and maxillary third molars. The results of this investigation show that in the prehistoric sample the most frequently impacted teeth were the maxillary third molars followed by the maxillary canines and the mandibular canines. Although the overall number of impacted teeth in this population is much less than that found in contemporary populations, the number of impacted maxillary and mandibular canines is significantly much higher.

53 OCCLUSAL CHANGES BEFORE AND AFTER RETENTION

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AIM: To assess the changes in occlusion that occur between the end of active treatment and one year after all retention has ceased.
MATERIALS AND METHODS: Retrospective analysis of study models of patients treated with fixed, or functional and fixed appliances who completed treatment in 1997. Subjects with cleft lip and palate, severe hypodontia or needing orthognathic surgery were excluded. One observer calibrated in the Peer Assessment Rating (PAR) index carried out all the measurements. The study models, trimmed in habitual occlusion, on completion of active treatment (CAT) and one year after retention (OR) had ceased were analysed. The gold standard was established as less than 5 to 10 points difference between the two PAR scores (CAT and OR). The data was collected on purpose designed forms and statistical analysis performed using SPSS.
RESULTS: Forty-one cases were included. The mean PAR score at beginning of treatment (BOT) was 34.27, PAR index score at CAT was 7.27 and at one year out retention 8. The mean PAR score change (BOT-CAT) was 27, BOT-OR was 26.27 and CAT-OR was –0.73.
CONCLUSIONS: It has been recommended that retention should be continued for at least 12 months after active treatment has ceased in non-growing patients. According to this study, there were small occlusal changes (CAT-OR <5 points) between CAT and 1 year after retention had ceased. This is understood as occlusal settling that is within an acceptable range for alignment and occlusion.

54 ORTHODONTIC TREATMENT COSTS IN DIFFERENT SETTINGS

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AIM: To assess the costs of orthodontic treatment in three different settings.
SUBJECTS AND METHOD: Eighteen specialist orthodontists were randomly selected from specialists providing care in three sectors of treatment provision. Two sectors (11 orthodontists) provided care in two different salaried services and a third sector (7 orthodontists) was remunerated on an item of service fee payment system. Each orthodontist was asked to prospectively identify 100 consecutively recruited patients. Questionnaires were completed prior to, during, and after treatment to provide information relating to the length of treatment, appointment times, travelling costs, loss of earnings and appliances used. The orthodontists all participated in a semi-structured interview to determine additional information relating to costs of providing care. Nationally produced fee scales were utilised to estimate costs in the fee per item sector.
RESULTS: The average cost per patient treated was €815 in the salaried local dental clinic, €1250 in the fee per item of service sector and €1456 in the salaried hospital service. Intangible costs can be considered the same in each sector. Patient costs of attending the appointment varied in each sector. The mean cost per visit was €15.77 in the salaried local dental clinic, €22.87 in the fee per item service sector and €26.29 in the salaried hospital service.
CONCLUSIONS: The costs of providing orthodontic care are of increasing interest, in particular in situations of third party funding.

55 THE RELATIONSHIP OF ANTERIOR TOOTH SIZE AND DEGREE OF OVERBITE IN CLASS II DIVISION 2 PATIENTS

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AIMS: A Class II division 2 malocclusion is a skeletal discrepancy, the typical feature of which is a deep overbite. The aims of this investigation were to determine possible relationships between the size of the incisors and the degree of overbite.
MATERIALS AND METHOD: Sixty-one sets of study models, 31 of which had a Class II division 2 malocclusion, a Class II molar relationship, deep overbite and upright or retroclined incisors (study group) and 30 a normal occlusion (Class I molar relationship, normal overjet and overbite without crowding or spacing) (control group). The ages were 14 years 5 months and 13 years 4 months, respectively. The degree of overbite of the upper and lower right central and lateral incisors was measured using a vernier calliper accurate to 0.1 mm. The proportion of tooth size and the overbite was examined in both groups.
RESULTS: The mesio-distal diameters of the anterior teeth in the study group were on average smaller than in the control group. This difference was especially large for the lower central and lateral incisors and was statistically significant. The results were in accordance with the Neff analysis.
CONCLUSION: An excessive overbite in subjects with a Class II division 2 malocclusions is usually accompanied by narrower lower incisors.

56 LOWER LIP AND CHIN THICKNESS IN 15 TO 18 YEAR OLD GIRLS WITH SKELETAL CLASS I AND CLASS II DIVISION 1 MALOCCLUSIONS

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AIMS: To compare the soft tissue chin thickness of patients with a Class II division 1 malocclusion with those with a Class I malocclusion to determine if the thickness of the soft tissues can compensate for the mandibular deficiency and if the patient needs treatment or not.
SUBJECTS AND METHOD: Eighty girls between 15 to 18 years of age. Fifty with a Class II division 1 malocclusion (mandibular deficiency) comprised the study group whilst the other 30 subjects with a Class I malocclusion who had not undergone any orthodontic or orthognathic treatment formed the control group. An ANB angle of 4 degrees was selected as normal and more than 4 degrees as Class II. The increase in ANB was due to mandibular deficiency. The points Pogonion, supramental and labrale inferious on the soft tissue profile were selected as reference points. The soft tissue thickness in this area of the mandible was measured relative to two perpendicular reference lines. The first line was drawn perpendicular to the SN plane at Sella and the second by projecting a perpendicular from orbitale to the Frankfort plane. The soft tissue thickness at the chin and lower lip area was determined by subtracting the measurements X1-Y1, X2-Y2, X3-Y3.
RESULTS: Statistical analysis of the data showed that the thickness of the soft tissues was increased only in labrale inferious in the Class II division 1 group compared with the Class I group.
CONCLUSION: The soft tissues of the lower face cannot compensate for the mandibular deficiency in Class II patients, and so cannot completely influence treatment planning.

57 EFFECTS OF A NASOALVEOLAR MOULDING APPLIANCE IN UNILATERAL CLEFT LIP AND PALATE CASES—PRELIMINARY REPORT

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AIM: Pre-surgical infant orthopaedics aims to reduce the width of the cleft in infants with cleft lip and palate (CLP) within the first few months of infancy. Pre-surgical infant orthopaedics allows surgical cleft closure without tension and mobilization of the surrounding soft tissue. Cast studies have shown that, with the use of orthodontic devices, alignment of the alveolar ridge and reshaping of nasal cartilages of the affected side can be achieved until the time of lip closure. The aim of this study was to evaluate the effects of a nasoalveolar moulding appliance on the alveolar ridge and nasal cartilages.
SUBJECTS AND METHODS: This prospective study involved seven patients (5 males, 2 females), with unilateral complete CLP. All patients received pre-surgical infant orthopaedics with a nasoalveolar moulding appliance (Grayson *et al*., 1999). Their mean age was 15 days (range: 2 days–3 months). Maxillary casts, including alveolar segments and nasal tissues, were taken both at the initiation of moulding therapy and 3 months post-therapy. The reference points marked on the study casts were: the midpoints of the margins of the alveolar processes medial and lateral to the cleft, and points of intersection between the alveolar ridge and groove of the medial and lateral labial fraenum and tuberosity. The points were digitized on the computer scanned casts using specially developed software (Dental Model Planner), which calculates the distance between reference points. Cleft width, arch circumference, anterior and posterior arch width and arch length, as well as columella length were evaluated. Paired sample tests were performed for statistical analysis.
RESULTS: Besides significant differences with growth, there were significant effects of the appliance in cleft width and columella length.
CONCLUSION: Pre-surgical infant orthopaedics with the use of the nasoalveolar moulding appliance is an efficient therapy to decrease the cleft width and increase the columella length.

58 SKELETAL CHANGES RELATED TO FUNCTIONAL THERAPY IN CLASS II PATIENTS

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AIM: To evaluate skeletal changes due to functional therapy in mandibular deficiency Class II malocclusions.
SUBJECTS AND METHOD: Thirty patients (12 males, 18 females) with a mean age of 10 years 5 months treated with a modified activator. The treatment time varied from 8 to 15 months. Pre- and post-treatment lateral cephalograms were traced. Four angular and four linear measurements were performed and evaluated.
RESULTS: Skeletal changes related to functional therapy were: continual maxillary growth, an increase in mandibular length, a forward positioning of point B, no change in the mandibular plane angle and an improvement in the sagittal relationship.
CONCLUSIONS: Functional therapy is a good treatment method for patients with a Class II malocclusion with mandibular deficiency.

59 SURFACE FINISHING EFFECTS ON THE CORROSION PROPERTIES OF A COBALT-BASED ALLOY

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AIM: To outline the dependence of the corrosion behaviour and thus the biocompatibility of Elgiloy®, a common Co-based alloy, on the surface topography and chemical composition of commercially available 0.016×0.022 inch orthodontic wires.
MATERIALS AND METHODS: The surface topography and chemical composition of blue Elgiloy® (soft) in the as received state and after electropolishing (sample of the same batch) was examined by means of scanning electron microscopy (SEM) and energy dispersive spectroscopy analysis. The corrosion behaviour in ½ Ringer solution of both Elgiloy® wires was investigated using potentiodynamic corrosion testing. The photometry based PAN-method was used in order to quantify the released Ni- and Co-ions. The *in vitro* biocompatibility was tested in cell cultures of the commercially available mouse fibroblast cell line L929.
RESULTS: Elgiloy® showed rather high pitting corrosion potential but lower repassivation potential and a strong increase of the current density once pitting had occurred, while the polished surface exhibited a smaller slope. The photometric results revealed an almost two-fold release of Ni- and Co-ions in the as received state. SEM showed a large number of grinding grooves, inclusions and inhomogeneities of the microstructure in the native state. After corrosion testing the same surfaces appeared severely attacked especially in areas of microstructural inhomogeneities. After polishing the surface appeared smooth with few remaining inhomogeneities. In the corroded state the polished sample showed less pronounced corrosion. *In vitro* biocompatibility testing showed substantially reduced dehydrogenase activity in the presence of the Elgiloy® samples, although the polished samples seemed to be slightly better tolerated.
CONCLUSION: The minor quality of surface finishing during the manufacturing process of blue Elgiloy® causes a decreased corrosion resistance compared with polished samples. A reduced *in vitro* biocompatibility is the consequence of a lowered corrosion resistance. Thus the introduction of a standard for surface quality of appliances used in orthodontics seems to be necessary.

60 PROFESSIONAL AND LAYMEN'S APPRECIATION OF VARIOUS OPTIONS FOR CLASS III SURGICAL CORRECTION

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AIMS: To evaluate the assessments of maxillofacial surgeons, orthodontists, and laymen on the predicted aesthetic outcome of various surgical options in Class III correction.
MATERIAL AND METHODS: Lateral cephalograms and facial profile photographs prior to surgery of 18 skeletal Class III adult patients (10 males, 8 females). All headfilms were digitized and conventional cephalometric analysis was performed. From headfilms and profile photographs, computerized predictions of three surgical options (Le Fort I advancement, mandibular setback and bimaxillary surgery) were made using the OTP software (Orthovision). For each case, the pre-surgical profile photograph with the three predictions was presented on a printed page. The questionnaire was submitted to 78 orthodontists (response rate 70.5%), 51 maxillofacial surgeons (response rate 45%) and 61 laymen (response rate 100%) to evaluate aesthetically the pre-surgical photographs and the surgical predictions by placing a mark along a visual analogue scale.
RESULTS: Compared with professionals, laymen gave significantly higher scores when assessing the pre-surgical profile, while no significant difference was found between the judgement of orthodontists and surgeons. In general, the laymen gave an improvement rate that was lower than those of the professionals, with the orthodontists being the most generous in the improvement score. All treatment predictions led to an improved scoring of facial aesthetics; however, due to diagnostic heterogeneity of the Class III sample, none of the options could be differentiated as the best prediction. Therefore, further analysis of the results to evaluate the correlation between certain

initial cephalometric values and the judges' preferred option was performed.
CONCLUSION: Laymen are not as critical as professionals when assessing the aesthetic value of Class III profiles but gave the lowest improvement score for the surgical predictions. A differential diagnostic cephalometric procedure may facilitate the prognostic evaluation of patient improvement rates after different surgical approaches.

61 THE EFFECTIVENESS OF CLASS II BIONATOR TREATMENT—LONG-TERM RESULTS

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AIM: To evaluate the changes and stability, induced by the Balter's Bionator in the treatment of mandibular Class II cases, using Ricketts' cephalometric analyses. The Bionator is a functional jaw orthopaedic device that changes the mandibular posture in the vertical and horizontal directions and induces complementary mandibular growth.
SUBJECTS AND METHOD: Forty-one patients (16 males, 25 females) with an average age at the start of treatment of 9.3 years. The average treatment time was 2.2 years. Final records were made 5 to 9 years after the end of treatment. Lateral cephalograms were obtained at the beginning of treatment and at the final long-term follow-up. The patients were classified as pro-, neutro- and retro-vesion facial types. The diagnosis of the patients was previously established as Class II with a retrognathic mandibular position. Five cephalometric variables were used to determine the facial type and the maxillary and facial depth. Wilcoxon's non-parametric test was used in the statistical evaluation.
RESULTS: There were significant changes in facial depth, no decrease in facial axis and no increase in maxillary depth. The clinical results were stable with good occlusion, good facial aesthetics and efficiency with regard to the neuro-muscular system.

62 COMPUTER INFORMATION TECHNOLOGY FOR RAPID DIAGNOSIS IN ORTHODONTICS

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AIM: Creation of a computer program for rapid diagnosis.
SUBJECTS AND METHOD: Sixty-five patients (35 females, 30 males) aged 7 to 18 years with Angle's Class I, II and III mal-occlusions. On the basis of diagnostic equipment and observations, software was developed enabling location of soft tissue landmarks, the positions of the apical base and teeth, and the degree of inclination of occlusal plane with reference to the vertical plane (Vp) on photographs and study models of the patients. This program also allowed investigation of the patient's profile and anthropometry. The distance between the digital camera and cephalostat was kept constant. The photographs were standardized with the use of a customized cephalostat fixed on the patient's head. The digital images were fed in to the computer and orbitale and porion were located on the images. Points n, pn, sn, st, sm and Pog were located on the photographs and points A and B, and points on all teeth were located on photographs of the study models.
RESULT: The program confirmed the use of the diagnostic equipment and the results of previously conducted observations.
CONCLUSION: This program enables the orthodontist to achieve an accurate and time saving diagnosis.

63 TREATMENT OF ECTOPIC MAXILLARY MOLARS WITH A MODIFIED PENDULUM APPLIANCE—A CLINICAL EVALUATION

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AIM: To evaluate the effectiveness of a Pendulum appliance, specifically modified to treat irreversible ectopic eruption of the maxillary first permanent molars.
SUBJECTS AND METHOD: Eleven children aged between 7 and 10 years, with irreversible ectopic eruption of the maxillary molars (five bilateral, six monolateral). The degree of impaction, according to Harrison and Michal, was 2 and 3 (moderate and severe). Each patient was treated with a modified Pendulum. For insertion of the distalizing spring, a tube was bonded to the palatal surface of the impacted molar. No other orthodontic appliance was used. After distalization was achieved, the Pendulum was removed and the permanent molars freed to rebound mesially onto the distal surface of the second primary molars. Tracings (modified from Bjerklin and Kurol) were obtained from pre- and post-treatment dental panto-mograms to assess the angular modifications of the molars during treatment.
RESULTS. The mean treatment time was 18 ± 2 weeks. The mean angulation of the molars pre- and post-treatment was 85.5 ± 7.5 and 98.5 ± 8.0 degrees, respectively. No change in the angulation of the second primary molar was found: 94.0 ± 9.5 degrees. Full eruption of the permanent molars to the occlusal plane was obtained.
CONCLUSIONS. The biomechanics of the Pendulum seems to be optimal in intercepting the ectopic eruption of maxillary molars: crown tipping produced by the springs is desirable, leading to an appropriate uprighting of the element. Good contact points are obtainable between second primary and first permanent molars, after their guided recovery. This method, aesthetic and non-compliant, avoids extraction of the second primary molar.

64 SIMILARITIES, CORRELATION AND DIFFERENCES IN DETRIMENTAL HABITS OF PARENTS AND CHILDREN

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AIM: Orthodontic anomalies occur by the interaction of inherited and external factors during growth of the craniofacial structures. The effect of inheritance on the development of certain forms of open bite, and the inherited component of detrimental habits, which can incite or worsen symptoms of open bite, are still the subject of discussion. The aim of this study was to establish the factor of inheritance in the occurrence of open bite and detrimental habits, such as visceral swallowing, thumb- and finger-sucking and dyslalia, and to determine the correlation between detrimental habits with symptoms of open bite.
SUBJECTS AND METHOD: Fifty families were clinically examined and plaster cast models analysed (209 subjects). Logistic regression analysis was used to determine the statistical significance of the correlation for visceral swallowing between children and parents of different sex.
RESULTS: Visceral swallowing was correlated with the profile of the subjects, incisor angulation and decreased overbite. No inherited component or significant correlation was found between thumb- and finger-sucking and dyslalia with open bite.
CONCLUSION: The result confirms that the manner of swallowing is inherited, that the type of inheritance is not connected with sex, and that it does have an influence on the occurrence of a dentoalveolar open bite.

65 ROTATIONAL GROWTH IN LATE LOWER ARCH CROWDING

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AIM: Late lower arch crowding is a problem frequently encountered in orthodontic practice. There is a strong tendency for the untreated lower arch to become more crowded in the post-adolescence period. The cause of this late increase in crowding is obscured by its multifactorial nature. The controversy about the aetiology of late lower arch crowding has not yet been satisfactorily resolved. Skeletal structure and complex growth pattern have been implicated in the cause (occurrence) of late lower arch crowding. The aim of this study was to examine the rotational growth pattern in two groups of subjects with and without lower anterior crowding.
SUBJECTS AND METHODS: One hundred and thirty subjects with lower arch crowding were compared with a group of 90 subjects without crowding. Twelve angular and six linear vertical cephalometric variables were evaluated.
RESULTS: With the exception of the vertical position of the maxilla, all the observed cephalometric variables showed significant posterior rotational growth in the group with crowding. In addition, a significant correlation was found between posterior mandibular rotational growth and crowding.
CONCLUSIONS: A post-rotational growth pattern is an important characteristic of late lower arch crowding.

66 FUNCTIONAL TREATMENT OF CLASS II MALOCCLUSIONS: IS THERE AN IMPACT ON SPEECH?

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AIM: Long-term evaluation of the fricative formant spectrum during functional treatment of Class II patients.
SUBJECTS AND METHOD: Twenty children aged between 9 and 11 years (before mutation) with a Class II malocclusion treated with functional appliances. Speech recordings were made at T1 (beginning of treatment), T2 (at the next control) T3 (after muscular adaptation, 6 months) and T4 (after skeletal adaptation, at least one year). With the linear predictive coding method certain fricatives from repeatedly spoken sentence were evaluated. Plaster casts were analysed at T1 and T4.
RESULTS: Compared with normal speech, articulation was clearly audibly hindered with the appliance. At any time an acceptable and understandable articulation is possible and no significant changes were observable after T2. No change in articulation was measurable without the appliances over time. The occlusion clearly improved towards a Class I over the observed time in 16 patients whereas no changes were measurable in four. No differences in the formant spectrum of the fricatives were detectable between the good responding and the non-responding group without appliances over time.
CONCLUSION: An improvement in pronunciation with appliances in the mouth during the course of functional therapy helps the orthodontist to judge the patient's compliance. The sagittal jaw position seems not to influence articulation.

67 MISSING INCISORS. MAXIMIZING ANTERIOR AESTHETICS: FROM STANDARD TO INDIVIDUALIZED POSITIONING

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AIM: To evaluate if individualized bracket placement can be advantageous in space management of upper lateral incisor agenesis in subjects treated with the straightwire technique.
SUBJECTS AND METHOD: Twenty-eight patients (18 females, 10 males) with upper lateral incisor agenesis (21 bilateral, 7 monolateral). Space management in subjects with upper lateral incisors agenesis with the straightwire technique requires accurate bracket placement in order to obtain a good final result both functionally and aesthetically. The correct bracket placement in subjects where space for an implant and related prosthetic substitution was needed and where, on the contrary, the choice was the space closure was investigated.
RESULTS: Canine position and its related tip, torque and in-out are different in the abovementioned clinical options: is the accurate bracket positioning the only answer? Can it be also utilized bracket with different features? The research focused on the possibility to obtain a good final aesthetic result especially concerning the smile and gingival display.
CONCLUSIONS: Upper incisors agenesis can be successfully managed with the straightwire technique and individualized bracket positioning is the best option to obtain an aesthetic and functional final result.

68 INFLUENCE OF SEX HORMONE DISTURBANCES ON MANDIBULAR GROWTH IN NEWBORN MICE

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AIM: It has not been clarified how sex hormones affect craniofacial bone growth immediately after birth. In this study, a deficiency of sex hormones was simulated by means of orchiectomy (ORX) and ovariectomy (OVX) in newborn mice, and mandibular growth was examined histomorphometrically.
MATERIALS AND METHODS: ORX and OVX were performed on 5-day-old C57BL/6J mice. Four weeks after surgery, the mice were killed under general anaesthesia. The mandibles were excised, embedded in paraffin and cut into frontal sections. The condyle sections were stained with AZAN and observed microscopically. Lateral cephalograms were taken of all the mice using a rat and mouse cephalometer. Cephalometric analysis of the mandible was performed on a personal computer.
RESULTS: The total thickness of the articular cartilage layers was significantly greater in the experimental mice than in the controls. The number of cartilage cells in the maturative/hypertrophic layer was significantly greater in the experimental groups than in the controls. On the other hand, trabecular bone volume was significantly smaller in the experimental mice than in the controls. Morphometric analysis with lateral cephalograms showed that the amount of mandibular growth was significantly less in the experimental groups as compared with the controls, whereas no significant differences in gonial angle were found between the experimental and control groups.
CONCLUSIONS: It is speculated that deficiency of sex hormones may decrease trabecular bone volume and inhibit cartilaginous growth of the condyle and subsequent mandibular growth in newborn mice. These findings emphasize that the level of sex hormones is a critical determinant for mandibular growth immediately after birth.

69 CEPHALOMETRIC EVALUATION OF JUVENILE PATIENTS WITH MULTIPLE AGENESIS AND THERAPEUTIC IMPLICATIONS

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AIM: To study the sagittal and vertical dimensions in subjects with multiple agenesis in relation to the number of missing teeth

and to describe the orthodontic and restorative protocol of Vienna University.
SUBJECTS AND METHODS: One hundred and twenty nine adolescents (80 females, 49 males with a mean age of 15.6 years) with two or more missing teeth. Twenty-nine subjects could not be evaluated due to incomplete records. The remaining patients were divided into three groups according to the number of missing teeth (Group 1: 2–4, $n = 29$; Group 2: 5–7, $n = 30$; Group 3: 8–26, $n = 41$). Ten cephalometric parameters of the craniofacial morphology (SNA, SNB, E-line, nasolabial angle, PP/MP, ODI, overbite, face heights) were measured on the tracings of lateral headfilms by one investigator. Differences between the groups were calculated statistically using Student's *t*- and Wilcoxon's tests, respectively.
RESULTS: Statistically significant differences in the mean values of SNA were observed between groups 1 and 2. No statistically significant differences between the groups were found for the vertical dimension. There was no statistically significant difference in the amount of overbite. However, compared with cephalometric norms, all groups showed a more retrognathic maxilla, the vertical dimension to be diminished and the prominence of the lips to be reduced.
CONCLUSION: As the maxilla is retruded and as the vertical dimension is reduced in these juvenile patients interdisciplinary therapy is administered according to the following protocol: 1) Bite raising mechanics with functional orthopaedics or fixed appliances. 2) Very early implantation in the lower arch at 11 years of age. 3) Alignment of the upper dentition before insertion of the maxillary implants after growth is complete. 4) Final prosthetic restoration, which might again include a bite raising appliance according to the individual demands of the patient

70 FINITE ELEMENT ANALYSIS OF THE BIOMECHANICAL PROPERTIES OF THE CANINE PERIODONTAL LIGAMENT

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AIM: To analyse the influence of the material model of the periodontal ligament (PDL) using a finite element (FE) method to establish the position of the centre of resistance in a human lower canine. While the material parameters of a tooth and the bony structure have been reported by different authors within a certain limit, values reported for the parameters of the PDL differ significantly.
MATERIAL AND METHOD: Isotropic, bilinear and anisotropic material behaviour was assumed for the PDL. As an alternative, the anisotropy of PDL can be simulated by introducing fibres between the root and the alveolar bone modelled by unilateral link finite elements. A three-dimensional FE model of the human canine was developed in order to analyze displacements and stress in the PDL, root and alveolar bone. The displacements of a tooth were calculated when acted upon by force and couple applied at the position of fixation of a bracket.
RESULTS AND CONCLUSION: The anisotropic model is able to predict movements of the tooth in the PDL with a high level of accuracy. However, validation is still necessary in order to establish the appropriate values of anisotropy parameters.

71 THREE-DIMENSIONAL ANALYSIS OF COMPUTED TOMOGRAPHIC SCANNED STUDY MODELS IN 3-YEAR-OLD CLEFT CHILDREN

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AIMS: To establish the accuracy of computed tomographic (CT) scanning of stone study models and to examine the three-dimensional (3D) arch form in unilateral cleft lip and palate (UCLP) patients compared with non-UCLP subjects at 3 years using Procrustes analysis.
SUBJECTS AND METHOD: Eleven 3-year-old children with UCLP and 61 age-matched controls were recruited. Impressions of the upper and lower dental arches were recorded using addition-cured polyvinylsiloxane, and stone study models prepared. The intercanine width was recorded by digital callipers on each study model. Images of the upper and lower study models were recorded using spiral CT scanning. Cusp-tip landmarks were digitised on the images and the 3D co-ordinates recorded. The accuracy of CT scanning of stone models was determined by comparing indirect measurement of the intercanine width with direct calliper measurement. Precision of the imaging process and operator error in landmark identification were determined. Average maxillary and mandibular arch shapes were created for each group using Procrustes analysis and compared using Hotelling's T squared test. The arch shape in the cleft subjects was compared with that of the controls on a tooth by tooth basis.
RESULTS: Mean operator error for landmark digitisation was 0.24 mm (SD 0.10). Mean landmark displacement between duplicate scans was 0.5 mm (SD 0.25). Overall precision of CT scanning was 0.38 mm (SD 0.18). The distance calculated between landmarks identified on CT scanned models was 1.4 per cent greater than the directly measured distance. Significant differences ($P < 0.001$) in the upper and lower arch shapes existed between both groups.
CONCLUSION: The accuracy of CT scanning of stone study models is acceptable. The displacement of single teeth relative to the normal dental arch can be described using Procrustes analysis.

72 QUANTITATIVE DETERMINATION OF THE PRIMARY STABILITY OF IMPLANTS FOR ORTHODONTIC ANCHORAGE IN HUMAN BONE

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AIM: To compare the primary stability of Orthosystem implants (Straumann, Switzerland) in human bone for orthodontic anchorage.
MATERIALS AND METHOD: Cadaveric human formalin fixed heads were used to evaluate the stability of two different implant lengths (4 and 6 mm, screw-type) and different localisation (palatal suture or paramedially). The implants with a length of 6 mm were only placed in the suture. Primary stability was determined by the non-invasive method with the resonance frequency (Osstell®). The invasive method for the analysis of the morphometric parameters of the implant/bone contact was carried out by means of histological and radiological examinations. For better comparison of the radiographs to CT images of other patients, the histological samples were radiologically examined.
RESULTS: Longer implants had significantly better primary stability in the palatal suture ($P < 0.05$). Larger deteriorations in stability were measured after placement of a 4 mm implant paramedially ($P < 0.01$). However, no differences were found between the palatal suture and paramedially with 4 mm implants. The histological and radiological results also demonstrated the ability of the method to measure stability by investigation of the bone and density distribution around the implant. Bone structure, especially pore size in the trabecular bone and the precision of placement, can influence the stability.
CONCLUSIONS: Short orthodontic implants give sufficient bone fixation, independent of placement. However, longer implants provide greater fixation, which may account for its clinical success.

73 HISTOLOGICAL APPEARANCE AND CHANGES IN THE MYOSIN mRNA CONTENT OF PORCINE MASTICATORY MUSCLES AFTER MASSETER TREATMENT WITH BOTULINUM TOXIN

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AIM: Botulinum toxin A (Botox) is used frequently in the treatment of temporomandibular joint pain. The aim of this investigation was to identify possible morphologic and chewing changes in patients induced by Botox therapy. Muscle fibre and myosin heavy chain (MyHC) mRNA alterations were examined in this animal study.
MATERIALS AND METHOD: Fifteen pigs (7 treated, 8 controls) 14-week of age. To initialise the total immobilisation of the right masseter, the Botox injection was distributed in nine areas. After a 56-day period, muscle tissue was taken from the left and right side of the masseter (3 regions), temporal (2 regions), medial pterygoid and geniohyoid muscles by a standardized method. The muscle fibre cross-sections were examined immunohistochemically. Fibre staining was accomplished with antibodies specific to MyHC. The MyHC mRNA changes were analysed by real-time PCR.
RESULTS: The muscles adapted to the stress by changing fibre type and mRNA content. The paralysed masseter displayed atrophy and another masticatory muscle showed hypertrophic changes. The results indicated that the typical distributions of masticatory muscles by type II fibres (IIa and IIb) were due to Botox in the masseter (IIb, $P < 0.05$). However, no change was observed in type I fibres of this masseter in comparison with the control masseter. The masseter without Botox in the treated group showed an increase in type I MyHC ($P < 0.01$).
CONCLUSIONS: Treatment with Botox can lead to uncontrolled changes in affected-unaffected muscles structure. This can be a cause of a new imbalance.

74 LIP DYNAMOMETRIC TESTS TO DISCRIMINATE IN THE CHOICE OF ORTHODONTIC RETENTION

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AIM: To evaluate the tonicity of the lower lip in patients who have undergone orthodontic treatment and to verify the relapse.
SUBJECTS AND METHOD: Twenty-five patients (10 males, 15 females) aged 14–20 years who had undergone fixed orthodontic treatment for lower incisor crowding, without other skeletal problems. During treatment no lip bumper or other buccal shield was used. Alignment was obtained. A custom-made resin shield, to obtain retention in the upper part of the lip, covering the entire crown and 2 mm of the gingivae was designed. It was connected to a tension gauge with elastics. The patient was requested to sit comfortably with the bipupillar line parallel to the floor with the lips slightly open in order to avoid superior lip interference during the test. The measurements were repeated three times, but without exercising or fatiguing the lip. Clinical records were evaluated 2 years after completion of treatment, without any retention device in place.
RESULTS: In subjects with lower lip hyper- and hypotonia, there was a higher relapse frequency with vestibolarization or lingualization of the lower incisors (evaluated with Ricketts' analysis).
CONCLUSION: A purely clinical diagnosis might not be sufficiently accurate to estimate hyper- or hypotonicity of the lower lip; the dynamometer (a device that is simple to use) can precisely evaluate the strength of the lower lip.

75 CORROSION OF ORTHODONTIC WIRES: TEST OF STAINLESS STEEL IN AN OXIDISING ENVIRONMENT

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AIM: To evaluate the resistance to corrosion of orthodontic wires in a saline environment simulating saliva containing sulphide.
MATERIALS AND METHODS: Five wires were tested according to ASTM G5 protocol in different media, with increasing corrosion ability, in order to simulate the oral environment under different conditions (pitting and crevice corrosion). The tarnish arising conditions were tested by scrubbing and lapping of the specimens. The tarnish *per se* was not considered as detrimental to specimen integrity but was recorded, both as time and consistency dependence. The colour depth of the tarnish was not recorded, as variance between specimen areas was too high. The surface of the specimen was checked by means of a metallographic microscope in order to reduce external variables. The saline was under constant mechanical movement to prevent differences in concentration. The temperature and the nitrogen degasification were checked in order to lower the side-effects of handling crevice condition. The corrosion was evaluated both as electrochemical behaviour and as surface integrity.
RESULTS: The saliva with a higher content of sulphide promoting agents developed a tarnish attack to all the wires tested. Corrosion was dependent on the Cr content and was sensitive to pH conditions. Even the material with the lowest resistance to corrosion appeared to be resistant to corrosion in the mouth (until 300 mV).
CONCLUSION: Corrosion testing is an essential requirement of new materials, particularly if they are to be used in an aggressive environment. Tarnish alters the appearance of the specimen but does not change the corrosion resistance of the wire.

76 COMPUTER-AIDED PLANNING OF ORTHODONTIC MICRO-IMPLANTS IN THE MAXILLARY TUBEROSITY REGION

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AIM: Computer-aided planning of dental implants is well established in restorative dentistry but not used in orthodontics. The aim of this study was to evaluate the suitability of an implant software program for the planning of orthodontic micro-implants that may serve as anchorage devices for the distalisation of the upper dentition.
MATERIALS AND METHODS: Data from 50 dental computed tomograms of 50 patients (average age 37.0 ± 13.2 years, 25 male 25 female) were analysed and used for implant planning in the tuber maxillae region supported by the SIM/Plantâ computer program. All patients had undergone third molar osteotomy at least one year previously. Using this tool, the width and height of the alveolar process, the dimension of the cortical bone layer, palatal, buccal and crestal, and the distance from the alveolar crest to the floor of the maxillary sinus could be measured. Placement of orthodontic micro-implants of different diameters (1.0, 1.5 and 2.0 mm) and lengths (3.5, 5, 7 mm) was simulated in the retromolar region of the upper jaw. Differences between male and female patients were assessed with the Student's *t*-test ($\alpha = 0.05$).

RESULTS: Average values and standard deviation are shown below:

Millimetres	Maximum		Minimum		&AElig		SD		*P*
	M	F	M	F	M	F	M	F	
Width	15.3	16.1	7.7	7.9	11.3	10.8	2.4	2.5	0.09 NS
Height	39.2	36.2	21.9	25.3	33.4	31.5	5.4	5.3	0.09 NS
Buccal corticalis	2.2	1.9	0.8	0.7	1.1	1.2	0.2	0.2	0.68 NS
Lingual corticalis	2.4	2.1	0.9	0.9	1.3	1.3	0.2	0.2	0.34 NS
Crestal corticalis	2.1	2.0	1.0	1.0	1.3	1.3	0.2	0.2	0.25 NS
Distance alveolar crest/ maxillary sinus	25.2	22.9	17.3	16.2	20.4	18.7	3.9	4.7	0.22 NS

No significant differences were found between male and female patients.
CONCLUSION: In all cases the total amount of bone and the distance to the floor of the maxillary sinus was sufficient for the insertion of orthodontic micro-implants. The computer program used is a comfortable tool for the planning of implants in orthodontics.

77 A CLINICAL COMPARISON OF MICRO-ETCHED AND NON-MICRO-ETCHED BONDABLE MOLAR TUBES

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AIM: To compare the time to first failure of two non-convertible bondable first molar tubes with contoured mesh bases, one micro-etched (ME) and the other non-micro-etched (NME), over the full course of fixed appliance treatment.
MATERIALS AND METHOD: This study took the form of a prospective split mouth clinical trial in which ME tubes (micro-etched mesh base system, American Orthodontics, Sheboygan, WI, USA) and NME tubes (Victory series, 3M Unitek, Monrovia, CA, USA) were randomly allocated to left or right molars in the upper arch, with the lower tubes being allocated contralaterally. A total of 85 tube pairs were bonded using light cured composite resin (Transbond XT, 3M Unitek) according to the manufacturers' instructions on 68 consecutively treated fixed appliance patients in three centres. All times to first tube failure were recorded and survival analysis carried out.
RESULTS: Overall tube failure rates of 12 (14%) for the NME group and six (7%) for the ME group were found. The mean survival times for the NME group (29 months) and the ME group (30 months) showed no significant difference ($P > 0.05$).
CONCLUSIONS: In the subjects studied, NME bondable first molar tubes showed a tendency to more frequent failure during treatment than ME tubes, but their mean survival times were not significantly different.

78 LONGITUDINAL CHANGES IN GINGIVAL HEALTH IN CROWDED AND NON-CROWDED DENTITIONS

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AIM: A previous study has shown that initial crowding in the dentition is negatively correlated with the gingival bleeding index (GBI) at the end of orthodontic treatment. The aim of the present investigation was to examine further the longitudinal relationship between initial crowding and gingival health during fixed orthodontic treatment.
SUBJECTS AND METHOD: Two hundred and twenty subjects followed longitudinally during treatment. Within this material, two groups, one consisting of 48 patients with severe crowding and 44 subjects with no crowding were examined more closely. GBI was recorded at bonding, 12, 24 and 48 weeks after bonding and at debonding. The patients' prophylaxis records were evaluated.
RESULTS: At bonding GBI was the same in the two groups. However, the GBI improved significantly from 12 weeks after bonding to debonding in the patients with crowded dentitions, whereas the patients with non-crowded dentitions showed no change. The individuals with a crowded dentition had received twice as much oral hygiene instruction within the two years prior to bonding.
CONCLUSION: In order to have the same GBI at bonding, despite severe crowding, the patients in this group probably had a better oral hygiene technique. When the crowding was eliminated after approximately 3 months, these patients' better oral hygiene technique resulted in a lowered GBI. One could also speculate that correcting the crowding during the first few months of treatment had a positive psychological effect, motivating the patients to perform the skills in oral hygiene they had adopted prior to treatment.

79 ULTRASONOGRAPHY OF MASSETER MUSCLE VOLUME AND ITS RELATIONSHIP WITH FACIAL MORPHOLOGY

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AIM: To investigate whether the thickness of the human masseter muscle affects facial morphology in different individuals.
SUBJECTS AND METHOD: Forty-seven healthy, fully-dentate young adults (25 females, 22 males) divided into three groups (high angle, low angle and normal vertical growth pattern) according to analysis of their lateral cephalometric radiographs. Masseter thickness measurements were performed bilaterally, both during relaxation and maximal clenching. Each measurement was repeated three times with five minute intervals. The results were evaluated with a 95 per cent confidence interval ($P < 0.05$).
RESULTS: The mean value of masseter muscle thickness during relaxation was 13.29 ± 2.52 mm in high angle individuals, 15.20 ± 1.90 mm in low angle individuals and 13.5 ± 1.95 mm in the normal group. Tukey's multiple comparison test revealed that there was a significant difference between the high angle-low angle ($P < 0.001$) and low angle-normal ($P < 0.01$) groups. The mean value of masseter muscle thickness during maximal clenching was 14.72 ± 2.63 mm in the high angle, 16.31 ± 2.18 mm in the low angle and 14.57 ± 1.83 mm in the normal group. There was a statistically significant difference between high angle-low angle ($P < 0.01$) and low angle-normal ($P < 0.001$) groups.
CONCLUSION: Former studies have highlighted the negative correlation between the width of the masticatory muscles and anterior face height. The results of the present study also show that low angle individuals had thicker masseter muscles compared with high angle and normal subjects.

80 BIOMECHANICAL ANALYSIS OF OPEN BITE MALOCCLUSIONS USING THE FINITE ELEMENT METHOD

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AIM: The biomechanical events that accompany functional loading of the human mandible are not fully understood. The techniques normally used to record them are highly invasive. Computer modelling offers a promising alternative approach, with the additional ability to predict regional stresses and strains in inaccessible locations. The aim

of this study was to investigate dentoalveolar stresses in an open bite occlusion and to compare it with different clenching tasks.
MATERIALS AND METHODS: A three-dimensional finite element model (FEM) of a human mandible was constructed. The model consisted of 111,014 elements and 22,499 nodes with 67,497 degrees of freedom. The different structures in the FEM of the human jaw were assigned material characteristics conforming to data available in the literature. The right and left axes of the mandibular condyles and the occlusal surfaces of the clenching teeth of the model were restrained. These restraints acted against the loading of the masticatory forces, which consisted of a pair of masseter, temporal and also medial pterygoid muscles. Two groups of clenching tasks were modelled: the first consisted of unilateral clenching and compared four clenching tasks; the second consisted of symmetrical clenching with five clenching tasks.
RESULTS: High stress magnitudes were observed around the occlusal restraints in all the models and important differences in the stress distribution were found not only in the rest of the tooth and alveolar bone but also in other teeth. Unilateral clenching tasks showed the highest principal stresses on the cervical, vestibular and mesial aspects of the teeth and adjacent bone. However, bilateral clenching tasks showed the highest principal stresses on their cervical, vestibular and distal aspects. In the open bite models the stress in these areas on the molars was higher than with the other clenching tasks. The more teeth included in the clenching tasks the less stress occurred in the distal teeth and alveolar bone, but stress increased in the mesials.
CONCLUSIONS: Although in these models it was assumed that the mandible was a rigid beam and as a consequence behaved according to the static equilibrium theory, the results confirm that in an open bite occlusion a greater magnitude of force is transmitted in the molar region during unilateral or bilateral isometric molar biting, compared with other clenching tasks that included more teeth.

81 A PHOTOGRAPHIC ASSESSMENT OF THE RELATIONSHIP BETWEEN SKELETAL DISCREPANCY AND MANDIBULAR ASYMMETRY

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AIMS: To investigate the relationship between mandibular outline asymmetry and skeletal discrepancy in both an orthodontic and orthognathic sample of patients.
MATERIAL AND METHODS: Skeletal discrepancy was assessed in both anteroposterior and vertical planes using standard cephalometric analyses. Sixty-six orthodontic patients and 26 orthognathic patients were photographed under standardised conditions. The photographs were then digitised for analysis using a computerised system to assess differences in four variables (area, perimeter, compactness and moment ratio) between the right and left sides of the mandibular outline.
RESULTS: The repeatability of the photographic method was demonstrated both intra- and inter-site by photographing 12 patients twice, not less than two weeks apart, and by photographing a group of seven patients at two hospital sites. Digitising and cephalometric repeatability was also measured. The results showed good repeatability for the photographic, cephalometric and digitisation methods. A significant relationship was found between mandibular outline asymmetry and both anterior posterior and vertical skeletal discrepancy in this sample, when compared with patients with an average skeletal pattern.
CONCLUSIONS: A reduced ANB angle (≤2°) and mandibular outline asymmetry was shown to be significantly related in both surgical ($P = 0.028$, $\chi^2 = 4.850$) and orthodontic ($P = 0.030$, $\chi^2 = 4.729$) groups. Patients with an average lower anterior face height percentage (53–57%) had a significantly increased incidence of mandibular asymmetry in the orthognathic ($P = 0.034$, $\chi^2 = 4.516$) group in comparison with those with the same vertical facial dimensions in the orthodontic group.

82 STIMULATION OF OSTEOBLAST-LIKE CELLS WITH VALINOMYCIN—EVIDENCE FOR POTASSIUM CHANNEL INVOLVEMENT

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AIM: Previous studies have suggested that the response of Saos-2 cells to stimulation by parathyroid hormone (PTH) involves G-protein mediated opening of potassium channels. The aims of this study were to investigate the effect of valinomycin, a known potassium channel opener, on osteoblast cells.
MATERIALS AND METHOD: Saos-2 cells, cultured in a modified Eagles medium (DMEM) with 10 per cent foetal calf serum and antibiotics, were seeded onto Pioloform-covered gold electron microscopy grids. The grids with cells attached were exposed to valinomycin 10 μM [1:100 dilution with a solution made up in ethanol (ETOH)] for 0, 5 and 10 minutes or 1 per cent ETOH for 5 minutes. The grids were washed in distilled water at 0°C for 10 seconds, blotted, immediately immersed in liquid nitrogen, freeze dried overnight and carbon coated before analysis with electron probe X-ray microanalysis.
RESULTS: Cells rounded-up after valinomycin treatment. The P/K ratio increased in the Soas-2 cells [Control 0.58 ± 0.05, ETOH 0.62 ± 0.07 (not significant compared with the control)], valinomycin 5 minutes 0.66 ± 0.10 ($P < 0.01$ compared with control) and valinomycin 10 minutes 0.64 ± 0.21 ($P < 0.5$ compared with control) suggesting that potassium channels had opened. The experiment was repeated with another osteoblast cell type (M63), cultured in the absence of either antibiotics or antifungals and similar results were obtained: control 0.61 ± 0.07, ETOH 0.62 ± 0.09, valinomycin 5 minutes 0.72 ± 0.06, and valinomycin 10 minutes 0.67 ± 0.15.
CONCLUSIONS: Valinomycin causes both a change in cell shape and a reduction of [K] in osteoblast cells, changes that are similar to those found after PTH stimulation. The results from the MG-63 cells confirm the effect of a K channel opener on these cells and also suggest that there may be a slight 'blunting' of the response in Saos-2 cells.

83 THE EFFECT OF LACEBACK MECHANICS ON ARCH LENGTH AND CANINE ANGULATION

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AIM: To examine the effect of laceback mechanics on canine crown angulation and arch length when using the straight wire appliance.
MATERIALS AND METHOD: A laboratory model was used *in vitro* to study the effects of the mechanics. Sixteen typodonts were used in control and study (laceback) groups. Each had the same malocclusion and prescription of appliance fitted. The study group had laceback mechanics between canines and molars and the control group had none. The typodonts were immersed in a thermostatically controlled water bath and at set time intervals the position of the teeth was recorded for image analysis by a frame mounted digital camera. The images were imported into and processed by Image Pro Plus (V4, Media Cybernetics, USA). Outcome measures: Linear and angular measurements of the canine, and linear measurements of the first molar and between these teeth and a fixed reference point.
RESULTS: Limits of agreement and paired tests in a repeatability study showed good levels of measurement agreement with no systematic error. Canine crown angulation of 10–12 degrees was seen during levelling of the teeth in both groups and there was no difference between the groups. Lacebacks were associated with an average decrease in arch length of 3.13 mm, when compared with the no laceback controls ($P < 0.001$). Without lacebacks there was a significant increase in arch length of 1.2l mm ($P < 0.004$) mainly due to forward movement of the canine. The first molar moved mesially

with lacebacks present but did not do so in the non-laceback group ($P = 0.018$).
CONCLUSIONS: Lacebacks limit forward movement of the canine and affect arch length. They do not influence the amount of canine angulation.

84 LABORATORY ASSESSMENT OF A NEW SELF-ETCH AND PRIMER FOR ORTHODONTIC BONDING USING HALOGEN AND PLASMA LIGHT SOURCES

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AIM: To compare the *in vitro* bond strength of pre-coated brackets bonded using a new modified self-etch and primer when cured with a conventional halogen light compared with those cured using a plasma light. It is alleged that the photo-activator in the new modified self-etch primer is more sensitive to the spectrum of light used by the plasma light.
MATERIAL AND METHODS: Sixty-four extracted intact human premolar teeth were divided equally into two groups. Each group had the buccal surface bonded with Transbond XT precoated (APC) metallic Mini Uni-Twin® (0.022-inch pre-adjusted Edgewise), brackets bonded using the modified self-etch and primer. In group 1 halogen curing light (Ortholux XT visible light-curing unit) was used and in group 2 a plasma light (Ortho Lithe™ curing light). Both groups were subjected to thermal cycling. The brackets were then debonded using an Instron-like electromechanical testing machine. The mean shear bond strength was recorded for the two groups.
RESULTS: Paired *t*-test for the mean shear bond strength values [Group 1 = 6.45 MPa/mm^2; (SD 3.78); Group 2 = 8.5 MPa/mm^2; (SD 3.79)] showed that there was a significant difference ($P = 0.039$; 95% CI) when using the plasma light compared with a halogen light source to cure orthodontic brackets using the modified new self-etch and primer.
CONCLUSION: The modification of the new self-etch and primer would appear to be more sensitive to the wavelengths of the plasma light curing unit when compared with the halogen light. This resulted in greater mean bond strength when using the self-etch and primer if the plasma light is compared with the halogen light source.

85 EVALUATION OF FRICTIONAL RESISTANCE IN AN INNOVATIVE BRACKET-SYSTEM WITHOUT TORQUE PLAY

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AIM: To investigate the frictional forces generated by a new bracket with a five-edge slot in comparison with conventional metal brackets and to evaluate the influence of wire size, especially the friction between the new bracket and the corresponding five-edge wire.
MATERIALS AND METHODS: The new five-edge slot bracket, conventional metal brackets (0.018 inch Dentaurum Minitrim), stainless steel wires (0.016, 0.018, 0.016 × 0.022, 0.018 × 0.022, and five edge wire 0.017 × 0.025 inch). A Zwick universal testing machine was used to measure the forces needed to overcome friction. The rate of movement was 5 mm per minute with a load of 1 Newton.
RESULTS: The experimental bracket showed a higher friction than the conventional bracket, and for all bracket/wire combination friction increased with wire size. The five edge wire exhibited non-statistically lower friction compared with the 0.018 × 0.022 wire. Scanning electron microscopy showed a much rougher surface structure in the experimental, milled out five-edge slot.
CONCLUSION: With the new slot design the loss of torque control can be reduced to the twist of the arch. The frictional resistance is higher compared with conventional brackets. The roughness of the prototype bracket design might explain this result, which needs to be further investigated following professional surface treatment of the bracket slot and wire.

86 LONG-TERM CHANGES IN THE ANGULATION OF MAXILLARY CANINES FOLLOWING DISTAL TIPPING

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AIM: To establish whether maxillary canines, which have been deliberately or inadvertently over-retracted distally using removable appliances, will remain in their new position over the long-term.
SUBJECTS AND METHODS: Eighteen subjects who had been treated with extraction of upper first premolars and removable appliance therapy to retract the canines and reduce the overbite and overjet 10–25 years previously were approached to take part in the study. Using the pre-, post-treatment and long-term follow-up models, the maxillary canine angulations were determined using a Reflex microscope. Acrylic templates were constructed to fit over the canines and first molars and score marks were placed in these along the long axes of the buccal aspects, along with two crosshatches at the occlusal and gingival ends of these lines. The templates were transferred between all three sets of models for each patient. The occlusal and gingival crosshatches were digitized for the first molars and the canines on each study cast to calculate the angle between these teeth. To test operator reliability, a randomly selected side and time-point was re-measured for each subject 2 weeks after the initial recording.
RESULTS: The changes in canine angulation between pre- and post-treatment ranged from –30.55 to +17.05 degrees (median –13.47º). The change between post-treatment and long-term follow-up ranged from –11.2 to +16.8 degrees (median –0.4º). There was no significant change in the angulation of the maxillary canines between post-treatment and long-term follow-up ($P = 0.35$). There was also no significant intra-operator disagreement.
CONCLUSION: The position of maxillary canines at the end of upper removable appliance therapy appears to be stable in the long-term (10–25 years).

87 LOWER THIRD MOLARS FORMATION

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AIM: To determine changes in position and crown dimensions of lower third molars at different stages of their formation.
MATERIALS AND METHOD: Dental pantomograms of 53 patients aged 9 to 30 years on which the formation stages of 101 lower third molars were defined using the method of Gleiser and Hunt (1955). Evaluation of molar position was made in the mesiodistal (Evans, 1988) and orovestibular (Richardson, 1992) directions. The true mesiodistal dimensions of third molars were determined based on the proportion of the radiographic defined crown dimensions of the first and third molars to the crown dimension of the first molar, defined on study models of the lower arch. Significance of positional changes at every stage of germ formation was determined using a Student's *t*-test.
RESULTS: The mesiodistal inclination of the third molars decreased during their formation, on average by 24 degrees. Changes during stages 3 to 4 and 4 to 6 of molar formation were statistically significant ($P < 0.001$). Orovestibular inclination of the third molars during stages 2 to 8 was in the range of 27 to 5 degrees ($P < 0.001$), which was

probably related to the tendency of the tooth germs to upright during formation and eruption. The mesiodistal dimensions of the third molars increased on average by 3.84 mm for every stage of formation, which may be due to crown mineralization and orovestibular inclination changes of the tooth germ.
CONCLUSIONS: Initially there is a considerable mesiodistal and orovestibular inclination of third molars germs. During root germ formation their position tends to upright. Tooth formation is also accompanied by an increase in crown dimension.

88 CURRENT ORTHODONTIC STANDARDS IN POLAND IN RELATION TO RECOMMENDATIONS OF THE INDEX OF ORTHODONTIC TREATMENT NEED

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AIM: 1) To test the reliability of Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) in reflecting demand for treatment and 2) To verify the criteria of the Dental Health Component (DHC) with current orthodontic standards in Poland.
SUBJECTS AND METHODS: A questionnaire survey was carried out among 264 schoolchildren and a clinical examination with application of the AC to test the reliability of this component. Subjective assessment of treatment need of 50 diagnostic casts representing a wide range of occlusal anomalies by six orthodontists was also compared with the recommendations of the DHC to verify the degree of acceptability of the DHC criteria by Polish orthodontists.
RESULTS: The AC demonstrated significant correlation with a demand for treatment within the category 'no treatment need'; the demand increased together with the AC grade. Total crossbite without RCP-ICP slide, a Class II and Class III tendency and anomalies of the anterior teeth (reverse overjet, open bite, moderate crowding, overjet 3.5–6 mm) were perceived by orthodontists as definitely needing treatment.
CONCLUSIONS: The separate interpretation of grades 1–2 and 3–4 more accurately reflects demand for treatment. For acceptance of the IOTN as a method of qualifying for treatment some of the criteria of the DHC would have to be shifted from the category 'borderline' or 'no treatment need' to the category 'treatment need'.

89 TWO RAPID CANINE RETRACTION TECHNIQUES: ALVEOLAR BONE DISTRACTION OSTEOGENESIS VERSUS PERIODONTAL MEMBRANE DISTRACTION OSTEOGENESIS

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AIM: To investigate two modalities of distraction osteogenesis in one clinical setting to assess and compare their efficiency in providing rapid canine retraction.
SUBJECTS AND METHODS: In five adolescent patients with an initial mean age of 18.3 years, rapid retraction of the maxillary canines was carried out with custom-made, tooth-borne, intra-oral, unidirectional distraction devices. In each patient the canine on one side was retracted by alveolar bone distraction (ABD) and the other by periodontal membrane distraction (PMD). The appliances were inserted immediately after minor surgical intervention and activated 0.4 mm a day after a three-day latency period. The nature of tooth movement, anchorage loss, root resorption and dental pulp vitality were evaluated. Periodontal health was monitored by measurement of pocket depth, attachment level and crestal bone height before and after treatment.
RESULTS: The nature of tooth movement was a combination of translation and distal crown tipping in both groups; however, the extent of tipping was greater in the PMD group. Anchorage loss in the posterior segment was minimal with both techniques. Root resorption was absent with both modalities. In both groups, the canines gave positive responses at higher thresholds to electronic pulp testing, which indicated decreased sensitivity. Comparison of the two groups showed insignificant results with regard to pocket depth, attachment level and crestal bone height. In the ABD group there were significant differences in pocket depth in the middle of the canine, in the attachment level distal to the canine and in crestal bone height mesial to the canine and distal to the lateral incisor. In the PMD group there was a significant difference in pocket depth only distal to the canine.
CONCLUSION: Both techniques were effective, with ABD being slightly more efficient for the retraction of canines.

90 QUANTITATIVE TEMPOROMANDIBULAR JOINT REMODELLING DURING HERBST TREATMENT ASSESSED WITH MAGNETIC RESONANCE IMAGING

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AIM: To evaluate the quantity of temporomandibular joint (TMJ) remodelling and to examine the relationship of the human disc, glenoid fossa and condyle during Herbst appliance treatment.
SUBJECTS AND METHOD: Forty-seven young adults (13.5 years of age) with an Angle Class II malocclusion treated for 6.8 months with a Herbst appliance. Before (T0), during (T1) and after elimination of the appliance (T2) magnetic resonance images (MRI) of the right TMJ were taken. In addition, a pre- and post-treatment lateral cephalogram (T0, T2) was available. All MRIs were evaluated three times with metric MRI analysis. The variables describe positional changes of the disc and condyle during the investigated intervals. The lateral cephalograms were evaluated three times with Pancherz's analysis using FR-WIN 6.0 (Computer Konkret, Germany).
RESULTS: Treatment with the Herbst appliance had no negative effects on disc, condyle and fossa. In nine of 27 subjects with anterior disc displacement even improvements of the relationship were seen. MRI analysis demonstrated that condyles (4.0 mm) and discs (1.6 mm), moved forward during treatment and almost back to the starting position at the end of active Herbst treatment. The true sagittal changes in condyle and disc position to a perpendicular reference line were higher for the condyle than for the disc, but the absolute values were much less than expected.
CONCLUSION: The changes in condyle and disc position were mainly related to mandibular and dentoalveolar adaptation and not so much depending on glenoid fossa remodelling. In this patient group the percentage of condyle and glenoid fossa remodelling was much smaller than described in the literature.

91 SYMPHYSIS DISTRACTION OSTEOGENESIS—A PRACTICAL CONCEPT FOR THE ORTHODONTIC OFFICE

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AIM: The goals of symphysis distraction osteogenesis (SDO) are to increase mandibular arch length and to address severe interarch size discrepancies. Thus, it can serve as a viable treatment alternative to extraction therapy. The aim of this presentation was to demonstrate and compare the use of bone-borne and a combination of tooth- and bone-borne SDO devices to increase arch length.
SUBJECTS AND METHOD: Twelve patients (mean age 36.5 years) with transversal mandibular deficits underwent SDO and subsequent

orthodontic treatment. Ten patients had a bone-borne device (Martin, Germany) and two combined tooth- and bone-borne devices (Leone, Italy). One week (latency phase) following osteotomy and monocortical screw fixation of the distractor, activation was performed at a rate of 1 mm/day (distraction phase). The distractor was removed 3 months after distraction (retention phase). The investigated parameters were surgical complication, tissue inflammation and arch width stability.
RESULTS: The combination of tooth- and bone-borne devices were better tolerated by the patients than the bone-borne distractors. None of the distractors was lost and no surgical complications were found. However, several patients experienced soft tissue inflammation because of the size of the bone-borne distractors. Bands and brackets need to be placed before osteotomy and the first wire immediately after the distraction phase to prevent arch collapse during the retention phase.
CONCLUSION: SDO is an effective technique to achieve sufficient arch length within a short time period. The complication rate is low and subsequent orthodontic treatment is accelerated.

92 DENTAL AND SKELETAL CHANGES INDUCED BY TREATMENT WITH THE INTEGRATED HERBST APPLIANCE

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AIM: To study the effect of the integrated Herbst appliance (IHA) on some skeletal and dental variables, and to compare the treatment changes with the corresponding growth changes in untreated subjects with post-normal occlusion.
SUBJECTS AND METHOD: Thirty boys (mean age 14.2 ± 0.94 years and maturation phase MP3-F, MP3-FG, MP3-G), were selected from a group of 174 consecutive patients who had undergone treatment with the IHA. The ANB angle was ≥4 degrees and the overjet ≥6 mm in all patients. All treatments were carried out without extractions. The average treatment time was 8 months 13 days (253 ± 37 days). Cephalometric lateral head films, taken before and after Herbst treatment, were used for analysis of skeletal and dental changes. The average treatment changes were compared with the growth changes that took place during 8 months in the untreated age- and sex-matched post-normal subjects.
RESULTS: In the treatment group SNPg angle increased by 0.9 degrees and in the control group (CG) by 0.1 degrees. In the treatment group angles SNA and ANB were reduced by –1.1 degrees (CG +0.1°) and –2.1 degrees (CG +0.1°), respectively. The angle, ML/NSL, was reduced in both the treatment (–0.4°) and the CG (–0.2°). As regards dental variables, overjet was reduced by –7.3 mm in the Herbst group (CG +0.2 mm). The distance incision inferius to the NPg plane increased +2.8 mm in the treated group, but only +0.1 mm in the CG.
CONCLUSION: Treatment with the IHA modifies the unfavourable pattern of growth seen in subjects with Class II malocclusions and results in a normalisation of dentofacial relations. The response to treatment varies. Accordingly, the amount of change recorded in different individuals may vary from only small modifications to very pronounced changes.

93 TEMPOROMANDIBULAR JOINT PROBLEMS IN ADULTS WITH EHLERS-DANLOS SYNDROME—A QUESTIONNAIRE STUDY

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AIM: To study temporomandibular joint (TMJ) problems and self-registered mandibular opening capacity in a group of adults with the connective tissue disorder, Ehlers-Danlos syndrome (EDS).
SUBJECTS AND METHODS: Among 131 eligible subjects from the Swedish EDS association 114 returned a measuring spatula and a questionnaire. The controls were 114 adults from a randomised population based cohort. Their mean ages were 42 and 43 years, respectively. The participant marked the maximal inter-incisal distance on a spatula. The type of overbite was selected by comparing the participant's bite in the intercuspal position with photographs.
RESULTS: The mean values for maximal mandibular opening capacity were similar in the two groups, 54 and 53 mm. The EDS subjects who reported problems when biting into thick pieces of food had a lower mean maximal mandibular opening value compared with the other EDS subjects ($P < 0.05$). The difference between sample means was 5.8 mm. The proportion of 'yes' answers concerning the experiences of more mobile TMJs during mouth opening, present TMJ problems, reduced bite opening capacity when biting into thick food, clickings, crepitations and permanent lockings were significantly more frequent compared with the controls.
CONCLUSION: Adults with EDS report significantly more TMJ problems compared with controls. The EDS subjects who reported problems when biting into thick pieces of food had a lower maximal mandibular opening capacity.

94 FIXED APPLIANCES MODIFY THE ORAL CARRIAGE OF *CANDIDA* SPECIES AND COLIFORMS

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AIM: To evaluate the prevalence of *Candida* and a group of gram-negative bacterial genera in a group of adolescents during fixed orthodontic therapy (FOA).
SUBJECTS AND METHOD: Fifty consecutive subjects assigned to therapy ($n = 27$; 15 ± 2.3 years) were clinically examined at baseline, and the experimental group four times after insertion of a FOA. Before baseline examination all subjects underwent oral hygiene instruction and professional cleaning. The whole mouth plaque score was obtained using the method of Silness and Löe, and the oral cavity was sampled for *Candida* and coliforms using three microbiological culture techniques.
RESULTS: A significant increase in candidal density was observed after FOA insertion when the imprint technique was used, although the overall candidal prevalence rates obtained using oral rinse and pooled plaque techniques did not demonstrate such a change. The predominant *Candida* species isolated was *C. albicans* and the number of coliform carriers significantly increased after the insertion of a FOA, as detected both by the oral rinse and the pooled plaque techniques. A total of eight coliform species were isolated following FOA therapy in comparison with the three species isolated before insertion of the appliance. The results also revealed a significant increase in plaque index due to the introduction of a FOA.

95 TREATMENT RESPONSE TO ALTERNATIVE FUNCTIONAL APPLIANCE THERAPY

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AIM: To compare the mechanism change of jaw base relationship with various modes of functional appliances.
SUBJECTS AND METHOD: Four groups of consecutive skeletal Class II patients were studied; two groups were treated with the headgear-activator ($n = 30$) and conventional Herbst appliance

(n = 24) both with maximal jumping of the mandible, and two groups with step-by-step advancement of the mandible using the Herbst appliance with (n = 22) and without (n = 14) headgear. Lateral cephalograms obtained before and after 12–15 months of treatment were analyzed using Pancherz's method.
RESULTS: The improvement of jaw base relationship was significantly larger in the two groups treated with step-by-step advancement of the mandible compared with the two groups treated with maximal jumping of the mandible. The use of headgear in combination with the Herbst appliance was the superior method. The headgear-activator and Herbst appliance with maximal conventional jumping of the mandible showed no difference in improvement of the jaw base relationship, which was less than half that achieved with the headgear Herbst with step-by-step advancement.
CONCLUSION: The choice of functional appliance is critical to the orthopaedic effect on the jaw base relationship.

96 MORPHOMETRIC EVALUATION OF THE CRANIOFACIAL PATTERN

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AIM: Conventional cephalometric analyses aim to evaluate craniofacial patterns by a multitude of angles and distances. However, these have a limited and regional scope, while often being conflicting. The purpose of this study was to measure and describe the shape of the craniofacial complex as a whole, using morphometric methods of shape analysis.
MATERIAL AND METHODS: Pre-treatment cephalometric radiographs of 120 consecutive patients aged 8–15 years, covering a broad range of malocclusions, were scanned and digitized. The average of the sample was calculated using generalized Procrustes superimposition and the variability of shape was assessed using Principal Component Analysis (PCA). This method identifies the most significant shape patterns that contribute to the variability of the sample. It allows for a comprehensive description of shape using a small number of factors and provides a simple measure of how similar two patients are regarding their overall skeletal pattern.
RESULTS: Two PCA factors accounted for half of the total variance and eight factors were sufficient to explain more than 90 per cent. The most influential factor described vertical measurements, being closely related to the relative inclinations of the cranial base, palatal plane and mandibular plane. The second most significant factor was related to the horizontal relationship of the jaws, and especially of the lower jaw relative to the craniomaxillary complex. No difference in shape could be detected between the two sexes. The three Angle Classes could not be distinguished by definite boundaries, but there was considerable overlap, the sample appearing as one homogeneous group.
CONCLUSIONS: The craniofacial complex appears more variable in the vertical than in the horizontal direction, in contrast to traditional orthodontic emphasis. Morphometric methods, gaining wide acceptance in the biological sciences, could be used as an alternative to conventional cephalometrics, both for comprehensive shape description (diagnosis) and treatment planning.

97 PRENATAL DEVELOPMENT OF THE VOMEROMAXILLARY SUTURE

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AIM: To elucidate the prenatal connection between the maxilla and the nasal septum, with special emphasis on the development of the vomeromaxillary suture.
MATERIAL AND METHOD: Midaxial tissue blocks from 38 human embryos/foetuses were dissected from the specimens. The ages of the specimens ranged from 8 to 22 weeks gestational age (GA). The 38 midaxial tissue blocks were demineralised, paraffin embedded and cut in serial sections of 4–6 μm (12 sagittally, 12 horizontally and 14 vertically). Staining for metachromasia was performed with Toluidine blue in 30 per cent ethanol (pH 7). Nerve fibres and blood vessels were identified by immunohistochemical reaction for NGFR. The areas of development considered were: 1) Cartilage in the anterior cranial base. 2) The connection between the cartilage in the anterior cranial base and vomer. 3) The connection between vomer and the maxilla, which is the region where the vomeromaxillary suture develops.
RESULTS: In the first half of prenatal life there was a continuous cartilage extending from the anterior cranial base to the vomeral region of the nasal septum. Between vomer and the maxilla the sequence in the vomeromaxillary suture development was: 1) Apoptosis of the Y-shaped fused epithelium initiating at the centre of the Y at 12–13 weeks GA. 2) Vascularization indicating onset of suture formation starting laterally at the age of 16 weeks GA.
CONCLUSION: Growth in the vomeromaxillary suture contributes to vertical growth of the craniofacial complex and sagittal sliding between the anterior cranial base and the maxilla. From the prenatal age of 16 weeks GA these growth processes are possible.

98 ANALYSIS OF THE SOFT TISSUE PROFILE IN THE MANAGEMENT OF UPPER LATERAL MISSING INCISORS

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AIM: To include the soft tissue analysis of adult patients with missing lateral incisors in orthodontic management and treatment planning.
SUBJECTS AND METHODS: Nineteen adult patients with bilateral upper incisor agenesis divided in to two groups. One group (n = 11) was treated with lateral incisor space closure. In the second group (n = 8) re-opening of the space for implant placement or prosthetic restoration of the lateral incisor was carried out. Lateral radiographs and enhanced profile photographs were obtained for each subject before and after treatment. The nasolabial angle (Powell) was measured on the pre- and post-treatment radiographs and photographs by one person. The results were statistically measured and compared.
RESULTS: In the group where the lateral incisor space was closed a slight opening of the nasolabial angle was observed, making the profile look less aesthetic. In the group where the space was maintained and the lateral incisor space prosthetically replaced, no significant changes were found in the nasolabial angle after treatment.
CONCLUSIONS: In patients with missing lateral incisors where the nasolabial angle is open, a re-opening of this space is indicated, so no further aesthetic changes can take place. In these subjects the nasolabial angle is the determining factor in treatment planning.

99 OPEN BITE IN PREMATURELY BORN CHILDREN

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AIM: To examine the incidence of open bite in prematurely born children compared with children born full-term.
SUBJECTS AND METHOD: Three hundred and twenty eight prematurely born (<37 gestational weeks) Caucasoid and Afro-American children and 1,804 control children, who participated in the cross-sectional study of the Collaborative Perinatal Project (USA) in the 1960s and 1970s. Dental examinations, including dental casts and

photographs, were carried out at the age of 6–12 years in the mixed dentition. The occlusion was recorded by examining and measuring the hard stone casts. The pre-term and comparison groups were divided by sex and race. The statistical method used was the Chi-square analysis.
RESULTS: Significant differences in the incidence of anterior (from left to right canine) open bite was found between the pre-term and control groups and between sex and ethnic groups. Afro-Americans had significantly more open bites than Caucasoids and the prevalence of open bite was significantly increased especially in pre-term Afro-American boys compared with the controls.
CONCLUSIONS: These results highlight the ethnic and sexual differences and individual variability in the development of occlusion and in the incidence of open bite. Pre-term children, especially boys, may be more predisposed to aetiological factors for the development of open bite, respiratory infections and other medical problems, mouth breathing and oral habits.

100 IMMUNOREACTIVITY OF NEUROTROPHIC RECEPTORS IN THE RAT PERIODONTAL LIGAMENT DURING ORTHODONTIC TOOTH MOVEMENT

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AIM: To investigate the immunoreactivity of neurotrophins and their receptors in the rat periodontal ligament (PDL) and to record the chronology of events observed over several time intervals during experimental tooth movement.
MATERIALS AND METHODS: Six-week-old male rats were sacrificed at 1, 3, 7, 14 and 28-day time points after insertion of an elastomeric module between the right M1 and M2. The contralateral molars served as controls. After fixation with 2 per cent paraformaldehyde and decalcification in 4 per cent EDTA, the resected maxillae were frozen, sectioned and processed for immunohistochemical analysis of p75, Tyrosine Receptor Kinase A (Trk A), Trk B, nerve growth factor and brain derived neurotrophic factor. The roots and PDL of the first and second maxillary molars were examined.
RESULTS: By day 7, areas of root resorption were observed more frequently on the compression side of the roots. The number and extent of the resorption bays increased until 28 days. There was an increase in Trk A and p75 immunoreactivity until day 7 on the compression side of the PDL. Subsequent time points showed a return to normal when compared with the control side. p75 positive filaments were observed extending into repairing resorption bays. Epithelial rests of Mallasez were immunoreactive for TrkA. These were distributed around and close to the root surface, but were not evident in close proximity to root resorption bays.
CONCLUSIONS: The histological response to orthodontic load with respect to bone remodelling and root resorption was in agreement with previously reported investigations. The regulation of sensory nerve innervation by neurotrophic mechanisms in the PDL appeared to coincide with the occurrence of events evident in orthodontic tooth movement.

101 COMPARISON OF TWO CANINE RETRACTORS WITH DISTRACTION OF THE PERIODONTAL LIGAMENT

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AIM: To compare two designs of canine retractor appliances.
SUBJECTS AND METHOD: Ten patients in each group chosen by a through selective available sampling procedure. Pre-treatment clinical and radiographic records were collected. All patients required extraction of the first premolars and retraction of the canines as the first stage of treatment. In each group, 20 maxillary premolars were extracted and minor surgical scoring of the interseptal bone was carried out. Two types of appliances with modified Hyrax screws were used. The screws were activated twice a day.
RESULTS: Analysis of the dental casts and radiographs showed that the anchorage units were able to withstand the retraction force with minimal anchorage loss of 0.10 ± 0.25 mm. The canines were retracted (6.25 ± 0.75 mm) into the extraction space within 2–3 weeks in the unilateral group. The rate of failure and appliance breakage was more in bilateral types due to the different paths of retraction of canines.

102 UNILATERAL CROSSBITE IN FUNCTIONAL LATERALITIES

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AIM: To explore unilateral crossbite malocclusion prevalence in functionally true-right-sided and non-right-sided children, having one or more functions (eye, hand, foot) left sided or indeterminate.
SUBJECTS AND METHOD: One thousand eight hundred and thirty five young Afro-American (60%) and Caucasoid (40%) children in a cross-sectional sample with the mean age of 8.5 years. The transverse relationships of the primary and mixed dentitions were determined on dental casts. Hand, foot and eye preferences (right, left, or indeterminate) were recorded at the age of 4 years during the Collaborative Perinatal Study. The prevalence of left and right crossbites was compared between true right-sided and mixed or completely non-right-sided children using Chi-square analysis.
RESULTS: In general a crossbite occurred in 10 per cent of children, unilaterally in 140 cases, 65 were right- and 75 left-sided. True-right-sided children had significantly less right-sided crossbites and more bilaterally symmetric occlusions than those having non-right-sidedness in functions. The differences were statistically significant ($P < 0.01$).
CONCLUSIONS: The results highlight the anatomical relationships of structures supporting the occlusion and the asymmetry of the neurocranium and cranial base, the development of the masticatory apparatus, sidedness and the growth stimulating effect of early lateralized functions and oral habits.

103 THE INFLUENCE OF MALOCCLUSION ON BITE FORCE

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AIM: To evaluate the influence of malocclusion on bite force.
SUBJECTS AND METHOD: Eighty-three patients with unilateral malocclusion were examined. To establish the pattern of bite force in normal occlusion another 20 patients were examined. Clinical examination (orthodontic diagnosis) and measurement of bite force, using the T-scan system, were performed. To analyze the data a computer program was used.
RESULTS: 1. The bite forces were of different values for each particular tooth and symmetrical for the right and left sides. The findings were compared with the results of other authors. 2. There was no difference between the bite force of patients with a normal occlusion compared with those with malocclusions in the opposite quadrant in the same patient. The only exceptions were in subjects with open bites and crossbites. 3. The bite force in patients with unilateral malocclusion were slightly less than in subjects with normal occlusion.

104 EVALUATION OF TREATMENT OUTCOME

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AIM: Evaluation of treatment outcome is a basic need in quality management and evidence-based medicine. Different points of view are to be compared: general degree of improvement, fulfilment of the plan of treatment and the degree of deviation of normal occlusion.
MATERIALS AND METHOD: The records of 85 subjects (41 females, 44 males) were selected. Inclusion criteria were regularly finished active treatment in 2001 and complete documentation. The Peer Assessment Rating (PAR) Index, an evaluation concerning the individual aim of treatment, and the newly published classification of 'KIG' (diagnosis related groups of indication) were performed and compared.
RESULTS: Applying KIG categories only 79 cases would have been included for public health service. With regard to the PAR Index, 31 of those were greatly improved, improved 30, no difference 14, missing 4. The cross table of PAR Index and plan fulfilment showed severe discrepancies for success. Only 18 greatly improved cases were classified with complete plan fulfilment. One only partly completed plan was classified as greatly improved.
CONCLUSIONS: The KIG categories selected more than 90 per cent for public health treatment. Criteria of different dimensions are to be selected for better evaluation of treatment outcome. Differences between fulfilment of individual treatment plan and PAR Index of improvement are apparent.

105 LONG-TERM FOLLOW-UP OF CRANIOFACIAL DEVELOPMENT IN PATIENTS WITH BILATERAL CLEFTS OF THE LIP, ALVEOLUS AND PALATE

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AIM: To locate and examine different developmental processes in the craniofacial skeleton in cleft patients compared with children with normal occlusion
SUBJECTS AND METHODS: Seventy-nine patients from Berlin and Rostock (61 boys, 18 girls), 6 to >18 years of age. Two hundred and forty four cephalograms were analysed and divided in to seven age groups. The palate was closed in the patients from Berlin in a one-stage procedure and in those from Rostock in a two-stage procedure. Thirty children without a cleft served as the control group. The cephalometric analysis was supported by tensor analysis (ROTA), a technique developed in Rostock. Tensor analysis is a geometric technique that illustrates local alterations in the jaws and cranial base using 18 well-defined triangles. Statistical evaluation was carried out using a Student's *t*-test with significance set at $P < 0.05$.
RESULTS: After eruption of the incisors sagittal growth of the maxilla ceased when compared with the cranial base and lower jaw. As a consequence, SNA angle significantly decreased. In contrast vertical posterior growth did not change. Tensor analysis confirmed the moderate retardation of midfacial growth as there were significant dilatations of form and size of the triangles (SNA, SsppA, NSppA). The highly significant differences found when comparing these results with those in the control group demonstrated clearly the growth deficit in patients with clefts. Only few variations were found between the patients from Berlin and those from Rostock.
CONCLUSION: Inspite of the good clinical results achieved and the surgical technique applied aimed at reducing the effects on the growth potential, there was growth retardation after 8 years of age. At that time a moderate protrusion of the premaxilla counteracted the growth stagnation. Therefore protrusion of the premaxilla should be aimed for as an intermediate result in order to avoid later orthognathic surgery.

106 *IN VITRO* SEATING CHARACTERISTICS OF METALLIC APC1 AND APC2 PRECOATED AND OPERATOR COATED BRACKETS

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AIM: Light-cured composite materials often differ in tensile and shear bond strength as well as their handling characteristics, such as pressure needed to seat the bracket and bracket mobility during excess composite removal. Some of these characteristics may vary with different primers. Since the introduction of adhesive precoated composite (APC) brackets (3M Unitek), its bond strength has been compared with operator coated (OC) composite from the same manufacturer, but handling characteristics do not appear to have been tested. The aim of this investigation was, therefore, to assess the handling characteristics of OC metallic Victory Series Brackets (3M Unitek) and APC1 and APC2 precoated brackets after application of self-etching primer.
MATERIALS AND METHOD: Two operators, both blind to the brackets used, seated the brackets on 45 premolar teeth each and completed a questionnaire. The amount of adhesive on the bracket base, amount of pressure needed to seat the bracket, bracket mobility on removal of excess adhesive, ease of use and which bracket the operators thought had been used was investigated. Application of Transbond XT to the OC brackets was performed by an experienced dental nurse.
RESULTS: Both operators showed a tendency to prefer APC2 and OC brackets over APC1 in terms of pressure needed and amount of adhesive used. Bracket sliding on adhesive removal rarely occurred in any of the groups. Both operators found APC1, APC2 and OC brackets easy to use; correctly guessed the adhesive more often than incorrectly. However one operator was undecided 50 per cent of the time. There was a statistically significant difference regarding the pressure needed to seat the bracket types.
CONCLUSION: Differences in handling characteristics were not reliably detected and the results for OC and APC2 were almost identical.

107 BONDING CHARACTERISTICS OF METALLIC BRACKETS USING A CONVENTIONAL AND SELF-ETCHING PRIMER

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AIM: Previous studies suggest that metallic adhesive precoated brackets (APC) show lower shear bond strength (SBS) than those obtained with Transbond XT on uncoated brackets. One manufacturer has addressed this by modifying the adhesive used for precoating (APC1 to APC2). Bond strength testing of self-etching primers (SEP) has also been associated with lower SBS and more adhesive remaining on the teeth following debond. Studies suggest that the SBS associated with APC and SEP is adequate for clinical use. As the combined effects do not appear to have been investigated, the aim of this study was to compare the SBS, rebond strength (RBS) and site of failure of Victory Series APC1, APC2 and operator coated brackets using SEP and conventional etchant and primer (All 3M Unitek).
MATERIALS AND METHOD: The SBS and RBS of Victory Series brackets, precoated with APC1, APC2 and operator coated (OC) with Transbond XT were compared ($n = 30$) using a SEP. A second group of OC brackets ($n = 30$) where conventional etch (37% phosphoric acid) and primer was used, served as the control. The Adhesive Remnant Index (ARI) of the groups was also compared.
RESULTS: With SEP, the SBS of APC1, APC2 and OC brackets were similar (68.4, 74.9 and 75.4 N, respectively) and bond failure occurred mainly at the enamel/adhesive interface, ARI1. RBS were significantly lower than their original SBS (35.9, 36.7 and 34.1 N, respectively).

The OC brackets conditioned with conventional etchant and primer showed the lowest SBS of all groups.
CONCLUSION: When using SEP there was no significant difference in the SBS of APC1, APC2 and OC brackets. With conventional etch/primer the SBS of OC brackets was significantly lower. The type of primer used has a greater influence on SBS than the mode of bracket coating.

108 THREE-DIMENSIONAL COMPUTED TOMOGRAPHIC EVALUATION OF MANDIBULAR AND MUSCULAR MALFORMATIONS IN OTO-MANDBULAR DYSPLASIA

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AIM: 1) To metrically evaluate unilateral malformations of the condyles and 2) To compute muscular parameters.
SUBJECTS AND METHODS: Computed tomographic scanning was carried out in 16 patients. Using the software, Voxim, the volume of the condyles, the density of the cancellous bone and the maximum diameter of the condyles were measured. In nine patients the muscle volume and the maximal cross section area of the masseter and the pterygoid group of muscles were computed.
RESULTS: The volumes of the condyles were significantly reduced on the affected side (0.5 ± 0.3/1.6 ± 0.4 ml) as well as the density (346 ± 142/408 ± 84 HU). Seven condyles could be classified as degree 2 and 6 as degree 3 of hypoplasia, with one missing condyle. The mean volume of the masseter was calculated as 5.7 cm^3 on the affected side and 11.7 cm^3 on the contralateral side. The volume of the pterygoid muscle group was reduced by a factor of 1.4 on the affected side.
CONCLUSIONS: Use of three-dimensional metric analysis allows the heterogeneous spectrum of unilateral condyle deficiencies to be classified more exactly. The deficiency in condyle volume was more pronounced than muscle hypoplasia.

109 FACIAL SOFT TISSUE SIMULATION BY THE FINITE ELEMENT METHOD

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AIM: Soft tissue changes following orthognathic surgery play a major role in post-operative facial aesthetics. Conventional soft tissue prediction systems (e.g. Dentofacial Planner) display the predicted changes as two-dimensional results. Moreover, in general, it is not possible to predict accurately changes regarding nasal tip, nasal wing, nasolabial sulcus and buccal soft tissues. The major aim was to develop a new prediction system based on proven and reliable mathematical procedures, thereby enabling three-dimensional (3D) simulation and prognosis of facial soft tissue changes following orthognathic surgery. Further, it had to be easy and fast to use to be applicable for patient specific simulation with little costs in the clinical practice.
MATERIALS AND METHODS: Finite element method (FEM) was selected for the mathematical basis of the new prediction system. This proven numerical procedure is already established in engineering sciences. The facial surface of the patient was digitized by a 3D-scanner and the recorded 3D point cloud was transformed into a patient specific simulation model, which consisted of FEs with specific characteristics of the facial soft tissue. The results can be visualized afterwards and correspond to the predicted post-operative facial surface.
RESULTS: The new prediction system enabled 3D simulation and prediction of soft tissue changes following orthognathic surgery. The extent of soft tissue deformation could be quantified and visualized by pseudo colours. Deformation of nasal tip, nasal wing, nasolabial sulcus and buccal soft tissue could be accurately simulated.
CONCLUSIONS: The new prediction method is reliable, fast and simple in practice. System development and implementation are already complete; the next step is the clinical verification of the computed results.

110 COMPARISON OF TENSILE STRENGTH IN WELDED AND SOLDERED HEADGEAR TUBES

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AIM: When using headgear (HG) tubes on orthodontic wires there is the possibility to apply industrial laser welded junctions additionally to soldered and manually laser welded junctions. It is not clear to what extent these linking procedures are different with regard to their mechanical loading capacity.
MATERIAL AND METHOD: Three groups with 10 trials each were examined using these parameters: industrial laser welded, manual laser welded and soldered. HG tubes and stainless steel wire (Forestadent) with a thickness of 0.8 mm were used. The manual laser welding was carried out with a Heraeus Haas Laser 44 P (Nd:YAG) at a wavelength of 1064 nm. The number of welding spots was equivalent to those in industrial welding. The maximal tensile strength of the junctions was then established in a tensile test.
RESULTS: Tensile testing showed that the maximal tensile strength of industrial manufactured laser seams could be measured at 330.1 ± 66.4 N. At the manual welded junctions 268.0 ± 35.8 N were measured in spite of the same number of laser welding spots. The lowest maximal tensile load was established for soldered junctions (210.7 ± 37.1 N). It was noticeable that at soldered junctions the lines of force showed a fast loss of power after reaching the maximal tensile load, while laser welded junctions showed a step-by-step loss of power in the stress-strain diagram. Thus the manual manufactured junctions displayed a much more irregular pattern in comparison with industrial manufactured welding seams.
CONCLUSION: Industrial manufactured HG tubes on welded wire junctions can withstand a much higher mechanical strain than manual welded or soldered junctions.

111 THE ROLE OF *CANDIDA ALBICANS* IN THE DEVELOPMENT OF WHITE SPOT LESIONS DURING MULTIBRACKET APPLIANCE TREATMENT

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AIM: To determine *Candida* colonisation in patients with multibracket appliances to assess if differences exist between patients with good/poor oral hygiene and with/without development of white spot lesions.
SUBJECTS AND METHOD: Sixty-five patients with fixed orthodontic appliance. None had untreated carious lesions. The subjects were assigned to two groups: A: 25 patients with excellent oral hygiene; B: 40 patients with very poor oral hygiene. Group B was subdivided in to 15 patients with and 25 patients without white spot lesion development during treatment. Saliva and plaque samples from the area around the brackets were taken and analyzed for *Streptococcus mutans*, *Lactobacillus* and *Candida* species.
RESULTS: Patients with poor oral hygiene exhibited significantly ($P < 0.05$) larger amounts of *Candida* species both in saliva and plaque taken from sound enamel surfaces around the bracket. The highest *Candida* concentrations were found in dental plaque samples from the white spot lesions compared with plaque from sound enamel surfaces.
CONCLUSION: *Candida* colonisation of saliva and plaque increased during orthodontic treatment in the presence of poor oral hygiene.

Candida albicans plaque could play a role in the demineralisation of enamel.

112 RELATIONSHIP BETWEEN NASAL CAVITY GROWTH AND THE MAXILLARY ANTRUM

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AIM: To investigate nasal cavity development in relation to dental occlusal development via measurement of left and right nasal cavities with reference to the maxillary antrum location employing computed tomography (CT) as well as image analysis.
MATERIAL AND METHODS: One hundred dried human skulls (Indian origin) were utilized. Ten samples were selected for each of Hellman's dental stages. X-ray photography was carried out using a CT Scanner (TXT-700S, Toshiba Medical) with a tube voltage of 120 kV, tube current of 110 mA, scan time of 2.7 seconds and slice width of 2 mm. Measuring objects were obtained as axial images from left and right lateral angles of the eye to the maxillary antrum dental occlusal plane surface. The Frankfort horizontal plane served as a benchmark. CT images were set with WW680 and WL10 and imported with a computer-based CCDTV camera TI-124A (NEC). Image input was then A/D converted, followed by analysis with an image analysis device (TVIP-4100 Excel, Nippon Avionics Co., Ltd.). Measuring points were established for processed CT images and the distance from each measuring point was determined with a computer. These intersecting reference points were between: 1) the frontal and internal walls of the maxillary antrum (a); 2) the internal and rear walls of the maxillary antrum (b); 3) the rear wall of the maxillary antrum and the cheek bone (c); 4) the frontal wall of the maxillary antrum and the cheek bone (d); 5) a perpendicular line from point d and the internal wall (e); 6) a perpendicular line from point c and the internal wall (f); 7) a perpendicular line from the point centroid (G) and the internal wall (g), and 8) the intersecting point of a perpendicular line from G and the external wall of the maxillary antrum (h). The measured ranges were the distances between: 1) point a to median point a' (A), 2) point b to median point e' (B), 3) point e to median point e' (E); 4) point f to median point f' (F); 5) point g to median point g' (G); 6) point e to point d (E'); 7) point f to point c (F'); 8) point g to point h (G'), and 9) point a to point b (I).
RESULTS AND CONCLUSION: 1. The length to the outer dimension from points a and b and the nasal cavity began to increase to approximately 50 per cent of adult size during the IA period. Subsequently, these distances increased gradually until the VA period. 2. Development of the nasal cavity in the outer direction of points e and f was completed by the IIIA period (around 9–11 years of age). 3. Due to the proximal location with respect to point b, point g, which connects centroids, demonstrated conditions similar to those of point b. 4. Points d, c and h demonstrated s-shaped growth curves, which suggest developmental influence due to eruption of the teeth. 5. Up to the IIC period, the length to the frontal aspect from points a and b from the nasal cavity revealed 70 per cent of adult size. Growth stopped during the IVC period; subsequently, the remaining 20 per cent of growth occurred until the VA period.

113 EVALUATION OF TEN DIFFERENT CEPHALOMETRIC ANALYSES FOR CRANIOFACIAL GROWTH PATTERN ASSESSMENT

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AIM: To evaluate variables and the corresponding means derived from 10 different cephalometric analyses used for craniofacial growth pattern assessment and to investigate the possible similarities and/or differences concerning the diagnosis between these cephalometric analyses.
SUBJECTS AND METHODS: Seventy-two patients with various types of malocclusion were selected and the mean values of Downs, Tweed, Steiner, Ricketts, Jarabak, Wits, Burstone, and McNamara's analyses, as well as the mean values of Humboldt University of Berlin and Aristotle University of Thessaloniki were used. Growth pattern was evaluated by the following variables: (a) inclination of facial axis, (b) mandibular rotation in relation to the anterior cranial base (SN), and (c) mandibular rotation in relation to the Frankfort plane (FH). The statistical evaluation was performed by means of paired *t*-tests, Kappa, Spearman's rho and cluster analysis.
RESULTS: Concerning the inclination of facial axis, four different groups of variables were formed using the cluster analysis. Differences in growth pattern evaluation existed when different reference planes as well as when similar reference planes were used. Similarly, for mandibular rotation three groups of variables were formed with parameters associated to different or identical mandibular planes (Go–Gn or Go–Me), and to different or identical reference planes (FH or SN). The most profound differences were observed in the assessment of normal facial axis inclination and normal mandibular rotation.
CONCLUSIONS: The 10 different cephalometric analyses used in this evaluation were unable to produce similar information for the assessment of craniofacial growth pattern, a fact that can be attributed to the different mean values used in these analyses.

114 RELATIONSHIP BETWEEN MAXILLOFACIAL MORPHOLOGY AND MASSETER MUSCLE VOLUME. PART 2: MEASUREMENTS ON FRONTAL CEPHALOGRAMS

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AIM: Many investigators have reported that masticatory function has a great influence on maxillofacial morphology. This study was performed to investigate the relationship between maxillofacial morphology, inclination and masseter muscle volume, and physical features.
SUBJECTS AND METHODS: Twenty-one male volunteers (mean age 23.4 years) with normal occlusion. Maxillofacial morphology was observed on frontal cephalograms. A magnetic resonance image (MRI) of each subject was scanned from the region of the mandibular condyle to the mandibular border with an interval of 1 mm. The volume and inclination of the masseter muscles were determined from the MRI and analyzed by a personal computer with Exavision Lite software. The subject's stature and weight was also measured. From a frontal view, both sides of the masseter muscle inclination to the Frankfort horizontal plane were measured, and the difference between them calculated. The difference in inclination was compared with all items using multiple regression analysis.
RESULTS: The variation in inclination in the anterior view was related to the difference in the Z plane to Ag. The difference in masseter inclination in the sagittal view was related to the difference of the Z plane to Cd.
CONCLUSION: It is suggested that the inclination of the masseter muscle is influenced by the difference of the Z plane to Ag. The more the inclination differed, the more the lower face was asymmetric.

115 BONE RESORPTION MARKER LEVELS IN GINGIVAL CREVICULAR FLUID DURING ORTHODONTIC INTRUSION

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AIM: To determine whether the amount of two bone resorption markers, Deoxypridinoline (Dpd) and cross-linked N-telopeptides of type I collagen (NTx), can be detected in gingival crevicular fluid (GCF), and if so, whether they reflect bone turnover changes induced by activation of intrusive springs on upper first premolars.
SUBJECTS AND METHOD: Randomly selected patients who required fixed appliance therapy involving the extraction of the maxillary first premolar teeth. Brackets were bonded to the maxillary first premolars and intrusive springs were tied to the brackets with a Nance appliance as the anchorage unit. GCF samples were collected from each patient using paper strips before appliance insertion and 1, 24, and 168 hours after appliance activation. After the second activation at day 21, samples were collected on days 22 and 28. ELISA tests were performed.
RESULTS: Only Dpd values showed statistically significant changes over time. On days 1, 7, 22 and 28 the results showed a significant decrease when compared with day 0. The extra decrease at day 22 (the day after the second activation) was also significantly lower than for the 1 hour results. NTx values could not be detected in the experimental samples.
CONCLUSION: There was a statistically significant decrease of Dpd values in GCF after the activation of intrusive springs on the maxillary first premolars. NTx could not be detected. Lower force levels and longer follow-up intervals should be considered in the design of further studies in order to have a better understanding of the bone resorption process during intrusion.

116 THE OMENSZ CLASSIFICATION OF HEMIFACIAL MICROSOMIA

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AIM: To propose a broadening of the OMENS (orbit, mandible, ear, nerves, soft tissue) classification of patients with hemifacial microsomia (HFM) by an evaluation of occlusion.
SUBJECTS AND METHOD: Eighteen patients were analysed recording to the OMENS classifications. The degree of the deformities in HFM was analysed on a four-point scale (from 0 to 3). The degree of malocclusion was added and the acronym OMENS was broadened to OMENSZ:
0 point—normal occlusion
1 point—malocclusion in one plane (sagittal, Frankfort or, frontal)
2 points—malocclusion in two planes
3 points—malocclusion in three planes
RESULTS: Most patients examined to the OMENSZ classification (37.1%) were regarded as highly malformed. It has been reported that 62.7 per cent of malocclusions were three dimensional in nature. With the OMENSZ classification two groups of patients were identified: a) With small or medium deformations up to 9 points and b) With significant deformations from 10 to 18 points.
CONCLUSIONS: Supplementing the OMENS classification with evaluation of occlusion allowed broadening the diagnosis of deformations accompanying HFM. The proposed OMENSZ system adds orthodontists to the multidisciplinary team.

117 TREATMENT OF POSTERIOR CROSSBITE WITH THE QUADHELIX AND LOWER LINGUAL ARCH APPLIANCES

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AIM: To evaluate the effect of simultaneous application of the quadhelix and lower lingual arch appliance on maxillary and mandibular intermolar widths during crossbite treatment.
SUBJECTS AND METHOD: Twenty Polish children with an average age of 9.5 years at the start of therapy. The treatment procedure comprised slow maxillary expansion with the quadhelix appliance. A lower lingual arch initially activated inwards by 1 mm was simultaneously used in order to prevent expansion of the mandibular intermolar width through occlusal contacts. The records consisted of the initial and post-treatment study models. The maxillary and mandibular intermolar widths were measured to the nearest 0.1 mm using sliding callipers. Comparison of the pre- and post-treatment intermolar widths was undertaken using Wilcoxon's test.
RESULTS: The mean expansion of the upper intermolar width was 4.1 mm. The mean change in lower intermolar width was –0.1 mm and was statistically insignificant. The average treatment time was 17 weeks.
CONCLUSION: 1. Simultaneous application of the quadhelix and lower lingual arch appliances prevents lower intermolar expansion through occlusal contacts during crossbite treatment. 2. This method can be recommended for the treatment of posterior crossbites in mixed dentition patients who have premature loss of the lower primary molars.

118 ROENTGEN CRANIOMETRIC RADIOGRAPHIC ANALYSIS OF PATIENTS WITH SKELETAL OPEN BITE

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AIM: To determine craniofacial morphology in patients with a skeletal open bite in all three Angle Classes.
MATERIALS AND METHOD: Ninety-six profile cephalograms of patients in the permanent dentition (44 patients with a skeletal open bite with Angle Class I, II and III malocclusions and 52 subjects with normal occlusion) were analysed. The following parameters were measured: ANB, ANB, NS/SpP, NS/MP, SpP/MP, SpP/OcclP, OcclP/MP, NSAr, SarGo, ArGoMe, NGoAr, NGoMe, Björk's polygon, NS/OcclP, NS/GOcclP, NS/DocclP, I/SpP, I/MP, I/i, SGo, NMe, NSnA, SnAMe.
RESULTS AND CONCLUSIONS: In subjects with an open bite the anterior cranial base angle was smaller, and articulare, gonial and basal angles significantly larger compared with the control group. Mandibular retroclination was significantly larger, maxillary protrusion, mandibular incisor retroclination and total anterior height were also significantly larger, especially lower anterior face height. Subjects with a skeletal open bite malocclusion have a vertical type of facial growth.

119 ORTHODONTIC TREATMENT OUTCOME IN CLASS II DIVISION 1 PATIENTS

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AIM: To evaluate the outcome of orthodontic treatment in Class II division 1 patients treated with different types of appliances.
MATERIAL AND METHODS: Patient records and dental plaster casts of 47 Class II division 1 patients aged 7 to 13 years at the start of treatment and treated with fixed ($n = 17$), combinations of fixed and removable ($n = 17$), or removable ($n = 13$) appliances. Pre- and post-treatment Peer Assessment Rating (PAR) scores, determined from measurements of plaster casts, were divided into two categories, scores for overjet and overbite, and scores for other components of the index.
RESULTS: In patients treated with removable appliances (activators), the reduction in PAR scores for overjet and overbite was greater than in those treated with fixed ($P < 0.01$)) or combinations of fixed and removable appliances ($P < 0.05$). This reduction in the removable

appliance group was also more prominent (96%) due to a reduction in scores for overjet and overbite than in those treated with fixed (72%) or combinations of fixed and removable appliances (84%).
CONCLUSIONS: Treatment with removable appliances (activators) is efficient in Class II division 1 patients with an increased overjet and overbite.

120 AIRWAY ANALYSIS IN ADULT OPEN BITE PATIENTS WITH MOUTH BREATHING

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AIM: To evaluate the hyoid bone, airway and adenoid size in adult open bite patients with mouth breathing.
SUBJECTS AND METHOD: Thirty adult open bite patients (15 males, 15 females) with mouth breathing and a Class I molar relationship formed the experimental group and 30 Class I malocclusion students (15 males 15 females) the control group. Fourteen linear, angular and size measurements of the hyoid bone, airway and adenoid size were analyzed on lateral cephalometric radiographs. These data were statistically examined to determine the difference between the open bite and normal occlusion group. Statistical analysis was carried out with the SPSS program.
RESULTS: 1. The hyoid bone was more posteriorly positioned in both males and females in the open bite group compared with the normal occlusion group ($P < 0.05$). 2. The hyoid bone was positioned lower to the mandibular inferior border in the open bite group than in the normal occlusion group, both males and females ($P < 0.01$). 3. There were no significant differences between adenoid size and angular measurements of hyoid bone position in either the open bite or normal occlusion group for both males and females ($P > 0.05$). 4. Airway size was smaller for both males and females in the open bite group than in the normal occlusion group ($P < 0.05$).

121 THE RELATIVE PREVALENCE OF ANTERIOR TOOTH AGENESIS IN TIMISOARA

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AIM: To determine the relative prevalence and distribution pattern of anterior tooth agenesis.
SUBJECTS AND METHOD: One hundred and seventy patients (17.5% males, 82.9% females) with agenesis treated during the past four years.
RESULTS: The mean number of missing teeth per patient was 2.14. From the total number of missing teeth, 10.15 per cent were in males and 89.5 per cent in females. Two or more missing teeth were present in 43.52 per cent of all patients, and in most of them (54.70%) the upper lateral incisors. The upper central incisor was absent in 2.94 per cent, the upper canine in 4.11 per cent, the lower central incisor and the lower canine in 3.52 per cent and the lower central incisor in 5.88 per cent.
CONCLUSIONS: From the recorded data and the literature an increase was observed in the prevalence of agenesis among females.

122 BOND STRENGTHS OF TWO DIFFERENT ATTACHMENTS TO ALIGN IMPACTED CANINES: AN *IN VITRO* STUDY

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AIM: To measure the shear forces of different types of bonded attachments used to align impacted canines.
MATERIAL AND METHODS: Forty extracted human teeth were typically prepared before etching and bonding. Two different types of attachments (mashpad with gold chain or gold chain alone) were subjected to test shear forces in the strain and stress Zwick® testing machine. In the first test the force of action was direct to the long axis of the tooth and in the following at a 90-degree angle.

Group	Attachment	Force of action
A	Mashpad	180° to the long axis of the tooth
B	Gold chain	180° to the long axis of the tooth
C	Mashpad	90° to the long axis of the tooth
D	Gold chain	90° to the long axis of the tooth

RESULTS:

Group	Standard Deviation	X
A ($n = 10$)	80.85 N	3.6
B ($n = 10$)	42.60 N	6.5
C ($n = 10$)	11.54 N	3.73
D ($n = 10$)	33.21 N	6.55

CONCLUSION: The gold chain alone is sufficient for alignment of impacted canines. As in most orthodontic cases the direction of the force is 90 degrees to the long axis of the tooth at the beginning of tooth movement, the gold chain shows better bonding capacity than the mashpad.

123 OUTCOME IN CLASS III SURGICAL-ORTHODONTIC CASES

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AIM: To investigate the treatment outcome in Class III surgical-orthodontic (SO) patients.
MATERIAL AND METHODS: As part of a larger retrospective multi-centre study, each consultant orthodontist in the United Kingdom was asked to provide pre- and post-treatment cephalometric radiographs of six consecutive SO patients who had surgery prior to September, 1998. Two hundred and thirty one Class III subjects with an overjet of 0 mm or less were included. Cephalometric films were digitised. Multivariable logistic regression analysis was used to identify predictors of the best outcome.
RESULTS: SO treatment achieved a post-treatment overjet within 2 standard deviations (SD) of normal in 92 per cent of cases and within 1SD in 61 per cent of cases. A post-treatment ANB angle within 2SD of normal was achieved in 68 per cent of cases and within 1SD in 36 per cent of cases. Logistic regression analysis indicated that the predictors of a post-treatment ANB angle within 1SD of normal were a less severe pre-treatment ANB angle, less pre-treatment retroclination of the lower incisors and the use of bimaxillary rather than single jaw surgery.
CONCLUSIONS: SO treatment of Class III malocclusions was generally successful in bringing the main cephalometric parameters within the normal ranges. A better treatment outcome was associated with less pre-treatment lower incisor compensation, a less severe pre-treatment ANB angle, and the use of bimaxillary surgery.
This project was funded by the UK Consultant Orthodontists Group.

124 ACCURACY OF A THREE-DIMENSIONAL MEASUREMENT SYSTEM IN TOOTH CROWN MORPHOLOGY

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AIM: To determine the accuracy of a three-dimensional (3D) measurement system developed for occlusal crown morphology

measurements in measuring any points of interest, e.g. to show how the marking of the points affects the accuracy of the system.
SUBJECTS AND METHOD: The measurements were carried out on 20 first-degree relatives of 45,X-females (Turner syndrome) with a normal chromosome constitution. From the dental casts various linear and angular variables of the occlusal morphology of the maxillary first permanent molars were examined. The method used was Orthometrics, which is a 3D measurement system based on the machine vision technique, where results can be stored digitally and further mathematical processing of data can be performed. The marking and capturing of the points was performed repeatedly by the same observer to show the intra-examiner and methodological error.
RESULTS: The accuracy of the machine vision technique for linear measurements was 0.02–0.07 mm. The highest error was found in angular parameters and when the points were traced and measured repeatedly, which conceivably results from three digitized points of angular measurements instead of the two needed in linear measurements.
CONCLUSIONS: The error of the method showed sufficient accuracy for both linear and angular variables when measuring 3D occlusal crown morphology. The results emphasize the importance of the marking of the points.

125 EVALUATION OF A NEW CONCEPT OF FUNCTIONAL THERAPY SUPPORTING ORTHODONTIC TREATMENT

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AIM: Myofunctional therapy with the aim of establishing competent lip closure and nose breathing is an important factor for long-term stability after orthodontic treatment. Waiting periods before the beginning of myofunctional therapy and the myofunctional treatment time itself often delay the beginning of orthodontic treatment. This clinical longitudinal study was designed to evaluate a new concept of functional therapy, face-former therapy, in comparison with myofunctional therapy only.
SUBJECTS AND METHOD: Forty-four children aged 5–12 years with orofacial disturbances such as incompetent lip closure, habitual mouth breathing, infantile swallowing pattern, generalized orofacial hypotonus and sigmatism. Myofunctional therapy was indicated in all children. Seventeen children referred for myofunctional therapy in private practices in Hamburg served as controls. The remaining 27 children were treated with face-former therapy. The overall observation time was eight months. The development in all children was evaluated every three months by an orthodontist and speech pathologist. At every control date lip closure was measured with the myobar, changes in breathing were evaluated rhinomanometrically, swallowing pattern was controlled by palatography and changes of the dentition were determined by extra- and intra-oral examination.
RESULTS: There was an improvement in all children with orofacial disorders. Those treated with face-former therapy tended to have more palatal tongue movement during swallowing, stronger lip pressure and habitual mouth closure than children who had undergone myofunctional therapy.
CONCLUSION: Face-former therapy seems to be a good alternative to myofunctional therapy. Longitudinal studies will be undertaken to judge if the established orofacial balance could be automated.

126 ASSESSMENT OF INTERDISCIPLINARY ASPECTS BETWEEN ORTHODONTICS AND OTHER DENTAL DISCIPLINES BY UNDERGRADUATE STUDENTS

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AIM: Interdisciplinary aspects between orthodontics and specific syndromes or severe dysgnathic cases are taught within the dental curriculum. As most dental students will be general practitioners, the understanding of such aspects between orthodontics and other dental disciplines is of importance. The aim of this investigation was to find out if undergraduate students are aware of interdisciplinary aspects between orthodontics and other dental disciplines and if there is growing understanding during the course of the dental curriculum.
MATERIALS AND METHODS: With the use of a questionnaire, 138 students from four clinical terms were asked to report connections between orthodontics and other dental disciplines. They were also asked about the importance of orthodontics for general dentistry and *vice versa*.
RESULTS: Of 12 dental disciplines, a high percentage of students reported connections between orthodontics and aesthetic dentistry, paediatric dentistry and diseases of the temporomandibular joint. Few connections were reported for periodontology, implantology and endodontics.
CONCLUSION: Interdisciplinary aspects between orthodontics and other dental disciplines should be stressed more in the dental curriculum.

127 HOW TO SET THE LOWER INCISORS DURING ORTHODONTIC TREATMENT. PART I: AN ASSESSMENT OF THE SOFT TISSUE PROFILE IN JAPANESE ADULTS

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AIM: The soft tissue profile plays an important part in orthodontics. The controversy concerning the reliability of correlations between the soft tissue and its underlying hard tissue, including anterior teeth have been discussed. The aims of this study were to explore if there was acceptable indication from soft tissue lines, which could provide the orthodontist with a measure of beauty with respect to the position of the lower anterior teeth.
MATERIAL AND METHODS: Sixty lateral cephalometric radiographs chosen as the attractive profiles from 500 dental students. For the attractive profile all subjects whose upper and lower lip were within the soft tissue E-line were chosen. The following measurements were mainly used in the analysis: Ricketts's E line, Steiner's S line, soft tissue facial angle, angle of S-tip of nose (NT) and S-Soft tissue pogonion (SP), FMA, Pogonion and lower 1 to NB.
RESULTS AND CONCLUSION: The angle S-NT and S-SP were 32 degrees when both lips were located within the S line. The relationship observed in lower anterior position and soft tissue facial profile was not consistent in all subjects. These findings are in agreement with the idea that the nose and soft tissue pogonion should be taken into consideration when judging a beautiful profile.

128 CLINICAL APPLICATION OF POSTERO-ANTERIOR CEPHALOMETRIC METHODS IN DIAGNOSING POSTERIOR CROSSBITE

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AIM: To examine dental deficiencies and the relationship between skeletal-morphological changes in the orofacial region in patients with posterior crossbite.
MATERIAL AND METHOD: Postero-anterior cephalometric analysis (Ricketts) was preformed on 100 patients, 35 of whom had a unilateral crossbite and 35 a bilateral crossbite. A group of 30 subjects formed the control group.
RESULTS: Telerentgenography showed that subjects with a bilateral posterior crossbite had an increased value of 20.6 degrees for the

angle (<Z-Ag-J) which shows the level and type of crossbite. Patients with a unilateral crossbite had a value of 19.8 degrees for this angle. The morphological configuration of the orofacial region with crossbite has many variations, including a more prominent deficiency of the maxillary dental arch, constriction of the buccal segments and acute angle of the maxillary teeth. There was an asymmetric position of the teeth in the dental arches, which resulted in a lateral occlusion.
CONCLUSION: The early diagnosis and treatment of patients with a posterior crossbite will facilitate establishment of function, occlusion and facial harmony.

129 THE EFFECTS OF MAXILLARY MOLAR DECOMPENSATION PRIOR TO RAPID MAXILLARY EXPANSION ON DENTOSKELETAL STRUCTURES

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AIM: To assess dentoalveolar and skeletal changes in patients undergoing maxillary molar uprighting for eliminating the adverse side-effects of rapid maxillary expansion (RME).
SUBJECTS AND METHOD: Thirty patients (19 girls, 11 boys) who had relative or absolute transverse maxillary deficiency with the posterior teeth typically inclined to the buccal, treated by means of bonded expanders between 11 and 15 years of age. The patients were divided into two groups of 15 each. The first group received maxillary first molar uprighting with a palatal bar before initiation of RME (Group A). The second group were treated with RME alone, without the molars being uprighted (Group B). A cast analysis was used for evaluation of dentoalveolar (maxillary first molar inclination, palatal vault angle, palatal depth, palatal width, trans-arch widths and clinical crown height) changes. Lateral and frontal radiographs were analyzed to determine vertical and transverse skeletal alterations. Wilcoxon matched-pairs signed rank and Mann-Whitney *U* tests were performed.
RESULTS: There was a significant ($P < 0.01$) increase in maxillary basal and transarch widths in both groups. Expansion commenced with flared molars had a greater influence on molar inclination ($P < 0.01$ versus n.s.) and palatal vault angle ($P < 0.01$ versus $P < 0.05$) compared with Group A. RME without uprighting led to a significant ($P < 0.01$) increase in clinical crown height while group A revealed no changes. Comparison of the results for both groups showed no significant differences in palatal depth and palatal width changes. However, palatal width measured at the gingival margin increased significantly more ($P < 0.01$) in group B.
CONCLUSION: Dentoalveolar tipping and clinical crown elongation was minimized when posterior uprighting was performed prior to RME.

130 *IN VITRO* AND *IN VIVO* EVALUATION OF SHEAR BOND STRENGTHS OF INDIRECT BONDING RESINS

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AIM: To compare the shear bond strength (SBS) of two indirect bonding resins and a frequently used light cure adhesive. The failure rates of the indirect resins were also evaluated *in vivo* on 15 patients whose brackets were bonded using a split mouth design and followed for six months.
MATERIALS AND METHOD: Sixty extracted premolars were divided into three groups of 20 teeth. In group A, the brackets were bonded to stone models using Therma Cure laboratory resin for indirect bonding. They were then transferred to the teeth using Custom IQ resin for indirect bonding. For group B, the teeth were attached to models using Transbond XT and transferred to the teeth using Sondhi's indirect bonding resin. In group C, the brackets were bonded to teeth directly using Transbond XT. The SBS were evaluated and comparisons between the groups were made. In the second part of the study, the left halves of the upper and right halves of the lower teeth were bonded using Sondhi's indirect bonding resin and the right halves of the upper left halves of the lower teeth were bonded using Therma Cure as the laboratory resin and custom IQ as the bonding resin. The failure rates of the brackets were followed for six months. Analysis of variance (ANOVA) was performed, followed by Tukey's test.
RESULTS: The mean SBS values (MPa) were 10.3 ± 4.2, 6.1 ± 1.6, 12.8 ± 5.4 for groups A, B and C respectively. There were no significant differences between groups A and C ($P > 0.05$) while both of these yielded significantly higher SBS values compared with group B. *In vivo* evaluation showed no differences between the two indirect bonding resins available on the market.
CONCLUSION: Although the SBS values of the two indirect resins were significantly different *in vitro*, both resins showed similar clinical results.

131 QUALITY OF LIFE OF PATIENTS WITH SEVERE MALOCCLUSION BEFORE SURGICAL-ORTHODONTIC TREATMENT

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AIM: Severe malocclusions may cause functional disorders and also serious pain. The aim of this study was to measure perceived oral health problems and impact of oral disorders in patients with severe malocclusion or dentofacial deformities. The hypothesis was that pain and problems related to mastication and facial appearance are prevalent among patients with severe malocclusion.
SUBJECTS AND METHOD: Forty-six adult patients all with severe malocclusions with considerable functional disorders who during one year were referred for orthodontic or surgical-orthodontic treatment. A standardized questionnaire was given to all patients during the first examination. The questionnaire collected information regarding personal background data and perceived problems related to oral health. The Oral Health Impact Profile-14-scale was used to measure the impact of oral disorders during the last month.
RESULTS: Fifty-nine per cent of the patients had experienced pain and 52 per cent had felt tense occasionally, fairly or very often because of problems with their teeth or mouth. Nearly two-thirds of the patients (63%) reported discomfort during eating. Only 15 per cent of the patients had felt that their occlusion was appropriate and did not cause any inconvenience. Seventy per cent of the patients considered that they had problems with their appearance related to their teeth, mouth or occlusion.
CONCLUSIONS: Patients with severe malocclusions suffer from several inconveniences related to their teeth and mouth, which may result in deterioration in their oral health related quality of life.

132 THE EFFECT OF QUADRILATERAL FIRST PREMOLAR EXTRACTIONS ON VERTICAL OCCLUSAL DIMENSIONS

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AIM: To evaluate the effect of quadrilateral first premolar extractions on the vertical occlusal dimension and to determine the ratio of extrusion of posterior teeth as they move mesially to close the extraction space.
SUBJECTS AND METHODS: Forty-two patients with a Class I malocclusion between the ages of 14–21 years (mean 16 years) with a

Jarabak index ranging from 62 to 65 and an overbite between 0–3 mm. All patients had undergone orthodontic treatment with 0.022 standard edgewise brackets and extraction of four first premolars (average treatment time 26.3 months; range 19.7–29.2 months). Lateral cephalograms obtained at the start and end of treatment were used for analysis. The positions of the upper and lower first molars were calculated with intra- and extra-oral co-ordinates in the vertical and sagittal planes on the pre- and post-treatment cephalograms. Paired *t*-tests were then was used to analyze the change in the vertical and sagittal positions of the upper and lower first molars pre- and post-treatment.
RESULTS: Closing the extraction space increased the vertical dimension of the occlusion and also lower anterior face height ($P < 0.05$). Mesial movement of the upper and lower posterior teeth was coincidental with extrusion to such an extent that it increased the vertical occlusal dimension, although basal angle and FMA remained unchanged during treatment.
CONCLUSION: Extraction of teeth only to increase the depth of the bite or decrease the mandibular angle is not justified.

133 A CLINICAL STUDY OF MAXILLARY CANINE TRANSPOSITION AND THEIR ORTHODONTIC MANAGEMENT

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AIM: Tooth transposition is the positional interchange of two adjacent teeth within the same quadrant of the dental arch (Peck and Peck, 1995). Maxillary transposition frequently involves the canine and either the first premolar or the lateral incisor. Treatment depends on the position and condition of the teeth, the space available and the time of intervention. The transposed order of teeth is usually retained but sometimes correction of the transposition is attempted. The aim of this study was to investigate the distribution of maxillary canine transpositions in a sample of orthodontic patients and report on their management.
SUBJECTS AND METHODS: Ten subjects with maxillary canine transpositions from the records of two orthodontic clinics. The patients' age range was 12–17 years. Initial and final panoramic radiographs, study casts as well as clinical evaluation were used to determine the type of transposition and the accompanying anomalies. The type of treatment and the possible side-effects were also noted.
RESULTS: Maxillary canine-lateral incisor and canine-first premolar transposition presented the same prevalence in this sample. Maxillary canine transposition occurred more often in males than in females. Left side predominance was evident while bilateral involvement was found only in one patient. The majority of the subjects had a Class I occlusion and retention of the primary canine was the most common finding. Four cases were treated by correcting the tooth order and the rest by preserving the transposition. Correction of the tooth order was connected with longer treatment time and gingival recession in three cases.
CONCLUSION: Maxillary canine transposition in this sample showed left side predominance and involved equally the lateral incisor and the first premolar. Correction of tooth order was completed over a longer treatment time and, in most cases, with gingival recession.

134 CEPHALOMETRIC COMPONENTS OF CLASS III MALOCCLUSION

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AIM: To identify the cephalometric characteristics and sex differences of a Class III malocclusion in a sample of adult patients.
MATERIAL AND METHODS: The pre-treatment cephalometric radiographs of 57 adult Greek patients (26 male, 31 females) with Class III malocclusions. The mean age of the males was 23.77 years (range 18 to 34 years) and of the females 24.81 years (range 19 to 37 years). The cephalometric analysis included 18 angular and two linear measurements concerning the sagittal and vertical skeletal and dentoalveolar relationships. Mean values, standard deviations, minimum and maximum values were calculated and *t*-tests were performed to determine differences between males and females. The significance level chosen was $\alpha = 0.05$.
RESULTS: The patients presented mainly with an open bite facial type, mandibular protrusion and negative facial convexity. Significant differences between males and females were found for anterior cranial base inclination and anterior cranial base angle (greater in females), the convexity, the Wits and the ANB angle (greater in males).
CONCLUSION: The Class III malocclusion in this adult Greek sample was more severe in males.

135 EXPERIMENTAL TOOTH MOVEMENT IN THE RAT—A HISTOLOGICAL AND NUMERICAL STUDY

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AIM: Explanation of the biological responses of surrounding tissues to orthodontic force application requires investigations as to whether stress or strain may be the initiating factor in orthodontic tooth movement. A correlation of the biomechanical results with histological findings could help to optimize orthodontic force application.
MATERIALS AND METHODS: The upper first molar of 16 Wistar rats was moved with a closed nickel titanium alloy coil spring (0.012 inch, 0.5 N) mesially for 3–12 days. Four rats served as the control group. Tartrate resistant acid phosphotase activity was evaluated to detect osteoclasts and their mononuclear precursors. Finite element (FE) models were developed, based on histological sections. Calculations were performed with the FE package COSMOS/M 2.6 using its three-dimensional solid element. A bilinear behaviour of the periodontal ligament (PDL) was assumed, with a parameter set determined in a previous study (E1 = 0.15 MPa, E2 = 0.6 MPa, ultimate strain 6.3 per cent). The tooth's crown in the FE model was loaded with the same force system as used in the animal experiment. The stress/strain distributions associated with orthodontic loading were determined and compared with the histological results.
RESULTS: A high concentration of strains in the PDL was observed, particularly at the furcation. In this area the strains reached a maximum of 40 per cent and were 100,000 times higher than strains in the bone, while the magnitude of stresses in the bone and in the PDL seemed to be similar (bone 0.9 MPa, PDL 1.6 MPa). The distributions of shear and normal strains could be correlated with the histological findings.
CONCLUSIONS: The first results of this combined biomechanical and histological study indicate that a direct correlation of calculated strain values with the distribution of osteoclasts as a factor of tissue reaction to orthodontic force application is possible.

136 RELIABILITY OF COMPUTER SOFTWARE IN SPACE ANALYSIS

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AIM: Determination of the reliability of computer software used in orthodontic treatment analysis is needed, as their range of use gets wider. The aim of this study was to determine the reliability of 'Joe 32' software in space analysis.

MATERIALS AND METHOD: Fifty dental casts of treated patients. The space analysis consisted of the measurements of intermolar width, intercanine width, available space and required space. Paired *t*-tests were used to evaluate systematic error between the measurements carried out with a digital gauge and the software. The method error for each of the measurements and the coefficient of reliability were calculated according to Houston's formula. A variance homogeneity test was used to determine reproducibility between the two methods and Wilcoxon's test for evaluating the four main measurements with the digital gauge and the computer. In addition, the two methods were compared with each other in terms of time.
RESULTS: Even though the space requirement analysis ($P < 0.05$), intermolar width ($P < 0.001$) and intercanine width ($P < 0.01$) measurements were statistically significant, when the two methods were compared for the four measurements, the difference for available space was not statistically significant. The method error was mostly in the 'Joe 32' software when calculating the available space and least for the digital gauge method when calculating intercanine width. The coefficient of reliability was found to be low for the available and required space analysis when the 'Joe 32' software was used. For both methods, the highest number of systematic errors was found for the required space analysis, and the lowest for the available space analysis.
CONCLUSION: The 'Joe 32' computer software is less reliable for space analysis when compared with the manual method.

137 EVALUATION OF ORTHODONTIC PATIENTS USING THE TREATMENT PRIORITY INDEX

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AIM: To evaluate the prevalence of malocclusion and to assess the need for orthodontic treatment of orthodontic patients.
SUBJECTS AND METHODS: Two hundred and twenty three patients (125 girls, 98 boys) aged between 6–14 years. None had any history of craniofacial abnormalities or had undergone prior orthodontic therapy. The Treatment Priority Index (TPI) was used to record and measure the malocclusions. The items measured described occlusal anomalies such as incisor relationship horizontally and vertically, buccal segment occlusion and tooth displacement. These symptoms were weighted according to the first molar relationship. A total TPI score was calculated for each subject. To assess the range of malocclusions the 'malocclusion severity estimate' was also used. The differences between the TPI values of the boys and girls were evaluated by Student's *t*-test.
RESULTS: Of the observed population 3.1 per cent showed a normal occlusion, 28.7 per cent had minor manifestation of malocclusion and treatment need was slight, 37.2 per cent showed definite malocclusion and treatment need was selective, 18.4 per cent had a severe malocclusion and treatment need was highly desirable, and 12.6 per cent a very severe malocclusion with a mandatory requirement. The difference between TPI values for the boys and girls were not statistically significant.
CONCLUSION: Epidemiological surveys are important to document the profile of the population and to plan for the provision of orthodontic treatment in a community

138 FACIAL GROWTH DISTURBANCE IN UNILATERAL CLEFT LIP AND PALATE PATIENTS FOLLOWING NEONATAL LIP AND EARLY PALATE REPAIR

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AIMS: To assess levels of facial growth disturbance following surgical repair of complete unilateral cleft lip and palate at Stoke Mandeville Hospital (SMH) and to compare these levels with those previously reported from other centres.
SUBJECTS AND METHOD: One hundred and one consecutively treated subjects satisfied the selection criteria, which were based upon those of the Eurocleft study (Shaw *et al*., 1992a) and the Clinical Standards Advisory Group Report (1998). Twenty-five patients were excluded leaving a final sample of 76. The subjects underwent primary repair between 1st November 1975 and 31st May 1991. During the period of the study, lip repair was undertaken in the early neonatal period and palate repair within 16 weeks of birth. Dental study models were obtained within 12 months of the 10th or 12th birthdays; and dental arch relationships were assessed by application of the Goslon Yardstick (Mars *et al*., 1987).
RESULTS: Approximately 30 per cent of the subjects were scored to Goslon groups 1 and 2, 26 per cent to group 3 and approximately 44 per cent to groups 4 and 5. Non-parametric statistical analysis revealed significant differences in the levels of growth disturbance between SMH and the Copenhagen and Oslo centres (adjusted $P < 0.05$).
CONCLUSIONS: Levels of growth disturbance following treatment at SMH were similar to those reported for most of Europe, and for the U.K. as a whole; but significantly higher than those for Copenhagen and Oslo.

139 FIRST CERVICAL VERTEBRA, HEAD POSTURE AND CRANIOFACIAL MORPHOLOGY IN JAPANESE ADULT FEMALES

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AIM: To investigate the relationship between the first cervical vertebra, head posture and craniofacial structures in Japanese adult females on lateral cephalometric radiographs.
MATERIALS AND METHODS: One hundred and forty seven lateral cephalometric head films of adult females taken in the natural head position (NHP), including the chain at the side of the skull with the subjects looking at their eyes in a mirror, were evaluated. The individuals were healthy Japanese female, dental college or dental hygiene students over 20 years of age, who had not undergone orthodontic treatment and did not have any breathing or swallowing disorders. Linear and angular measurements for cervicovertebral and craniofacial form and postural angles (cranio-vertical, cranio-cervical and cervico-horizontal) were analyzed using StatView for MAC.
RESULTS: The height of the atlas dorsal arch (D1) was 10.8 mm in 30 subjects with a normal occlusion. Among all 147 subjects, there were statistically significant correlations to each other in cervicovertebral form ($P < 0.05$). The height of D1 and the anterior tubercle arch (Vent) showed low but significant correlations ($P < 0.05$) with postural angles (NTV–SN, CVT–SN, OPT–CVT) and craniofacial form (N–S–Ar, S–Ar, S–Go, Gn–Cd), although there was no correlation in the height of the dorsal arch of the second cervical vertebra (D2) with these measurement items. The item and correlation coefficient with the correlation increased, when D1 and Vent and NTV–SN were combined. On D1 and Vent, there were significant differences in NTV–SN, S–Ar, S–Go and Gn–Cd in the group with a reduced height and between the groups with higher values ($P < 0.05$).
CONCLUSIONS: In addition to head posture, the first cervical vertebra form was significantly associated with craniofacial structures. A combination of atlas morphology and head posture was related to the craniofacial structures better than either variable alone.

140 CHANGING OCCLUSAL PATTERNS AND THE INDICATOR LINE IN BIOBLOC TREATMENT

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AIM: To investigate changes in the values of occlusal patterns, overjet/overbite, and the length of the Indicator Line (distance from the lowest point on either upper central incisor to the tip of the nose) before and after Biobloc treatment.
SUBJECTS AND METHODS: Twenty-four Japanese subjects with a Class III malocclusion undergoing Biobloc treatment. The occlusal patterns were measured using the Dental Prescale-Occluser System for occlusal contact areas (mm^2; abbreviated as 'area'), average occlusal pressure on occlusal contacts (MPa, abbreviated as 'ave'), and all occlusal force (N, abbreviated as 'force'. The Indicator Line and occlusal pattern was used to compare subjects before and after treatment.
RESULTS: The average treatment time was 3 years 2 months. The average values before treatment were area 4.99 mm^2, ave 53.22 MPa and force 244.48 N. The average values after treatment were area 7.21 99 mm^2, ave 49.08 MPa and force 349.97 N. The average difference from the ideal Indicator Line before treatment was 5.21, and 2.25 mm after treatment. The overjet/overbite changed from –1.90 / 2.42 mm to 2.38/2.2l mm. There was effective improvement in all subjects, exhibited by horizontal change, and improvement in occlusal and facial appearance.
CONCLUSIONS: Biobloc therapy might result in an increase of occlusal stability over extraction treatment.

141 POST-ADOLESCENT DENTOSKELETAL CHANGES IN TREATED CLASS II PATIENTS THREE AND NINE YEARS OUT OF RETENTION

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AIM: To retrospectively analyze the dentoskeletal and soft tissue changes in successfully treated Class II patients, three and nine years out of retention.
MATERIAL AND METHODS: Lateral headfilms of 55 patients (25 females, 30 males) were taken pre-treatment (T1), immediately post-retention (T2) and three (T3) as well as nine years (T4) out of retention. The mean age at T1 was 11 years and at T2, 17 years. The cephalograms were evaluated according to the analysis of the University of Berne as well as to the S.O. analysis of Pancherz (1982).
RESULTS: Most measurements increased significantly from T2 to T3 but few changes achieved significance thereafter. The mandibular length increased significantly ($P < 0.01$) during T2-T3 both in males (2.8 mm) and females (1.4 mm), while a significant change was noted only in the males (1.1 mm, $P < 0.001$) during T3-T4. The overall changes in overjet and overbite were no greater than 1.5 mm and 1 mm, respectively. The soft tissue profile flattened significantly ($P < 0.05$).
CONCLUSIONS: All subjects exhibited post-adolescent growth. Sexual dimorphism was apparent concerning mainly the magnitude and sometimes the direction of the developmental changes. The combination of inter-maxillary skeletal and dental changes contributed to the stability of the orthodontically achieved Class I dental arch relationship.

142 ASYMMETRY OF POSTURE, LOCOMOTION APPARATUS AND DENTITION IN CHILDREN

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AIM: To clinically evaluate the association between the development of malocclusion and asymmetry of posture and locomotion apparatus in young children.
SUBJECTS AND METHODS: Two hundred and eighty two Caucasian children aged 2–10 years (M:F = 2:1). A clinical and radiological orthopaedic examination was performed with particular attention to posture. A functional motion analysis as well as a radiological examination revealed in all children anatomical and functional asymmetry of the cervical spine. After applying manual therapy intra- and extra-oral records and orofacial dysfunction were evaluated in all patients.
RESULTS: More than two-thirds of the children showed orthodontic disorders. No correlations could be found between individual orthodontic symptoms such as midline shift, sagittal jaw relationship, crossbite side and orthopaedic pathologies. There was a high correlation between orofacial dysfunction and orthopaedic disturbances: 62 per cent of the children showed hypotension of the orofacial muscles, in 89 per cent tongue dysfunction was found and 72 per cent were habitual mouth breathers. In two-thirds of subjects myofunctional therapy was carried out and in one-third early orthodontic treatment was initiated.
CONCLUSION: The soft tissues and orofacial function/dysfunction seem to be important factors in the pathology of malocclusion and orthopaedic disorders. The high percentage of orthodontic treatment need in children with orthopaedic pathologies suggests an interaction of the hard tissues, including the jaw and spine. Early orthodontic screening in children should also focus on symmetric posture and function, and the balance of orofacial power.

143 CORRECTION OF CLASS III SKELETAL OPEN BITE VIA A MANDIBULAR BODY OSTECTOMY APPROACH

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AIM: To find and determine skeletal morphometric changes as well as long-term skeletal stability of Class III open bite dentofacial deformities corrected by mandibular body ostectomy.
SUBJECTS AND METHOD: Ten Class III open bite subjects treated with fixed appliances before a bilateral mandibular body ostcotomy. Four patients were treated with fixed appliances after surgery. Retention was undertaken with removable plates in two subjects and fixed retainers in the other two patients. In the remaining six subjects no orthodontic treatment after surgery was performed (declined by patients) and no retention device was worn. Lateral cephalograms were taken before treatment, before surgery, immediately after surgery and at the long-term observation (range 2–10 years). Euclidean Distance Matrix Analysis was used to assess immediate post-surgical and long-term changes in mandibular shape (the relationship between proximal and distal segments) and changes in the relationship of both basal bones.
RESULTS: There were only dental changes between the cephalometric records taken pre-treatment and pre-surgery (namely extractions in the upper dental arch and decompensation in the lower incisor region). Statistically significant changes in mandibular shape as well as in basal bone relationship were found between cephalometric records pre- and post-surgery. There were no significant changes in mandibular shape and a minimal shift in basal bone relationship between cephalometric records taken post-surgery and at the long-term observation.
CONCLUSION: Combined orthodontic-surgical treatment of Class III open bites via a mandibular body ostectomy type of surgery seems to be a stable procedure regarding skeletal stability in the long-term.

144 THE POSITION OF THE LOWER INCISORS IN UNILATERAL CLEFT PALATE INDIVIDUALS

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AIM: To compare the incisor position in unilateral cleft palate patients (UCLP) compared with patients with a skeletal Class III malocclusion.
MATERIAL AND METHOD: Fifty lateral cephalograms of UCLP patients and 50 cephalograms of subjects with a skeletal Class III malocclusion. ANB angle, Wits appraisal, inclination of the upper incisors and their position according to the S-N line, inclination of lower incisors and the position according to the A-Po line, and the mandibular plane angle were measured. The data were analysed statistically (*t*-test and correlation coefficient).
RESULTS: There were no significant differences in ANB angle and the inclination of lower incisors between the samples. A high correlation between ANB angle and the position/inclination of the lower incisors was found for both groups.
CONCLUSION: The similarity in lower incisor position in the UCLP and Class III subjects is of clinical importance for long-term treatment planning and timing of extractions in the lower arch.

145 CHANGES IN ORTHODONTIC TREATMENT NEED RESULTING FROM CROSSBITE TREATMENT WITH A QUADHELIX APPLIANCE

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AIM: To evaluate the effect of crossbite treatment with the quadhelix appliance on orthodontic treatment need.
SUBJECTS AND METHOD: Twenty Polish children, average 9.5 years of age, with a crossbite treated with the quadhelix appliance. The initial and post-treatment study models were assessed using Summer's occlusal index (OI).
RESULTS: In 19 patients a reduction of the OI was found. It was caused not only by crossbite elimination, but also reduction of crowding, midline correction, molar rotation and reduction of overjet. In 12 patients a reduction in treatment need was found. In the remaining 8 patients the change in OI did not cause a reduction in treatment need.
CONCLUSION: 1. Treatment of a crossbite with the quadhelix appliance considerably reduced OI and the class of treatment need. 2. Some patients required further orthodontic treatment in order to eliminate occlusal disorders not corrected by the quadhelix appliance.

146 AN INVESTIGATION OF THE PREFERRED RATIO FOR LOWER ANTERIOR FACE HEIGHT

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AIM: An aesthetic facial profile is important to orthodontists in many aspects. Even though it is one of the principal treatment goals, judgement of facial aesthetics is complex and generally considered to be highly subjective. Nevertheless, the rule of 'Balance and Harmony' should be emphasized. Balance and harmony may apply to lower anterior face height ratio (LAFHR). The purpose of this study was to investigate preferences for LAFHR in Koreans.
SUBJECTS AND METHOD: The assessors were 283 males and 102 females. The sample comprised two males (A and B) and two females (A and B), containing five morphing profiles according to LAFHR. (Sn-Sto/Sto-Me' –1/1.8, 1/1.9, ½.0, ½.1, ½.2). To determine the order of preference a questionnaire was used. Computerized statistical analysis was carried out with SPSS program.
RESULTS: 1. There was no statistical significance in the preference of LAFHR for males and females. 2. For the male sample, the most attractive profile was 1/1.8 (male A) and 1/1.9 (male B), 3. For the female sample, the most attractive profile was 1/1.8 and 1/1.9 (female A) and 1/1.9 (female B). 4. For the whole sample the least attractive profile was ½.2. 5. For the whole sample the most attractive LAFHR was between 1/1.8 and 1/1.9.
CONCLUSION: The results how that the preferred range of Sn-Sto/Sto-Me for the general public is between 1/1.8 and 1/1.9.

147 SIDE DISTRIBUTION OF TEMPOROMANDIBULAR JOINT INTERNAL DERANGEMENTS AMONG CHRONIC FACIAL PAIN PATIENTS WITH CONDYLAR ASYMMETRY

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AIM: Differences in the radiological height of the left and the right temporomandibular joint (TMJ) condyle (condylar asymmetry) as depicted on panoramic radiography have been shown to be associated with signs of temporomandibular disorders (TMD). The aim of this investigation was to relate condylar asymmetry to clinical signs of condyle-disc derangements.
MATERIALS AND METHODS: From a sample of 244 patients with chronic facial pain, the data of 67 subjects (57 females, 10 males, average age 41 years) were analyzed retrospectively. These patients showed condylar asymmetry and presented with internal TMJ derangements clinically diagnosed as either anterior disc displacement (ADD) with or without reduction or disc degeneration. The asymmetry index (AI) as proposed by Habets *et al*. (1988) was used as an indicator for differences in the vertical height of the two condyles and diagnostic criteria from the German Society of Dentistry and Oral Medicine were employed in the clinical diagnosis of signs of TMD. Box plots and analysis of variance were used to relate asymmetry with internal derangements and to determine the mean condylar asymmetry in the unilateral and bilateral appearance of ADD.
RESULTS: The mean condylar AI in the sample was 13.5 per cent. Forty-four patients presented bilateral clicking, 13 clicking on the right and 10 on the left side. Analysis of variance showed a statistical effect between condylar asymmetry and the anatomical location of the internal derangement. In subjects with unilateral clicking, disc degeneration or TMJ closed lock, the AI index was significantly higher than in those with bilateral derangements (16% versus 7%, $P = 0.009$).
CONCLUSIONS: There is a strong association between soft and hard tissue conditions in certain TMD patients with possible aetiological implications regarding internal derangements.

148 EFFECT OF CERVICAL HEADGEAR ON UPPER FIRST MOLAR ROTATION— AN EIGHT-YEAR FOLLOW-UP STUDY

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AIM: To determine the effects of early headgear treatment on rotation of the upper first molars.
SUBJECTS AND METHOD: Fifty-eight children of both sexes aged 7.6 years (SD 0.3 years) with a Class II tendency in occlusion and moderate crowding. The children were randomly divided into two groups of equal size, matched according to gender. In the first group headgear treatment was initiated immediately. The mean treatment time in the headgear group was 16 months. In the second group, which served as a control, only interceptive procedures were performed during the first follow-up period. Study casts were taken after follow-up periods of two and eight years. Linear and angular measurements were obtained using Orthometrics, a three-dimensional measurement system based on the machine vision technique.
RESULTS: The upper first molars were significantly rotated distally in the headgear treatment group. The mean distal rotation was

5.9 degrees (SD 4.5) at the two-year follow-up. No significant changes could be found in rotation of the upper first molars in the control group. The mean difference between the distobuccal and mesiobuccal cusps of the upper first molars was a decrease in the headgear treatment group, indicating rotation. No significant change was found in the control group. At the eight-year follow-up period no significant relapse was observed.
CONCLUSION: Cervical headgear rotates the upper first molars distally and the change is significant after a follow-up period of several years.

149 SEXUAL HORMONE SERUM LEVELS IN PATIENTS WITH TEMPOROMANDIBULAR DISORDERS

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AIM: To evaluate β-oestradiol, progesterone, total and free testosterone serum levels in a young adult population affected by disc displacement and/or other arthropatic diseases of the temporomandibular joint compared with a healthy control group.
SUBJECTS AND METHODS: The experimental and control groups each comprised 24 aged-matched temporomandibular disorder (TMD) subjects. All the males had a normal pubertal development and the females a normal menarche and regular menstrual cycle. Subjects who had used hormonal therapies in the previous six months and those affected by systemic diseases were excluded from the study. Blood samples were collected from all females but only one male both in the follicular and luteal phase. Gnathological examinations were conducted by the same operator and the diagnosis performed following the Research Diagnostic Criteria/TMD.
RESULTS: Significantly higher luteal phase β-oestradiol levels were found in the pathologic female group compared with the healthy control group ($P < 0.05$). For males, there was no significant difference, but higher β-oestradiol levels resulted in the pathologic sample. There was no significant difference between the TMD subjects and controls for the other hormones studied.
CONCLUSION: High serum oestrogen levels could be implicated in the physiopathology of some forms of TMD and could explain the different prevalence of this disturbance with respect to gender.

150 BOLTON INDEX ANALYSIS OF ORTHODONTIC PATIENTS

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AIM: To determine anterior (ABI) and total Bolton (TBI) indices among treated orthodontic patients and to evaluate the clinical significance of estimated tooth size discrepancies (TSD).
MATERIAL AND METHOD: One hundred and eight diagnostic models (37 males, 71 females) were examined by three investigators. The measurements were undertaken using a fine point Boley gauge. Statistical analysis was performed with SPSS® (SPSS for Windows 2000).
RESULTS: Sixty-eight patients (62.3%) had a normal TBI, 21.3 per cent (23 patients) had wider upper than lower teeth, and 15.7 per cent (17 patients) wider lower than upper teeth. Estimated ABI was normal for 48.1 per cent (52 patients); in 20.4 per cent (22 patients) the upper anterior teeth appeared to be wider than the lower anterior teeth and the reverse for 31.5 per cent (34 patients). TBI for the females was 90.72 ± 2.14, and for males 91.48 ± 1.81. The variation coefficient was 0.39 for the lower first molar and 0.29 for the upper second incisor. TSD in both posterior and anterior segments were found in 37.7 per cent of orthodontic patients while 51.9 per cent had a TSD only in the anterior segment. Of the examined patients, 5.5 per cent had significant TSD in the posterior [91.3–3.86 (2S) ≥ TBI ≥ 91.3+3.86 (2S)] and 18.5 per cent only in the anterior part of the dentition [77.2–3.30 (2S) ≥ ABI ≥ 77.2+3.30 (2S)].
CONCLUSIONS: Both Bolton indices values showed no statistically relevant dependence on patient gender and occlusion. The indices were mostly influenced by changes in the width of the first permanent molars, upper second incisors and upper canines.

151 CORRELATION BETWEEN OVERBITE AND AVAILABLE SPACE FOR LOWER ANTERIOR TEETH

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AIM: To determine the relationship between available space for the lower anterior teeth and overbite.
SUBJECTS AND METHOD: Thirty randomly selected patients (23 females, 7 males) during the 1970s treated with light-wire edgewise appliances. The models pre- and post-treatment and at the long-term follow-up examination were used. The following measurements were performed: overbite, intercanine width in the upper and lower dental arches, the space available for the lower anterior teeth, tooth size discrepancy, irregularity index, and the width of the six upper and six lower anterior teeth.
RESULTS: The overbite increased on average 1.9 mm during active orthodontic treatment. The space available for the lower anterior teeth increased by 6.9 mm. The correlation coefficient between the change of overbite and enlargement of the space for the lower anterior teeth was 0.6 (highly significant). The overbite had deepened by 1.1 mm at the long-term follow-up, the change being statistically significant. The space available for the lower anterior teeth was reduced on average by 3.5 mm.
CONCLUSION: The space for lower the anterior teeth is increased significantly, both statistically and clinically, by raising the bite. A deepening bite results in a decrease of the space available for the lower anterior teeth and crowding develops.

152 REGENERATION OF BONE WITH VASCULAR ENDOTHELIAL GROWTH FACTOR AND VICRYL MESH SCAFFOLD

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AIM: To examine the osteogenecity of vascular endothelial growth factor (VEGF) *in vivo* using Fibrin sealant (Tisseel®, Immuno AG) as a carrier and polyglactin 910 mesh (Vicryl; Ethicon, Somerville, NJ) as a scaffold. The amount of new bone formed in rabbit cranial defects in the presence and absence of VEGF was compared.
MATERIALS AND METHOD: Thirty-two adult New Zealand White rabbits (3.5–4.0 kg) with 40 parietal skull defects (10 mm diameter). Twelve defects were grafted with Vicryl impregnated with rhVEGF (Calbiochem) and Fibrin (Group 1); 12 defects were grafted with Vicryl and Fibrin only (Group 2), eight defects grafted with Vicryl alone (Group 3) formed the active controls and eight defects left empty (Group 4), formed the passive control. An equal number of rabbits were sacrificed at 1 and 2 weeks post-surgery and the tissue specimens harvested for histological analysis. The amount of new bone formed was analyzed using the Image Pro Plus software.
RESULTS: Defects grafted with Vicryl impregnated with fibrin and rhVEGF (Group 1) harvested at 2 weeks, showed significantly more new bone formation compared with the control groups. Significantly more bone and blood vessels were formed at 2 weeks compared with 1 week in Group 1. Complete osteoid bone bridging across the defect

was seen in Group 1 at 2 weeks while all other groups showed only limited amounts of new bone formed adjacent to the defect margins.
CONCLUSIONS: The responses to exogenous VEGF observed in the rabbit model indicate that VEGF, delivered with Fibrin and Vicryl, applied locally at the site of bone defects increases bone formation *in vivo*. This may potentially be an effective therapy to promote human bone repair.

153 VALIDITY OF DELAIRE'S ANALYSIS FOR TREATMENT PLANNING OF GENIOPLASTY IN ORTHOGNATHIC SURGERY

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AIM: Delaire described a method for analysis of lateral cephalographs to assess parameters of the viscero- and neurocranium. In contrast conventionally used methods of analysis are largely based on parameters of the viscerocranium. This study was conducted to assess differences between both planning techniques concerning displacement vector and dimension plus objective and subjective evaluation of treatment outcome.
SUBJECT AND METHODS: Between 1990 and 2000 a total of 48 patients underwent different genioplasties to improve facial harmony or lower lip inability. The primary treatment planning for vector prescription was made using Delaire's analysis. Pre-, post-operative and before appliance removal lateral cephalograms were analysed with both methods as described above. In addition the subjective opinion of the patients at the end of treatment was analysed with a questionnaire regarding functional and aesthetic criteria.
RESULTS: Surgery planning with both analysis methods resulted for 66.7 per cent (n = 32) in differences of more than 2 mm (vector horizontal and vertical displacement). A post-operative dislocation of Menton from the planned Menton smaller than 2 mm was voted a success and diagnosed in 95.8 per cent (n = 46). No significant differences were found on appliance removal. Analysis of the subjective view of the patient showed a high degree of aesthetic (93.8%) and functional (79.2%) improvement.
CONCLUSION: Significant differences between the two analyses exist regarding the vector and dimensions of surgical planning. Because of positive post-operative results Delaire's analysis is an efficient planning method for genioplasty.

154 MANDIBULAR ASYMMETRY IN HEALTHY CHILDREN

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AIM: To assess mandibular asymmetry in healthy children and its possible fluctuation during growth.
SUBJECTS AND METHODS: One hundred and eighty two healthy children (88 girls, 94 boys) with no orthodontic history, who had had a dental pantomogram (DPT) taken at the ages of 7 (mean 7.5) and 16 (mean 15.9) years. The DPTs were digitized and condylar and ramal heights on both sides were measured perpendicular to the ramal tangent. Paired t-tests were used to determine the significance of the difference between the sides, and ANOVA to test the significance of the change in asymmetry during growth and between genders.
RESULTS: Whilst a statistically significant mandibular asymmetry was found, the mean difference was small. It seems that at the age of 7 years the left condyle was longer than the right, but the right ramus was longer than the left in both genders. At 16 years of age no difference between the right and left sides was found in girls, but in boys the right ramus was longer than the left.
CONCLUSION: There seems to be a statistically significant difference between right and left condylar and ramal heights when measured on DPTs. While the mean differences are small and may be clinically unimportant, the range is large.

155 BONE REGENERATION USING VEGF WITH POLY-E-CAPROLACTONE SCAFFOLD AND FIBRIN GLUE

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AIM: To investigate the osteogenic capability of vascular endothelial growth factor (VEGF) in bone defects using Fibrin glue (Tisseel®, Immuno AG) as the carrier and poly-E-caprolactone (PCL) as the scaffold.
MATERIALS AND METHODS: Thirty-two adult New Zealand White rabbits (3.5–4 kg) with 40 defects (4 groups). Defects with a diameter of 10 mm were created in the parietal skulls of the rabbits. Twelve defects in 12 rabbits were grafted with PCL impregnated with rhVEGF (Calbiochem) and fibrin glue (PCL/VEGF/Fibrin). Another 12 defects in 12 rabbits were grafted with PCL impregnated with fibrin glue only (PCL/Fibrin) (active control). Sixteen defects in eight rabbits were used for the other two control groups. Eight defects were grafted with PCL (active control) and the other eight were left empty (passive control). The rabbits were sacrificed and the tissue specimens were harvested at 1 and 2 weeks (equal numbers from each group) for histological analysis. The amount of new bone formed was quantitatively analysed using the Image Pro Plus software.
RESULTS: New bone was formed after 2 weeks in the defects grafted with VEGF/PCL/Fibrin compared with the control groups. The amount of bone and blood vessels were found to be significantly higher in the 2 week PCL/VEGF/Fibrin group compared with the corresponding 1 week group.
CONCLUSION: VEGF with fibrin glue and PCL scaffold promotes osteogenesis in bone defects and may be used for its angiogenic and osteogenic role in bone regeneration.

156 RELATIONSHIP BETWEEN MALOCCLUSION AND RESPIRATORY PATTERN

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AIM: To evaluate the relationship between malocclusion and respiratory pattern, and to determine the most informative aetiological criteria of the need for orthodontic treatment.
SUBJECTS AND METHOD: One thousand four hundred and sixty three children in three randomly, selected schools. From these subjects 103 children, with nasal obstruction confirmed by otorhinolaryngologists and a control group of 30 children, with no signs of malocclusions or history of mouth breathing, were selected. The study included an interview, extra- and intra-oral examination, dental cast and cephalometric analysis, otorhinolarynologists' examination, posterior rhinomanometry test, and recording of electromyographic activity of the orbicularis oris. Statistical analysis was performed using the software package Statistica 5.0.
RESULTS: Mouth breathing was associated mainly with the presence of I-III degree adenoids (46%), chronic rhinitis (17%) or defects of nasal septum deviation (14%). Malposition of the incisors was most common in children with primary adenoids, 85.2 per cent in the maxilla and 59.3 per cent in the mandible. Mouth breathing related to II and III degree adenoids caused the most severe malocclusion compared with other types of nasal or nasopharyngeal pathology. An overjet greater than 6 mm was registered in 63.64 per cent of children with II and III degree adenoids. For subjects with other types of nasal or nasopharyngeal pathology it was in 45.16 per cent ($P < 0.05$), and for posterior crossbite 71.43 and 23.53 per cent, respectively ($P < 0.001$).

CONCLUSION: An algorithm of the probability for orthodontic treatment need using multivariate logistic regression was created. The probability algorithm for orthodontic treatment need is compounded of aetiological factors demonstrating a high coincidence (85%) with orthodontic treatment need determined by the Index of Orthodontic Treatment Need.

157 SOMATIC STATUS IN ADOLESCENTS FOLLOWING EARLY EXTRACTION OF PERMANENT TEETH

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AIM: Prophylactic examination has shown that the first permanent molars are mostly exposed to caries, and with maturation (aged 14–18 years) the dentition defect frequency increases because of extractions. The aim of this study was to determine the modification in the functional condition in adolescents with early extraction of the permanent teeth.
SUBJECTS AND METHODS: Twenty-five adolescents with absent first molars were examined and their functional status was studied using Folle's electropuncture diagnostic method on the 'Elena' apparatus-programme complex. A limited number of points were used localized on the fingers and toes.
RESULTS: Absence of the first molars showed the most negative influence on the energetic points of the lymphatic system meridians (from –6.7 to –10.1 units), endocrine system (from 1.5 to –1.0 units). There were no significant influences on other energetic meridian points.
CONCLUSION: Significant index changes were found on two meridians: the lymphatic and endocrine systems (average indices decreased from 3.2 to 10.1 units).

158 HISTOLOGICAL AND MAGNETIC RESONANCE IMAGING FINDINGS DURING HERBST TREATMENT

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AIM: To develop an experimental animal model for monitoring temporomandibular joint (TMJ) growth changes occurring during Herbst treatment and to compare magnetic resonance image (MRI) findings with histological changes.
MATERIAL AND METHOD: One Göttingen minipig treated with the Herbst appliance for 2 months. The minipig was 2 months old at the start of the experimental period and treatment was thus performed just before sexual maturity, which on average occurs at 4–5 months of age. The Herbst appliance comprised casted splints and the amount of bite jumping was 4–5 mm. The primary canines were extracted at the start of the experimental period to avoid interference when the mandible was positioned forward. MRIs of the TMJ were taken before (without and with appliance), after 1 month, and at the end of the experimental period when the minipig was sacrificed. The TMJ complex was embedded in methylacrylate and sagittal histological sections stained with Goldener were analysed. The study was approved by the Animal Experimental Committee at the University of Lund, Sweden.
RESULTS: A distinct bright band was clearly observed on the MRIs at the superior border of the right and left condyles. The band was seen at all stages of treatment and did not seem to change in thickness during the observation period. The band was also identified on the histological sections.
CONCLUSIONS: The Göttingen minipig is a suitable experimental animal for investigating condylar growth changes during Herbst treatment. The bright MRI band seen in patients treated with the Herbst appliance can also be identified and analysed in minipigs.

159 FACTORS INFLUENCING ORTHODONTIC TREATMENT TIME FOLLOWING ORTHOGNATHIC SURGERY

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AIM: To assess the variation in post-surgical orthodontic treatment time and to identify factors which could affect this.
MATERIAL AND METHODS: Records of all patients who had undergone orthodontic treatment combined with orthognathic surgery in the previous 5 years ($n = 69$) were collected from the Leeds Dental Institute, St James' and Seacroft Hospitals. Patients with cleft lip/palate or craniofacial syndromes were excluded. As these three major hospitals serve a population of 715,000 it was thought likely that the data would be relevant to most modern conurbations. The data collected included: patient's age and sex; incisor relationship; extractions (excluding third molars); presence/absence of an open bite; surgical procedure (maxillary, mandibular or bimaxillary); retainer type; the orthodontist involved; number of broken appointments/breakages requiring repair. The length of post-surgical orthodontic treatment was measured from the operation date to the date of debond. The patients were treated by two consultant orthodontists and one senior trainee in orthodontics; surgery was performed by two surgeons. Data analysis was undertaken using the SPSS program.
RESULTS: Thirty per cent of the patients were male and 70 per cent female; the mean age was 24.6 years at the time of surgery. The median post-surgical treatment duration for all patients was 30.1 weeks (range 12.7–65.1 weeks). No statistically significant differences in treatment duration for any of the variables were found as assessed by box and whisker plots or, where appropriate, Mann-Whitney *U*-tests.
CONCLUSIONS: Patients should be informed that post-surgical orthodontic treatment is likely to take 7–15 months. None of the variables investigated had a statistically significant effect on the length of post-operative orthodontic treatment but a long-term prospective study would be beneficial to confirm this.

160 CLASS II DIVISION 1 AND CLASS II DIVISION 2 MALOCCLUSIONS—DO THEY GROW DIFFERENTLY IN THE TRANSVERSE DIMENSION?

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AIM: To analyse the transverse morphology and development of the dental arches and skeletal mandibular-maxillary bases in subjects with untreated Class II malocclusions.
MATERIALS AND METHOD: Using the records of the Belfast Growth Study, a Class II division 1 and a Class II division 2 group were compared with a Class I group and a control group with good occlusion. On postero-anterior cephalograms, maxillary skeletal base width, bigonial and biantegonial widths were determined at two-year intervals between 7 and 15 years. Maxillary and mandibular intermolar widths were measured on the associated study casts.
RESULTS: Maxillary skeletal base widths were smallest in the Class II division 1 subjects. In addition, maxillary intermolar widths were smaller in the Class II division 1 group than in the Class I and the good-occlusion group. These group differences were present for the total observation period, i.e. 7 to 15 years and statistically significant at most ages. The Class II division 1 cases were also found to have the largest average difference between the maxillary and mandibular

intermolar widths (approximately –2.5 mm for males and –1.5 mm for females), indicating a relatively narrow maxillary arch. Smaller mean molar differences were found in the Class II division 2 group. During the transition from early mixed to permanent dentition, no self-correction of the molar differences occurred in the Class II division 1 subjects.
CONCLUSIONS: Due to the relationship between transverse and sagittal anomalies, attention should be paid to transverse interarch discrepancies in the diagnostic process of Class II malocclusions, e.g. by a determination of molar differences or comparable measurements of interarch discrepancies.

161 VERTICAL, SAGITTAL AND TRANSVERSE CRANIOFACIAL DEVELOPMENT—GROWTH INCREMENTS OF THE MAXILLO-MANDIBULAR COMPLEX

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AIM: To longitudinally evaluate facial growth in all three planes of space from childhood to late adolescence.
SUBJECTS AND METHOD: Using the records of the Belfast Growth Study, transverse growth was measured from standardised postero-anterior cephalograms, and sagittal and vertical growth increments were recorded from contemporaneous lateral cephalograms. The sample included 18 untreated Class I subjects with good occlusion. Analysis was completed at five time points, i.e. 7, 9, 11, 13 and 15 years of age.
RESULTS: The facial skeleton exhibited a characteristic pattern of growth, where among the males face height increased most, i.e. Nasion-Menton 23.0 per cent and Sella-Gonion 29.2 per cent when compared with facial depth (Basion-point A, 14.1%) and facial width (Zygion-Zygion, 15.5%). With respect to the mandible, ramus height increased among the males by 34.4 per cent (Ar-Go) and 35.7 per cent (Co-Go) between 7 and 15 years. Less growth was found in the mandibular body (24.1%), and the smallest percentage increase was recorded for mandibular width (Go-Go, 17.6%). Similar growth patterns were found among females, but growth increments were smaller.
CONCLUSIONS: In the growing facial skeleton: (1) vertical growth is dominant between 7 and 15 years (posterior face height > anterior face height), and that (2) the mandible shows a characteristic pattern of growth increments, i.e. vertical > sagittal > transverse. In addition, sagittal growth increments are more pronounced in the mandible than in the maxilla. The results of this three-dimensional growth analysis increase understanding of normal growth and will assist clinicians in treatment planning for patients with growth related anomalies, e.g. skeletal open bites.

162 OUTCOME OF ORTHODONTIC TREATMENT WITH FIXED AND REMOVABLE APPLIANCES

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AIM: To compare the orthodontic treatment outcome in Class II division 1 patients treated with fixed and removable appliances using the Peer Assessment Rating (PAR) Index.
SUBJECTS AND METHOD: One hundred and twenty four Class II division 1 orthodontic patients (overjet 5 mm or more) treated at eight practices. Active orthodontic treatment began in January-June, 1998; the assessment of treatment outcome was made in June, 2002. Fifty-five patients were treated with removable appliances in the late mixed dentition, of these 39 patients finished and 16 interrupted treatment. Sixty-nine patients were treated with fixed appliance in the permanent dentition. The PAR Index was used as a measure of malocclusion severity and post-treatment occlusal outcome.
RESULTS: The mean change in PAR score was 9.4 points in the group treated with removable appliances; the mean percentage reduction in PAR was 36. If patients interrupting treatment were included in this group, the mean change was 6.7 PAR points; the mean percentage reduction in PAR was 25. In the group treated with fixed appliances the mean change in PAR score was 18.3 points and the mean percentage reduction in PAR was 71.
CONCLUSION: The effectiveness of orthodontic treatment of Class II division 1 subjects was considerably higher with fixed than with removable appliances.

163 ORTHODONTIC MANAGEMENT ACCORDING TO THE POLISH PROGRAMME OF COMPLETE UNI- AND BILATERAL CLEFT LIP AND PALATE TREATMENT

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AIM: Since 2002 the Polish Ministry of Health has operated a programme of multidisciplinary care for cleft lip and palate (CLP) children. The main aim of this programme is to organize cleft palate centres with interdisciplinary teams for complex patient care. The basic requirements for the unit are: two highly specialist plastic surgeons, two maxillofacial surgeons and two orthodontists with at least 5 years experience.
SUBJECTS AND METHOD: Approximately 350 babies with clefts are born annually in Poland, with a number of them treated in the cleft units. In 2002, 2556 children with CLP aged 0 to 18 years were surgically treated in these centres. Orthodontic treatment in the same year was performed in 2089 patients 0 to 18 years of age. The orthodontic protocol contains the following procedures: (1) from 0 to 6 months pre-surgical orthopaedic treatment, (2) from 2 to 12 years treatment with removable appliances, (3) from 11 to 18 years fixed appliance and prosthodontic treatment. Documentation-registration of data according to unified medical charts, monitoring according to the record keeping guidelines elaborated by the Eurocleft, intercentre comparison study of treatment outcomes at the end of each year.
RESULTS: During 2002 in 10 cleft centres 173 infants were treated pre-surgically with a palatal plate, 121 children with removable and 739 with fixed appliances. Prosthodontic treatment was carried out in 16 patients. Thirty patients completed treatment or are in retention.
CONCLUSIONS: Sixty-four per cent of children with complete uni- and bilateral clefts were treated to a high standard in the cleft palate centres by specialized interdisciplinary teams.

164 A MATHEMATICAL MODEL TO DESCRIBE THE RELATIONSHIP BETWEEN ORTHODONTIC FORCE AND TOOTH MOVEMENT

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AIM: To develop a mathematical model that describes the relationship between the magnitude of an orthodontic force and the rate of subsequent tooth movement.
MATERIAL AND METHODS: Data were used from different experimental studies in beagle dogs, in which mandibular second premolars were moved distally by well-controlled standardised forces. Tooth movement was induced in 120 experimental sites by forces of 10, 25, 50, 100, 200, 300, 600, or 1200 cN, and time-displacement curves were constructed. The mean rate of experimental tooth movement was determined after hyalinisation had ceased. To develop

a mathematical model, iterative non-linear regression techniques were used, based on the following equation:
Sqrt(V(F)) = sqrt(Vmax)*(F/Fmax)Fmax/Fb*e(Fmax-F)/Fb.
The equation was based on the following assumptions: (a) no tooth movement without force, (b) a positive correlation between force and velocity at low forces, (c) a maximum or plateau at higher forces, (d) the velocity may remain stable or decrease with further increase of force, and (e) the velocity will never become negative.
RESULTS: An optimal fit of this equation to the force-velocity data was obtained with the following parameters: Vmax = 0.28 mm/wk (95% CI = 0.24–0.31 mm/wk), Fmax = 219 cN (95% CI = 108–369 cN), and Fb (a scaling parameter) = 2043 cN. The correlation coefficient between force and velocity was R = 0.2, so R2 = 0.04, meaning that 4 per cent of the variability was explained by the force magnitude.
CONCLUSION: This mathematical model shows that in dogs the maximum rate of experimental tooth movement is between 0.24 and 0.31 mm/week, and is achieved using forces between 108 and 369 cN. The magnitude of the applied force, however, is only of minor importance and individual differences in morphology and physiology of bone and periodontal ligament are probably more important for the rate of tooth movement.

165 MANDIBULAR MORPHOLOGY IN SUBJECTS WITH DIFFERENT VERTICAL FACIAL GROWTH PATTERNS

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AIM: An important aspect of comprehensive orthodontic therapy is managing the vertical dimension of the patient's face. The aim of this study was to estimate the influence on mandibular morphology to enable prediction of the type appropriate to orthodontic therapy.
MATERIAL AND METHOD: Mandibular morphology was examined on lateral cephalograms of 60 subjects (30 females, 30 males) aged 8–14 years with different vertical facial growth patterns. SN/GoGn angle was used to define low-, normal-, and high-angle groups. The other angular parameters were IMPA, Y-axis, CdSN, RL/SN and GoGn/chin line. The linear parameters included were: Go–Pg, Cd–Go, symphysis depth, S–Gn (S–SNA and SNA–Gn) and S–Go. The effects of SN/GoGn angle and gender on mandibular morphology were investigated by means of analysis of variance.
RESULTS: IMPA was found to be related to SN/GoGn, and the measurements of Go–Gn and symphysis depth to sex. An increase in lower posterior face height was consistently positively correlated with forward matrix rotation, irrespective of mandibular plane angle or age. The same applied to the increase in ramus height. The increase in lower anterior face height was weakly correlated with mandibular rotation, but positively correlated with an increase in corpus length.
CONCLUSIONS: Although the reasons for growth differences are not well understood, these affect the entire craniofacial complex. The muscles of mastication act in different directions in horizontal and vertical growers, and produce different muscular pressures and tensions in the two types of growth. This results in different apposition and resorption of surface bone, and, therefore, different mandibular morphology in horizontal and vertical growers.

166 MANAGEMENT OF MISSING LATERAL INCISORS

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AIM: To analyse the data collected in a longitudinal investigation of growing and adult orthodontic patients with a missing lateral incisor.
SUBJECTS AND METHODS: Ten adults (mean age 20 years) and 10 growing (mean age 10 years) patients with a missing lateral incisor due to congenital absence, trauma or impaction were investigated. The subjects were treated during a mean period of 2 years with functional appliances in growing patients, fixed appliances and orthognathic surgery if necessary in adult patients. Diagnosis was performed clinically and on panoramic films, cephalograms and study models. In patients where extractions were indicated three extractions were performed to obtain occlusal symmetry and space closure. In borderline and non-extraction patients the space for the lateral incisor was opened.
RESULTS: In all patients a skeletal and a dental Class I occlusion was achieved resulting in a pleasant aesthetic and functional occlusion.
CONCLUSIONS: A number of factors should be taken into consideration when selecting the appropriate treatment for subjects with a missing lateral incisor, such as skeletal pattern, degree of interlocking intercuspation, axial inclination of the teeth, presence or absence of teeth, and age. In cases where space is to be opened, the therapy can be enhanced through restorative techniques such as implants and prosthetics.

167 POSTERIOR BITE BLOCK AND ADAPTATION OF THE GROWING RAT MANDIBLE UNDER DIFFERENT FUNCTIONAL DEMANDS

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AIM: The posterior bite block can be an effective tool in the treatment of open bite, although its exact mode of action has not been thoroughly investigated. The aim of this study was to evaluate the effect of the posterior bite block on the dentoalveolar and skeletal adaptation of the mandible in the growing rat, as well as the possible role of the masticatory muscle capacity in this adaptation.
MATERIALS AND METHODS: One hundred and four young male rats, divided into two groups, were fed a hard and soft diet respectively, in order to develop different masticatory functional capacities. After 2 weeks, 20 animals from each group were sacrificed to serve as a reference. Half of the remaining animals in each group were fitted with upper posterior bite blocks (4 subgroups of 16 animals) and after another 4 weeks they were sacrificed and their left mandibles excised. They were subsequently photographed with a standardized configuration and digitized on screen using customized cephalometric software. The general linear model multivariate statistical procedure was employed.
RESULTS: Apart from the inhibitory effect on the vertical dimensions of the lower dentoalveolar process, the upper bite block resulted in significant changes of the occlusal plane, condyle inclination and length, as well as the size of the coronoid process. Different masticatory muscle functional demands were associated with different adaptive outcomes in certain areas, as in the coronoid and gonial processes.
CONCLUSIONS: Significant morphological adaptation of the mandible was found after insertion of a posterior bite block in the growing rat. The dentoalveolar and the functional processes were the sites of major changes. The functional capacity of the masticatory muscles seems to influence the effect of the bite block in certain areas of the mandible.

168 VERTICAL GROWTH: THE EFFECTS OF TREATMENT AT DIFFERENT AGES WITH DIFFERENT TECHNIQUES

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AIM: The long-term success of orthodontic treatment is dependent on the direction of facial growth. This study compared the direction

of growth of five groups of patients treated at two different ages using three different techniques. Biobloc appliances encourage forward growth by using 'semi-rapid' expansion followed by postural training. The growth direction was defined as, 'the angle of intersection between gnathion at T1 and T2 and the Frankfort plane'.
MATERIAL AND METHOD: Five groups were taken from the practice records of the second author. 1. Under 14 years of age, non-extraction, treated with straightwire appliances; 2. Adults, over 16 years of age, non-extraction, treated with straightwire; 3. Under 14 years of age, four premolar extractions, treated with Begg appliances; 4. Adults over 16, four premolar extractions, treated with Begg appliances; 5. Under 14, non-extraction, treated with 'postural' appliances (Biobloc). The first 30 consecutive cases in each classification were included provided they had cephalometric records taken immediately prior to and shortly after treatment. The distribution appeared random with the exception that there was a higher ratio of Class II division 2 subjects in the adult groups. The starting age for the Biobloc group was younger but it was followed until the same age as the other two groups and so was probably comparable. One of the adult groups was younger than the other but no patient in either of the adult groups grew more than 1 mm along SN. The measurements were tested for error and significance.
RESULTS: Early treatment, non-extraction treatment, and postural training are highly significant factors in reducing vertical growth.

169 DIFFERENTIAL AETIOLOGY OF CLASS II MALOCCLUSIONS—TWO METHODS OF ANALYSIS

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AIM: To compare diagnostic information on distocclusion obtained by two methods: Björk and projection on the occlusal plane points of posterior (Sella, Gonion, articulare) and anterior (Nasion, Pogonion, A, B) facial skeleton.
MATERIAL AND METHOD: Two groups were compared: Class I: Wits less than 4 mm, neutral molar occlusion, Class II: Wits 4 mm or more with a full distal molar occlusion. All patients were analyzed with Björk's method and the method of projecting points A, B, pg, n, s, go, ar on the occlusal plane. Descriptive statistics and *t*-tests were used to analyze the results.
RESULTS: The following characteristics for Class II were found ($P < 0.001$): posterior position of B described by ss-n-sm, Wits and projection on the occlusal plane. It corresponds to the way of selecting the Class II group. Analyzing the distribution, kurtosis, and skewness, the Class II characteristics were: smaller n–s–ba, s–n–pg, s–n–sm, gonion angle and greater n–s–ar, beta angle. Estimating morphology by positioning of projected on occlusal plane points Class II characteristics were: posterior position (closer to n) of A, B, pg and posterior position (distal to n) of ar and Go. In Class I, projection Go was more often anterior to n point projection.
CONCLUSIONS: When describing the position of selected structures of the facial skeleton by the angular projection method, corresponding observations can be carried out.

170 CHANGES IN THE GROWTH AND ROTATION OF THE FACE IN CLASS II PATIENTS TREATED WITH TWIN BLOCK APPLIANCES

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AIM: With Class II cases, the most desirable goal of correction is to stimulate forward mandibular growth and inhibit maxillary forward growth. The aim of this study was to enhance the skeletal effects of the Twin Block appliance on facial growth.
SUBJECTS AND METHOD: Thirty patients aged 8–10 years treated with the Twin Block appliance. The two control groups (CG) consisted of 60 children with Class II malocclusions (CGI aged 8–10, and CGII aged 10–12 years). To qualify for inclusion in either group the patients satisfied the following criteria: Class II skeletal pattern with ANB >6 degrees; Class II division 1 incisor relationship with an overjet greater than 6 mm. Pre- and post-treatment lateral cephalograms were taken of the treated group. In the control groups, patients underwent radiographic investigation before the initiation of treatment. The pre-treatment data from the treated group was compared with that from CGI, and post-treatment data with CGII. The following parameters were measured: Angles: NSAr, SArGo, ArGoMe and the sum of them, ArGoN, NGoMe, NSGn: Linear parameters: N–Me, S–Go, upper and lower anterior and posterior face heights.
RESULTS: The Twin Block appliance was very effective in correcting Class II malocclusions. When compared with the control groups there was an improvement of the skeletal growth characteristics in the treated group.

171 INFLUENCE OF TOOTH AGENESIS ON DENTOFACIAL STRUCTURES

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AIM: To examine the effect of tooth agenesis on dentofacial structures, in particular to assess whether cephalometric analysis confirmed the clinical assumption of reduced anterior lower face height, and to determine the relationship of these structures with different numbers of missing teeth.
SUBJECTS AND METHOD: Fifty-one patients, mean age 12.1 years (range 9–16 years), with congenitally missing teeth and 25 children without tooth agenesis, mean age 12.5 years (range 9–16 years), selected as the control group. The average number of missing teeth was 2.5, ranging from 1–15 (excluding third molars). All subjects ware evaluated cephalometrically.
RESULTS: The maxilla was retrognathic and the sagittal jaw relationship angle was smaller in the patients with hypodontia. The ANB angle decreased as the number of missing teeth increased. The upper incisors displayed greater anterior inclination but this did not affect facial aesthetics. The patients with more severe hypodontia showed a tendency to a Class III skeletal relationship.
CONCLUSION: Congenital absence of teeth leads to aesthetic and functional disturbances and must be taken into consideration in orthodontic treatment planning.

172 TREATMENT OUTCOME OF ORTHODONTIC 'TRANSFER' CASES

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AIM: To determine whether any difference in treatment outcome and active treatment time exists between a 'single-operator' group of orthodontic cases and a 'transfer' group treated by two orthodontists.
SUBJECTS AND METHOD: The sample consisted of two groups each of 50 patients. All had been consecutively treated with two-arch fixed appliances in a busy hospital department. The two-operator subjects (mean age 14.4 years, SD 3.2) had been under treatment >6 months prior to their transfer and required >6 months further orthodontics to complete their treatment. The single-operator subjects (mean age 14.9 years, SD 3.5) had all been diagnosed and treated by one of the authors. The Peer Assessment Rating (PAR) index was used to score all 200 pre- and post-treatment study models. All recordings were carried out randomly and 'blind' by a fully calibrated technician. Pre-treatment index of orthodontic treatment need

(IOTN) scores and length of active treatment (in months) were also recorded. Differences between the two groups were tested using Mann-Whitney *U* tests.
RESULTS: The mean PAR percentage and point reduction was similar for both groups (90% compared with 86% and 34.7 compared with 32.8, respectively). The mean treatment time for the transfer cases was 3.5 months longer. No statistically significant differences were found. The majority were classified as 'greatly improved' on the PAR nomogram.
CONCLUSIONS: The study sample demonstrated a 'definite need' for treatment with an overall severe level of malocclusion. Both groups were ultimately well treated although the transfer cases did take longer to complete to a similar standard.

173 FUNCTIONAL OCCLUSION AFTER FIXED APPLIANCE TREATMENT

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AIM: To analyse the functional occlusion of orthodontic patients directly after removal of the fixed appliance.
SUBJECTS AND METHODS: Fifty-one consecutive subjects who had undergone two-arch fixed appliance treatment were examined clinically on the day when the bands and brackets were removed. The occlusal slide between retruded contact position (RCP) and intercuspal position (ICP) in the antero-posterior and lateral directions, as well as tooth contacts on protrusion and lateral mandibular excursions were recorded.
RESULTS: Directly after removal of the fixed appliance 11 subjects (22%) had a good functional occlusion (neither RCP/ICP interferences nor posterior contacts on protrusion or non-working side contacts on lateral excursions). Twenty-three subjects exhibited RCP/ICP interferences in an anterior direction. Fifty-two per cent of these occlusal slides ranged between 1 and 2 mm, 44 per cent were less than 1 mm and 4 per cent exceeded 2 mm. Twelve subjects revealed RCP/ICP interferences in a lateral direction. Most of the slides (83%) were less than 1 mm, 17 per cent ranged between 1 and 2 mm, but none exceeded 2 mm. Seventeen subjects exhibited posterior contacts on protrusion and six subjects revealed non-working side contacts.
CONCLUSION: The majority (78%) of the present patients treated with fixed appliances did not exhibit a good functional occlusion directly after appliance removal.

174 MANDIBULAR KINESIOLOGY IN CHILDREN WITH ENLARGED TONSILS BEFORE AND AFTER TONSILLECTOMY

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AIM: To examine mandibular kinesiology in a group of children before and after tonsillectomy and to evaluate the relationship between enlarged tonsils and jaw movement.
MATERIALS AND METHOD: Three-dimensional tracings of the border jaw movements of 50 Greek children, aged 7–12 years with enlarged tonsils were assessed. A clinical and radiographic examination was carried out on the day prior to and one year after tonsillectomy. Mandibular border movements were calculated with a kinesiograph (Myotronics K6-1 INC Seattle, WA, USA) at the same time intervals. Subjects with temporomandibular disorders were not included in the study. From the initial group 20 subjects with enlarged tonsils were compared with a normal control group matched for age and sex.
RESULT: Children with enlarged tonsils had a significantly smaller mean jaw-opening, jaw-protrusion and jaw lateral (left and right) movement compared with the controls. The mandibular kinesiology in children with enlarged tonsils changed after tonsillectomy. The maximum jaw-opening and the maximum jaw-lateral (left-right) movement showed a significant increase one year after surgery. This increase was smaller for the maximum jaw-protrusion movement. All the changes were statistically significant.
CONCLUSION: It would appear that functional and/or morphological disorders, causing an open posture of the mouth and a lowered anterior posture of the tongue are associated with the differences in mandibular kinesiology between the two groups. The obstruction of the oropharynx by enlarged tonsils might be one factor responsible for these dysfunctions.

175 CERVICAL HEADGEAR VERSUS PENDULUM APPLIANCE FOR THE TREATMENT OF MODERATE SKELETAL CLASS II

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AIM: To compare two different methods of Class II correction in growing individuals, one depending on patient co-operation with cervical headgear, and another with a non-compliance technique using the Pendulum appliance.
SUBJECTS AND METHOD: From a group of 63 patients treated with fixed appliances and cervical headgear, 30 were selected to match a group of 30 cases started with a Pendulum appliance. The pre-treatment age ranged from 8.0 to 14.1 years in the headgear group and from 9.3 to 14.3 years in the Pendulum group. All patients presented initially a dental Class II malocclusion with an ANB angle between 4 and 8 degrees and were treated non-extraction. Lateral headfilms were obtained before (T1) and after completion (T2) of treatment. Horizontal and vertical linear changes were recorded. Tracings were digitized using OTP software (Orthovision). Statistical significance was tested using the Student's *t*-test.
RESULTS: Active treatment time was slightly longer for the Pendulum group (+4.5 months). Restriction of maxillary growth measured at SNA was more pronounced in the headgear group (–1.33° $P < 0.001$) compared with the Pendulum group, where it was not statistically significant. Molar tipping at the end of treatment was more persistent in the headgear group (+5.1° $P < 0.001$). Soft tissue changes produced by the two different therapies were similar in both groups, except for more restriction of forward movement of Subnasale in the headgear group (difference: 1.64 mm, $P < 0.05$). Vertical changes seemed not to be influenced by these two types of therapy.
CONCLUSIONS: The Pendulum appliance is a good non-compliance alternative for Class II correction. However, in patients presenting maxillary protrusion, headgear therapy remains the method of choice.

176 PROSPECTIVE CONTROLLED STUDY OF AIRWAY CHANGES WITH TWO DIFFERENT MANDIBULAR ADVANCEMENT SYSTEMS

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AIM: To compare airway changes in relation to mandibular protrusion produced by Twin Blocks and the Silensor in growing children.
SUBJECTS AND METHODS: Sixty-five Class II division 1 children aged between 8 and 15 years were randomly allocated to either Twin Block or Silensor functional appliance groups. Forty children (19 males, 21 females) completed the study (25 Twin Blocks, 15 Silensor) over a mean treatment time of 1.1 years. The treated children were compared with untreated controls matched for age and sex. Pre- and post-treatment cephalograms were assessed for facial and airway changes.
RESULTS: Both study groups showed significant mandibular protrusion compared with untreated controls, with airway changes

reflecting those seen in the mandible. Both Twin Block and Silensor appliances produced significant increases in intermaxillary space ($P < 0.01$) with concomitant reductions in tongue proportion. In Twin Block patients, nasopharyngeal width increased by 1.5 mm in males and 0.9 mm in females ($P < 0.01$). Twin Block males also showed significant increases in minimum post-palatal and post-lingual airways of 2.8 and 3.1 mm, respectively ($P < 0.01$). In the Silensor groups, oropharyngeal length increased by 7.2 mm in males and 3.1 mm in females ($P < 0.05$). Oropharyngeal area was equally improved. Airway dimensions in the controls remained unchanged.
CONCLUSIONS: Both appliances produced favourable airway changes when compared with controls. The Twin Block may be useful as an appliance to improve airway dimensions of children with mandibular retrusion.

177 RELATIONSHIP BETWEEN MAXILLOFACIAL MORPHOLOGY AND MASSETER MUSCLE INCLINATION AND VOLUME. PART 1. MEASUREMENTS ON LATERAL CEPHALOGRAMS

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AIM: Many investigators have reported that masticatory function has a great influence on the maxillofacial morphology. This study was performed to investigate the relationship between maxillofacial morphology and inclination and volume of the masseter muscle.
SUBJECTS AND METHOD: Twenty-one male volunteers, mean age 23.4 years, with normal occlusion. Maxillofacial morphology was observed by lateral cephalograms. Magnetic resonance images (MRI) of each subject were scanned from the region of the mandibular condyle to the mandibular border at intervals of 1 mm. The volume and inclination of the masseter muscle was determined from the MRIs and analyzed by a personal computer with Exavision Lite software. Stature and weight were also measured.
RESULTS: Multiple regression analysis showed that the increase of masseter muscle volume was correlated with the mandibular plane angle, saddle angle, stature, and the inclination of the masseter muscle, viewed from the sagittal plane, and gonial angle.
CONCLUSION: These results suggest that masseter muscle volume increases more, and the gonial angle and mandibular plane angle reduces. However, the saddle angle increases and there is a tendency for the inclination of the masseter muscle to shift vertically.

178 DISSATISFACTION WITH FACIAL APPEARANCE AND PERSONALITY IN PATIENTS WITH MANDIBULAR PROGNATHISM

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AIM: To analyse the relevance between dissatisfaction with facial appearance and personality in patients with mandibular prognathism.
SUBJECTS AND METHODS: Seventy-six surgical patients with mandibular prognathism (28 males, 47 females, mean age 21.8 years). The control group consisted of 128 university students without facial discrepancies (51 males, 77 females, mean age 20.8 years). A self-rating 10-point score and personality using Z scores of 14 scales of the Minnesota Multiple Personality Inventory evaluated dissatisfaction. Correlation analysis was carried out between dissatisfaction and personality as well as the severity of mandibular prognathism, gender and age.
RESULTS: 1) The dissatisfaction score was 7.2 in the patient group, and 4.2 in the controls. 2) Z scores for Pd, Pt and Ma scales were significantly larger and those for Hs and Hy scales significantly smaller in the patient group. 3) In the patient group, dissatisfaction showed significant correlations with Z scores for D, Pd and Pa scales, gender and age, but not with severity of mandibular prognathism. With the cluster analysis using Z scores in D, Pd and Pa scales, the patient group was divided into three subgroups. The first subgroup characterized with the highest Z scores in these three scales had significantly higher dissatisfaction than the remaining two subgroups. However, the severity of mandibular prognathism, gender and age showed no significant differences among the three subgroups.
CONCLUSIONS: Facial dissatisfaction might have relevance to the combination of D (depression), Pd (maladjustment to society) and Pa (paranoia) of the personality scales.

179 CALCIFICATION IN THE PERIODONTAL LIGAMENT DURING TOOTH MOVEMENT

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AIM: To longitudinally investigate calcification of degenerating tissues in the periodontal ligament (PDL) during tooth movement.
MATERIALS AND METHOD: The upper first molars of male Wistar rats were moved lingually for 1, 7 and 21 days, following which unfixed, undecalcified sections of the lingual PDL (in the pressure zone) were examined histologically and histochemically (autoradiography and electron probe microanalysis).
RESULTS: On day 1 of tooth movement, degenerating tissues, together with some calcified particles, were visible in the pressure zone of the lingual PDL. On day 7, substantial calcified aggregations were seen in the degenerating tissues, predominantly situated between the bone and root. This was confirmed by 45Ca autoradiography. On day 21 of tooth movement, large calcified aggregations were still clearly evident between the bone and root.
CONCLUSIONS: Calcification of the degenerating tissues is a self-defence response of the living body to prevent direct contact between alveolar bone and the tooth root during compression of the PDL, so preventing friction between them and the development of ankylosis.

180 SKELETAL, DENTAL AND SOFT TISSUE CHANGES INDUCED BY THE JASPER JUMPER APPLIANCE USED IN LATE ADOLESCENCE

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AIM: To evaluate the skeletal, dental and soft tissue changes in late adolescent patients treated with the Jasper jumper, which was applied with a sectional arch.
SUBJECTS AND METHOD: Eight patients (6 males, 2 females) with Class II dental and skeletal relationships. They had a low or normal growth pattern. The mean age of the subjects was 14.75 ± 1.17 years. Jasper jumper mechanics were applied on sectional arches connected to a continuous 0.017×0.025 inch stainless steel archwire by means of $0.018 \times 0.025/0.022 \times 0.028$ inch cross tubes. The appliances were used for a mean period of 6.25 ± 1.49 months. Lateral cephalometric radiograms taken before placement and after removal of the Jasper jumper were used to evaluate the skeletal, dentoalveolar and soft tissue changes produced by the appliance. A non-parametric Wilcoxon signed rank test was used for statistics.
RESULT: Evaluation of the lateral cephalograms revealed that all patients were corrected to Class I or overcorrected Class I molar relationship. The mandibular incisors were protruded and intruded while the maxillary incisors were retruded and extruded. There were no significant changes in SNA and SNB angles. The occlusal plane was rotated in a clockwise direction as a result of intrusion of both the

lower incisors and upper molars. Straightening of the labiomental fold was significant.
CONCLUSION: In late adolescent patients, the Jasper jumper corrected the Class II discrepancies mostly through maxillary and mandibular dentoalveolar changes, whereas skeletal changes played a minor role. The use of the sectional arches did not prevent protrusion of the mandibular incisors.

181 THE RELIABILITY OF BJÖRK'S METHOD IN THE DETERMINATION OF MANDIBULAR GROWTH

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AIM: To investigate the reliability of Björk's method (structural characteristics) in determination of lower jaw growth type.
SUBJECTS AND METHOD: Thirty-five subjects divided into two groups: group 1 included patients from 7 to 10 years of age (pre-pubertal spurt) and group 2 from 11 to 18 years of age (young and older teenagers). Both groups were further sub-divided into three groups: patients with anterior growth, without rotation and a posterior model of the growth (Björk and Jarabak method) showed the same growth direction. Eleven orthodontists assessed the type of mandibular growth using Björk's structural characteristics on the cut up mandibular fragments of the radiographs. The orthodontists' assessments of mandibular growth type were then compared with the values obtained with Björk and Jarabak analyses.
RESULTS: 1. For the first subgroup of 7–10 year old patients, in 54.50 per cent the results of the orthodontists' assessments were the same as Björk and Jarabak analyses. In the second subgroup it was 31.70 per cent and in the third group 65.65 per cent. 2. In the first semi-group of patients 11–18 years old, the results were 72.70, 38.60 and 74.00 per cent, respectively.
CONCLUSION: On the basis of structural characteristics of mandibular growth, it is not possible to assess types of growth in pre-pubertal spurt patients.

182 THIRD MOLAR INFLUENCE ON DENTAL ARCH CROWDING

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AIM: To analyse changes in the length and width of the dental arch over three and nine years of observation. The change in crowding was also assessed to determine the effects of third molar extractions.
SUBJECTS AND METHODS: One hundred and twenty patients divided into four groups based on extraction or non-extraction of the molar in a given quadrant of the dental arch. The measurements were made on dental plaster casts and Xerox copies. Ganss coefficient was calculated from dental pantomograms and the results were statistically analyzed.
RESULTS: Ganss coefficient can be useful in predicting crowding.

183 TOOTH MOVEMENT WITH A NEW RATCHET BRACKET

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AIM: To accomplish effective tooth movement without causing tissue degeneration. In an attempt to realize this goal, a new bracket with a ratchet-locking system was designed. This 'Ratchet Bracket' incorporates a mechanism to permit tooth movement near the width of the periodontal ligament (PDL) over short distances of 0.26 mm, so maintaining blood circulation.
SUBJECTS AND METHOD: The appliance was used in five female patients and four male Beagle dogs for distal movement of the upper canines. The total period of tooth movement was in the range of 40–91 days in the patients and on days 7, 14, 30, and 46 in the dogs. Study models and clinical and radiographic outcomes were assessed. In addition, fluorescent substances, calcein and tetracycline, were administrated in the dogs in order to assess bone remodelling.
RESULTS: All canines were moved rapidly, approximately 0.26 mm per 4 days (1.92 mm per month) in the patients, and 0.24 mm per 4 days (1.79 mm per month) in the dogs. None of the patients reported pain. Expansion of the lamina dura was visible radiographically on the tension side of the PDL in some cases, and root resorption was not apparent. On fluorescent observation, remarkable bone formation was observed on the bone surface of the tension side in the dog on day 46.
CONCLUSION: The results support the use of the ratchet bracket for rapid and pain-free tooth movement.

184 COMPARISON OF SHEAR BOND STRENGTH OF TWO DIFFERENT BRACKETS ADHESIVES

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AIM: To investigate *in vitro* the bond strength of brackets bonded with Ortho Solo and Enlight LV (Ormco) and to compare it with brackets bonded using a no-mix conventional primer and adhesive (Dentaurum).
MATERIALS AND METHODS: Fifty extracted premolars with sound buccal surfaces were stored in distilled water at 4°C for between 2 and 6 months. All buccal surfaces were acid etched with 37 per cent orthophosphoric acid liquid (Dentaurum) for 30 seconds. The teeth were divided into two groups, 25 samples each. In group 1, brackets were bonded with Ortho Solo and Enlight LV and light-cured for 30 seconds. In group 2, the brackets were bonded with the no-mix adhesive. Standard edgewise brackets 0.022-inch slot width (Ultra-Minitrum, Dentaurum) were used. The brackets were debonded under shear force and debonded enamel surfaces were subjected to ×10 magnification and graded according to the Adhesive Remnant Index (ARI).
RESULTS*: In vitro* findings indicated a significantly ($P < 0.05$) higher shear bond strength in group 1 (mean 10.5 MPa) than in group 2 (mean 6.8 MPa). Comparison of the ARI scores indicated that there was significantly ($P < 0.05$) more residual adhesive remaining on the teeth in group 1, whereas in group 2, bond failure mainly occurred at the enamel-adhesive interface.
CONCLUSION: Ortho Solo and Enlight LV showed better results for shear bond strength, with more residual adhesive remaining on the teeth. The glass filter, unique to Ortho Solo, acts as a stress and shock absorber, preventing cracks that can lead to bond failure.

185 LOCALISATION OF OESTROGEN RECEPTORS ON HUMAN OSTEOBLAST-LIKE CELLS: AN OPTICAL AND ELECTRON MICROSCOPIC EVALUATION

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AIM: It has been shown that oestrogen regulates osteoclast function indirectly through regulation of osteoblast cytokine or growth factor production. The identification of oestrogen receptors (ER) in osteoblasts has implicated the osteoblast as a direct target for

oestrogen. Attempts to identify oestrogen target cells in bone by immunocytochemistry using antibodies to the receptor have proved to be controversial. The aims of this study were: (1) to determine whether immunogold labelling can be used as a valuable technique for the localisation of ER on a human osteoblast-like cell line (Saos-2 cells) and (2) to determine the distribution of ER on the cell surface with a scanning electron microscope (SEM) and intracellularly with a transmission electron microscope (TEM).
MATERIALS AND METHOD: Saos-2 cells were cultured and immunofluorescence was first undertaken to confirm positive labelling of the primary antibody and to determine the optimal primary and secondary antibody concentrations before immunogold labelling. A two-step indirect labelling technique was used. Digital images were taken using a Zeiss Axioscope with epifluorescence and wide band FITC filters after immunofluorescence. Digital images after immunogold labelling were taken in a Hitachi H7600 Transmission- and S-3500N SEM.
RESULTS: With limited observation, a consistent labelling pattern could be seen in areas around the surface of the cell in relation to matrix deposition. Labelling of the cytoplasmic material was seen around areas of what appeared to be a disrupted plasma membrane. No nuclear or perinuclear labelling could be detected.
CONCLUSION: Although further refinement of the technique is needed for SEM viewing, immunogold labelling combined with TEM can be regarded as a valuable technique for localising ER on human osteoblasts. Osteoblast-like cells do express ER at low levels and that although cytoplasmic immunoreactivity could be detected, no nuclear or perinuclear labelling was found.

186 CAN DIET INFLUENCE DENTOFACIAL DEVELOPMENT? A STUDY IN PIGS

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AIM: To study the effect of a soft (SD) or hard (HD) chewing diet on the development of the dental arches and the skeletal structures in pigs.
MATERIAL AND METHODS: Seventeen pigs (*Sus Scrofa*) from two litters were divided into two groups and separated after five weeks. The pigs on the soft diet were fed feed mixed with water at a dry matter content of about 25 per cent. Pigs drink such liquid feed without chewing movements. The other pigs were fed solid feed. The pigs were slaughtered after 22 months. Mesio-distal tooth widths, arch lengths, intercanine arch widths and several cranial measurements were performed. Statistical analysis was carried out with *t*-tests after correcting for weight.
RESULTS: The approximal attrition was pronounced in the HD group, the lower first molars being most affected ($P < 0.001$). All fourth premolars (P4) were more rotated in the SD group, reaching significance for the upper left ($P < 0.01$). The occlusal attrition was significantly more pronounced for the HD pigs ($P = 0.05$). As a result of the heavy aproximal attrition the lateral segments of the dental arches were shorter for the HD pigs ($P < 0.01$). The dental arches were wider in the SD pigs at P4 and M1. The SD pigs had developed in a post-normal way, which was especially pronounced in the canine region. Posterior crossbites were more common among the HD pigs. The upper jaw was wider in the SD pigs and the anterior border of the mandible was more inclined.
CONCLUSION: The results do not support previous studies that hard chewing diets result in wider dental arches. The approximal attrition in the HD pigs resulted in less crowded arches compared with the SD pigs.

187 EFFECTS OF TWIN BLOCK THERAPY IN JAPANESE SUBJECTS WITH CLASS II MALOCCLUSIONS

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AIM: To clarify the effects of Twin Block (TB) therapy in Japanese subjects with Class II division 1 malocclusions.
SUBJECTS AND METHOD: The TB group consisted of 20 patients with Class II division 1 malocclusions (11 males, 9 females) aged 6 years 9 months to 11 years 11 months (average 9 years 11 months). The mean research period was 8 months for the TB group. The Class II division 1 control group (5 males, 9 females) ranging in age from 9 years to 11 years 11 months (average 10 years 1 month) were followed for 12 months without any intervention. Lateral cephalograms were obtained at the first examination and 1 year after the initial examination, or control period. Unpaired *t*-tests were used to assess differences in variables between the two groups.
RESULTS: In the TB group, a reduction in ANB of 1.5 degrees ($P < 0.01$) was observed mainly as a result of an increase in SNB of 1.4 degrees ($P < 0.01$). Treatment resulted in an increase in Ar-Go of 3.2 mm ($P < 0.01$) compared with the control group increase of 1.7 mm, a net gain of 1.5 mm. The overjet was reduced by a combination of maxillary incisor retroclination of 2.2 degrees ($P < 0.05$), mandibular incisor proclination of 2.3 degrees ($P < 0.01$) and forward movement of the mandible. No statistically significant restraint in maxillary growth was observed.
CONCLUSION: TB therapy is very effective for forward growth of the mandible, which can reduce the overjet in subjects with a Class II division 1 malocclusion.

188 THE INCIDENCE OF ORAL CLEFTS IN TIMISOARA

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AIM: To retrospectively evaluate the incidence of oral clefts in Timisoara, during the last 5 years.
MATERIAL AND METHODS: Epidemiological data from all the maternity centres in Timisoara together with the case histories of all newborns with oral clefts were examined.
RESULTS: The incidence of oral clefts was 1.78/1,000. A cleft of the lip and palate (CLP) was the most common presentation (43%), followed by an isolated cleft palate (ICP; 27%) with approximately the same percentage for isolated cleft lip (26%) and the least for a cleft lip and alveolus (4%). The incidence was higher among males (54%) than females (46%). A combined CLP was most common in males. An ICP was more common in females. Sixty-two per cent of all patients with clefts were born to fathers over 30 years of age and 55 per cent had mothers over 30 years of age. The young mothers of patients with clefts (67% of cases) generally had associated diseases (syphilis, tuberculosis, diabetes mellitus).
CONCLUSIONS: The recorded data corresponds generally with that from the international literature but there are some differences.

189 ASSESSMENT OF TOOTH PAIN DURING MULTI-BRACKET TREATMENT

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AIM: To assess the intensity of tooth pain during multi-bracket (MB) treatment in adult orthodontic patients and to investigate its relationship to the orthodontic procedures.
SUBJECTS AND METHOD: Eight female adult patients treated with MB appliances including six extraction cases (20–36 years of age)

and two non-extraction cases (34 and 50 years of age). Tooth pain at clenching was assessed by means of 100 mm visual analogue scales (VAS) over the first 1-week period at every check-up, and was evaluated with the receptivity level 1 (not affecting daily activity) and level 2 (bearable but affecting daily activity).
RESULTS: Mean VAS scores were 31 (23–35) for level 1, and 56 (53–59) for level 2. The number of peaked VAS scores over level 2 were 1–8 in 19–30 check-ups for the extraction cases and none in 7 and 9 check-ups for the non-extraction cases. The peaked VAS scores over level 2 were detected after the following procedures: 1) first placement of archwires, 2) archwire changes from round to rectangular or from Ni-Ti to Co-Cr, 3) replacement of bracket position, 4) activation of closing loops or first or second order bends in Co-Cr archwires, 5) application of extrinsic force exceeding 50 g.
CONCLUSION: The intensity of tooth pain could be evaluated by the receptivity levels. Tooth pain over level 2 was detected in 5–42 per cent of the check-ups for the extraction cases, after the change to stiffer archwires, bending or activation of loops on Co-Cr archwires and application of excessive force.

190 PREVALENCE OF A DIASTEMA AND ITS RELATIONSHIP WITH OVERJET AND OVERBITE

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AIMS: To show the prevalence of a diastema, its relationship with the degree of overjet and overbite, and is correlation with sex and age.
SUBJECTS AND METHOD: Four hundred and fifty five randomly selected subjects between 12–20 years (129 boys, 320 girls). From these 455 subjects 271 had a combination of anomalies (diastema, increased or decreased overjet and overbite). Study models and lateral cephalograms were obtained for all subjects and the degree of overjet and overbite was measured together with the size of the diastema in the maxillary and mandibular arches. The percentage of measurements was calculated using SPSS 6 for Windows. A Student's *t*-test was preformed on all samples.
RESULTS: The prevalence of a maxillary diastema was greater in females than in males, whilst the prevalence of a mandibular diastema was greater in males than in females.
CONCLUSION: A significant correlation was found between age and diastema size, with the greatest percentage of diastemas found in subjects with a 0-(–2) mm overbite.

191 EFFECTS OF BIONATOR AND ORTHOPAEDIC HEADGEAR TREATMENT OF MANDIBULAR RETROGNATHISM

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AIM: To compare the dentofacial results after treatment with the Balters Bionator and orthopaedic cervical headgear.
SUBJECTS AND METHOD: Forty-four growing patients (22 treated with a Balters Bionator and 22 with orthopaedic cervical headgear) with a Class II division 1 malocclusion with mandibular retrognathism. Eighty-eight lateral cephalograms taken pre- and post-treatment were analysed.
RESULTS: 1) The headgear caused significant restriction in maxillary development between the beginning and end of the observation period; 2) After use of the Balters Bionator, the mandibular development was highly expressed, bringing a more balanced relationship between the maxilla and mandible concerning antero-posterior and vertical planes; 3) The Balters Bionator also promoted a better translation of the upper and lower incisors relative to basal structures; 4) Treatment of Class II division 1 malocclusions with mandibular skeletal retrusion with the Balters Bionator and orthopaedic cervical headgear achieve different results.
CONCLUSIONS: Appliances that might alter the amount and direction of mandibular growth are more appropriate in the treatment of Class II division 1 subjects with mandibular retrognathism than those that restrict maxillary development.

192 A RETROSPECTIVE STUDY EVALUATING THE EXTENDED CLINICAL ORTHODONTIC TRAINING SCHEME

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AIMS: The aims of this two-year retrospective study carried out in 2001 of General Dental Practitioners (GDPs) in the East Anglia Region was to assess the severity of malocclusions treated, the degree of improvement attained by orthodontic treatment, the case mix treated by the GDPs, the orthodontic diagnostic ability of the participants and to determine whether differences existed between the assessments for the three groups.
SUBJECTS AND METHODS: Three groups of GDPs (9 in total) were identified from the surrounding area and selected according to their interest in orthodontics and with respect to their attendance/non-attendance on the Eastern Region Clinical Assistant Orthodontic Training Scheme. One hundred and fifty seven consecutively treated cases were examined. Each set of study models was assessed using the Index of Orthodontic Treatment Need, Peer Assessment Rating and Index of Complexity, Outcome and Need.
RESULTS: There was a wide variety of treatment outcomes attained by individual practitioners irrespective of their attendance on the course, suggesting that other factors apart from an individual's attendance on an extended training scheme affected the outcome of the standard of treatment provided.
CONCLUSIONS: Practitioners produced similarly good results irrespective of their attendance on the scheme. This could have been due to a number of factors including most importantly, the individual motivation of the GDP and his/her personal interest and experience in orthodontics as well as the GDP's clinical skill.

193 LONGITUDINAL FOLLOW-UP STUDY OF MORPHOLOGICAL AND FUNCTIONAL MALOCCLUSION TRAITS FROM 3 TO 9 YEARS OF AGE

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AIM: To follow longitudinally a cohort of children regarding the dynamics of morphological and functional malocclusion traits to assess malocclusion severity from 3 to 9 years of age.
SUBJECTS AND METHOD: One hundred and ninety eight 3-year-old children randomly selected from the population of Maribor, Slovenia in a longitudinal follow-up study. Morphological and functional malocclusion traits were assessed annually using a modification of Eismann's method for the primary and mixed dentition (Farčnik *et al*., 1985, 1988). Recordings and measurements of 10 morphological occlusal traits and five functional malocclusion traits were used to evaluate malocclusion severity score. Occlusal and functional traits were weighted and scored against the evaluation table for each subject (Eismann, 1974; Farčnik *et al*., 1985, 1988). The weighted sum of recorded occlusal and functional traits thus represented the total malocclusion index score. The overall malocclusion scores were categorised according to Eismann (1974) in terms of mild (1–15), moderate (16–40), severe (41–65) and very severe (over 65) malocclusion.

RESULTS: The dynamics of morphological malocclusion traits were almost the same from 3 to 9 years of age, while functional malocclusion traits decreased significantly: from 88 per cent at 3 years of age to 37 per cent at 9 years of age. The overall malocclusion severity score in children from 3 to 9 years increased for the mild malocclusion severity grade (from 31 to 54%), due to the decreased number of children with no malocclusion (from 13 to 8%) and severe malocclusion (from 11 to 2%).
CONCLUSION: The very small number of children having neither morphological nor functional malocclusion traits at 3 years of age was the most alarming finding of this research. Therefore, in interceptive orthodontic treatment planning functional malocclusions, which are caused to a high degree by incorrect feeding habits, need to be eliminated as early as possible.

194 COMPUTER-BASED EXAMINATION OF TEMPOROMANDIBULAR JOINT SOUNDS AND ITS SIGNIFICANCE FOR DIAGNOSTICS

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AIM: Over recent years, many techniques have been proposed to objectively diagnose various craniomandibular disorders by recording and analyzing the acoustic characteristics of sounds emitted by the temporomandibular joints (TMJ). An advanced system for the analysis of joint sounds is presented. This study investigated TMJ sounds by means of the joint time frequency analysis (JTFA) in respect of the diagnostic potential using computer-based measuring software (Labview).
MATERIALS AND METHODS: Clinical auscultation of TMJ sounds in 25 subjects with different hearing disorders and crepitation phenomena were recorded on either side by two microphones and processed by JTFA.
RESULTS: Not only characteristic frequence-intensity spectra were observed with weight variability, recognition of directly interfering noises, but also the influence of different tissue properties could be shown. The JFTA method provided a dynamic representation in the form of a STFT spectrogram of characteristic patterns of frequence-intensity, which changed over time. However, due to the limited resolution precision (window effect), no accurate description of TMJ sounds was possible, but merely an approximation. This approximation offered the opportunity to describe physical conditions (impact phenomena) as well as individual influencing factors (filter properties). The different sound patterns can thus be interpreted as an acoustic image of intracapsular disturbances and varying anatomic-morphological conditions.
CONCLUSIONS: The JTFA is a refined computerized analysis method for TMJ sounds. Further research aimed at improving the measuring technology and additional clinical studies comparing the acoustic results with intra-operative findings or magnetic resonance imaging scans are required.

195 TEACHING ENVIRONMENT FOR UNDER-GRADUATE STUDENTS: COMPARISON OF ELECTRONIC MEDIA AND TRADITIONAL LECTURES

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AIM: To evaluate the effectiveness of electronic support to orthodontic teaching in comparison with the 'front' lecturing system.
MATERIALS AND METHODS: Electronic teaching material was provided to a half randomised group of students (22) (first group), while the second half (23) underwent traditional lectures on the same four selected topics (cephalometrics, growth, history taking, skeletal age assessment) during the seventh semester. Their knowledge was assessed through 15 multiple choice questions (MCQ) repeated four times every 3 months. The questions were selected by an external examiner on the basis of the didactic material; taught and web-based material was coincident. The score per student and per group was evaluated using Wilcoxon's signed rank test. Both groups also took part in a discussion group, without rating *per se*. The discussion groups only answered questions raised by the students, but the submission of questions was traced. Competency was evaluated separately and monitored through assessment and *ad hoc* support in the first group. Technical support facilitated the media management.
RESULTS: The first group showed a slower understanding of concepts, assessed through conventional MCQ tests. Long lasting knowledge was better in the first group, even if the drop out of students was higher. Competency increased during the year.
CONCLUSION: Electronic media appears to be capable of motivating and even if an enthusiastic acceptance is expected at the beginning because of novelty, the results show a prevalence of long lasting performance. Long lasting knowledge might be the basis for long lasting competence and might foster a life long learning attitude, useful for continuing professional development.

196 COMPUTER VOLUMETRIC TOMOGRAPHY: EFFECTIVENESS IN TREATMENT PLANNING OF IMPACTED CANINES

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AIM: To evaluate the effectiveness of a new method of computed tomography (CT) in treatment planning of impacted canines, compared with conventional radiographic techniques.
MATERIALS AND METHODS: Computer volumetric tomography (CVT) using the cone-beam technique for data acquisition. The measurement accuracy of CVT was estimated on treated patients and on skulls buckets (measuring dental elements, which were later extracted). The main information helpful for correct diagnosis and treatment planning includes: angle-shot of the canine to the median line, distance between the crown of the canine and the alveolar crest margin and overlapping of the canine on the lateral incisor root. Measurements carried out on dental pantomograms (DPT) and intra-oral radiographs were compared with those obtained with CVT in a blind design (gold standard for comparison was the position recorded at operation). The estimated dose was effectively used in CVT in 30 cases of impacted canines. The group consisted of 16 females and 14 males (aged 12–23 years).
RESULTS: The measurement error for the CVT and the real dimension was approximately 1 per cent. Using conventional radiographic techniques it was not always possible to establish the real position of the impacted canine without further means: occlusal radiographs or CT. CVT allows characterization of the shape of the impacted canine and the relationship with contiguous anatomical structures. The mean dose used with CVT was 3.82 mA compared with 12 mA for DPT and 7.5 mA for intra-oral radiography.
CONCLUSION: The use of the CVT and the relative low irradiation appears effective.

197 VERTICAL AND SAGITTAL DISPLACEMENTS INDUCED BY FRONTAL MAXILLARY ASYMMETRY

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AIM: To investigate the vertical and sagittal displacements induced by frontal asymmetry of the maxilla.

MATERIAL AND METHODS: A clinical and radiographic three-dimensional (3D) analysis of severe skeletal discrepancies in 20 adult patients. The records included lateral, postero-anterior and axial cephalograms. The transverse discrepancies were classified as horizontal, frontal and mid sagittal asymmetry.
RESULTS: Maxillary frontal asymmetry can produce an asymmetric downward or upward rotation of the mandible on the mid sagittal plane, a horizontal rotation of the maxilla with monolateral crossbite and oscillation of the mandible with condylar problems.
CONCLUSIONS: An appropriate linear and rotational diagnosis is essential to identify the type of asymmetry for every jaw and has important therapeutic implications: in fact the rotational movements are made by the surgeon in the direction opposite to the alteration evaluated through a complete 3D diagnosis.

198 THE OCCLUSAL PLANE IN ACTIVATOR, HERBST AND MULTIBRACKET APPLIANCE TREATMENT

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AIM: To analyse the long-term impact of three treatment methods (Activator, Herbst and multibracket appliance) on the inclination of the occlusal plane.
SUBJECTS AND METHODS: Eighty-two successfully treated subjects with a Class II division 1 or a Class I malocclusion with a large overjet and overbite were surveyed before, after, and up to 4 years after treatment. Subject distribution: Activator (n = 31), Herbst with partial anchorage (n = 14), Herbst with total anchorage (n = 14) and Tip-Edge multibracket appliance (n = 23). Lateral head films in habitual occlusion were analysed. A comparison was made between three occlusal planes: maxillary (Mx–P), mandibular (Md–P) and functional (F–P).
RESULTS: Activator: None of the three occlusal planes was significantly influenced by treatment. Herbst: During treatment the inclination of all occlusal planes in both anchorage groups was considerably increased with the exception of Mx–P, which remained relatively stable in the partial anchorage group. After treatment the inclination of the Md–P and F–P recovered in both anchorage groups. Multibracket appliance: During treatment the inclination of Mx–P and F–P was reduced while the inclination of Md–P was increased. After treatment the Md–P recovered.
CONCLUSION: Occlusal plane inclination changes were smallest in the Activator group and largest in the Herbst group with total anchorage. The inclination changes of the mandibular occlusal plane (Md–P) were larger than those of the maxillary (Mx–P) and functional (F–P) occlusal planes.

199 MEDICOGENETIC CONSULTATION—AN ADDITIONAL DIAGNOSTIC METHOD IN PATIENTS WITH HYPODONTIA

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AIM: To analyse the genetics of patients with hypodontia.
SUBJECTS AND METHOD: Thirty-eight patients with hypodontia for whom panoramic radiographs were available. All were genetically examined and a genetic questionnaire together with a family tree was compiled.
RESULTS: Hypodontia, being a congenital pathology, can be named as a separate diagnosis or can be a symptom of an inherited disease, particularly with ectodermal dysplasia (ED). The differentiation was made only after medical and genetic consultation. Sixty-five per cent of subjects had hereditary hypodontia. The patients were divided into four groups: I. Hydrotic form (Clouston's syndrome); II. Hypohydrotic form (Rapp and Hodgkin's syndrome); III. Anhydrotic form (Christ-Siemens-Tourane's syndrome); IV. Hypodontia detected for the first time. No significant tooth disorders (from microdontia and amelogenesis imperfecta to hypodontia of up to 15 teeth) and other derivatives of ectoderm (hair, skin, mucous) in group I (34.21% of cases) were identified. Concurrent disorders were determined mostly in group II (18.42% of cases): hypodontia was from 2 to 27 teeth, where ectodermal changing symptoms were combined with congenital dentofacial malformations. In group III there was hypodontia from 15 teeth to anodontia of all primary and permanent teeth, hard injury of the skin, hair and mucous structures (10.52% of cases). Single tooth hypodontia of non-hereditary origin was defined in group IV (36.84% of cases).
CONCLUSIONS: The data showed the patients in groups I and II had autosomal dominant inheritance with high recurrence risk. In group III hypodontia had an X-linked recessive inheritance in not more than 25 per cent of cases. In 20 per cent of cases hypodontia was detected for the first time due to mutation *de novo*.

200 THE DENTAL CONDITION OF CHERNOBYL CHILDREN DURING 5 YEAR MONITORING

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AIM: Five year monitoring of the dentitions in children, who were born and have been living in radiation polluted areas.
MATERIALS AND METHODS: Within the Federal Programme 'Children of Russia' in the part 'Children of Chernobyl', from 1997–2002 monitoring was undertaken of children who were born and have been living in Donskoi town, Tula area, with polluted soil by Cs-137 from 0 to 5 Ku/km^2 (R-I), and in Novozybkov town, Bryansk area with polluted soil by Cs-137 from 15 to 45 Ku/km^2 (R-II). Five hundred and fifteen subjects were clinically examined (aged 7–12 years); 207 in 1997 and 308 in 2002.
RESULTS: In 1997 the abnormalities in the R-I group were: 30.43 per cent occlusal, 26.09 per cent dental. Age norm was defined in 15.22 per cent of the R-I group and in 2.61 per cent of the R-II group. Tooth abnormalities were found in 29.56 per cent, occlusal abnormalities in 29.56 per cent and tooth and dental abnormalities in 7.84 per cent of subjects. Concurrent dentition abnormalities were determined in 30.43 per cent of cases. In 2002 it was found that there was an increase in dental abnormalities in the R-I group: occlusal 52.69 per cent, concurrent abnormalities 16.17 per cent, tooth and dental abnormalities 3.59 and 2.99 per cent of cases.
CONCLUSIONS: 1. In the R-II group (1997 investigation), the age norm was 5.8 less then in R-I, in 2002—in 3.1 times less then in R-I. 2. In R-I and R-II groups for the 5 year period an increase of $\times$ 1.6 of aged norm cases in R-I and R-II to 3 times was established.

201 THE ROLE OF THE TONGUE IN SLEEP APNOEA

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AIM: To radiographically record the diagnostic characteristics of the craniofacial complex of Greek patients with obstructive sleep apnoea (OSA).
MATERIAL AND METHODS: Forty lateral cephalometric radiographs of male patients aged 27–64 years, with symptoms of mild OSA,

and 44 radiographs of male individuals (control group) aged 20–59 years. The criterion for selection was that none of the subjects had undergone orthodontic treatment. The lateral radiographs of both groups were taken according to the principles of the Broadbent method. Deviations (of mean values) in the skeletal morphology of the craniofacial complex may be responsible for the dysfunctions of the muscular system of the pharyngeal tube (decrease of its dimensions), resulting in the destruction of the stability of the upper airways and, consequently, the emergence of sleep apnoea. All the parameters that participate in the craniofacial morphology seem to readjust their position, size, or indirectly their function, so that essential functions, such as breathing, are accomplished.
RESULTS: A relationship existed between the hard and soft tissues of the craniofacial complex, so that an unhindered function of the airway was ensured. Comparing the volume of the tongue in the OSA subjects and the control group, there does not seem to be any difference. However, there were differences in the position of the tongue (more vertically positioned) and its orientation inside the airway and the oral cavity, which is influenced by the position of other anatomical elements of the pharyngeal way. All these alterations in the architecture of the area tend towards a unique aim: the viability of the individual.

202 REPRODUCIBILITY OF MAXILLARY REPOSITIONING IN ORTHOGNATHIC SURGERY: A MULTI-CENTRE STUDY

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AIM: To evaluate retrospectively the surgical accuracy of maxillary repositioning by comparing model surgery plans with actual changes, as taken from pre- and post-operative lateral cephalograms.
SUBJECTS AND METHOD: Ten subjects from three units and nine subjects from a 4th unit were studied. Four surgeons, one from each centre, performed the surgery. Surgical plans were recorded from model surgery. Pre- and post-operative films were hand traced by a single orthodontist. Limits of agreement (Altman and Bland) were used to check tracing repeatability and also to compare planned versus actual movements.
RESULTS: Only one surgeon was able to consistently and accurately locate the vertical anterior position of the maxilla—differences between planned and actual movements were all within 2 mm. This surgeon was the only one to use external reference markers. For all units, when locating the posterior maxilla vertically, there was a general trend to under-impact. This operator bias (as shown with paired *t*-tests) was statistically significant in two units ($P = 0.003$ and $P = 0.021$). For horizontal movements of the maxilla, 47 per cent of subjects had discrepancies greater than 2 mm between planned and actual movements.
CONCLUSIONS: External reference markers improve the ability of the surgeon to accurately place the anterior maxilla in the correct vertical position. There appears to be operator bias when impacting the maxilla posteriorly. Horizontal movements of the maxilla were variable and least predictable when the maxilla was also impacted.

203 A RANDOMISED CLINICAL TRIAL TO COMPARE TWO INTRA-ORAL METHODS OF MOLAR DISTALISATION

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AIM: To compare the effectiveness of two intra-oral methods of distalising upper first permanent molars: an upper removable appliance (URA) and a Jones Jig.
SUBJECTS AND METHOD: Twelve patients were randomly allocated to URA treatment and 11 patients to a Jones Jig. Upper study models were collected at the start of treatment and after 6 months of appliance wear. The amount of distal movement, tipping and rotation of the upper first permanent molars and mesial movement of the upper first premolars was measured using a reflex metrograph.
RESULTS: There were no statistically significant differences between the two treatment methods for any of the outcome measures ($P < 0.05$). Distal movement obtained with both appliances was approximately 1 mm.
CONCLUSIONS: The amount of distal movement obtained with both appliances was small and there were no differences in the amount of molar tooth movement. It is suggested that there is no advantage in using the Jones Jig as a non-compliance appliance.

204 EFFECTS OF CERVICAL HEADGEAR AND LOWER UTILITY ARCH THERAPY ON THE MANDIBLE IN CLASS II DIVISION 1 MAXILLARY PROTRUSION

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AIM: To evaluate the effects of cervical headgear and lower utility arch (CHG+LUA) in Class II division 1 hypodivergent patients.
SUBJECTS AND METHOD: Thirty patients having initial cephalometric, panoramic and hand-wrist radiographs were divided in to two groups. The first group comprised 15 patients treated with CHG+LUA for a period of 1.23 ± 0.42 years while the second group consisted of 15 patients treated with CHG only for a period of 1.17 ± 0.42 years. At the beginning of treatment, the mean ages of the CHG+LUA and CHG groups were 10.54 ± 1.05 years and 10.52 ± 0.96 years, respectively. No other appliance was used during the treatment period. After achieving an Angle Class I molar relationship, cephalometric radiographs were taken. The changes in maxillary and mandibular skeletal and dental responses were compared with paired and independent *t*-tests.
RESULTS: Significant molar distalization, extrusion, maxillary clockwise rotation and reduction of maxillary protrusion were obtained in both groups. There was no difference between the groups for mandibular skeletal response, except effective mandibular length. LUA significantly influenced lower molar uprighting and lower incisor intrusion. The measurements used for the assessment of rotation of the mandible showed a significant increase in the CHG group, while the rotation of the mandible remained constant in CHG+LUA group. All predictors of facial growth increased in the CHG group, while only two predictors, i.e. lower anterior and total posterior face height increased significantly in CHG+LUA group.
CONCLUSION: CHG+LUA prevents mandibular rotation by a reverse response effect.

205 FUNCTIONAL MUSCLE ACTIVITY IN MIXED DENTITION SUBJECTS WITH CLASS II MALOCCLUSIONS

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AIM: A Class II malocclusion is related to occlusal sagittal anomalies and is important in functional and morphological abnormalities. The aims of this study were to determine the condition of the muscles in the maxillofacial area in Class II patients.
SUBJECTS AND METHODS: An electromyographic investigation was undertaken of the masseter, temporal and genioglossal muscles in 22 patients aged 6 to 12 years with disto-occlusion in the mixed dentition. Lateral cephalometric radiographs were also obtained and

measured. Correlation coefficients were calculated to establish the relationship between functional muscle activity and cephalometric measurements.
RESULTS AND CONCLUSION: There was a significant relationship between functions of the masseter, temporal and genioglossal muscles and the parameters of the lower face: A′–Snp; Pg–Go; Co–Go; N–Gn; S–Go; NL–Go; Snp–Ocl and dentoalveolar heights in the region of the incisors and molars.

206 EXAMINATION OF FACIAL PARAMETERS WITH REGARD TO THE VERTICAL PLANE

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AIM: To determine the vertical morphological values of facial soft tissues and apical base bones in patients with normal and distal occlusion and the morphological factors that influence the values of inter-apical height on position points A and B of the apical bases of the jaws.
MATERIALS AND METHODS: Fifty-two lateral cephalograms of patients with normal and distal occlusion. The vertical values of the facial soft tissues were determined by measuring the points: n–gn, n–sn, sn–gn, sn–stm, stm–sm, sm–gn, sm–pg (Lendengolts, 2001). The vertical plane (Vp) on the cephalograms was drawn perpendicular to Frankfort horizontal, 65.6 ± 1.1 mm from point n and 50.9 ± 1.1 mm from point pn. Perpendiculars were placed from the soft tissue points to Vp and the distances were evaluated. The average values of morphological face height, upper morphological face height, vertical parameters of the lips, genial tubercle and basic morphological parameters were determined.
RESULTS: The mid-face height of patients 10–12 years of age with normal and distal occlusion was smaller than lower morphological height: 6.8 and 4.9 per cent, respectively. In 10–12 year old subjects there was a strong dependence between general morphological face height and parameters that characterize the position of the apical base of the jaws with regard to Vp.

207 COST-EFFECTIVENESS OF ORTHODONTICS IN WALES

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AIM: To assess the cost-effectiveness of orthodontic care in three settings in Wales.
MATERIAL AND METHODS: Six orthodontists from two salaried services and a fee-for-item service were randomly selected and asked to identify 100 consecutively started patients that could be followed to completion. Questionnaires were completed by patients and practitioners prior to, during, and on completion of treatment to provide information on costs and outcomes. Assessments of treatment need, complexity and outcome were assessed using the Index of Complexity, Outcome and Need (ICON). A number of cost-effectiveness models were undertaken, to take into account change in ICON, whether cases needed treatment, whether acceptable outcomes were achieved, cost of re-treatment for unacceptable outcomes and cost of generating improved outcomes. Sensitivity analysis was carried out on the findings.
RESULTS: Cost per ICON point reduction was €20 and €30 in the salaried services compared with €38 in the fee-for-item service with variation across practitioners ranging from €15 to €51. The probability of achieving an acceptable outcome was 0.63 and 0.62 in the salaried service and 0.54 in the fee-for-item service. Incremental cost-effectiveness ratios were computed and one of the salaried services was dominant. Sensitivity analysis showed the significance of cases needing treatment and the proportion of cases receiving acceptable outcomes, while within each of the care settings there was considerable variation between practitioners in costs and outcomes achieved.
CONCLUSIONS: Although cost-effectiveness is highly dependent on practitioner expertise in case selection and delivery of acceptable outcomes, it can assist policy makers in making an informed choice on the levels and settings of care provision.

208 MECHANICS OF DISTALIZATION: A COMPARISON OF TWO METHODS

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AIM: To compare the effectiveness of two devices to distalize upper first permanent molars: the headgear and the Cetlin appliance.
SUBJECTS AND METHOD: Fifty-one patients, 6 to 12 years of age, were randomly selected: 30 were treated with the headgear and 21 with the Cetlin appliance. The mean treatment time was 22 months with the headgear and 11 months with the Cetlin appliance. Cephalometric tracings before and after treatment were analyzed. The amount of distal movement and tipping of the molars, the inclination of the upper incisors and the skeletal effects on the maxilla and the mandible were measured. Casts were used to measure the transverse dimension and the amount of distalization.
RESULTS: Statistically significant differences between the two treatment methods were observed: the headgear appeared to have an orthopaedic effect on the maxilla (–1.1°) and to increase the transverse dimension of the upper arch (+3.3 mm). The Cetlin appliance produced a greater amount of distal movement (Cetlin appliance: 3.7 mm, headgear: 2.5 mm) and a greater tipping of the molars (7.5–1°). Retention would therefore be mandatory during premolar eruption. Treatment time was shorter with the Cetlin appliance, which is also more comfortable for the patient, hence its greater effectiveness/efficiency, even though treatment must later include uprighting of the tipped molar.
CONCLUSIONS: Both appliances are effective in distal movement of the upper permanent molars and the choice depends on the type of movement required, orthodontic or orthopaedic. Finally, it could be advisable to apply both appliances together to optimise the results, and reduce tipping of the molars.

209 GENETICS OF ANTERIOR AND POSTERIOR AGENESIS

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AIM: To determine if agenesis is a genetic characteristic, and if there are differences between incisor-canine agenesis and premolar-molar agenesis transmission.
SUBJECTS AND METHOD: Seventeen patients with agenesis were questioned about their family dental history to construct their family trees. Fifteen family trees were constructed as two families contained siblings. The patients were questioned about all dental anomalies present (supernumerary, agenesis, microdontia, iperodonzia). Panorex, casts, and examinations were performed. For their relatives mostly oral histories were collected.
RESULTS: The data allowed two different groups to be distinguished. Nine families showed agenesis as a genetic characteristic, and six as a sporadic factor. In the first group the most agenetic teeth were the maxillary lateral incisors. This characteristic seemed to be an autosomal transmitted dominant trait, with variable expression and incomplete penetrance. In these families, both in individuals with and without agenesis, other anomalies were present, such as supernumeraries, microdontia, anomalous teeth, indicating that the agenesis could be

one manifestation of an anomaly of the dental lamina, i.e. mild dysplasia. In the second group the individuals with agenesis were the only representatives in the family. In this group the most agenetic teeth were the second molars and second premolars.
CONCLUSIONS: Agenesis of the anterior teeth depends on genes, while agenesis of the posterior teeth is sporadic.

210 PLANNING OF ORTHODONTIC IMPLANTS IN THE RETROMOLAR REGION

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AIM: Implants may provide sufficient anchorage for the distalisation of the dentition but stability depends on the amount and quality of bone in the receptive area. The aim of this study was to evaluate the suitability of the maxillary and mandibular retromolar region for orthodontic implants.
MATERIAL AND METHODS: Mandibular computed tomographs of 51 adult patients before osteotomy for displaced third molars (average age 24.0 ± 8.1 years, 27 male, 24 female). The dimensions of the jaw, the cortical layer and the distance alveolar crest/mandibular canal were measured. Mandibular panoramic radiographs of 61 orthodontic patients (32 males, 29 females) average age 20.1 ± 7.6 years. In all patients third molars had been removed at least one year previously. Using the crown of the second molar as a radiopaque marker, the factor of magnification in the receptive area was calculated by the ratio of the diameter on the radiograph to that on the dental cast. Considering this factor the real dimension of the implant area and the real distance from the alveolar crest to the floor of the maxillary sinus could be measured on the panoramic radiograph. Placement of orthodontic micro-implants (intra-alveolar length 5 mm, diameter 1.5 mm) was planned for the upper and lower jaw using implant templates. Differences between the males and females were assessed with a Student's *t*-test ($\alpha = 0.05$).
RESULTS:

[mm]	Males	Females	Difference
Maximum corticalis buccal	3.1 ± 0.7	3.0 ± 0.5	0.68 ns
Maximum corticalis lingual	2.6 ± 0.5	2.4 ± 0.6	0.34 ns
Maximum corticalis cranial	3.2 ± 0.6	3.0 ± 1.1	0.25 ns
Distance alveolar crest/ mandibular canal	20.4 ± 3.9	18.7 ± 4.7	0.22 ns
Minimum width	7.7 ± 2.1	7.9 ± 2.5	0.18 ns
Maximum width	11.3 ± 2.4	10.8 ± 2.3	0.09 ns
Maximum height	33.4 ± 5.4	31.5 ± 5.3	0.08 ns
[mm]	Males	Females	Difference
Minimum height	8.6 ± 3.1	7.9 ± 3.0	0.09 ns
Maximum height	10.9 ± 3.1	10.6 ± 3.2	0.22 ns
Minimum length	6.9 ± 3.0	6.6 ± 3.3	0.11 ns
Maximum length	9.1 ± 3.7	9.2 ± 3.2	0.12 ns

Ns = not significant
CONCLUSION: In all cases bone quantity was sufficient for the insertion of orthodontic micro-implants.

211 EFFECT OF IMMEDIATE LOADING WITH HORIZONTAL ORTHODONTIC FORCES ON SCREW IMPLANT STABILITY

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AIM: During recent years implants of reduced diameters have been used for orthodontic anchorage. The stability of loaded screw implants depends on the friction between bone and implant and consequently on the bone to implant contact. The aim of this study was to investigate the influence of immediate loading on the percentage of bone to implant contact.
MATERIAL AND METHODS: Forty-eight screw implants (length 7 mm, group 1: 24 screws with a diameter of 1.5 mm and group 2: 24 screws with a diameter of 2.0 mm) made of commercially pure titanium were placed in the anterior region of 12 human cadaverous mandibles. Twelve implants in each group were loaded immediately. After fixation of the mandibular bone an orthodontic coil spring delivering a continuous horizontal force of 1.5 N for four weeks was fixed between the implant and a robust stationary post. Undecalcified thin bone sections of all implant areas were obtained and stained with Toluidine blue using the Donath technique. Bone to implant contact was microscopically investigated by the image C-computer program. A Student's *t*-test ($\alpha = 0.05$) was performed to analyse differences between the groups.
RESULTS:
Average percentage of bone to implant contact in cortical bone

Screw diameter	Unloaded	Loaded	Difference
1.5 mm	75.2 ± 12.3	71.4 ± 12.1	0.14 Not significant
2.00 mm	62.9 ± 12.8	62.1 ± 11.22	0.12 Not significant

Percentage of bone to implant contact in cancellous bone

Screw diameter	Unloaded	Loaded	Difference
1.5 mm	44.2 ± 19.3	42.3 ± 23.2	0.19 Not significant
2.00 mm	39.2 ± 17.5	38.5 ± 16.2	0.24 Not significant

CONCLUSION: No significant difference between the percentage of bone to implant contact in the two groups was found.

212 PRIMARY STABILITY OF SELF-TAPPING SCREW IMPLANTS FOR ORTHODONTIC ANCHORAGE

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AIM: Pre-drilling usually precedes the placement of conventional screw implants used for orthodontic anchorage. This may endanger neighbouring structures, such as roots or nerves. Recently self-tapping screw implants without pilot holes have been successfully used in traumatology. The aim of this study was to investigate the bone to implant contact of self-drilling screw implants compared with conventional implants and to assess their primary stability for orthodontic use.
MATERIAL AND METHODS: Twenty-four self-tapping (length: 7 mm; 12 screws with a diameter of 1.5 mm and 12 with a diameter of 2.0 mm) and 24 conventional titanium screw implants (length: 7 mm; diameters: 12 at 1.5 mm and 12 screws at 2.0 mm) were placed into the anterior region of 12 human cadaver mandibles. Undecalcified thin bone sections of the region were obtained and stained with Toluidine blue using the Donath technique. Bone to implant contact was microscopically investigated by the image C-computer program. The Student's *t*-test ($\alpha = 0.05$) was used to analyse differences between the groups.
RESULTS: The average thickness of the cortical layer in the examined region was 2.64 (±0.59) mm.
Average percentage of bone to implant contact in cortical bone

Screw diameter	Conventional	Self-tapping	Difference
1.5 mm	75 2 ± 12.3	87.4 ± 11.1	0.04 Significant
2.00 mm	62.9 ± 12.8	77.1 ± 13.2	0.02 Significant

Percentage of bone to implant contact in cancellous bone

Screw diameter	Conventional	Self-tapping	Difference
1.5 mm	44.2 ± 19.3	49.3 ± 23.2	0.09 Not significant
2.00 mm	39.2 ± 17.5	40.5 ± 16.2	0.21 Not significant

CONCLUSION: Due to higher bone to implant contact in the cortical bone, self-tapping screw implants seem to provide more primary

stability than conventional screw implants and reduce the risk of complications. Further *in vivo* studies are necessary to prove the clinical suitability of self-tapping screw implants as orthodontic anchorage devices.

213 THERAPEUTIC EFFICACY OF AN ORAL APPLIANCE IN THE TREATMENT OF OBSTRUCTIVE SLEEP APNOEA

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AIM: To investigate the effects of an oral appliance (OA) in patients with obstructive sleep apnoea (OSA).
SUBJECTS AND METHODS: Forty-three patients were fitted with an OA designed to hold the mandible antero-inferiorly. Lateral cephalometric radiographs were obtained before treatment and with the appliance *in situ*. All patients were asked about their subjective assessments on treatment and 18 were referred for an outcome polysomnographic study. Treatment with OA was considered successful when the initial oxyhaemoglobin desaturation index (ODI-4) decreased at least 50 per cent or the post-treatment ODI-4 was less than 10/hour.
RESULTS: Almost 80 per cent of the patients reported a decrease in snoring and/or daytime sleepiness. For patients who had a positive response to the treatment, the initial ODI-4 was significantly lower than in the others. In 61 per cent of the subjects there was a clear decrease in apnoeic episodes. Significant differences in the position of the hyoid bone between patients with successful and unsuccessful treatment were found. Those with an extremely low hyoid bone position did not seem to benefit from OA treatment, although the appliance in general significantly decreased the MP-H distance.
CONCLUSIONS: OAs may be an effective treatment alternative for snoring and sleep apnoea, especially in mild and moderate OSA cases. Subjects with an inefficient reduction in ODI-4 tend to have an extremely low hyoid bone position, which thus seems to be one of the factors to resist the success of OA treatment in OSA.

214 POLYALKENOATE ADHESIVES: *IN VITRO* BOND STRENGTHS AND EFFECTS OF LABORATORY VARIABLES

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AIMS: To evaluate *in vitro* the shear bond strength of two new resin-modified polyalkenoate cements compared with a widely used composite adhesive, and to investigate the effect of the following variables involved in bond-strength testing: sterilisation, disinfection and different rates of crosshead speeds.
MATERIALS AND METHOD: Debonding standard Edgewise brackets bonded with Fuji Ortho LC, a new experimental resin modified polyalkenoate, and Transbond XT, to extracted human premolars using a Universal testing machine. The effects of sterilisation, disinfection and different crosshead speeds on shear bond strength of Fuji Ortho LC were investigated.
RESULTS: There was a significant difference between all three adhesives. Transbond XT exhibited the highest mean bond strength, and Fuji Ortho LC had a clinically acceptable mean bond strength and was the most dependable according to Weibull analysis. The new adhesive had inadequate bond strength. Autoclaving premolars prior to bonding with Fuji significantly increased the bond strength, disinfection did not. There was a significant difference with 0.1 mm/minute crosshead speed compared with 0.5, 1 and 5 mm/minute crosshead speeds.
CONCLUSIONS: 1) Fuji Ortho LC has acceptable bond strength for clinical use and is dependable; 2) The new experimental adhesive should be rejected; 3) Teeth autoclaved prior to *in vitro* testing with polyalkenoate cements produce significantly higher bond strengths; 4) *In vitro* testing with different crosshead speeds produces different results.

215 ORTHODONTIC TREATMENT CO-OPERATION AND CARIES ACTIVITY AMONG IMMIGRANT AND NATIVE SWEDISH ADOLESCENTS

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AIM: To examine co-operation and caries activity during orthodontic treatment with fixed appliances in two groups; one comprising immigrant and another native Swedish adolescents, residing in two suburbs of Stockholm County.
SUBJECTS AND METHODS: Information about the study was sent to 130 parents of immigrants and 110 parents of native Swedes. Informed consent was given by 53 (41%) of the immigrants and 68 (62%) of the native Swedes, whose treatment records were retrieved. The mean age at the start of orthodontic treatment was 13 years for the immigrants and 13 years 4 months for the Swedes. For co-operation evaluation the following data were collected: number of cancellations, failures to attend, emergency visits, comments noted about poor oral hygiene and lack of compliance. Caries activity was calculated as the difference between the DFT and DFS-index, immediately before and after active orthodontic treatment.
RESULTS: The total treatment time was almost equal: 18.8 months for the immigrants and 18.1 months for the Swedes. The number of failures to attend was significantly higher among the immigrants (1.7/treatment period and 0.6/treatment period, respectively, $P < 0.001$), whereas the Swedes showed a higher frequency in the number of cancellations (1.6/treatment period and 0.6/treatment period, respectively, $P < 0.001$). Although, the frequency of caries-free subjects was significantly lower among the immigrants both before and after orthodontic treatment, no significant difference in caries activity during treatment was found between the groups. Furthermore, in neither group did caries activity exceed the national mean values for adolescents. In both groups, a strong relationship between poor oral hygiene and prevalence of caries was observed.
CONCLUSIONS: Ethnic and socio-economic conditions are not risk factors for caries activity during orthodontic treatment. Regarding co-operation, native Swedish adolescents are more active in keeping their appointments.

216 MASSETER THICKNESS, ENDURANCE AND EXERCISE-INDUCED PAIN IN SUBJECTS WITH DIFFERENT VERTICAL CRANIOFACIAL MORPHOLOGIES

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AIM: To compare neuromuscular features of the masseter muscle in subjects with different vertical craniofacial morphology.
SUBJECTS AND METHODS: Fifteen short-faced (mandibular plane-Frankfort plane angle <15°) and 15 normal- to long-faced (mandibular plane-Frankfort plane angle ≥23°) male students participated. The thickness of the masseter was assessed by ultrasonography. Onset and endurance of exercise pain were recorded during sustained biting at a level of 15 per cent maximum voluntary contraction and 30 μV electromyographic activity. Pain and fatigue was measured on visual analogue scales before and after biting, as well as before and after 10 minutes chewing.
RESULTS: Statistical comparison showed that the masseter muscle was significantly thicker in the short-faced than in the normal- to long-faced subjects. The pain onset time and endurance time were also consistently shorter in short-faced subjects, whereas the intensity of pain and fatigue did not differ significantly between the two groups.

Multiple stepwise regression showed positive influences from the mandibular plane inclination and the masseter thickness on pain onset and endurance times.
CONCLUSION: These findings give support to the concept that subjects with different craniofacial morphologies show neuromuscular differences.

217 PROS AND CONS OF FIBRE-REINFORCED COMPOSITES IN ORTHODONTICS—A PRELIMINARY CLINICAL REPORT

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AIM: To investigate whether fibre-reinforced composite is an adequate material for anchorage and retention during or after orthodontic treatment.
MATERIALS AND METHODS: In nine patients woven fibre-bands (Splint-It; Pentron Technologies, Connecticut, USA) were used to reinforce composite (Sculpt-It, Flow-It; Pentron Technologies) as described by Burstone (2000). They served to connect several teeth as an anchorage unit or as a fixed retainer post-treatment. Orthodontic forces were applied, e.g. for space closure or torque effects on the anchorage units to find out whether the fibre-reinforced system could stabilize the tooth position in the anchorage unit. Model analysis and evaluation of lateral cephalometric radiographs was performed.
RESULTS: Fibre-reinforced composites provided excellent stability when used as retainers. However, their stability was not sufficient to resist orthodontic forces for space closure or torquing forces. In some cases of unilateral tooth extractions they could prevent midline deviation. A number of problems were observed in the bonding quality between teeth with natural mobility and the rigid composite block. As the fibre-reinforced units were very bulky, in many cases problems with oral hygiene were observed.
CONCLUSIONS: Fibre-reinforced composites show good potential for use in orthodontic treatment. A reduction of the composite block dimension is desirable. The quality of bonding between the fibre-reinforced unit and mobile teeth has to be improved. Bonding materials with a certain degree of elasticity have to be developed and are the subject of further research.

218 DENTAL MORPHOLOGY BEFORE AND AFTER ORTHODONTIC TREATMENT OF DISTAL OCCLUSION

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AIM: Morphological and functional evaluation of the dentition following orthodontic treatment of an open bite.
SUBJECTS AND METHOD: Sixty children aged 7–12 years with an open bite. Lateral cephalograms (< I, < OrGoMe, U1–NL, U6–NL, L1–ML, L6–ML, N–Me, SNA–Me, Se–Ba), TMJ tomography (articular spaces dimensions—a, b, c), anthropometry of the palatal dimensions on dental casts, muscle electromyography of the jaw-facial area (muscles co-ordinate coefficient of jaw-facial area). Periotest measurement of the permanent teeth. Treatment was carried out using Persin's apparatus (patent no. 456, 1984).
RESULTS. In all subjects the vertical distance between the upper and lower incisors averaged 3.0 mm. Pre-treatment the functional dentition condition was changed in the following way: maxillary rotation (<I more than norm $P < 0.01$), an increase of the maxillary posterior alveolar tooth height (U6–NL more than norm ($P < 0.01$) and a decrease of anterior alveolar tooth-height (U1–NL less than norm ($P < 0.01$). It was found that transmission of the condylar head was below and retroclined. Palatal depth increased by 10 per cent ($P < 0.01$), and the palatal angle decreased by 18.0 per cent ($P < 0.01$). Co-ordinated muscle activity decreased to 42.0–51.0 per cent ($P < 0.01$). Active treatment was undertaken using a removable orthodontic appliance with occlusal additions on the posterior teeth.
CONCLUSIONS. The use of a functional-active orthodontic appliance normalizes the occlusion and functional dentition condition, as a result of a decrease in maxillary posterior alveolar tooth height.

219 EVOLUTION OF TREATMENT PLANS DURING THE ORTHODONTIC TREATMENT PROCESS

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AIM: To prospectively estimate the reliability of treatment planning decisions and the extent of compromised treatment plans in two salaried services and one fee for item service setting.
SUBJECTS AND METHODS: Eighteen randomly selected orthodontists, six from each of three different services, two salaried and one fee for item service. One hundred patients (from each orthodontist) were followed from acceptance to completion of orthodontic care. Details of need, outcome (assessed using the Index of Orthodontic Complexity, Outcome and Need), treatment plans and treatment process were recorded.
RESULTS: Eight hundred and thirty two valid cases were collected. A compromise treatment plan was made for 12 per cent of the fee for item service and 24 per cent for the salaried services. Outcomes were slightly worse in compromised cases. Initial extraction patterns changed in 6 per cent of the fee for item service and 14 per cent in the salaried services. Extraction rates were as high as 80 per cent of cases. Appliance choice was consistent only in 40 per cent of cases (range 0–88%). Upper and lower fixed appliances were used in the majority of cases and removables in 8 per cent. Incomplete treatments were recorded in 11 per cent of the fee for item service and 22 per cent of the salaried services.
CONCLUSIONS: Reporting of treatment appliances is inconsistent pre- and post-appliance therapy. Treatment outcome is better in completed cases.

220 A MODIFIED HEADGEAR ACTIVATOR TO PROVIDE GRADUAL ADVANCEMENT OF THE MANDIBLE

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AIM: Gradual mandibular advancement treatment of skeletal Class II malocclusions with functional appliance therapy results in a more favourable outcome compared with a single large advancement. With fixed functional appliances gradual advancement is a simple chairside procedure, whereas with removable appliances, re-adjustment involves laboratory assistance. The aims of this study were to develop a removable appliance to provide gradual mandibular advancement without laboratory assistance and investigate patient compliance and complications.
MATERIALS AND METHOD: Impressions, face bow records, centric and protrusive indices were obtained. The models were mounted on an articulator and the mandible advanced 4 mm with a vertical opening of 10 mm. The appliance was constructed with maxillo-mandibular occlusal bite planes, connected in the anterior by a 12 mm expansion screw, opening path parallel to the occlusal planes. To address perceived problems of instability developing during re-activation, through opening of the posterior segments (Christensen's phenomenon), an adjustable articulator was used to simulate the patient's condylar track. The expansion screw was modified to provide an anterior hinge action to facilitate an increase in the vertical

dimension of the posterior section after re-activation. Stabilizing nylon screws were fitted to the occlusal bite planes to compensate for posterior opening during re-activation. The device was tested in 37 consecutive patients with skeletal Class II malocclusions.
RESULTS: The appliance comfortably fitted all patients, allowed gradual advancement of the mandible up to 12 mm, i.e. 4 mm of initial advancement plus 8 mm via the mechanism. No laboratory assistance was required and patient compliance was noteworthy.
CONCLUSION: The data support the use of a functional activator as it applies gradual advancement that is well tolerated by patients.

221 HISTOMORPHOMETRIC STUDY OF AGE-RELATED CHANGES IN OSTEOCYTES DURING MANDIBULAR BONE MATURATION

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AIM: To assess age-related changes in the mandible regarding the quantity and structure of osteocytes in the cortical bone.
MATERIAL AND METHODS: Pig mandibles were taken from the slaughter-house 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 = weaning pig, <2 months, weight: 30–40 kg, B = young adult 4–6 months, weight: ca. 110 kg, C = adult, 2> × >5 years, <200 kg). In each age group the cortical bone of the mandibular body was studied in 10 animals. Histological samples were prepared and assessed qualitatively with a bright field microscope and quantitatively with a confocal laser scanning microscope in a total stack of 27.3 μm in 1.3 μm steps. The following parameters were measured: the number of osteocytes per unit volume, the maximum size, and the maximum perimeter of osteocytes. Ten different areas per sample were evaluated. The data and the group differences were statistically analysed using a Kruskal-Wallis test.
RESULTS: There was an increase in bony structure with increasing age. This change was associated with alterations in osteocyte morphology: the numbers of cells per unit volume, the maximum size, and the maximum perimeter of osteocytes decreased significantly from the weaning pig to the young adult and the adult group ($P < 0.001$).
CONCLUSION: Maturation of the mandible includes a decrease in cell numbers per unit volume and changes in osteocyte morphology. This may imply an altered cellular reaction to orthopaedic and orthodontic forces with increasing age.

222 CRANIOFACIAL MORPHOLOGY IN OBESE ADOLESCENTS

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AIM: To investigate craniofacial morphology in obese adolescents and to compare the morphological data with those of normal adolescents.
MATERIAL AND METHODS: The study was based on measurements of lateral cephalometric roentgenograms of adolescents who were diagnosed as obese. Linear and angular measurements were obtained from cephalometric tracings of 27 girls (mean age 15.64 ± 0.83 years) and 23 boys (mean age 13.83 ± 0.98 years). The data were compared with corresponding measurements of sex- and age-matched controls.
RESULTS: Both males and females in the obesity group exhibited significantly greater mandibular and maxillary dimensions than the controls. On average, mandibular length (cd–pgn) was 10 mm greater in boys and 7 mm greater in females. Maxillary length (pm–A) was 3.5 mm greater in boys and 3 mm greater in females. As regards vertical dimensions, lower anterior face height (ans–gn) and posterior face height (s–go) were 4 and 5 mm greater in the obese males and in the obese females, both these distances were 4 mm greater compared with the controls. Both maxillary (SNA) and mandibular prognathism (SNB, SNPg) were more pronounced in the obese group than in the controls. This also influenced the average soft tissue profile, which was less convex in the obese groups. The mandibular plane angle (ML/NSL) was smaller in the obese group than in the control group.
CONCLUSIONS: Craniofacial morphology differs between obese and normal adolescents. In general, obesity was associated with bimaxillary prognathism and relatively greater dimensional facial measurements.

223 INTERMAXILLARY TOOTH SIZE DISCREPANCIES IN SUBJECTS REQUIRING ORTHOGNATHIC SURGERY

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AIMS: To evaluate tooth size discrepancies in patients requiring orthognathic surgery.
MATERIAL AND METHODS: The pre-treatment records of 78 Caucasian subjects, minimum age 18 years, requiring orthognathic surgery. All had a complete dentition with no evidence of inter-proximal lesions/restorations as confirmed on dental pantomographs. Lateral skull cephalometric analysis grouped subjects according to skeletal discrepancy. The relative maxillary protrusion, relative mandibular prognathism and vertical skeletal discrepancies were determined. Digital callipers were used to determine maxillary and mandibular mesiodistal tooth widths from the study casts for each subject. Overall and anterior Bolton ratios were calculated.
RESULTS: Considering the groups as a whole, many subjects presented with significant discrepancies when compared with the Bolton 'ideal' ratios, especially for the anterior ratio. However, the results were not statistically significant. Subjects with relative mandibular prognathism were found to have larger ratios than those with relative maxillary protrusion (NS). Considering the groups according to gender, significant differences were found in the overall Bolton ratio only ($P = 0.021$), with males exhibiting a larger ratio compared with females. The overall Bolton ratio for all female subjects and those with either mandibular prognathism or vertical skeletal discrepancies were similar to the 'ideal' overall Bolton ratio. A significant correlation was found between effective mandibular length and overall Bolton ratio in females with relative maxillary protrusion ($r = 0.736$, $P = 0.015$). No significant correlations were found between jaw length and tooth size discrepancy in other groups.
CONCLUSIONS: Although no significant differences in tooth size discrepancy were noted in the group as a whole, individual variation was large. Identification of tooth size discrepancies is essential when planning orthognathic surgery in order that an ideal occlusion can be achieved.

224 A CEPHALOMETRIC ANALYSIS OF SEVERE AND NON-SEVERE OBSTRUCTIVE SLEEP APNOEA PATIENTS

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AIM: To determine the cervicofacial skeletal and upper airway soft tissue morphology of severe and non-severe obstructive sleep apnoea (OSA) patients using lateral cephalometric radiography to establish the characteristics of each group.
SUBJECTS AND METHODS: Ten severe cases of OSA with an apnoea-hypopnoea index (AHI) >40 and 10 non-severe OSA subjects

with an AHI of 5<(AHI)>20. A cephalometric analysis of the cervicofacial skeletal and upper airway soft tissue morphology was performed in all subjects. Cephalometric comparisons were made between the two groups.
RESULTS: Compared with the non-severe group, the severe OSA patients demonstrated increased maxillo-mandibular retrognathism, deep overbite, and a high mandibular plane angle resulting from a decreased posterior face height. In addition, the craniocervical extension, inferiorly positioned hyoid bone, and elongated soft palate were more exaggerated.
CONCLUSIONS: Cephalometric analysis is recommended to verify the aberrant cervicofacial morphology in severe and non-severe OSA patients. The findings also imply that there should be different treatment regimes for the severe and non-severe groups of OSA patients to achieve treatment success.

225 COMPLICATIONS DURING HERBST TREATMENT

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AIM: Assessment of complications (type and frequency) during the active phase of Herbst treatment.
SUBJECTS AND METHODS: Three hundred and fourteen randomly selected Herbst subjects were screened. One hundred and thirty four subjects (82 male, 52 female) were treated with a banded (B) and 182 subjects (93 male, 89 female) with a casted splint (S) Herbst appliance. The average treatment time was 7 months. Three types of complications were assessed: loosening and breakage of bands or splints and breakage of telescopes.
RESULTS: Thirty one per cent of the B subjects and 38 per cent of the S subjects did not have any complications. In 69 per cent of the B subjects with complications, band loosening occurred 2.7 times/patient and band breakage 1.9 times/patient. In 62 per cent of the S subjects with complications, splint loosening occurred 3.3 times/patient and splint breakage 1.0 times/patient. Breakage of the telescope mechanism occurred seldomly and no difference between B and S subjects existed.
CONCLUSION: One-third of the patients treated with the Herbst appliance completed their treatment without complications. Two-thirds of the patients had complications. Breakage was twice as common with the banded than with the casted splint Herbst appliance.

226 POST-OPERATIVE DISSATISFACTION WITH FACIAL APPEARANCE AND PERSONALITY IN PATIENTS WITH MANDIBULAR PROGNATHISM

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AIM: To assess post-operative dissatisfaction with facial appearance and personality in patients with mandibular prognathism.
SUBJECTS AND METHODS: Forty-eight patients aged from 15 to 38 years with mandibular prognathism, who received surgical orthodontics. Dissatisfaction with facial appearance using a self-rating 10-point scale and the personality using Z scores of 14 scales of Minnesota Multiple Personality Inventory (MMPI) were evaluated both pre- and one-year post-operatively. The subjects were divided into two groups: 17 patients with high post-operative dissatisfaction (Group H) and 31 patients with low post-operative dissatisfaction (Group L). Gender, age, pre-operative mandibular prognathism severity and personality were compared between the two groups.
RESULTS: 1) Mandibular prognathism was corrected in all patients. The facial angle showed no significant difference both pre- and post-operatively between the two groups. 2) Dissatisfaction was significantly higher in females and in older patients both pre- and post-operatively. The pre-operative dissatisfaction was significantly higher in group H. 3) Dissatisfaction with the lower face significantly decreased post-operatively in both groups, but the decrease was significantly higher in group H. Dissatisfaction with the upper and mid face decreased in Group L while it increased in Group H post-operatively, resulting in significant differences between the two groups. 4) Z scores for the depression and psychopathic deviate scales were significantly larger in group H both pre- and post-operatively.
CONCLUSION: 1) Dissatisfaction was much higher in Group H even pre-operatively, and increased for the upper and mid face post-operatively; 2) These features might have relevance to the depression and psychopathic deviate scales of the personality.

227 EFFECTS OF MAXILLARY DISTRACTION ON THE MORPHOLOGY AND FUNCTION OF THE NASOPHARYNX

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AIM: To describe the morphological changes of the nasopharynx following maxillary distraction and to clarify how these changes relate to velopharyngeal function (VPF).
SUBJECTS AND METHODS: Nine patients with repaired cleft palate in the mixed dentition. Once the maxillary protracting appliance was used, their response fell short of expectations. Consequently, they underwent maxillary distraction using a facemask and an intraoral fixed appliance system. The average age at the time of surgery was 10 years 7 months. The amount of forward maxillary distraction ranged from 2.4 to 6.9 mm. Before and after treatment, VPF was confirmed by nasendoscopy and the pharyngeal depth, velar length, and the rotation of the palatal plane were measured using lateral cephalograms.
RESULTS: One patient experienced a deterioration of VPF post-operatively despite the smallest amount of forward distraction. In this patient the velar-pharyngeal contact point estimated by the palatal plane situated on the hypertrophied adenoid pre-operatively, migrated immediately below it post-operatively with a counterclockwise rotation of the palatal plane. A hypertrophied adenoid appeared to be a potential risk factor to cause unexpected widening of the pharyngeal depth. The increase in the pharyngeal depth might not always be proportional to the amount of advancement; it depends on the posture of the posterior pharyngeal wall and the rotation of the palatal plane.
CONCLUSION: Especially in patients in the mixed dentition, forward maxillary distraction should be postponed until the hypertrophied adenoid subsides, otherwise, limitation of the amount of advancement to prevent subsequent deterioration of VPF is suggested. Cephalometric measurements considering the above structures would enable clinicians to predict VPF.

228 RELIABILITY OF VISUALIZED TREATMENT OBJECTIVES

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AIM: To evaluate the deviation of prediction and visualised treatment outcome (VTO) after 2 years of treatment.
MATERIALS AND METHOD: Tracings of pre-treatment cephalograms, VTO and post-treatment cephalograms of 15 premolar extraction cases were superimposed and compared using Quick Ceph® imaging software.
RESULTS: (1) In most cases, there was a deviation between prediction and treatment outcome. (2) This variance was mainly caused

by dental changes, i.e. differences in anchorage requirement and achieved anchorage and thus different positions of the teeth (first molars) compared with the initial cephalograms. (3) Skeletal changes seem to correlate.
CONCLUSIONS: Treatment prediction for skeletal changes during treatment is reliable and can be used for treatment planning. For dentoalveolar changes, the prediction can give a good estimated value.

229 HUMAN JAW MUSCLE REFLEX RESPONSE TO AXIAL STIMULATION OF PERIODONTAL MECHANORECEPTORS

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AIM: To develop a method for axial stimulation of periodontal (PDL) mechanoreceptors and identify jaw opening and closing reflex responses.
SUBJECTS AND METHODS: Ten, healthy female volunteers (age range 18–25 years) were selected for normal occlusion and absence of orthodontic treatment or dental trauma. Axial stimuli (fast 90 ms, medium 20 ms and slow 12 ms) were randomly applied to the maxillary left central incisor by a computer driven vibrator using a profile of 0.5 N (pre-load) to 2.5 N. Surface electromyographic recordings of masseter and digastric responses were made at bite force levels of 5, 10 and 20 per cent maximum voluntary contraction. Nine combinations of stimulus profile and bite force were delivered with an average of 50 stimuli per combination (Brinkworth and Türker, 2002). PDL receptor input was determined before and after local anaesthesia and reliability by repeat measurements after 8 weeks.
RESULTS: Axial stimulation elicited predominantly inhibition (73%) in the masseter reflex and no response in the digastric. Occasionally (3.9%), an early excitation with latency of 13 ms and increased incidence (17%) after anaesthesia was seen and suggested muscle spindle involvement. Anaesthesia significantly reduced the inhibition by 53 per cent, supporting the view that inhibition reflex in jaw closing muscles is of PDL origin. A late excitation (56%) decreased with anaesthesia (24%) but may represent recovery of an early inhibition. Bite force had minimal effect but medium and fast stimuli most influenced the reflex.
CONCLUSION: The jaw-opening reflex is most likely due to inhibition of jaw closing muscles rather than active contraction of jaw openers. The axial stimulation of PDL mechanoreceptors is a useful method to further investigate any influence of orthodontic tooth movement on jaw muscle reflexes.

230 EFFECTS OF A MODIFIED UNILATERAL APPLIANCE ON DENTAL AND SKELETAL STRUCTURES

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AIM: To distalize molars unilaterally without distal tipping and with minimum anterior anchorage loss.
SUBJECTS AND METHOD: Eleven patients (4 females, 7 males) with a mean age of 13.52 ± 3.07 years. All presented with a Class II molar relationship on one side and no crowding in their lower arch. They had a normal or low vertical growth pattern. No anterior bite plane was used. The diameter of the stainless steel wire, which was used as a guide for maxillary molar sliding, was increased to 1.2 mm as a modification of the Keles slider appliance. An 11 mm long Ni-Ti open coil spring which gave 150 g of force was used to slide the molars distally. Lateral cephalograms and cast models were taken and analysed before and after molar distalization. A non-parametric Wilcoxon signed rank test was used for statistical evaluation.
RESULTS: After distalization of the upper first molars, the cephalometric results were as follows: The maxillary first molars were distalized an average of 3.5 ± 0.77 mm without any tipping or extrusion. The maxillary first premolars were mesialized an average of 1.2 ± 0.95 mm and extruded an average of 1.45 ± 0.98 mm. The maxillary central incisors were tipped labially an average of 1.81 degrees. Model analysis showed that there was an average increase of 1.04 ± 0.56 mm in the transverse distance between the upper first molars. No change was seen in skeletal vertical parameters.
CONCLUSIONS: Parallel upper first molar distalization was achieved with this modified Keles slider appliance. Although the molars were distalized without tipping, negligible anterior anchorage loss was observed.

231 BONE TURNOVER MARKER LEVELS IN GINGIVAL CREVICULAR FLUID DURING ORTHODONTIC INTRUSION

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AIM: To determine whether the amount of two bone turnover markers, osteocalcin and bone alkaline phosphatase, can be detected in the gingival crevicular fluid (GCF), and if so, do they reflect the bone turnover changes induced by the activation of intrusive springs on upper first premolar teeth.
SUBJECTS AND METHODS: Nine patients (4 males, 5 females) between the ages of 13 and 15 years who were in good general and periodontal health were randomly selected from those who required fixed appliance therapy and the extraction of the maxillary first premolars. Brackets were bonded to the maxillary first premolars and intrusive springs were tied to the brackets, with a Nance appliance as the anchorage unit. GCF samples were collected from each patient using paper strips before the appliances were fitted, and 1, 24, and 168 hours after activation of the appliances. After the second activation on day 21 of the study, dry samples were collected on days 22 and 28. The paper strips from the individual sites were placed in sealed plastic micro-centrifuge tubes and centrifuged twice at 3000 rpm for 20 minutes by adding 50 microliters of phosphate buffered saline each time. The extracts then were stored at –80°C until the assays were carried out following the manufacturer's recommendation.
RESULTS AND CONCLUSION: Both osteocalcin and bone alkaline phosphatase values showed a decrease in markers over time. The values showed a slight increase only at day 7. The results of the Kruskal-Wallis test showed that there was no statistically significant change in either marker.

232 CRANIOFACIAL MORPHOLOGY OF MALES WITH 46,XX CHROMOSOMAL CONSTITUTION

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AIM: To compare the craniofacial morphology of males with 46,XX chromosomal constitution with the craniofacial morphology of normal males and females, males with Klinefelter syndrome (47,XXX) and females with Turner syndrome (45,X0 chromosomal constitution)
MATERIALS AND METHOD: Cephalometric radiographs of five groups of patients were examined: 31 normal males (46,XY), 62 normal females (46,XX), 15 females with Turner's syndrome (45,X0), 28 males with Klinefelter's syndrome (47,XXY), and five males with 46,XX chromosomal constitution. The following angular and linear measurements were analyzed: SNA, SNB, ANB, NS/SpP, NS/MP, SpP/MP, NSAr, SArGo, ArGoMe, sum of the posterior angles according to Björk, Cd–Go, Go–Pg, and Ans–Pns. The mean values,

standard deviation, minimum and maximum value and variance were calculated.
RESULTS: Males with 46,XX chromosomal constitution showed bimaxillary retrognathism combined with a skeletal Class III malocclusion compared with normal males and females. The lengths of the maxillary and mandibular bases were also smaller. Females with Turner's syndrome (45,X0) exhibited more pronounced bimaxillary retrognathism, inclination of the upper jaw, and backward rotation of the mandible during growth. Males with Klinefelter's syndrome (47,XXY), during the same time period, showed significant bimaxillary prognathism, a skeletal Class III malocclusion and marked anterior rotation of the mandible during growth.
CONCLUSION: Craniofacial morphology in males with 46,XX chromosomal constitution is significantly altered compared with normal males and females.

233 BOND STRENGTH OF ORTHODONTIC BRACKET-ADHESIVE SYSTEMS ON HUMAN AND BOVINE ENAMEL—A COMPARATIVE *IN VITRO* STUDY

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AIM: To critically investigate the use of bovine versus human teeth *in vitro* with shear and tensile bond strength of bracket-adhesive systems.
MATERIALS AND METHODS: Stainless steel orthodontic brackets (Ultra Trim, Dentaurum) were bonded with Concise (3M Unitek) to bovine and human enamel in two test series. Thirty bovine teeth, divided in two test-groups (n = 15), were placed for 1 hour and 1 day, 75 bovine teeth, divided in five test-groups (n = 15), for 1 day, 1 week, and 1 and 3 months. Thirty human teeth, divided in two test-groups (n = 15) were also placed for 24 hours in NaCl chloride solution. To determine bond strength the first test series was carried out on 30 bovine and 15 human teeth using tensile debonding forces. In a second test series the shear bond strength was tested on 75 bovine and 15 human teeth.
RESULTS: The shearing tests generally resulted in a higher bond strength value (mean 17.6 MPa human; 22.44 MPa bovine) than the tensile bond strength tests (mean 7.16 MPa human; 7.22 MPa bovine). The standard deviation was higher in tests using tensile debonding forces than in shear bond strength tests. The values of shear bond strength of teeth placed for 24 hours in sodium chloride solution were higher than those of bovine enamel (22.4 MPa) than on human enamel (17.6 MPa).
CONCLUSION: Even though the absolute values of the shear bond strength of bovine teeth were higher than for human teeth, the ratio was same. Thus, for subsequent studies, bovine teeth can be used instead of human teeth.

234 CLINICAL FUNCTIONAL ANALYSIS OF PATIENTS WITH BIONATOR THERAPY 20 YEARS AFTER TREATMENT

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AIM: Evaluation of (1) the stability of results 20 years after treatment in patients with Class II malocclusions treated with the Bionator and (2) the frequency of functional disorders of the orofacial system in these patients.
SUBJECTS AND METHOD: Thirty-seven patients (20 females, 17 males) with Class II malocclusions. The concept of the study was based on the clinical and functional analysis according to Krogh-Poulsen, Gutowski and Helkimo. In addition overbite, overjet, and condyle position (interferences between centric relation and centric occlusion) were analysed.
RESULTS: Twenty years after Bionator therapy overjet and overbite remained mostly stable. Only a few patients showed mild temporomandibular joint disorders (TMD) and moderate occlusal disharmony. Disturbances in chewing and biting were subtle. Muscle function according to Helkimo's indices (AI, DI) were within normal range. In contrast to patients with Class II malocclusions, who tended to develop severe TMD during adulthood, these patients were characterized by a normal function of the stomatognathic system.
CONCLUSION: These results show that the stomatognathic situation remains stable 20 years after treatment with a Bionator.

235 INTEGRATED AND CONVENTIONAL HERBST APPLIANCES: A COMPARISON OF TREATMENT EFFECTS

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AIM: To compare the integrated Herbst appliance (IHA) with the conventional Herbst appliance with respect to skeletal and dental treatment changes.
SUBJECTS AND METHOD: Thirty boys (mean age 14.2 ± 0.94 years and maturation phase MP3-F, MP3-FG, MP3-G), were selected from a group of 174 consecutive patients who had undergone treatment with the IHA. The ANB angle was ≥4 degrees and the overjet ≥6 mm in all patients. All treatments were carried out without extractions. The average treatment time was 8 months 13 days (253 ± 37 days). The IHA is a combination of a fixed orthodontic appliance and a Herbst appliance. The Herbst pistons are connected to an auxiliary archwire that is inserted in buccal tubes on the first lower molars. The Herbst tubes are attached to the upper first molar bands. Cephalometric lateral head films, taken before and after Herbst treatment, were used for analysis of the skeletal and dental changes according to Pancherz's method (1982). The variables investigated were (1) position of the mandibular and (2) maxillary bases, (3) mandibular length, (4) overjet, and (5) lower incisor inclination The results were compared with those of Pancherz (1979, 1982).
RESULTS: The lower incisors were slightly more proclined than in Pancherz's sample. This could be due to age differences between the samples, and that the initial overjet in the present sample was more severe. With this exception, the results from the two studies were comparable.
CONCLUSION: Similar treatment changes were obtained with the two different types of Herbst appliance.

236 ASSOCIATIONS BETWEEN MOUTH BREATHING AND POSTERIOR CROSSBITES

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AIM: To investigate further the associations between mouth breathing and posterior crossbites (UXPB) in children.
SUBJECTS AND METHOD: Ninety-three mixed dentition children with UXPB and 97 contemporaneous mixed dentition children with no crossbites (Comparison) were retrospectively identified from the orthodontic practice at Mayo Clinic (n = 190). The parents were mailed a 10-question survey collaboratively developed with a paediatrician to identify those children perceived by their parents to be mouth breathers. The child was classified as a 'mouth breather' if at least one positive response was noted to three questions that addressed the child's mode of breathing.

RESULTS: One hundred and seventy three surveys were returned (91% response rate). There were no differences in sex or age between children of responders and non-responders ($P = 0.42$ and 0.35). At the time of the survey, the mean ages of the UXPB and comparison children were 13.5 ± 2.4 and 13.9 ± 2.9 years ($P = 0.26$). Forty-seven children were classified as mouth breathers. The prevalence of mouth breathing was the same in children with (29%) and without (25%) ($P = 0.51$) crossbites. The prevalence of crossbites was not significantly different between mouth breathers (53%) and presumed nasal breathers (48%) ($P = 0.51$). Approximately one-quarter of the total sample (27%) was classified as mouth breathers using a parental survey instrument. The prevalence of mouth breathing was not found to be significantly different between UXPB and comparison children.
CONCLUSIONS: These findings suggest that there is no significant association between the two clinical presentations. Because of the study design, however, a comparison of crossbite prevalence between mouth breathers and nasal breathers is misleading since the UXPB and comparison groups were selected to be approximately the same size. Questioning parents about the breathing habits of their children may not be a valid method to identify mouth breathers. A prospective longitudinal study of objectively identified mouth breathers and comparison children may be required to clarify the influence of mouth breathing on the development of UXPB.

237 TEMPOROMANDIBULAR DYSFUNCTION SYMPTOMS IN 100 SUBJECTS FOLLOWING ORTHOGNATHIC SURGERY

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AIM: To evaluate the longitudinal transition of temporomandibular dysfunction (TMD) symptoms following orthognathic surgery.
MATERIAL AND METHODS: The questionnaires of 100 patients with jaw deformities (40 females, 60 males, mean age 21.2 years) taken at four stages: pre-treatment, just before surgery, post-treatment, and during retention were used to evaluate the longitudinal transition of TMD symptoms. The answer for each question including pain, noise, and jaw-opening disturbance was scored as 1 for 'yes' and 0 for 'no'. Based on the reported symptoms at the pre-treatment stage, patients were divided into two groups; symptomatic and asymptomatic. Increases and decreases in the scores at each stage in the two groups were examined. Furthermore, gender, treatment time, type of malocclusion and presence of extractions were statistically analyzed to determine whether these factors were associated with the changes in TMD symptoms.
RESULTS: There were 71 symptomatic patients and 29 asymptomatic patients. During treatment, the score decreased in 49.3 per cent of the symptomatic group, in 9.9 per cent the score increased and in 40.8 per cent there was no change. On the other hand, the score for 20.7 per cent of the asymptomatic group increased while 79.3 per cent showed no change. A significant difference was found in the variation of scores between the two groups during pre- and post-surgical orthodontic treatment.
CONCLUSIONS: Significant differences were found in the changes of TMD symptoms between the symptomatic and asymptomatic group, but other factors in symptoms causing TMD were unrelated.

238 CRANIOFACIAL MORPHOLOGY AND GROWTH IN CHILDREN WITH CHONDROPLASIA TREATED WITH GROWTH HORMONE

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AIM: To evaluate the effect of growth hormone (GH) therapy on craniofacial morphology and growth in children with achondroplasia (ACH) and to compare the findings with those in a normal control group and a group of ACH patients, who had not received GH treatment.
SUBJECTS AND METHODS: Six Danish children (2 males and 4 females) with ACH treated with GH during their growth period. The investigation was undertaken using cephalometry. Several craniofacial variables were measured and compared with mean values from normal and from untreated ACH groups matched for age and sex.
RESULTS: The effect of GH treatment was minimal on the maxilla. However, the length of the mandible and the mandibular prognathism increased resulting in a decrease in the sagittal jaw relationship. These skeletal changes were compensated for by dentoalveolar changes in nearly all cases, and only one patient developed a mandibular overjet during treatment.
CONCLUSION: GH therapy of children with ACH would seem to increase growth of the mandible, but the effect is relatively limited. However, until the problem is further investigated, it is suggested that this issue is included in decision making related to offering GH-treatment to children with ACH.

239 EVALUATION OF TREATMENT RESULTS: A COMPARISON OF TWO HEADFILM SUPERIMPOSITION METHODS

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AIM: To compare two headfilm superimposition methods in the assessment of the Class II correction mechanism during Herbst therapy.
SUBJECTS AND METHODS: Thirty male Class II division 1 malocclusions treated with the Herbst appliance. Lateral headfilms from before treatment, after treatment and 5 years after treatment were superimposed according to: (1) Björk's (B) method based on fitting bone structures of the anterior cranial base and (2) Fränkel's (F) method based on fitting bone structures of the occipital portion of the cranial base. To evaluate skeletal and dental treatment and post-treatment changes, Pancherz's (1982) analysis was used.
RESULTS: Treatment changes: No difference was found between the B and F method for any of the variables analysed, except for overjet reduction and anterior lower incisor movement, for which the F method showed larger changes than the B method. Post-treatment changes: The F method showed larger changes for all variables than the B method, except for molar relationship for which no difference existed between the two methods.
CONCLUSION: On a long-term basis, skeletal and dental treatment and growth changes are overestimated by the Fränkel method in comparison with Björk's method of headfilm superimposition.

Pancherz H 1982 The mechanism of Class II correction in Herbst appliance treatment. American Journal of Orthodontics 82: 104–113

240 INDIVIDUAL CHARACTERISTICS OF THE OCCLUSAL PLANE IN SUBJECTS WITH A NORMAL OCCLUSION

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AIM: To determine individual position and form characteristics of the occlusal plane in subjects with a physiological occlusion.
MATERIALS AND METHODS: Lateral cephalograms of 20 untreated patients aged 19 to 25 years with normal occlusion were studied. Tooth and bone position, depth of the curve of Spee and location of the occlusal plane in relation to the anterior cranial base, Frankfort horizontal plane, mandibular and maxillary planes and the perpendicular to the NSL were investigated.

RESULTS: It was established that deviations of investigated parameters comprised 20 per cent of their average values. Therefore all participants were divided into two groups based on the relative occlusal plane position to the anterior cranial base: high position (NSL/Ocl <10°) and low position (NSL/Ocl >10°). Comparison of the investigated parameters in the two groups revealed that differences in occlusal plane position in relation to the maxilla and the perpendicular to the NSL were statistically reliable. It was further established that with a high position of the occlusal plane, ML/NSL and NL/ML angles diminished by 23.1 and 24 per cent respectively ($P < 0.01$) and the maxillary incisors were inclined vestibularly (7.2%) and protruded (65%) to a greater extent. The depth of the curve of Spee was increased by 86 per cent at the most inferior position of the occlusal plane.
CONCLUSIONS: Individual characteristics of the occlusal plane under physiological occlusion are possible: high or low occlusal plane position. For each group individual location of the mandible, maxillary incisors position and depth of the curve of Spee are typical.

241 ECTOPIC ERUPTION OF THE FIRST PERMANENT MOLARS IN PATIENTS WITH A CLEFT PALATE

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AIM: To determine the relationship between ectopic eruption of the first permanent molars and cleft palate (CP) anomaly.
SUBJECTS AND METHOD: Thirty patients aged 5 to 11 years, with CP treated in the Department of Orthodontics of the Medical University of Lodz. All patients were in the mixed dentition stage. The study was undertaken according to Kurol and Bjerklin. Dental pantomograms were used for determination of the mesial angle (angle between a horizontal line joining the lowest points of the orbital cavities and a line joining the apex and cervix of the erupted permanent molar). The radiographs were also used for detection of tooth germs and signs of resorption of the primary molars.
RESULTS: Ectopic eruption of primary molars was observed in seven patients; two on the left side, four on the right and bilaterally in one subject. In six patients the ectopic eruption was on the same side as the cleft.
CONCLUSIONS: Ectopic eruption in children with CP was greater than in non-cleft children. Usually the side at which such eruption occurs is the same side as the cleft. Children with CP should be under special care due to the potential danger of ectopic eruption.

242 RADIOGRAPHIC COMPARISON OF APICAL ROOT RESORPTION AFTER ORTHODONTIC TREATMENT WITH REMOVABLE AND FIXED APPLIANCES

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AIM: To compare the severity of apical root resorption occurring in patients treated with removable and fixed orthodontic appliances.
SUBJECTS AND METHODS: Two groups of subjects who had completed orthodontic treatment. The first group 13 males and 7 females, mean age 12.5 years, had been treated with removable appliances. The second group comprised 9 males and 11 females, mean age 13.6 years, treated with fixed appliances. Variables, such as gender, age and duration of orthodontic treatment were examined. The crown and root lengths of the maxillary incisors were measured on the panoramic radiographs before and after active treatment. The crown length was defined as the distance between the incisal edge tip to the cemento-enamel junction (CEJ), and root length between the CEJ to the apex. Each tooth was measured with a viewer and a metric ruler and the percentage of root shortening and root length loss, in millimetres, was computed. Two-sample *t*-tests were used to assess differences between the groups.
RESULTS: The two orthodontic techniques (removable and fixed) significantly influenced maxillary incisor root resorption. Central and lateral incisors showed significantly more apical resorption in the first group compared with the second group. A higher level of resorption for longer treatment times was identified and a linear relationship was found between treatment duration and resorption.
CONCLUSION: The decrease in apical root resorption in the group treated with removable orthodontic appliances may be due to more efficient force control.

243 WHICH FACTORS INFLUENCE WILLINGNESS-TO-PAY FOR ORTHOGNATHIC TREATMENT?

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AIMS: The willingness to pay (WTP) method is a form of cost-benefit analysis and has been shown to be a comprehensive method as it assigns monetary values to both resources consumed and benefits gained. The more highly valued a programme, the more an individual is willing-to-pay. The aims of this study were to establish which factors influence WTP for orthognathic treatment, to assess WTP values from the general public and orthognathic patients and to compare these with the actual cost of the treatment.
SUBJECTS AND METHOD: This was an interview-based study using the payment card method. The subjects were 88 orthognathic patients and a convenience sample of 100 adults. Demographic data was recorded as well as ability to pay, incisor relationship and quality of life. In addition, the resources used were estimated for five patients.
RESULTS: There was a significant difference between the mean WTP values for the public and patient groups. Patients were prepared to pay €2,750 more than the public group. In addition, a significant relationship was found between WTP and incisor relationship, with Class II division 1 patients prepared to pay €3,130 more than Class III patients. Ability to pay did not significantly affect WTP. The mean total costs estimated were lower than the mean patient WTP value and similar to the mean WTP value for the public group.
CONCLUSIONS: In terms of cost-benefit, it appears that orthognathic treatment provides good value for money. This study showed that patients and the public are prepared to place a monetary value on the correction of dentofacial deformity and this form of economic evaluation is a useful tool in the evaluation of health care in the United Kingdom.

244 PREVALENCE OF MALOCCLUSION IN THE PRIMARY AND MIXED DENTITIONS—CONCLUSIONS FOR INTERCEPTIVE TREATMENT

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AIM: To assess the prevalence of malocclusion at two different stages of dental development in order to evaluate the need for preventive and interceptive orthodontic treatment. Different types of malocclusion were examined with regard to time of formation and degree of development.
SUBJECTS AND METHOD: Eight thousand eight hundred and sixty four randomly selected children in the primary (mean age 4.5 years) and mixed (mean age 8.9 years) dentitions. All irregularities in the antero-posterior, transverse and vertical planes as well as oral habits and dysfunctions were diagnosed clinically. Malocclusions

were classified according to their main symptoms. Statistical analysis (Chi-square and, Mann-Whitney *U*-tests) was carried out ($P < 0.05$).
RESULTS: Fifty seven per cent of all children had some form of malocclusion. Prevalence of malocclusion increased significantly from the primary to the mixed dentition ($P < 0.001$). Maxillary overjet increased significantly in size with advancing age ($P < 0.001$). Even though prevalence of an open bite reduced from the primary to the mixed dentition ($P < 0.001$), the percentage of children exhibiting oral dysfunctions remained high with this type of malocclusion.
CONCLUSIONS: The high prevalence rates of children exhibiting malocclusion in both dentitions highlight the lack of preventive orthodontic programmes in Germany. It is necessary to consider the increasing role of environmental e.g. orofacial dysfunctions, and psychosocial factors, in the developing dentition when planning programmes for prevention and interceptive orthodontics.

245 IMMUNOREACTIVITY OF NEUROTROPHINS AND THEIR RECEPTORS IN THE RAT MOLAR PERIODONTAL LIGAMENT

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AIM: To examine neurotrophin expression in the periodontium using a variety of labels for both neurotrophins and neurotrophin receptors.
MATERIALS AND METHODS: Six-week-old female rats were perfusion fixed with paraformaldehyde and the maxilla and trigeminal ganglion dissected out, decalcified in 4 per cent EDTA, impregnated with OCT and frozen at –20°C for sectioning at 25 mm. Untreated controls ($n = 7$) and an experimental group ($n = 6$) prepared as a one-week freezing trauma model were evaluated with immunolabels for neurotrophins [Nerve Growth Factor (NGF), Brain-Derived Neurotrophic Factor (BDNF) and NT3] and their receptors [P75 and Tyrosine Receptor Kinase (Trk) Family—TrkA, TrkB & TrkC].
RESULTS: Controls reacted positively to many tissues suggesting an interaction between neurotrophins and neural receptors at the cellular level to maintain the periodontal ligament (PDL). Epithelial rests of Malassez (ERM) were found around intact root surfaces but not in areas of resorption, implying a role for the ERM in root surface homeostasis and resorption. Observation of a neuronal-like cell within the pulp is very interesting because dental pulp cells have been used to stimulate rescue of injured motoneurons. NGF and BDNF are upregulated in the dental pulp prior to the onset of innervation and may be crucial to nerve in growth. The freezing trauma model exhibited areas of increased vascularity and loss of cellular detail due to hyalinisation. However, the limited time frame used in this study precluded full determination of the neurotrophic responses.
CONCLUSION: This study forms the basis for future trauma investigations, especially orthodontic tooth movement. Of particular interest is the neural input to modulation of the PDL homeostasis in response to orthodontic tooth movement.

246 WHITE SPOT LESIONS AROUND BRACKETS: *IN VITRO* DETECTION BY LASER FLUORESCENCE

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AIM: Demineralisation is one of the side-effects of orthodontic treatment. However methods for its early detection, quantification and monitoring are lacking. Therefore the aim of this investigation was to evaluate laser fluorescence for measurement of demineralisation around brackets *in vitro* and whether an interference of the brackets has to be expected.
MATERIAL AND METHODS: On 30 extracted human teeth with visually apparent decalcification on smooth surfaces, the area of future bracket-placement was determined by bur-marks and additionally by superimposition of a transparent bracket-outline-photograph on the tooth-photograph, using rulers as reference for size accordance. Areas of future measurement were drawn occlusally, distally, gingivally and mesially to the bracket-outline. Fluorescence was measured 1. at the beginning, 2. after etching, 3. after bracket-placement (Transbond, 3M, USA) (SS, Mini Diamond Twin, Ormco, USA), 4. after debonding. For statistical evaluation (SPSS) (level of significance: $P < 0.05$), the mean of two measurements was used and the base-value-mean (sound enamel) subtracted.
RESULTS: The high reproducibility between two measurements (alpha >0.98) showed that the method was valid. Enamel values at the beginning and after bracket placement were well correlated ($r^2 = 0.963$, $P < 0.001$) and their relationship was linear (ANOVA [$F = 2886.896$, $P < 0.001$]). For all sites together, bracket placement showed a small influence ($B = 0.915 \pm 0.017$) (Wilcoxon: $P = 0.006$), which was proportional to the enamel value at the beginning. After bracket-placement the value diminished approximately 9 ± 4 per cent (confidence interval 95%). For the different sites separately, a statistically significant difference was only found gingivally ($P < 0.001$).
CONCLUSIONS: *In vitro* demineralisation around brackets can be measured by laser fluorescence. The influence of bracket placement seems not to be clinically significant, but clinical studies are planned to validate the present findings.

247 POSTERIOR DENTOALVEOLAR HEIGHT AND CRANIOFACIAL VERTICAL PATTERN: A MULTIPLE REGRESSION ANALYSIS

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AIM: To determine the influence of vertical craniofacial dimensions on posterior dentoalveolar height.
MATERIAL AND METHODS: Lateral cephalometric tracings were obtained from 82 adult subjects. Maxillary posterior dentoalveolar height (MxPDH) and mandibular posterior dentoalveolar height (MdPDH) of each subject were entered into a stepwise multiple regression model as dependent variables. A set of 14 cephalometric measurements together with the age and gender of the subjects investigated were selected as independent variables.
RESULTS: Approximately 70 per cent of the total variance of the model was explained by anterior lower face height (ANS–Me) and the mandibulo-palatal plane angle (PP–MP). Increases in ANS–Me and PP–MP had opposite effects on the amount of MxPDH and MdPDH. The lowest values of MxPDH and MdPDH were found in subjects with a reduced ANS–Me distance and an increased PP–MP angle, whereas the highest values for MxPDH and MdPDH were found in subjects with an increased ANS–Me distance and a reduced PP-MP angle.
CONCLUSIONS: Individuals with a marked jaw divergence may frequently have reduced posterior dentoalveolar development.

248 STRAIGHT-WIRE LOW-FRICTION: CLINICAL AND NUMERICAL EXPERIMENTS WITH THE FINITE ELEMENT METHOD

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AIM: The combination of superelastic wires and low friction brackets represent a great advance in contemporary orthodontics, with the 'straight-wire low-friction: synergy system' representing the next era in the evolution of straight-wire systems. The resistance to sliding of

an archwire couple is the combined effect of up to three components: classical friction, elastic binding and physical notching: RS = FR + BI + NO (Thorstenson and Kusy, 2001). The frictional force is proportional to the force with which the contacting surfaces are pressed together and is affected by the nature of the surface at the interface, but friction is independent of the apparent area of contact. The aim of this study was to clinically and mathematically analyse two brackets: a low-friction bracket (Synergy, RMO) and a conventional bracket (MBT, 3M Unitek).
METHODS: A mathematical three-dimensional (3D) finite element model (FEM) of the brackets was made to study the forces between bracket slot and wire. Data analysis required specific hard and software (Institute of Data Processing and Automatism, Paris, France).
RESULTS AND CONCLUSION: The 3D FEM of brackets shows the possibility of performing, with mathematical accuracy, bracket-wire behaviour when different forces are applied. 1) The Sinergy bracket had better distribution of forces in the slot. 2) The MBT bracket showed pressure areas in the ends of the slot which produced a great leverage force. 3) The curvature of the bottom of the slot in the Sinergy bracket decreased the resistance to sliding and, when thick wires were introduced in to the slot, maximum control of the teeth was achieved in the three planes of space. 4) The Sinergy has the advantage of allowing ligation in a simple and economical way and in different ways according to the anchorage needs of each tooth. The force with which the wire is forced against the bracket by the ligature tie is a major determinant of friction. Sinergy brackets provide considerably less frictional resistance to sliding than conventional brackets. 5) The FEM study shows a great difference in biomechanical behaviour between Sinergy (low friction) and MBT (conventional) brackets.

249 PERCEIVED ORTHODONTIST'S BEHAVIOUR THAT INFLUENCES PATIENTS' TREATMENT SATISFACTION

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AIM: To identify variables pertaining to the orthodontist's overall image, as perceived by the patients, that influences satisfaction from treatment in a university clinic or private practice.
SUBJECTS AND METHOD: One hundred and fifty patients attending a postgraduate orthodontic clinic and 150 patients attending three private orthodontic practices. A questionnaire was developed, validated and administered to the subjects who were randomly selected by their consecutive admittance to each practice. The form included multiple items, evaluating the orthodontists' behavioural traits, including appearance, way of communication with the patient, personality and demeanour in practice, and patients' time management. Correlations between positive or negative responses and overall patient satisfaction from treatment were investigated. Differences between the responses of the two groups were assessed and their significance was tested using the Chi-square test.
RESULTS: A negative response rate was higher for the patients attending the university clinic than the private practices, for all factors investigated. Satisfaction from treatment in the university clinic was associated positively with the orthodontists' patience towards the patient ($P < 0.01$) and correlated negatively with excessive patient time spent in the waiting room ($P < 0.001$), and orthodontists' hastiness in patient manipulation ($P < 0.05$). Satisfaction from treatment in the private practices was associated positively with the orthodontists' beauty of smile ($P < 0.001$), consistent use of gloves ($P < 0.01$), careful manipulation of the patient ($P < 0.001$) consideration of the complaints ($P < 0.001$) and remembering personal details regarding the patient ($P < 0.01$). It correlated negatively with orthodontists' halitosis ($P < 0.05$), frequent interruptions during sessions ($P < 0.001$) and painful manipulation ($P < 0.01$).
CONCLUSIONS: Orthodontists' attitudes that influence patient satisfaction seem to follow a similar pattern in the university clinic and private practice. However, these variables differ, possibly reflecting differences in patient motivation for admittance of treatment in each type of practice.

250 PATIENTS' EXPECTATIONS AND MOTIVATION FOR ORTHODONTIC TREATMENT

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AIM: To investigate what motivates patients to attend for orthodontic treatment in a university clinic or in private practice, and to illustrate the patients' expectations from the anticipated treatment.
SUBJECTS AND METHOD: One hundred and fifty patients attending the postgraduate orthodontic clinic and 150 patients attending three private orthodontic practices. A questionnaire was developed, validated and administered to the subjects who were randomly selected by their consecutive admittance to each practice. The form included questions, regarding their reasons for seeking orthodontic treatment and for having decided to attend the specific practice. The degree to which, according to a 5-scale measure, their dental and facial aesthetics, oral function, self-esteem and social life were expected to benefit from treatment was assessed. The replies were anonymous and were cast into a ballot box. Differences between the responses of the two groups were evaluated and their significance was tested using the Chi-square test.
RESULTS: The university clinic was mostly chosen by patients for the lower treatment cost (42%) and the supervision of treatment by academics (59.5%), whereas the private practices were mostly chosen after referral from a friend or relative (54%), or a family dentist or doctor (48%). The patient's motivation for orthodontic treatment was mostly attributed to their desire to improve dental and facial aesthetics (68%), and the referral from a family doctor or dentist (41%). Patients' higher expectations from treatment included a great improvement of dental aesthetics (77%), oral health (51%), and psychological status (50%). Facial aesthetics, oral function, and social life, were less expected to substantially benefit from treatment (40, 31 and 28% respectively). The overall patients' motivation and their expectations from treatment were not found to be significantly different between the two groups.
CONCLUSIONS: Although patients attended the university clinic or private practice for different reasons, their motivation and expectations from treatment did not differ significantly.

251 INFLUENCE OF GROWTH ON NATURAL HEAD POSITION IN CLASS II MALOCCLUSIONS

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AIM: To elucidate the growth changes in Norwegian children with different skeletal features.
MATERIALS AND METHODS: Lateral cephalograms in the natural head position (NHP) of 96 subjects aged 6, 9 and 12 years who had not undergone any orthodontic treatment. The subjects were classified into two groups: skeletal and dental Class II malocclusions (22 females, 27 males) and Class I (23 females, 24 males). The cephalometric analyses were performed with linear and angular measurements. All the data were statistically compared between Class II and Class I.
RESULTS: Significant differences were found for cranio-cervical posture (OPT/CVT, NSL/NL, MBL/ML, NL/VER and ML/VER) between Class II and Class I subjects. The pharyngeal airway (AW3/PW3 and apw4-ppw4) was significantly anteroposteriorly constricted in both Class II males and females.

CONCLUSIONS: The dentoskeletal morphology in subjects with a Class II malocclusion may primarily reflect NHP.

252 A RETROSPECTIVE CASE SERIES OF 114 PATIENTS TREATED WITH THE TIP-EDGE APPLIANCE

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AIM: To evaluate treatment outcome and the effect of mechanics in a sample of patients treated with the Tip-Edge appliance system.
SUBJECTS AND METHODS: One hundred and fourteen consecutive patients treated by one practitioner (RP) with Tip-Edge were evaluated as a case series including all consecutive starts between January, 1997 and December, 2000, regardless of treatment outcome, excluding orthognathic and severe hypodontia patients. Data collection by pro-forma from case notes, start and finish study models [Peer Assessment Rating (PAR) and Index of Orthodontic Treatment Need] and lateral cephalometric radiographs (cephs). PAR was blindly re-assessed for reliability on a sub-set of 10 pre- and 10 post-treatment models to Kappa 0.87 for PAR and 0.63 for IOTN. Error on 20 blindly chosen cephs was 0.5–10 except for lower incisor angulation at 2.10
RESULTS: Seventy-nine females and 35 males, average pre-treatment age 15.4 years, treatment time in months 21.1 sd 5.1, 19 sd 5 appointments, 3.92 sd 1.0 upper archwires and 3.85 sd 1.32 lower archwires. Sixty-one per cent treated with the loss of four premolars had a pre-treatment mean PAR of 35.4 sd 10.7, post-treatment 5.9 sd 4.0, thus a reduction of 29.6 (82.1%). There were 22 high and 25 low angle patients. Post-treatment cephs showed that Class II traction in 69 patients proclined the lower incisor more than in the 19 patients without Class II traction ($P < 0.02$, ANOVA). There were no measurable effects on growth rotation, face height or cant of the occlusal plane in any of the subgroups.
CONCLUSIONS: The Tip-Edge treated difficult malocclusions to excellent results with PAR score reductions due to the rapid overjet and overbite reduction.

253 PHYSIOLOGICAL CHANGES IN SPACE CONDITIONS AND OCCLUSION BETWEEN 7 AND 13 YEARS OF AGE

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AIM: Establishment of molar relationships under physiological conditions is a dynamic process during development of the occlusion. For the clinician it is interesting to be able to predict these physiological proceedings from an early point of development to evaluate treatment need for a patient, possible self-corrections and interference of treatment with ongoing physiological maturation. The aims of this study were to describe longitudinal changes in molar relationship from the early mixed to the permanent dentition as a result of normal development and to study associations between the change in molar relationship and different dental parameters with special focus on the space conditions.
MATERIAL AND METHODS: Dental casts of 50 orthodontically untreated children were evaluated longitudinally at 7, 11 and 13 years of age. A space analysis for each quadrant was performed and the molar relationship was registered at each stage. To evaluate the effect of space conditions and possible molar migration on the existing molar relationship, the upper and lower molars were mentally transferred to a position in the dental arch, which neutralized the existing surplus or lack of space in each quadrant. The relationship of the lower molar to the upper molar in the new position was called 'corrected occlusion'.
RESULTS AND CONCLUSION: The mean molar occlusion has a tendency to develop a less distal relationship during the establishment of the permanent dentition. Self-corrections do occur, but not in a frequency warranting reduced importance of early initiation of orthodontic screening and treatment. When the cases were grouped according to the variable 'corrected occlusion', a rather good agreement between the early mixed and permanent dentition was demonstrated; indicating a certain stability of the molar relationship after isolating the effect of the space conditions.

254 COMPARING BOND FAILURE RATES BETWEEN DIRECT AND INDIRECT BONDING TECHNIQUES

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AIM: To determine the relative bond failure rates in direct and indirect bonding techniques.
MATERIALS AND METHODS: A prospective randomised controlled clinical trial was carried out. Twenty-five patients due to have fixed appliance therapy were consecutively selected from the waiting lists of two hospitals. The bonding method was randomly allocated, using random number tables, to diagonally opposite quadrants of the patient's mouth. The patients were monitored during the course of treatment, and the number and location of bond failures were recorded. The data were analysed using Chi squared and regression statistics.
RESULTS: There was no significant difference in bond failure rate between the two techniques.
CONCLUSIONS: Bond failure rate is not affected by the bonding technique used.

255 RADIOGRAPHIC QUALITY ASSURANCE IN AN ORTHODONTIC DEPARTMENT

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AIM: Correct identification of soft tissue points on lateral cephalograms is essential for orthodontic treatment planning and evaluation of treatment response. Successful identification of soft tissue points is often difficult. In order to improve the diagnostic yield of lateral cephalograms the medical physics department designed a 'dodger'. This was fitted to the end of the collimated tube. The dodger reduces soft tissues exposure to radiation, and it was hoped to improve soft tissue point identification. To assess the possible improvements an audit was undertaken to determine possible differences in the quality of the soft tissue profile.
MATERIALS AND METHOD: A retrospective pilot study of 50 randomly assessed pre- and 50 post-dodger lateral cephalograms was carried out. Each operator viewed the lateral cephalograms under clinical settings. Both clinician and radiographer assessed the radiograph in a standardised manner. Eight soft tissue points were agreed upon. These were: nasion, pronasale, subnasale, labrale superius, labrale inferius, supramentale, pogonion, and soft tissue chin point. A proforma of quality assurance (QA) as recommended by the Department of Health: 'Guidance Notes for Dental Practitioners on the Safe Use of X-Ray Equipment' (National Radiological Protection Board, 2001) was followed. Another clinician assessed 10 per cent of the radiographs for operator bias, this within the 5 per cent confidence interval. The following criteria were applied for assessment of the eight soft tissue points and overall exposure: Exposure 1—Excellent; Exposure 2—Diagnostically acceptable; Exposure 3—Unacceptable.

Minimum targets for radiographic quality:

Rating	Percentage of radiographs taken	
	Target	Interim Target
1.	Not less than 70%	Not less than 50%
2.	Not less than 20%	Not greater than 40%
3.	Not greater than 10%	Not greater than 10%

These targets should be achieved within 3 years of the implementation of the QA programme.
RESULTS: Pre-dodger pogonion, pronasale, subnasale and soft tissue chin point were unacceptable. Film exposure quality improved post-dodger, as did all soft tissue points. Some pronasale, subnasale and labrale superius points were still rated as acceptable. Some nasion and soft tissue chin point were rated as unacceptable but were far less numerous than in the pre-dodger group.
CONCLUSION: The audit target of not less than 70 per cent of radiographs being rated as excellent was exceeded with the new dodger. Improvements can still be made for the identification of nasion and subnasale. Despite this the new films demonstrated a marked improvement from pre-dodger films. A more comprehensive analysis is being planned.

256 FEATURES CO-EXISTING WITH IMPACTED MAXILLARY CANINES

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AIM: To determine clinical and radiographic characteristics of impacted maxillary canines.
SUBJECTS AND METHOD: Eighty-three subjects (55 females, 28 males), aged over 11.5 years, with unerupted permanent canines. Dental casts and panoramic radiographs were used for examination. The presence of persistent primary canines, buccal or palatal bulge, and position of the canine in sectors were examined. Mesial inclination to the midline and vertical distance to the occlusal plane of the impacted permanent maxillary canine were measured. For the adjacent teeth, agenesis, mesiodistally reduced crown size of the lateral incisor, rotation, transposition and delayed eruption were evaluated.
RESULTS: Maxillary canine impaction was more frequent in females than in males at a ratio of 2:1. Unilateral impaction was more than twice that of bilateral. In almost 70 per cent of subjects persistent primary canines were present. A canine bulge was palpated palatally in 66.7 per cent and buccally in 17.6 per cent of subjects. No bulge could be identified in 15.7 per cent. Most often the impacted upper canine was placed in sector 2 or 3 (sector of lateral incisor). The mean value of the angle between the long axis of the impacted canine and the midline was decreased (30.32°) with the mean distance of the canine cusp to the occlusal plane being 13.61 mm. Among the dental anomalies co-existing with canine impaction the most frequent were: rotation of lateral incisors (62%), agenesis or mesiodistally reduced lateral incisor crown size (41%), delayed eruption (25.3%) and transposition (6%).
CONCLUSIONS: Early detection of clinical and radiological features co-existing with impacted maxillary canines may help in the prediction of this anomaly.

257 A NEW ALTERNATIVE TO RESOLVE ANTERIOR MANDIBULAR DENTAL CROWDING: SYMPHYSIS DISTRACTION OSTEOGENESIS

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AIM: To examine the effects of a symphyseal distractor.
MATERIAL AND METHODS: The Martin intraoral device developed in the Trousseau Hospital in 1996 was used in patients aged from 4 to 15 years with bone- and tooth-borne fixations. An external device was used in 1994 but from 1996 this was changed to an internal device to avoid external scars and to allow more social acceptance.
RESULTS: The keratinized mucosa and the oral mucosa followed bone remodelling without pathology. Clinically no modification of the buccal aperture was necessary. Radiology of the temporomandibular joint showed no condylar morphological changes and no significant condyle dislocation. The enlargement of the chin after symphysis widening could be aesthetically unsatisfactory. In 7 patients, there was an average widening (measured on the device) in the midline osteotomy area, the transversal intercanine gain was approximately 6.5 mm (56 %) and the transverse intermolar gain about 3.1 mm (27 %).
CONCLUSION: Symphysis distraction osteogenesis indications must remain limited: when anterior transversal mandibular deficiency is above 5 mm, when there is a lack of lateral mandibular expansion and when an interceptive surgery must be carried out in young children.

258 DISTRACTION OSTEOGENESIS—THE ROLE OF THE ORTHODONTIST

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AIM: Distraction osteogenesis (DO) is becoming a treatment of choice for the surgical correction of hypoplasia of the craniofacial skeleton, especially in children. The aim of this presentation is to report the 10 year experience of the Trousseau Paris Team concerning the maxilla, the mandible, the symphysis DO, and the role of the orthodontist.
MATERIAL AND METHODS: Retrospective data from 1988–2001 of 63 patients, aged to 4–18 years: 37 mandible DO, 35 with internal device (unidirectional 7, bidirectional 28), two with external device, 17 maxillary DO, nine symphysis DO.
RESULTS: DO is indicated in subjects in whom previous functional therapy has been unsuccessful when the severity of the bone hypoplasia and the malocclusion cannot be resolved by orthodontics. In subjects with severe airway problems the preferred period for treatment is early. The pre-distraction treatment aims to provide stability after DO e.g. transverse arch expansion. During the period of activation the orthodontist can recommend changes in the DO vector by manipulation of the device, or by a guiding elastic.
CONCLUSION: Orthodontic treatment has to be adapted at every step of the dynamic process of DO

259 LOWER LIP MORPHOLOGY IN CLEFT LIP AND PALATE PATIENTS

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AIM: To evaluate the lower lip morphology of cleft lip and palate (CLP) patients comparatively with skeletodental normals, and to suggest clinical implications so as to obtain better aesthetic and functional results in the lower third of the face.
MATERIALS AND METHOD: Lateral cephalometric and hand-wrist radiographs obtained from 24 unilateral, nine bilateral CLP subjects and 20 control individuals. All the subjects were in the pre-peak stage of pubertal growth and the mean chronological age was approximately 12 years for all groups. Cephalometric landmarks were double-digitized and the measurements were calculated by a computer program. Besides conventional dentofacial variables, the lower lip area (upper, middle, lower) was also measured using a digital planimeter on the lateral cephalograms. Bonferroni's test was performed to evaluate the differences between the CLP and control groups.

RESULTS: The sagittal jaw relationship and mandibular plane inclination in the CLP and control groups was similar. Anterior and posterior face heights were smaller in the CLP groups than the normals. The upper and lower incisors were retruded, the upper incisors were positioned superiorly, and the overjet and overbite values were reduced in the CLP groups when compared with the control. The upper lower lip area was smaller in the CLP group, but the difference was statistically significant only between the unilateral and control groups ($P < 0.05$). The middle, lower and total lower lip areas of the CLP subjects were found to be significantly smaller than the normals ($P < 0.01$).
CONCLUSIONS: The lower lip is significantly smaller, retruded and postured with a deep labiomental sulcus in CLP patients.

260 TRANSPALATAL DISTRACTION IN PATIENTS WITH AND WITHOUT CONGENITAL DEFORMITIES

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AIM: To present the results of palatal expansion in adolescent patients with extreme maxillary micrognathia using a bone-borne transpalatal distraction device.
SUBJECTS AND METHODS: Seven patients, three with unilateral cleft lip and palate and four non-cleft patients without other congenital deformities, aged between 13.0 and 22.8 years, in whom transpalatal distraction with a transpalatal distractor (TPD T, Surgitec, Brugge) was carried out. According to the desired expansion, e.g. unilateral or bilateral, symmetrical or asymmetrical, different surgical procedures were performed. Dental models made prior to insertion and immediately and six months after removal of the distraction device, were analysed to compare changes and stability in intercanine, interpremolar and intermolar width.
RESULTS: In all patients sufficient maxillary expansion of approximately 10 mm was achieved after 3–4 weeks.
CONCLUSIONS: Different surgical procedures to insert the transpalatal distractor give the ability to perform the necessary type of expansion, which is especially interesting for cleft patients. Other advantages of the presented maxillary expansion method are shortening of treatment time, prevention of periodontal membrane compression, buccal root resorption and fenestration.

261 DISTALIZATION OF THE UPPER CANINES DURING LEVELLING

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AIM: To evaluate the effects of 'lacebacks' and superelastic NiTi closed coil springs on canine distalization.
SUBJECTS AND METHODS: In 15 subjects lacebacks (figure of eight 0.010 inch ligature wires) were used on one side and superelastic NiTi closed coil springs (generating a continuous force of 150 g) on the other side for upper canine distalization. In all cases 0.022-inch slot brackets were used. Canine distalization was performed during the levelling stage. For evaluation of the dental changes 13 parameters were measured on pre- and post-distalization lateral cephalograms and the values were compared with the Wilcoxon test.
RESULTS: In both groups the upper canines were distalized in a mean period of 2.53 months. In the laceback group distal tipping (4.50°) and distal movement (1.67 mm) of the canine were significant ($P < 0.01$ and $P < 0.001$, respectively). In the coil group distal tipping (11.63°) and distal movement (4.07 mm) of the canine were statistically significant ($P < 0.001$). Distal tipping and movement of the canines showed statistically significant differences between the groups ($P < 0.01$ and $P < 0.001$, respectively). Mesial tipping of the first molar was significant in both groups ($P < 0.05$). The amount of first molar mesial movement was larger in the coil group (1.93 mm, $P < 0.001$) than in the laceback group (0.70 mm, $P < 0.05$); these differences were significant between the groups ($P < 0.01$).
CONCLUSION: Lacebacks and coils may be regarded as an effective method for canine distalization during levelling. However, more controlled canine movement was obtained with lacebacks.

262 EFFECTS OF MODIFIED APPLIANCES ON UPPER MOLAR DISTALIZATION

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AIM: To evaluate the dentoalveolar effects of a modified Distal Jet (MDJ) and Pendulum appliance (PA) on upper molar distalization.
SUBJECTS AND METHODS: Thirty-seven patients (15 MDJ; 22 PA) all with a space deficiency in the upper arch and with their second molar crowns at or above the level of the first molar trifurcation. Twenty-six parameters were measured to analyze the changes on pre- and post-distalization lateral cephalograms and comparisons were made with Wilcoxon's test. Comparisons of the changes between the groups were undertaken using the Mann-Whitney *U*-test.
RESULTS: In both groups the increases in posterior and anterior face height and extrusion of the first premolars were significant ($P < 0.001$). In the MDJ group anterior movement and anterior tipping of the upper incisors (1.33 mm, 3.33°), anterior movement of the first premolars (2.20 mm), distal movement and distal tipping of first molars (3.07 mm, 9.67°) were significant ($P < 0.001$). In the PA group anterior movement and anterior tipping of the upper incisors (2.07 mm, 5.00°), anterior movement and anterior tipping of the first premolars (2.86 mm, 5.57°), distal movement and distal tipping of first molars (3.96 mm, 15.73°) were significant ($P < 0.001$). The increase in anterior face height, anterior tipping of incisors, extrusion of first premolars and distal movement of first molars showed statistically significant differences between the groups.
CONCLUSION: In both groups the first molars were distalized and tipped distally. The anchorage teeth (first premolars) moved anteriorly and were extruded.

263 CYTOTOXICITY TESTING OF ORTHODONTIC LIGHT-CURED RESINS USING HUMAN SKIN MODELS

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AIM: To determine the cytotoxicity of orthodontic bonding materials containing fluoride-releasing properties in conjunction with irradiation time and method.
MATERIAL AND METHODS: Testskin (a three-dimensional living skin equivalent) was used to determine cytotoxicity of orthodontic bonding resins and glass ionomer cement after irradiation with a plasma arc light and a conventional halogen light. An array of bonding material test pieces were irradiated at various durations with two different lights. The pieces were placed in wells on human skin models and the sets were incubated then tested for cytotoxicity using the MTT method.
RESULTS: Depending on the duration of irradiation with the plasma arc or conventional light, cytotoxicity levels were sometimes similar. A minimum duration of 9 seconds when using plasma arc light was established in order to reduce the level of cytotoxicity.

CONCLUSION: Cytotoxicity is an important factor when deciding irradiation times of orthodontic bonding material, and human skin models are useful for determining levels of cytotoxicity.

264 EFFECTS OF SEROTONIN RECEPTORS ON OSTEOCLAST DEVELOPMENT

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AIM: Orthodontic tooth movement is the induced stimulation of the bone remodelling process. On prolonged force application tooth movement occurs as the bone around the tooth remodels. It is essential, therefore, to understand the origin, function and regulation of bone cells, as well as the interaction of other systems in regulating bone mass. In particular, the regulation of bone mass by the neural system is an area that is neither well-studied nor understood. Serotonin (5-HT), is found primarily in the central nervous system, gastrointestinal (GI) tract, and blood platelets. Peripherally, 5-HT has effects on cardiovascular function, muscle contraction, endocrine regulation, platelet haemostasis, platelet-mediated vasoconstriction, and motility of the GI tract. The wide range of biological activities of 5-HT are the consequence of its interaction with a family of more than 15 receptors, and the regulation of its extra- and intra-cellular levels by a serotonin transporter (5-HTT). The aim of this study was to determine the expression and function of 5-HT receptor subtypes and 5-HTT on osteoblasts and osteoclasts, and the effect of 5-HT receptor agonist/antagonists on RANKL expression by osteoblasts.
MATERIALS AND METHODS: Primary osteoblasts were isolated from newborn mouse calvaria by collagenase digestion. Osteoclasts were generated from the murine macrophage cell line RAW264.7 by stimulation with receptor-activator of NFkB ligand (RANKL). RT-PCR was carried out to assess 5-HT receptor expression. The effect of 5-HT receptor agonist/antagonist on RANKL expression by osteoblasts was measured via ELISA. The non-paired Student's *t*-test was used for statistical analysis.
RESULTS: Primary osteoblasts expressed 5-HT1B, 5-HT1E, 5-HT2A, 5-HT2B and 5-HT4 receptors, and osteoclasts 5-HT1B, 5-HT2B and 5-HT4 receptors as well as 5-HTT. Selective modulation of 5-HT receptors regulated RANKL expression on osteoblasts. The 5-HT1B antagonist was found to increase RANKL expression.
CONCLUSIONS: Serotonin (5-HT) and serotonin transporter (5-HTT) potentially play an important role in bone homeostasis.

265 EFFECT OF BRACKET BASE DESIGN ON SHEAR BOND STRENGTH

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AIM: To compare shear bond strengths (SBS) and fracture sites of six different base types: standard mesh base (A) (Ultraminitrim, Dentaurum, Pforzheim, Germany), Supermesh base (B) (Microarch, GAC International, Inc, Central Islip, NY, USA), Integral base (C) (Dyna-Lock, 3M-Unitek Corp., Monrovia, Calif, IL, USA) and (D) (Microloc base, GAC International), Micro-etched base (E) (Miniature Twin, 3M-Unitek Corp.), laser structured base (F), (Discovery, Dentaurum).
MATERIALS AND METHOD: Twenty brackets of each type were bonded to 120 composite bases with Transbond XT (3M Unitek) bonding adhesive. The samples were debonded with a universal testing machine (Model 500, Testometric, Lancashire, UK) 24 hours later with a chisel edge plunger at a crosshead speed of 0.5 mm/minute. Analysis of variance was performed with a confidence level of 0.05.
RESULTS: Mean SBS values (MPa) necessary to debond were 8.7 (A), 4.2 (B), 7.3 (C), 10.9 (D), 11.4 (E) and 11.5 (F). Microloc (D), micro-etched (E) and laser structured (F) bases showed statistically significantly higher SBS values compared with mesh (A) and integral (C) bases. The weakest SBS was obtained with Supermesh (B). Almost all adhesive remained on the bracket base with Microloc (D), micro-etched (E) and laser structured (F) bases.
CONCLUSION: Differences in bracket base design may lead to significant differences in SBS. Microloc, micro-etched or laser structured bases may be preferred to achieve higher SBS values.

266 THE EFFECTS OF EARLY PRE-ORTHODONTIC TRAINER TREATMENT ON THE CRANIOFACIAL STRUCTURES OF CLASS II DIVISION 1 PATIENTS

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AIM: To clarify the dento-skeletal treatment effects induced by early trainer treatment.
SUBJECTS AND METHODS: Sixteen patients (8 girls, 8 boys), mean age of 9.6 ± 1.3 years, with a Class II division 1 malocclusion treated with a soft pre-orthodontic trainer appliance (Myofunctional Research Co., Australia). The patients were instructed to use the trainer daily for 1 hour plus overnight while sleeping. A control group of 20 patients (untreated Class II division 1 malocclusions) was used to eliminate possible growth effects. The mean age of the control group was 12.2 ± 0.8 years. Lateral cephalograms were obtained at the start and end of treatment. Final cephalograms were taken after 13.1 ± 1.8 months of trainer application, compared with a mean of 10.2 ± 2.4 months for the control group. The mean and standard deviations for the linear and angular cephalometric measurements were analyzed statistically and intra- and inter-group changes were evaluated by paired and independent sample *t*-tests.
RESULTS: At the end of the study period the significant changes observed in the trainer group were: anterior rotation and sagittal mandibular growth, increases of SNB, face height and lower incisor proclination, reductions of ANB and overjet and retroclination of the upper incisors. However, only total face height increase, lower incisor proclination and overjet reduction were significant when compared with the changes observed in the control group.
CONCLUSIONS: Pre-orthodontic trainer application induces basically dentoalveolar changes that result in a significant reduction of overjet and can be used with appropriate patient selection.

267 EFFECTS OF ORTHODONTIC IMPLANT ANCHORS IN GROWING PATIENTS

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AIM: To investigate the effects on growth of an orthodontic implant during orthodontic treatment.
MATERIALS AND METHOD: The cephalometric findings from 14 growing patients (9 males, 5 females) with a mean age of 15.3 years, during orthodontic treatment comprising an orthodontic palatal implant (Orthosystemâ, Strauman, Switzerland) 6 mm (n = 10) and 4 mm (n = 4) in length inserted parasagittally, were evaluated. At the time of insertion a hand-wrist radiograph was taken. A control group was matched with the experimental group according to sex, age and ANB angle. Lateral and frontal cephalograms were taken in the natural head position and were analysed by hand tracings. All tracings were then digitized and changes in the cephalometric measurements were evaluated statistically. An X-Y axis was constructed using

the orthodontic implant anchors (OIA). Twelve linear and four angular measurements were performed in relation to the implant. Comparisons of the various parameters between the implant and the control group were undertaken using paired and Student's *t*-tests.
RESULTS: Duplicate measurements showed a reliable method. No differences were found between the two genders. SN, ANS-PNS, S-PNS, N-ANS, distances were not altered in comparison with the control group ($P > 0.05$). There was no significant vertical displacement in relation to SN or ANS-PNS. Between the 4 and 6 mm OIA there was a significant difference ($P < 0.05$) in insertion angle. No significant rotational changes of the OIA were measured.
CONCLUSION: In this group and during orthodontic treatment an OIA does not alter normal growth of the maxilla in a sagittal or vertical direction. The insertion angle of an OIA is related to the length of the implant. Further research is needed to study the long-term effects with regard to transverse development.

268 TOXICITY OF SOLDERED AND LASER WELDED ARCHWIRES IN THREE-DIMENSIONAL CELL CULTURES

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AIM: To determine whether a difference exists in toxicity and loss of viability on three-dimensional (3D) cell cultures between point welded, laser welded and silver soldered orthodontic wires.
MATERIALS AND METHODS: Three types of soldered stainless steel wires, point welded, laser welded and silver soldered were prepared ($n = 5$) and subjected to two different techniques. Two pieces were cut from each wire. The first piece was placed on 3D cell cultures (reconstituted human epithelium model based on TR 146 cells). After 24 hours, the cell cultures were cut and stained with haematoxylin/eosin. Toxicity was assessed by evaluating the morphological changes and classified as mild, moderate or severe. The second piece of each wire was subjected to a MTT-test in order to quantify the viability of the *in vitro* cultures. Copper wires served as the control to determine severe toxicity and native cell cultures as a baseline. Untreated stainless steel (0.9 mm) was included for comparison with the welded pieces.
RESULTS: Morphological studies of the native cell cultures revealed no toxic reactions. The morphological ranking from mild to severe toxicity was: stainless steel < point welded < laser welded < silver soldered. The MTT-tests revealed the following mean variability values: native cell line (negative control) 98.1 per cent, stainless steel 96.8 per cent, point welding 99.6 per cent, laser welding 95.5 per cent, silver solder 85.7 per cent and copper wires (positive control) 52.2 per cent.
CONCLUSIONS: Histological evaluation with respect to toxicity and measurement of viability in the 3D cell cultures showed no severe toxicity or loss of viability caused by any of the wires. Relative comparison between the different welding techniques revealed however that laser and point welded wires induced less toxicity/loss of viability compared with silver soldered wires.

269 BODY IMAGE CHANGE IN ADULT ORTHODONTIC VERSUS ORTHOGNATHIC PATIENTS

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AIM: To compare the changes in body image (BI) of two groups of adult patients treated with conventional orthodontics (group A), and with orthognathic surgery (group B), respectively.
SUBJECTS AND METHOD: Two consecutive, independent, prospective studies were conducted in two groups of adult patients with dentofacial deformities belonging to the same reference population. Forty were treated with orthodontics and 54 by orthognathic surgery. BI score was measured at three different intervals: before (T0), during (T1) and two months after active orthodontic treatment (T3). In group B, the T1 measurement was made 6 months, after surgery but before discontinuation of orthodontics. The Secord and Jourard Body Cathexis Scale, modified by Kiyak, was used to measure overall and facial BI.
RESULTS: The T0, T1 and T3 facial BI scores in group A were: 2.6 8 ± 0.38, 3.0 ± 0.56 and 3.73 ± 0.31, and in group B 3.48 ± 0.63, 3.99 ± 0.56 and 3.84 ± 0.58, respectively. The mean score in the general population is 3.46 ± 0.40. In both groups the differences between T3 and T0 were significant ($P < 0.05$). The changes between T3 and T2 sores were only significant in group A. Comparing both groups, group B showed a significantly higher T0 score and a higher T2-T1 increase, but the final score for both groups did not show significant differences.
CONCLUSION: Both orthodontic and orthognathic surgery produce similar enhancement of BI independently of the severity of dentofacial deformity. This finding suggests that BI is more related to intrinsic psychological aspects than with objective severity of the deformity.

270 SHORT-TERM INTERCEPTIVE ORTHODONTIC TREATMENT RESULTS IN PATIENTS WITH A COMPLETE UNILATERAL CLEFT LIP AND PALATE

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AIMS. To evaluate maxillary dental arch morphology, occlusion and effectiveness of short-term interceptive orthodontic treatment in patients with a complete unilateral cleft lip and palate (UCLP) in the late primary/early mixed dentition stage.
MATERIALS AND METHOD: Plaster casts of the two groups of patients (mean age 6.4 years) with non-syndromic complete UCLP. Group 1, nine children treated with removable orthodontic appliances for 1.5–2.0 years, and group 2, 11 patients before the start of any orthodontic treatment. Occlusion and maxillary dental arch morphology was evaluated examining intermolar and intercanine width, and dental arch and palatal depth in the primary second molar region on the plaster models. Dental arch relationship was evaluated according to the 5-year-old index and Huddart scoring system. Descriptive statistics were performed in order to test distribution of the data, and correlation between morphological characteristics and standard ranking system was measured.
RESULTS: No statistically significant differences were found in the untreated and treated subjects. Dental arch depth after interceptive orthodontic treatment 27.0 ± 1.5 mm, non-treated group 26.0 ± 2.0 mm; palatal depth 11.3 ± 1.3 mm and 12.5 ± 1.6, mm, respectively. There was significant correlation between the 5-year-old index rank and dental arch depth in the UCLP patients in the early mixed dentition stage.
CONCLUSIONS: It seems that early orthodontic treatment is not efficient at preventing the development of a malocclusion in cleft-affected patients.

271 THE THREE-DIMENSIONAL STRUCTURE OF THE NASOMAXILLARY COMPLEX IN SKELETAL CLASS III PATIENTS

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AIM: To evaluate at what site and to what extent a growth deficiency within the nasomaxillary complex, at the cranial base and at the mid cranial fossa has taken place among Japanese patients with a Class III malocclusion, and a retropositioned maxilla.
SUBJECTS AND METHODS: Forty-five adult patients (25 females, 20 males) who had been diagnosed cephalometrically as having a Class III malocclusion and were recommended for orthognathic surgery. From these, 16 patients who had a smaller SNA angle than the Japanese normative mean –1 SD were considered as the test group, while the remaining patients showing an average SNA angle represented the control group. Computed tomographic (CT) images were recorded for each subject using a helical type CT scanner. CT image data were transferred to a workstation and a three-dimensional construction of the skeletal structures was carried out. Anatomic landmarks were determined and measurements were taken in the sagittal, vertical and transversal plane within the nasomaxillary complex, at the cranial base and at the mid cranial fossa. The measurement data were analysed statistically.
RESULTS: Compared with the control group, patients with a retropostioned maxilla did not show significant differences in the vertical and transversal dimension within the nasomaxillary complex or at the cranial base. Statistically, a growth deficiency at the mid cranial fossa was evident.
CONCLUSION: A posterior position of the maxilla among Japanese patients with a Class III malocclusion is not only caused by a short maxilla but can significantly be influenced by a growth deficiency in the mid cranial fossa.

272 IS IT POSSIBLE TO PREDICT THE MANDIBULAR GROWTH PATTERN WITH BJÖRK'S STRUCTURAL METHOD?

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AIM: To answer the question: is a hyper- or hypodivergent skeletofacial growth pattern characterized by a specific mandibular morphology?
SUBJECTS AND METHODS: Mandibular cuttings from lateral head films of 135 Class I or Class II subjects were surveyed twice by nine observers. Ninety-five subjects exhibited a large (ML/NSL >38°) and 40 a small (ML/NSL <26°) mandibular plane angle. Using the structural signs of mandibular growth rotation proposed by Björk (1969), the observers had to categorize the subjects as having either a high- or low-angle skeletofacial morphology.
RESULTS: In 14 per cent (n = 13) of the 95 subjects with a large ML/NSL angle the skeletofacial hyperdivergency was recognized in all registrations, while in 19 per cent (n = 18) the hyperdivergency was identified in less than half of the registrations. In 63 per cent (n = 25) of the 40 subjects with a small ML/NSL angle the skeletofacial hypodivergency was recognized in all registrations, while in only 2.5 per cent (n = l) the hypodivergency was identified in less than half of the registrations.
CONCLUSION: It is difficult to predict the mandibular growth pattern with Björk's structural method. However, skeletofacial hypodivergency was recognized more easily than hyperdivergency.

Björk A 1969 Prediction of mandibular growth rotation. American Journal of Orthodontics 55: 585–599

273 DISORDERS IN ANTERIOR BOLTON RATIO IN CLASS II MALOCCLUSION

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AIM: Assessment of Bolton ratio values in Class II division 1 and 2 patients.
SUBJECTS AND METHOD: Anterior Bolton ratio was calculated in 84 Class II division 1 patients and 50 Class II division 2 patients. The measurements were made on study casts.
RESULTS: In 62 (74%) Class II division 1 patients larger mandibular teeth were found. In 25 patients (28.5%) the difference was equal to or greater than 1.5 mm. Larger maxillary teeth were found in 15 patients (18%). Only in six patients (8%) was the ratio normal. In 26 (52%) of the Class II division 2 subjects the teeth were larger in the mandible. In 10 of the patients (20%) the difference was equal to or greater than 1.5 mm. In 21 patients (42%) larger maxillary teeth were found. The ratio was normal only in three patients (6%). In four patients with larger mandibular teeth the difference was equal to or greater than 2.5 mm and was accompanied by small lateral incisors.
CONCLUSIONS: 1. Disorders in the anterior ratio according to Bolton were observed in most Class II patients. 2. In most of the subjects the mandibular teeth were relatively larger. 3. Bolton ratio values indicating a relative excess of dental material in the mandible equal to or greater than 2.5 mm was caused by small upper lateral incisors. 4. This problem requires further investigation.

274 EFFECTIVENESS OF TWO CHLORHEXIDINE PREPARATIONS IN CLEFT LIP AND PALATE PATIENTS—A 1 YEAR TRIAL

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AIM: Patients with cleft lip and palate (CLP) often receive orthodontic treatment with fixed appliances for many years. Even though they are frequently seen by an orthodontist, the risk of developing caries is very high. Chlorhexidine (CHX) has been shown to reduce the caries risk. The aim of this study was to compare the caries preventive effect of two different CHX preparations.
SUBJECTS AND METHODS: Seventy-two CLP-patients with fixed appliances randomly allocated to two groups. All patients received professional tooth cleaning every 4 weeks. Group A received a CHX gel (Corsodyl) treatment for three periods of 5 minutes, while those in group B received a CHX varnish (EC40, Biodent BV) treatment every 3 months. After 4, 8, 16, 20, 28, 32, and 40 weeks fluoride varnish (Fluoridin, Voco) was applied to all teeth in both groups. Of all patients the total salivary counts of *mutans streptococci* and lactobacilli were determined with CRT tests (Vivadent) at the beginning and 4, 8, 12, 16, 24, 36, and 52 weeks to evaluate differences in the effectiveness of reducing salivary bacteria. Besides the DMFT/S-index, the white-spot-lesion-index were recorded and the KaVo Diagnodent device was used to compare the frequency of subclinical enamel lesions with EC40 and Corsodyl.
RESULTS: The recorded indices and the CRT tests: approximately 80 per cent of the patients belonged to the streptococci and lactobacilli CFU Class 3–4, confirming the high caries risk in CLP patients.

275 EFFICIENCY OF MANDIBULAR ANCHORAGE IN HERBST TREATMENT

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AIM: To analyse the efficiency of three mandibular anchorage forms in Herbst treatment of Class II division 1 and Class II division 2 malocclusions.
SUBJECTS AND METHODS: Sixteen Class II division 1 patients with premolar anchorage, 19 Class II division 2 subjects with premolar-molar anchorage and 34 Class II division 1 and 18 Class II division 2 subjects with a casted splint anchorage were scrutinized.

Lateral head films pre- and post-treatment and 2 and 4 years post-treatment were analysed. The amount of lower anterior tooth proclination as well as anterior movement of the lower molars during treatment was used as a measure of anchorage loss.
RESULTS: During the treatment period a pronounced anchorage loss was found for all anchorage forms: both proclination of the lower anterior teeth and anterior movement of the lower molars. The casted splint anchorage was comparable with the two banded anchorage forms. When comparing the casted splint anchorage in the Class II division 1 and Class II division 2 subjects no differences were found between the two malocclusions. After Herbst treatment, relapsing tooth movements (incisors and molars) were found for all anchorage forms.
CONCLUSION: None of the three mandibular anchorage forms used in Herbst treatment could prevent anchorage loss. Against expectation, the casted splint anchorage was not superior to the two banded anchorage forms.

276 PATIENTS' EXPERIENCES OF UNDERGOING COMBINED ORTHODONTIC-ORTHOGNATHIC TREATMENT

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AIM: It is well recognised that if patients are well-informed about what to expect during treatment then they are more likely to be satisfied with the results achieved. Much of the information that they are given however, is based on issues of importance to the clinicians rather than focussing on the concerns of the patients themselves. The aim of this research was to use a patient-centred measure to evaluate patient perception of the delivery and outcome of orthodontic/orthognathic surgical treatment in the southwest region of the United Kingdom.
SUBJECTS AND METHOD: Patients who underwent orthognathic surgery in the period 1.1.1995 to 30.9.2001 were surveyed about the delivery and outcome of treatment using a postal questionnaire. The questionnaire was based on issues of importance to patients identified from a previous qualitative study.
RESULTS: Thirty hundred and thirty (61%) patients returned the questionnaire. Although most participants (n = 285, 87%) felt that they were well-informed about what to expect during treatment, 119 (40%) reported that they wore braces for longer than anticipated. A significant proportion of subjects reported that pain (n = 107, 33%), swelling (n = 168, 52%) and/or difficulty in eating (n = 148, 47%) experienced following surgery were greater than expected. Participants were surprised at how long these problems persisted and at the time taken to recover. Most participants (n = 326, 99%) felt they had benefited from treatment. The main benefits were improved appearance (n = 282, 86%) and increased self-confidence (n = 265, 81%). Over half (n = 182, 56%) reported that they had residual problems, including difficulty in eating, numbness and dental pain, following their treatment.
CONCLUSION: Although patients undergoing orthognathic surgery feel well informed about their treatment they need more information about what to expect in the period following surgery. They also need more realistic guidelines about the overall length of treatment and the time needed to recover from their treatment.

277 A RETROSPECTIVE STUDY TO ASSESS THE QUALITY OF LATERAL CEPHALOGRAMS

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AIM: To investigate the technical errors in the production of lateral cephalograms necessitating a retake. The radiographic points most susceptible to error were examined to determine if predictive factors could be identified that would lead to poor landmark identification on lateral cephalograms.
MATERIALS AND METHODS: All new patients attending the department between March 2002 and September 2002 were identified. A 50 per cent random sample was taken and all lateral cephalograms retrieved. The overall quality of the radiographs was examined and scored using a defined proforma.
RESULTS: Thirty-two lateral cephalograms were examined. In 12.5 per cent of the lateral cephalograms there were technical errors requiring a retake. The main cause for rejection was due to poor head positioning. The most common unidentifiable soft tissue point was soft tissue menton (34%). The external auditory meatus was the most difficult hard tissue point to identify (19%).
CONCLUSION: The incidence of rejected lateral cephalograms is similar to other studies (13.75%; Ortendahl *et al*., 1994), the patient's posture being the main reason for a retake. Lack of soft tissue contour was due to under-exposure of films and the external auditory meatus appeared blurred. The age of the patient and type of malocclusion were analysed with respect to the rejected lateral cephalograms. There were no predictive factors that could be identified which might contribute to a poor quality cephalogram.

278 BITE-JUMPING IN ADULTS—A MORPHOLOGICAL STUDY

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AIM: To determine mandibular morphology before, during and after bite-jumping in a non-growing species.
MATERIALS AND METHOD: Fifty-two adult 120-day-old female Sprague-Dawley rats divided into four experimental groups and four control groups. The experimental groups were fitted with fixed bite-jumping devices that protruded the mandible (4 mm). The animals were sacrificed on day 3, 14, 30 and 60. The right halves of the mandible were harvested and freed of soft tissue. Digital pictures were obtained in a standardized manner. Selected linear and angular measurements were made.
RESULTS: There was no morphological difference between the controls and the experimental group on days 3 and 14. Mandibular length had increased significantly on day 30 and remained increased on day 60. The angulation of the condyle was significantly affected, due to increased opposition of bone in the middle and posterior parts of the condyle.
CONCLUSION: Bite-jumping of the mandible in adult rats affects the size and angulation of the condyle due to differential apposition of bone.

279 FORWARD MANDIBULAR POSITIONING ENHANCES GROWTH IN ADULT RATS

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AIM: To quantitatively assess adaptive changes in the condyles of adult rats to forward mandibular positioning by: quantifying the level of Type II and X collagens expressed in the condyles of adult rats; comparing their level of expression to that formed in response to forward mandibular positioning; correlating their levels of expression to the amount of bone formed in response to mandibular advancement and comparing the gross morphological changes in the condyles to those occurring as a result of mandibular forward positioning.
MATERIALS AND METHODS: Seventy-eight 120-day-old female Sprague-Dawley rats randomly allotted to six groups. Each group consisted of nine rats with bite-jumping devices and four untreated

controls. The animals in each group were sacrificed on days 3, 7, 14, 21, 30 and 60, respectively. Half of the mandibles were taken for immunocytochemical assessment and the other half for gross morphological assessment. Immunostaining was used for the detection of types II and X collagen, while Alcian blue-PAS was used to observe the extra cellular matrix and new bone formation.
RESULTS: New cartilage was formed in the posterior condyle. The highest levels of expression of types II and X collagen were present on day 21, the amount of increase was 248 and 540 per cent, respectively. The highest level of new bone formation was measured on day 30 of advancement and the amount of increase of new bone formation was 319 per cent. Measurements of the mandible revealed an increase in condylar length and change of direction of growth.
CONCLUSION: Forward mandibular positioning causes changes in the biophysical environment in the temporomandibular joints of adult rats that leads to condylar growth.

280 ARCH CIRCUMFERENCE REQUIREMENTS DUE TO THE CURVE OF SPEE IN THREE DIMENSIONS

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AIM: To evaluate and quantify arch circumference requirements due to levelling of the curve of Spee.
MATERIAL AND METHOD: Twenty-three sets of pre-treatment mandibular study models were digitized using a commercially available surface laser scanner. Using custom-developed software, various landmarks were identified on these three-dimensional images to generate individualized arch forms. The algorithm subsequently defined the simultaneous reduction in arch circumference as the curve of Spee was levelled.
RESULTS: Descriptive statistics indicated that an average of 0.47 ± 0.04 mm was required for levelling each millimetre of the curve of Spee. Analysis suggested that this relationship was non-linear in nature with a greater amount of arch circumference needed for levelling a deeper curve of Spee and *vice versa*. This relationship was not influenced by the degree of crowding. Further analysis demonstrated that significant differences existed between different modalities of levelling. True intrusion consumed a significantly greater arch circumference compared with extrusion or relative intrusion. The absolute value (0.07 ± 0.06 mm) was, however, too small to be clinically significant.

281 PREVALENCE OF HYPO- AND HYPERDONTIA IN WHITE CAUCASIAN AND PAKISTANI CHILDREN

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AIM: To investigate the clinical impression that congenitally missing teeth are less common in children of Pakistani origin than in white Caucasians.
MATERIAL AND METHOD: The records of 3000 consecutive patients who attended for orthodontic assessment were examined. The percentages were: 75.8 white Caucasian, 22.3 Pakistani origin and 1.9 of other or mixed race. The mixed race group was eliminated from the study sample in view of the small number. The occurrence of permanent tooth hypodontia, excluding third molars, and supernumerary teeth was determined from an audit record kept for all referred patients.
RESULTS: Two hundred and forty nine patients (8.4%) from the study group had one or more adult teeth congenitally missing. Hypodontia was present in 9.2 per cent of the Caucasians but only in 5.2 per cent of the Pakistanis. This was statistically significant ($P = 0.001$). However there was a statistically significant increase in the Pakistani group for missing lower lateral and central incisors. Supernumerary teeth were present in 1.1 per cent of Caucasians and 1.6 per cent of Pakistanis.
CONCLUSIONS: There was no statistically significant difference in the prevalence of hyperdontia between the Caucasian and Pakistani patients, the occurrence of hypodontia was less in the Pakistanis except in relation to missing lower incisors, which were more common in this group.

282 AGENESIS OF SECOND LOWER PREMOLAR(S): PERTINENT FACTORS FOR TREATMENT PLANNING

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AIM: To determine the influence of pertinent recorded factors on extraction/non-extraction treatment planning decisions in subjects with agenesis of the second lower premolar(s).
SUBJECTS AND METHOD: Thirty nine patients with agenesis of lower second premolar(s): 21 patients underwent extraction treatment (4 premolars) with space closure, 18 patients were treated without extraction in the lower dental arch and second primary molar(s) or space in lower dental arch were preserved. Pertinent factors with possible influence on the treatment plan decision were evaluated on plaster casts and radiographs: first molar relationship, skeletal jaw relationship (ANB and Wits), position of lower incisors to APo line, jaw growth pattern, mandibular space available (discrepancy and irregularity index), condition of lower second primary molars (infraocclusion, crown destruction, root resorption) and presence and condition of lower third molars. Chi-square statistics were used for all evaluated factors, and Mann-Whitney test for discrepancy and two-sample *t*-test for the irregularity index.
RESULTS: The only statistically significant ($P < 0.01$) factors influencing treatment decisions regarding an extraction/non-extraction approach were the amount of discrepancy in the lower dental arch and the irregularity index. There were statistically non-significant tendencies observed for growth pattern and first molar relationship. No influence of local factors was found.
CONCLUSION: Available mandibular space seems to be critical factor in extraction/non-extraction treatment plan decisions in cases of agenesis of second lower premolars(s).