ABSTRACTS

OF POSTERS

(The oral presentations and posters in English from Topic 3 submitted to the German Orthodontic Society will be published in a future issue of the Journal)

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1 OCCLUSAL TRAITS IN A GROUP OF NINE-YEAR-OLD FRENCH CHILDREN

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AIMS: The occlusal characteristics of the dentition were investigated in a group of 314 nine-year-old children (146 females, 168 males) taken at random from various primary schools in Strasbourg (France). Recording of the occlusal traits was made according to the method described by the Fédération Dentaire Internationale in 1973, adapted to the mixed dentition. Assessment of the anteroposterior relationships of the lateral segments was made using the canines as reference (Ravn, 1975).
RESULTS: Spacing or crowding (1–5 mm) was seen in the upper arch in 22.5 and 13.6 per cent of the cases respectively, and in the lower arch in 9.9 and 12.3 per cent respectively. There was no sex difference. Bilateral Class II (canine relationships) existed in 25.1 and 26.1 per cent for the boys and girls respectively. There was no sex difference. Class III was seen in 1.3 per cent of the males and 4.7 per cent of the females. The mean overjet in the study group was 3.2 mm (SD = 1.7) and was similar in boys and girls. In 9.7 per cent of the population the overjet exceeded 6 mm. The mean overbite was 3 mm (SD = 1.8) and was more important in males ($P < 0.05$); edge to edge relationships or open bites were seen in 6.4 per cent of the children. Lateral crossbites characterised 6.2 per cent of the right permanent molars and 5.6 per cent of the left permanent molars; there was no difference with sex.
CONCLUSIONS: In comparison with epidemiological data in the temporary dentition from children of the same area (Tschill *et al*., 1997), a decrease in the prevalence of open bites and crossbites could be seen with maturation.

Fédération Dentaire Internationale 1973 Commission on classification and statistics for oral conditions: a method for measuring occlusal traits. International Dental Journal 23: 530–537

Ravn J 1975 Occlusion of the primary dentition in 3-year-old children. Scandinavian Journal of Dental Research 83: 123–130

Tschill P, Bacon W, Sonko A 1997 Malocclusion in the deciduous dentition of Caucasian children. European Journal of Orthodontics 19: 361–367

2 CHANGES IN BITE HEIGHT DURING THE CLASS II DIVISION 1 BIONATOR THERAPY

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AIM: The bite or denture height is one of the most important aspects to be considered in the treatment of patients with a Class II division 1 malocclusion. To evaluate the changes and the stability of bite height during Bionator therapy this retrospective study was performed.
MATERIALS AND METHOD: Cephalometric lateral films obtained immediately before and after Bionator therapy of 30 consecutively treated patients. All radiographs were taken using the same equipment. Evaluation of the vertical bite height was carried out using the analyses of Sergl and Ricketts.
RESULTS: The values of the measured parameters before and after treatment demonstrated a considerable increase in bite height with this type of therapy. There was, however, no change in the inclination of the palatal plane to the Ba-Na plane. A Student's *t*-test showed highly significant scores.
CONCLUSION: The results show that an increase in bite height in the treatment of subjects with a Class II division 1 malocclusion with Bionator therapy, is a significant factor to be considered.

3 SHAPE-COORDINATE ANALYSIS OF MANDIBULAR GROWTH IN UNTREATED CLASS III MALOCCLUSIONS

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AIM: To analyse mandibular skeletal modifications in a group of subjects with untreated Class III malocclusions due to mandibular protrusion by means of longitudinal non-conventional cephalometry (shape-coordinate and tensor analysis according to Bookstein) in the early developmental ages.
SUBJECTS AND METHODS: Thirty subjects (13 males, 17 females), with untreated Class III malocclusions, selected from the files of the Department of Orthodontics, University of Florence. The mean age at the time of first observation was 6.06 ± 1.14 years, and for the second observation 8.45 ± 1.79 years. The mean observation period was 2.39 ± 1.28 years. Lateral cephalograms of all the subjects were taken at the time of the first and second observations. Mandibular skeletal changes during the observation period were evaluated by means of Bookstein's shape-coordinate and tensor analysis applied to the mandibular cephalometric triangle, Co-Pg-Go.
RESULTS: Shape-coordinate analysis showed that the vector representing the mean shape change was orientated upward and backward in relation to the baseline Go-Pg in the examined sample. Tensor analysis showed the direction of greatest modification (4.4 per cent per year) and was approximately aligned with the side Co-Pg of the mandibular triangle, whereas the direction of least modification (0.2 per cent per year) was orientated along the line bisecting the gonial angle. The interpretation of these skeletal shape changes indicates that during growth, point Co is displaced in a backward direction along a line parallel to the side Go-Pg of the mandibular triangle.
CONCLUSIONS: A 'posterior morphogenetic rotation' of the mandible according to Lavergne and Gasson (1977) is evident in untreated Class III malocclusions. The untreated malocclusions were associated with a backward direction of condylar growth in all examined subjects, leading to increases in total mandibular length (Co-Pg). These increases during

growth are particularly unfavourable as they constantly worsen the maxillo-mandibular discrepancy in the sagittal plane. On the other hand, the association between untreated Class III malocclusions and posterior morphogenetic rotation of the mandible suggests that the direction of condylar growth has to be one of the targets of early therapeutic intervention, with the aim of obtaining a significant anterior morphogenetic rotation of the mandible.

4 CONGENITALLY MISSING TEETH, TOOTH ANOMALIES AND RELATED MALOCCLUSIONS. A GENETIC LINK?

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AIM: To examine any putative relationship between congenitally missing teeth or other tooth anomalies (canine impaction, transpositions, supernumerary) in subjects with Class II division 2 and Class III malocclusions.
SUBJECTS AND METHODS: Two hundred and sixty seven patients with Class II division 2, and 200 subjects with Class III malocclusions were selected using the strict criteria determined for this study. The percentage of various congenital tooth anomalies was calculated for each type of malocclusion.

RESULTS:	Class II division 2 (percentage)	Class III (percentage)
Agenesis 12, 22	13.86	4.5
Peg-shaped laterals	7.49	3.5
Impacted canines	33.54	9.02
Transpositions	1.12	0.5
Supernumeraries	0	3.5

CONCLUSIONS: This is the first published study directly associating different malocclusions to congenital anomalies of teeth. A direct comparison of the above results to published data of the general population reveals a strong relationship of the two malocclusions to congenital tooth anomalies, but of different types. The significance of these findings in relation to genetics will be presented.

5 RESPONSES TO MANDIBULAR PROTRUSION IN SUBJECTS WITH OBSTRUCTIVE SLEEP APNOEA

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AIM: To investigate the effect of mandibular protrusion on airway size and hyoid position in subjects with obstructive sleep apnoea (OSA).
SUBJECTS: Forty five male and 13 female Caucasian adults with mild or moderate OSA participated in this prospective study. In all subjects the diagnosis of OSA had been confirmed by polysomnography.
METHOD: Pairs of supine lateral skull radiographs were obtained: one with the mandible in the intercuspal position and the second with the lower jaw at maximum, comfortable protrusion. Films were traced and digitised to show skeletal, oral and pharyngeal measurements, and differences in mandibular position, hyoid location and airway dimensions between the film pairs, were calculated. Males and females were examined separately and all measurements were corrected for magnification. Correlations were sought (for males only due to the small number of females) between the changes in hyoid and airway parameters and the initial and differential radiographic measurements.
RESULTS: Despite their smaller faces, females frequently showed larger responses than males. Mean protrusion of 5.3 mm in males and 6.4 mm in females was accompanied by 6.5 mm of mandibular opening in each group. Highly significant increases in tongue space were found. Improvements in oro-pharyngeal area and in its narrowest dimensions behind the soft palate and tongue were numerically small and generally statistically insignificant. In percentage terms these matched or bettered the amount of mandibular protrusion. Movement of the hyoid showed extreme inter-subject variability, both in amount and direction. With respect to the mandible, significant vertical and horizontal movements were seen ($P < 0.01$). No initial cephalometric features could be identified which might suggest a favourable response of the airway to mandibular protrusion. Larger increments of hyoid movement seemed to be associated with an improved airway response, but the correlations were weak.
CONCLUSIONS: 1) Increases in oro-pharyngeal air space in response to mandibular protrusion can be demonstrated by lateral skull radiographs taken in the supine position. 2) The behaviour of the hyoid varies widely during this manoeuvre. Further work to determine the relevance of these findings to the outcome of treatment with mandibular advancement devices in OSA subjects, would seem to be indicated.

6 ALTERATION OF MAGNETIC RESONANCE TOMOGRAPHY SEQUENCES BY ORTHODONTIC APPLIANCES *IN VITRO*

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AIMS: Magnetic Resonance (MR) imaging is used increasingly as a diagnostic tool in the head and neck regions because of its favourable soft tissue depiction. Orthodontic appliances may alter the MR images since they consist of stainless steel or other alloys which interfere with the magnetic fields and radio frequency pulses. Various orthodontic wires and devices (quadhelix, molar band, lip bumper, palatal bar, ceramic and metal brackets) were embedded within gelatine and imaged in a routine 1.0 Tesla MR machine (Philips Gyroscan NT 10) in two planes with conventional T1 and T2 spin-echo sequences, turbo spin-echo,

and gradient-echo sequences. The original size of the devices was compared with their size on the MR images calculating size ratios.
RESULTS: As a result of their ferromagnetic components, quadhelix, molar band, lip bumper, as well as round and wave wire, were severely dislocated along the magnetic field. In addition, with all sequences, they resulted in broad image artefacts (size ratio up to 7.3) and distortion of the adjacent image regions. Image artefacts were depicted as black elliptic or tubular regions (signal drop out) with high signal intensity margins. At the end of the wires the artefacts were amplified. Only the ceramic brackets showed no alteration of the MR images with size ratios near to 1.0. There was no evidence of dislocation.
CONCLUSIONS: Most of the orthodontic appliances resulted in heavy MR image artefacts reducing the diagnostic value of the images of all MR sequences. Failure to fix ferromagnetic wires or apparatuses properly carries the risk of adverse effects.

7 COMPARISON OF CLINICAL FAILURE RATES FOR TWO ORTHODONTIC BONDING AGENTS

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AIMS: Comparison of (1) clinical failure rates of brackets bonded directly using a tri-cure resin-modified glass ionomer, Fuji II (Ortho) LC, GC International Corporation, Tokyo, Japan) and a chemically-cured composite resin (Retain, 3M Unitek, 3M Dental Products, Monrovia, USA) during the first six months of fixed appliance therapy, and (2) the time required for direct bonding of an arch of eight teeth using each agent.
SUBJECTS AND METHOD: The subjects were consecutive cases treated at Falkirk and District Royal Infirmary. In 31 subjects 387 brackets were bonded using Fuji II (Ortho) LC, and in 32 subjects 418 brackets were bonded using Retain. Teeth bonded using Fuji II (Ortho) LC were not dried or acid etched prior to bonding. Bond failure data were collected retrospectively. The time required to bond 10 arches from the end of prophylaxis to the start of archwire placement was recorded for each agent.
RESULTS: The total bond failure rate was 9.3 per cent for Retain and 9.8 per cent for Fuji II (Ortho) LC. The difference was not statistically significant. The average time to bond a single arch of eight teeth with Fuji II (Ortho) LC was 65 seconds less than with Retain. This difference was statistically significant ($P < 0.001$, Mann-Whitney U test).
CONCLUSIONS: Fuji II (Ortho) LC compared favourably with Retain in its clinical bond failure rate during the first six months of fixed appliance treatment in the sample studied. The time saved using Fuji II (Ortho) LC was not considered to be clinically statistically significant.

8 COMPARISON OF COPPER NiTi AND NITINOL ARCHWIRES IN INITIAL ALIGNMENT

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AIMS: A 0.019 × 0.025 inch Copper NiTi (Ormco) and a 0.014 inch Nitinol (Orthocare) archwire were compared with regard to their clinical effectiveness during initial alignment.
SUBJECTS AND METHOD: Forty new patients attending for the placement of a fixed appliance were randomly allocated one of these two initial archwires, for use in the upper arch. Alginate impressions of the maxillary arch were taken and cast prior to archwire placement, and also at the subsequent attendance 6–7 weeks later. A travelling microscope was used to measure the study casts. The irregularity index (Little, 1975) and the radial tooth distance score, which assessed tooth position with respect to the palatal rugae, were used to determine changes in alignment in the upper labial segment over the observation period.
RESULTS: The mean change in the irregularity index over the observation period for the Copper NiTi and Nitinol groups was 3.54 mm and 4.33 mm, respectively. The mean change in radial tooth distance score for the Copper NiTi and Nitinol groups was 10.8 mm and 10.4 mm, respectively. No statistically significant difference (uncorrelated *t*-test) was detected in the change in alignment observed in the two groups when assessed by either of the two methods.
CONCLUSIONS: Both archwires were found to be equally effective during initial alignment and thus a more rapid progression to a rectangular stainless steel working archwire may be supposed for the Copper NiTi group.

Little R M 1975 The Irregularity Index; A quantitative score of mandibular anterior alignment. American Journal of Orthodontics 68: 554–563

9 FREQUENCY AND CAUSE OF BRACKET LOSS IN THE DIRECT BONDING TECHNIQUE

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AIM: Unfortunately some attachments come off during orthodontic treatment with a multibracket appliance. The aim of this investigation was to establish the causes and frequency of bracket loss in the direct bonding technique.
MATERIALS AND METHOD: The records of 300 patients treated with multibracket appliances from 1985 to 1995 were checked. The obtained data were evaluated and analysed with the statistical software SPSS (Version 7.5) with regard to different parameters including age, sex, vertical structure of the viscerocranium, type and location of tooth, oral hygiene, etc.
RESULTS: For the 4961 bonded attachments the overall failure rate was 17.9 per cent, with just over two-thirds of the patients having at least one failure. There were differences

between the upper and lower jaw and between separate parts of the jaws respectively. In addition the patient's age and oral hygiene status, the condition of the adjacent mesio-distal neighbouring teeth (extracted, without an attachment, banded or bonded) had an influence on the failure rate. In this study no correlation between the vertical growth of the viscerocranium and the frequency of bracket failure could be distinguished.
CONCLUSIONS: The results indicate that bracket failure is a multifactorial event, on which the above-mentioned factors have an influence. The increased frequency of failure at certain teeth demonstrates a need for increasing the bond strength at these sites by modifying the bracket base in size, form, or surface condition.

10 INFLUENCE ON SHEAR BOND STRENGTH OF ADJUSTING THE BRACKET POSITION IN DIRECT BONDING

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AIMS: A problem in treatment with a multibracket appliance is the possibility of unwanted bracket loss. Although only a slight difference in shear bond strength between light- and self-cured resin has been found in *in vitro* experiments, the clinical situation gives the impression that brackets bonded with light-cured resin have a lower failure rate than self-cured bonded brackets. The aim of this investigation was to investigate whether adjusting a bracket after a certain period of time had an influence on the shear bond strength.
MATERIAL AND METHOD: Brackets were positioned on 390 embedded human anterior teeth with either light- or self-curing resin. The adjusting procedure was then simulated by shifting (0.5, l or 1.5 mm), or turning (5, 10, or 15 degrees) the attachment after a certain amount of time (10, 20 or 30 seconds). A combination of turning and shifting movements were also tested. The shear bond strength was measured with a Zwick testing machine. The obtained data were evaluated and statistically analysed.
RESULTS AND CONCLUSION: A significant difference between light- and self-curing resin was found. It was particularly notable that an adjusting procedure after 30 seconds in the self-cured resin group sometimes led to spontaneous bond failure, whereas in the group with light-cured bonding there was no similar occurrence. The results indicate that light-curing resin allows more adjusting time for precise bracket positioning.

11 RECYCLING EFFECTS ON CERAMIC BRACKETS: A SHEAR BOND STRENGTH ANALYSIS

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AIM: To evaluate the shear bond strengths of recycled ceramic brackets in comparison with new ones after one, five and ten recycling processes.
MATERIALS AND METHOD: Sixty premolar ceramic brackets (Transcend 2000, 3M/Unitek) were bonded to 60 human freshly extracted premolars and subsequently stored in normal saline at 4°C. Each tooth was embedded in an acrylic block with its buccal surface exposed. After pumicing, the enamel was rinsed, etched with 37 per cent phosphoric acid for 60 seconds, rinsed with water for 30 seconds and subsequently dried for 20 seconds. The brackets were then bonded using a light-cured resin (Transbond, 3M/Unitek). Each bracket was exposed to a light-curing unit (Heliomat H2, Vivadent) with a 20 second burst to each of the mesial, distal, incisal and gingival margins. After bonding, the brackets were stored in normal saline at 37°C for 15 minutes and subsequently tested in a shear mode with an Instron machine according to the draft of ISO specification TC 106/SC2/WG16. The shear bond strengths of only 20 new brackets randomly selected were recorded in order to compare groups with the same number of brackets. After debonding, the brackets were divided into three subgroups of 20 units each: the groups were recycled for one, five and ten cycles, respectively. The brackets to be recycled were washed in a non-acid solution (Alpident Co.) and then dried. The adhesive burn-off was then carried out at 350°C for 24 hours. The remaining inorganic filler was removed by washing the brackets twice in the non-acid solution. An ultrasonic polishing of the cleaned brackets was performed for 20 seconds. The recycled brackets were rebonded to 60 freshly extracted human premolars and stored in normal saline at 37°C for 15 minutes before shear testing according to the above method. The shear bond strength of each specimen was recorded. The bracket bases and the surfaces were examined under a light stereomicroscope (×20) to determine the site of bond failure. Statistical analysis was performed by means of analysis of variance (ANOVA), followed by a multiple comparison analysis when a statistically significant value was obtained.
RESULTS:

Sample	N	Mean (MPa)	S.D.	Range
New	20	15.5	1.2	12.6–17.8
One recycling process	20	11.2	1.0	9.2–13.1
Five recycling processes	20	10.1	0.8	8.3–11.8
Ten recycling processes	20	10	0.9	8.2–11.8

CONCLUSIONS: The shear bond strengths of recycled ceramic brackets are clinically adequate, although significantly lower ($P < 0.001$) than those of new brackets. Recycled brackets fail mostly at the bracket/adhesive interface, without causing any enamel damage.

12 AN EVALUATION OF BOLTON'S RATIO IN SKELETAL CLASS II PATIENTS

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AIMS: The purpose of this study was to evaluate the correlation between tooth and jaw size using Bolton's

analysis, and the possible effects on achieving an acceptable occlusal relationship at the end of orthodontic treatment.
SUBJECTS AND METHOD: One hundred patients with skeletal Class II relationships were selected. The criteria for case selection was based on large maxillae and short mandibles. The angles SNA, SNB, ANB, IMPA, FMA, 1-SN, GoGn-SN and the inter-incisal angle were considered for case selection. Patients with jaw rotation (Class I rotated to Class II), caries or restored teeth and interproximal wear, were excluded from this study. Bolton's ideal ratios were selected as the control group. A digital calliper with an accuracy of 0.1 mm was used for tooth measurement on dental casts.
RESULTS: The following results were obtained and the *Z*-test was used for assessment of results.

A. The anterior ratio was 78.31 (SD = 3.34) which, in comparison with the control group, showed no relationship between tooth and jaw size.
B. The overall ratio was 91.01 (SD = 2.44) which, in contrast to the control group, showed correlation between tooth size and growth enlargement of the maxillary and mandibular bases.

CONCLUSIONS: It can, therefore, be considered that anterior ratio can influence the amount of overjet before treatment and also interfere with achieving an ideal occlusion and acceptable overjet after orthodontic treatment (significant). However if the sizes of the teeth in the maxillary and mandibular arches are in co-ordination it is possible to achieve an acceptable occlusion without considering the jaw size (non-significant).

13 ARCH DIMENSIONS IN AN ADULT SAMPLE WITH IDEAL OCCLUSION

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AIM: To assess the dimensions of maxillary and mandibular arches in a group of untreated subjects with ideal occlusion in order to establish an ideal arch size, after checking for sexual dimorphism.
SUBJECTS AND METHODS: From an initial sample of 198 untreated subjects, a group of 52 young adults (28 females, 24 males) with a mean age 26 years 3 months ± 2 years 5 months, was selected on the basis of the following criteria: Caucasian race (Italian ancestry), presence of full permanent dentition including the second molars, Angle Class I molar and canine relationships, normal overbite and overjet, absence of midline deviation, little or no incisor crowding or spacing (<2 mm), absence of tooth agenesis, tooth rotations or supernumeraries. Dental cast analysis, according to Bishara and co-workers, was performed in order to assess arch dimensions (intra-arch lengths and arch width at five different levels). All the measurements were carried out with a dial calliper to the nearest 0.01 mm. The method error, calculated using Dahlberg's formula on 30 repeated measurements, was 0.16 mm. Sexual dimorphism in arch size measurements was tested by means of a Student's *t*-test. With the aid of computer software (Microsoftware Draw) the mean 'ideal' maxillary and mandibular arches according to the results of the study were determined.
RESULTS: All measurements for arch length and width presented with a significant sexual dimorphism ($P < 0.05$ to $P < 0.001$). Arch dimensions both in the maxilla and the mandible were significantly larger in male subjects. Mean 'ideal' arches were computer-generated for young adult males and females.
CONCLUSIONS: Arch length and width are significantly influenced by sex differences in adult subjects. The 'ideal' dimensions of the dental arches in the permanent dentition should therefore be considered separately in the two sexes.

13 FUNCTIONAL OCCLUSION IN POST-ORTHODONTIC PATIENTS

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AIMS: To assess changes in the functional occlusal relationships of post-orthodontic patients over time.
SUBJECTS: The functional occlusal relationships of 37 subjects who had undergone fixed appliance therapy were assessed one week following removal of the appliances. Seventeen of the same individuals were reassessed between twelve and eighteen months later.
METHODS: Features of the functional occlusion were recorded from study casts of each subject mounted on a semi-adjustable articulator. Occlusal contacts in the retruded and lateral positions were detected by direct vision and with articulating paper.
RESULTS: At debond the majority (65 per cent) of subjects had a unilateral contact on initial closure in the retruded axis position. At 1.5 mm of lateral movement to the right, 5 per cent of subjects had canine guidance on the working side, 16 per cent had group function, and 51 per cent had non-working side contacts. When the lateral movement increased to 3.0 mm, 73 per cent of subjects had canine guidance, 3 per cent had group function, and 43 per cent had non-working side contacts. A similar pattern was seen with lateral movements to the left. In terms of the slide between the retruded axis position and the intercuspal position, 16 per cent of the subjects had a slide of >2 mm in an antero-posterior direction, 5 per cent had a slide of >2 mm in a vertical direction, and 22 per cent had a slide of >0.5 mm in a lateral direction. One year later functional occlusal relationships had altered, with a trend towards an increased numbers of subjects with group function and a reduction in the number of subjects with large slides between the retruded axis and intercuspal positions.
CONCLUSIONS: Functional occlusal relationships alter following the removal of appliances and this finding has implications in the 'finishing' of orthodontic cases.

15 DEFORMATION CHARACTERISTICS OF DIFFERENT CANTILEVER CONFIGURATIONS

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AIM: To study the effect of the configuration of a cantilever on its deformation pattern.
MATERIALS AND METHODS: Four different cantilever configurations (tip-back bend, utility shaped, curved, and with a helix) in both round wire (0.018 inch) and rectangular wire (0.017×0.025 inch) were analysed using Finite Element Analysis. The locations of the two end-points of the cantilevers, boundary conditions, material properties (ß-Ti) and external loading (bending by a vertical load of 20 up to 100 cN in increments of 20 cN) were equal in all analyses in order to obtain comparable results. The analyses were performed in non-linear mode with the so-called large displacement option active.
RESULTS: The round wires were more flexible than the rectangular wires: the deformation patterns for all configurations in round wire at 50 cN were the same as those in rectangular wire at 100 cN. For most of the deformation characteristics (total, horizontal, vertical and angular displacement) the cantilever with the helix bend showed the largest values. However, for higher loads, the curved cantilever had the largest horizontal displacement. The smallest deformations were found in the case of tip-back bends. Utility shaped cantilevers and those with helices showed the smallest maximal horizontal displacements at medium loads; increasing the load further led to a decrease of the horizontal displacement and it became even inverted at high loads.
CONCLUSIONS: When analysing the influence of material and configuration on the deformation of cantilevers, a round 0.018 inch wire is twice as flexible as a rectangular 0.017×0.025 inch wire. The type of configuration determines force/deformation behaviour of the cantilever. Adding length to the wire by creating a special configuration leads, in general, to higher flexibility, yet the relative vertical and horizontal components of the displacement under loading are very dependent on the configuration type and should thus be considered in clinical practice.

16 DENTAL ANATOMY AND ITS IMPLICATIONS ON THE RETENTION ABILITY OF CLASPS

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AIM: In deciduous and erupting permanent teeth there are often problems with fixation of removable orthodontic appliances, due to a lack of undercuts and missing retentive areas. This study was intended to examine retentive forces of orthodontic clasps with respect to different angulations of their dental insertion area.
MATERIAL AND METHOD: The tested clasps were made of Remanium® hard wire with a diameter of 0.7 mm. According to their number of branches and their localisation of insertion, they were divided into 3 groups. Together they consisted of eleven basic types of clasps. The testing device consisted of tooth models of 10 mm width. The angulation of the external surface of these tooth models could be altered between –30 and +30 degrees at intervals of 5 degrees The clasps, embedded in a standardised plastic base (Paladur®), were dislodged by means of a Universal Testing Machine (Zwick Company). The measurement of each clasp retention under each angulation parameter was performed 5 times. The results were statistically analysed by means of Wilcoxon tests.
RESULTS: Conical tooth surface configuration of less than –15 degree angulation resulted in insufficient retention of all tested clasps. Between 15 and 0 degrees the best results were obtained with the loop clasp of Zimmer (7.28 ± 2.79 N) and the prick clasp (6.89 ± 2.72 N). In undercut insertion areas the universal clasp (12.27 ± 3.73 N) and the retention clasp by Stockfisch (12.70 ± 2.58 N) proved to be the most effective.
CONCLUSION: When using removable orthodontic appliances a thorough choice of adequate clasps can significantly improve fixation and, as a consequence, treatment success.

17 DO LATERAL CEPHALOGRAMS REVEAL THE STATE OF BONE GROWTH AND MATURATION?

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AIM: Lateral cephalograms are essential for orthodontic diagnosis and therefore available for assessment in nearly all patients. This study was intended to examine the value of lateral cephalograms in assessment of bone maturation and consequently the patient's growth.
MATERIAL AND METHOD: The lateral cephalograms of 505 patients (288 females, 217 males) between the ages of 5 and 20 years were analysed. Skeletal maturity was measured according to the criteria described by Farman and Hassel (CVM-Index), orientating by structural aspects of the second, third and fourth cervical vertebrae. This method indicates six stages of cervical bone development. The results were compared with 224 hand-wrist radiographs taken from the same patients on the same day as the lateral cephalograms. Björk's analysis criteria was applied in assessment of the various degrees of hand maturity.
RESULTS: There was no significant difference between the results of maturity assessment in the cervical vertebrae and the hand. The hand evaluation, comprising more stages of assessment, revealed the individual position in the growth diagram in greater detail. The methods were statistically similar for both genders.
CONCLUSION: Lateral cephalograms can validly be used for assessment of bone growth. The CVM Index proved to be a valid diagnostic aid, whenever hand radiographs are not available or not indicated for reasons of radiation protection.

18 ORAL CANDIDA SPECIES IN ADOLESCENTS WITH AND WITHOUT FIXED ORTHODONTIC APPLIANCES.

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AIMS: To investigate the presence and levels of oral Candida species in two groups of adolescents, one with fixed orthodontic appliances and a control group without appliances.
SUBJECTS AND METHODS: Two groups, each comprising 20 subjects, were selected for the investigation. The study group comprised adolescents wearing fixed orthodontic appliances for longer than three months. The control group was selected matching for age and sex and comprised adolescents without fixed orthodontic appliances. Specimens for microbial sampling were collected by asking each subject to rinse with 10 ml of sterile phosphate buffered saline (PBS) for 1 minute. Following collection, 1 ml of each sample was concentrated by centrifugation and resuspended in 0.1 ml PBS prior to plating on CHROMagar Candida™ agar medium. Plates were maintained at 37°C for 48 hours and Candida colonies were then counted. Colonies of individual Candida species were identified on the basis of characteristic colony colour and other mycological tests.
RESULTS: Candida-positive cultures were recovered from 30 per cent (n = 6) of the control group compared with 65 per cent (n = 13) of the group with fixed orthodontic appliances. The colony count for the study group (mean 43.9, range 0–215) was significantly higher than the control group (mean 15.4, range 0–192); however, all levels were relatively low and consistent with oral carriage. The range of species identified was narrow, including only *Candida albicans, Candida glabrata* and *Candida dubliniensis. C. dubliniensis* has only previously been reported in adults, most of whom were severely immunocompromised.
CONCLUSIONS: In this preliminary study, wearing of fixed orthodontic appliances in adolescence appears to be associated with a higher rate of carriage of oral Candida species. The levels of Candida were also higher in the study group than in the control group. *C. dubliniensis* was recovered from 5 subjects, including 4 subjects from the study group and one from the control group. This is the first report of the isolation of *C. dubliniensis* from non-adult individuals.

19 A RETROSPECTIVE STUDY OF SURGICAL PROTOCOL IN THE TREATMENT OF CRANIOFACIAL MICROSOMIA PATIENTS

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AIMS: The surgical protocol for the management of a group of unilateral craniofacial microsomia patients treated at Great Ormond Street Hospital for Children was studied. The aim of the study was to assess the effect of the surgical protocol on the final mandibular symmetry, and to determine the progression of the deformity in a group of untreated patients.
SUBJECTS AND METHOD: The sample consisted of 21 patients, divided into three groups (7 in each group). In group I, early surgical intervention had been undertaken. A second bimaxillary procedure may have been carried out when facial growth was complete in some patients. In group II surgical intervention had been delayed and a single corrective procedure had been undertaken. The patients in group III had not received any surgical intervention. The type of deformity, the affected side, and the nature and timing of the maxillofacial surgery was recorded for each patient. The orthopantomogram (OPT) of each patient prior to any mandibular surgery was used to assess the mandibular component of the OMENS Classification. Tracings of 123 OPTs were made. The ratio of mandibular ramus length of the affected to the unaffected side was measured on the OPT and used to assess mandibular symmetry as described by Kaban *et al.* (1981). All the initial OPTs of each patient prior to any surgery and the final OPTs available were selected to provide a representation of the changes that had occurred. The mean ages at the initial and final radiographic recordings were 9 years 4 months and 17 years 4 months, respectively. The mean follow-up periods for the patients were: Group I (8 years 4 months), Group II (7 years 10 months) and Group III (5 years 8 months). The Mann-Whitney U test was used to assess the differences between the surgical groups.
RESULTS: The results showed that there was a statistically significant difference between the two surgical groups. Group I patients achieved more final mandibular asymmetry than group II patients. In group I all seven patients showed an improvement in symmetry with surgery. In group II four patients also showed an improvement, while three patients had a progression of the asymmetry. In group II three patients showed slight improvement in symmetry, three a slight and one a moderate progression of asymmetry. In group III patients with milder mandibular hypoplasia there was little progression of the deformity.
CONCLUSIONS: Early surgical intervention, before skeletal maturity, results in a statistically significant improvement in mandibular rami symmetry. In the milder cases, mandibular classification type 1, the deformity was not as progressive as previous findings in the literature suggest. In more severe cases, mandibular classification type 2, the deformity appears to be more progressive.

Kaban L B, Mulliken J B, Murray J E 1981 Three dimensional approach to analysis and treatment of hemifacial microsomia. Cleft Palate Journal 18: 90–99.

20 PENETRATION DEPTH OF PHOSPHORIC ACID INTO ENAMEL DURING ETCHING *IN VITRO*

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AIMS: To assess the extent of penetration of phosphoric acid into enamel during acid etch procedures in relation to etching duration, repetition, and presence of the bonding resin.
MATERIAL AND METHODS: Enamel specimens were prepared by sectioning crowns of extracted sound teeth perpendicularly to the long axis of the tooth and covering the cut surfaces with wax. Groups of specimens were either etched with 37 per cent H_3PO_4, for 15, 30, 45, 60 or 120 seconds, etched twice for 60 seconds, or etched for 60 seconds and re-etched after application of a bonding resin. The specimens were examined under a confocal laser scanning microscope through the cut surfaces and the images obtained were subsequently evaluated using an image analyser to determine the depth and extent of superficial enamel removal and structural changes under the enamel surface. The results were tested for statistical significance using ANOVA and appropriate pairwise comparison procedures.
RESULTS: The amount of superficial enamel removal increased between 15 and 30 seconds ($P < 0.05$) and remained unchanged after longer etching periods. The extent of subsurface alterations was related to the length of acid exposure ($P < 0.05$) and increased after repetitive etching ($P < 0.05$). Superficial enamel removal was more extensive in specimens which were etched once as compared with the specimens etched twice, or those etched twice with the application of the bonding resin between the etching events ($P < 0.05$). It occurred, however, to a lower extent when the effect of dual etching was compared with that of dual etching combined with the application of the bonding resin ($P < 0.05$). No significant increase of the extent of subsurface alterations occurred when etching effects before and after the application of the bonding resin were compared ($P = 0.68$).
CONCLUSIONS: The results suggest that application of phosphoric acid for periods longer than 15 seconds may lead to extensive structural alterations under the enamel surface without an accompanying increase of retentive surface area. Application of a bonding agent to the etched enamel has a protective effect against acid penetration during re-etching.

21 TORSIONAL PROPERTIES OF NiTi ORTHODONTIC WIRE

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AIMS: Commercially preformed edgewise Ni-Ti based archwires are currently used in orthodontic practice. The mechanical properties of such Ni-Ti wires seem to vary with their crystallographic phase under conditions of use. This investigation is a contribution to a better understanding of this relationship.
METHOD: The transformation temperatures of Ni-Ti orthodontic wires were measured using differential scanning calorimetry (DSC). The mechanical characteristics were studied with the aid of a specially designed torsion apparatus (French patent #8906480) to simulate conditions of clinical use. In order to study superelasticity under clinical conditions, each wire was first loaded at room temperature (22 degrees) with moments varying from 0 to 350, 0 to 700, 0 to 1050, and 0 to 1400 g.mm and then unloaded at buccal temperature (37 degrees).
RESULTS: The average unloading stiffness of steel-wires remained constant regardless of the amount of activation. This was not so with Ni-Ti wires when they were submitted to large deformations; the crystalline structure of the alloy resulted in weak forces when submitted to small deformations, the crystalline structure of the alloy delivered strong forces. Paradoxically, stiffness increased as strain decreased. The DSC graphs were used to characterise the crystallographic phase of Ni-Ti alloy at buccal temperature. Depending on the crystallographic structure, the performance of orthodontic wires varied.
CONCLUSIONS: It is recommended that the wire should be heated to its austenite finish before loading to determine its initial crystallographic phase and its true shape before being tied in. It is not necessary to retie the wire into the brackets to increase the magnitude of forces if the austenite finish is lower than the buccal temperature. These results have implications in the optimisation of Ni-Ti wire for clinical orthodontics. The greater our understanding of their behaviour, the better orthodontic use we can make of them.

22 IDEAL ARCH PLANNING UNDER CONSIDERATION OF THE MANDIBULAR ALVEOLAR PROCESS

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AIMS: The bony alveolar process in the mandible represents an important criterion for ideal arch planning in orthodontics, since it can only be therapeutically altered within tight limits. This study presents a computer-assisted method which integrates the mandibular alveolar process into ideal arch planning. The extension of the mandibular alveolar process can be recorded by entering three defined reference vectors. The objective of this study was to test whether these reference vectors can be entered reproducibly and objectively.
MATERIALS AND METHOD: Fifteen model pairs, with an average dental malocclusion, were used as the test material. Occlusal images of each model were taken using a commercially available video camera and displayed on a computer monitor. Firstly, the reference vectors were repeatedly entered on this image by one person on 15 different days to determine reproducibility (intra-observer comparison), and secondly, they were entered by 15 different people to determine objectivity (inter-observer comparison).
RESULTS: In the intra-observer comparison, there was a standard deviation of 0.12–0.15 mm for the length and 1.3–2.4 degrees for the angular position in the co-ordinate system, while the inter-observer comparison produced respective values of 0.17–0.19 mm and 2.25–4.2 degrees.

CONCLUSION: The results show that the reference vectors can be entered sufficiently accurately, which means that the computer-assisted model presented is a practicable method, providing reliable data. These data can be used as a basis for dental arch planning adapted to the individual patient, e.g. in combination with the Bending Art System.

23 THE EFFECT OF CYCLOPHOSPHAMIDE ON GROWTH OF THE MAXILLARY MEDIAN SUTURE IN RATS

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AIM: To examine the effects of cyclophosphamide (CY) on growth of the median suture of the maxilla in young rats.
MATERIAL AND METHOD: At ten days of age 12 experimental rats received an intraperitoneal injection of 0.04 ml CY dissolved in sterile water (30 mg/kg b.w.). Six control rats of the same age were injected intraperitoneally with 0.04 ml 0.9 per cent NaC1. New injections of the same respective types were given to the experimental and control rats at 13 days of age. Eighteen days after the second injections (31 days of age) the rats were killed. The maxilla of each rat was dissected free and fixed in Histofix®. After decalcification the specimens were embedded and sectioned at three levels, 30 μm apart, in the area of the first molar. The sections were used for histological examinations and histomorphometric measurements of the thickness of the palatal bone and the width of the suture.
RESULTS: Structural changes of the osteogenic layers and fibrous components of the median maxillary suture could be seen in the rats of the experimental group. The thickness of the palatal bone in the experimental rats was only 65 per cent of that of the control rats. The average width of the suture in the control rats was 328 μm at the nasal part of the suture and 229 μm at the oral part ($P < 0.001$). The experimental rats exhibited significantly reduced width of the suture (mean value 187 μm), and no difference in width between the nasal and oral parts of the suture.
CONCLUSIONS: Cyclophosphamide given to young rats has previously been shown to severely affect dental development. The present data show that CY also has a clear negative effect on the growth and development of the maxillary median suture.

24 TREATMENT AND POST-TREATMENT EFFECTS OF BONDED HERBST THERAPY

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AIM: To evaluate skeletal and dento-alveolar changes induced by bonded Herbst therapy of Class II malocclusions. The study included two matched control groups with untreated Class II and untreated Class I malocclusions respectively, the use of developmental staging of cervical vertebrae as an indicator of skeletal maturity, and treatment and post-treatment observations.
SUBJECTS: Treated Group: 55 subjects (27 females, 28 males) with Class II malocclusions treated with the acrylic splint Herbst appliance. Time 1 (T1, immediately before treatment): mean age 154.4 ± 14 months. Time 2 (T2, immediately after debonding of Herbst appliance): mean age 166.4 ± 14 months. Time 3 (T3, post-treatment observation comprising a phase of edgewise therapy): mean age 182.2 ± 15.7 months. Untreated Class II Control Group: 30 subjects (15 females, 15 males). Time 1 (T1): mean age 157.4 ± 14.5 months. Time 2 (T2): mean age 169.6 ± 14.3 months. Time 3 (T3): mean age 183.1 ± 13.6 months. Untreated Class I Control Group: 33 subjects (16 females, 17 males). Time 1 (T1): mean age 155.3 ± 10 months. Time 2 (T2): mean age 168.9 ± 10.8 months. Time 3 (T3): mean age 184.7 ± 10.4 months. The three groups were homogeneous at T1, T2 and T3 as to maturation of cervical vertebrae.
METHODS: A modified Pancherz's cephalometric analysis was applied to the lateral cephalograms of the three groups at T1, T2, and T3. Linear and angular measurements for mandibular dimensions and morphology were added to the original analysis. Differences for all the variables from T1 to T2 (treatment effects), from T2 to T3 (post-treatment effects), and from T1 to T3 (total effects) were calculated in the treated group and contrasted to corresponding differences in both untreated groups by means of ANOVA ($P < 0.05$).
RESULTS AND CONCLUSIONS: This study showed that two-thirds of molar correction and of overjet correction were due to skeletal effects, and only one-third to dento-alveolar effects. Both skeletal and dento-alveolar effects were mainly due to mandibular changes. The post-treatment period exhibited a certain amount of relapse in molar and in overjet correction. In both cases relapse was due to unfavourable changes in the sagittal position of the upper molars and of the upper incisors. As mean molar correction was 3.7 mm and mean overjet correction 4.0 mm in the treated group after the post-treatment period, bonded Herbst therapy appears to be indicated for the treatment of distal jaw relationships showing a moderate degree of sagittal discrepancy.

25 VERTICAL CRANIOFACIAL PATTERN OF UNTREATED CLASS II DIVISION 1 MALOCCLUSIONS AND GROWTH-RELATED CHANGES

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AIMS: Of the numerous cephalometric cross-sectional studies and the few longitudinal investigations on untreated Class II division 1 malocclusions, only a limited number focus on the vertical craniofacial pattern. The aim of this study is the description of the vertical craniofacial pattern of untreated subjects with Class II division 1 malocclusions at 9 to 12 years of age. How does growth influence this pattern?

SUBJECTS AND METHODS:
1. The results of the most important cross-sectional studies (n = 22) are presented.
2. A comparison between a group of subjects with Class II division 1 malocclusions (n = 138) and a group with Class I occlusions (n = 80) from Nittedal, Norway, was performed. For the determination of possible disharmonious skeletal configurations, the interrelation between different skeletal structures were analysed multivariately and compared with Class II division 1 subjects from Hamburg, Munich and Sweden.
3. For a total of 218 untreated Class II division 1 subjects, belonging to similar age groups, growth-related changes in the vertical dimension were described by means of longitudinal analysis, differentiated by origin (Nittedal, Norway; Umeå, Sweden; Hamburg, Munich).
4. Growth-related changes of Class II division 1 and Class I subjects from Nittedal were compared.
RESULTS:
1. According to the majority of cross-sectional studies Class II division 1 subjects showed the following trends when compared with subjects with neutral occlusion, Class I malocclusion or cephalometric standards: The vertical position of the maxilla was similar, the mandible was rotated posteriorly, the anterior facial height was extended. The mandibular angle is most commonly described as smaller. A greater variation, however, must be considered.
2. The comparison of mean values of Class II division 1 with Class I subjects from Nittedal showed a significant increase of the anterior facial height. However, no posterior rotation of the mandible was ascertainable.
A multivariate approach to the total craniofacial pattern showed an harmonious vertical pattern for those subjects possessing Class I occlusions as well as for the Class II division 1 subjects from Nittedal but also Munich, Hamburg, and Umeå, Sweden.
3. The vertical position of the maxilla remained approximately the same in all groups during the observation periods. The mandible of the Scandinavian subjects rotated anteriorly, while there were minimal changes within both German groups.
4. Growth-related changes were similar in both groups from Nittedal (Class I, Class II division 1) and corresponded to the result mentioned under 3.
CONCLUSIONS: The character of Class II division 1 malocclusions is not chiefly determined by the vertical dimension. Vertical deviations from normal are small, and the vertical craniofacial pattern is harmonious.

26 ANTI-INFLAMMATORY THERAPY AND TEMPOROMANDIBULAR JOINT FUNCTION IN SUBJECTS WITH RHEUMATOID ARTHRITIS

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The extent of temporomandibular joint (TMJ) function in patients with rheumatoid arthritis (RA) and the impact of disease activity, duration and immunomodulating medication on the severity of TMJ impairment was studied.
From 116 RA-patients, 50 (12 M, 38 F, 54 ± 9 years) were enrolled in the study (age > 30 years, > 12 teeth, duration of disease > 3 years) and compared with 101 matched healthy controls (25 M, 76 F, 54 ± 9 years). Evaluation of RA activity included serological, functional and radiological measures. The cumulative dose for corticosteroids (CDC), the duration of disease-modifying anti-rheumatic drug (DDU; DMARD) and corticosteroid use (DCU) was recorded. TMJ function was classified according to the criteria proposed by Helkimo (1974).
Duration of RA was 12 ± 8 years. Forty six patients received DMARDs, and 42 used non-steroidal anti-rheumatic drugs. Low dose cortisone was prescribed for 39 patients (range 2.5–15 mg/d). Mandibular mobility of RA-patients was much lower than that of the controls ($P < 0.05$). Significant correlations were observed between the DDU (80 ± 67 months), DCU (81 ± 76 months), CDC (15 ± 15 g) and the radiological destruction score (Larson *et al.*, 1977) with r = 0.47, $P = 0.001$; r = 0.64, $P = 0.0001$ and r = 0.72, $P = 0.0001$, respectively. However, except for a correlation between DDU and the TMJ dysfunction-score (r = 0.31, $P = 0.03$), no significant correlation was obtained between disease activity, duration, CDC, DCU and TMJ dysfunction score.
The data suggest that disease activity and duration as well as the use and dosage of corticosteroids do not influence the impairment of TMJ function observed in patients with long-term RA. This observation has to be confirmed by radiological and longitudinal studies.

Helkimo M 1974 Studies on function and dysfunction of the masticatory system. II. Index for anamnestic and clinical dysfunction and occlusal state. Swedish Dental Journal 67: 101–121

Larson A, Dale K, Eek M 1977 Radiographic evaluation of rheumatoid arthritis and related conditions by the standard reference films. Acta Radiologica Diagnostica 18: 481–491

27 AMOUNT OF RESIDUAL ADHESIVE AFTER TWO DIFFERENT DEBONDING TECHNIQUES

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AIM: Several reports have been published on the techniques of resurfacing the enamel following debonding, but the potentially harmful effects of bracket removal on the enamel surface have received little attention. This *in vivo* study aimed to examine the amount of residual adhesive and to evaluate the enamel surface structure following two different techniques of bracket removal.
MATERIALS AND METHOD: This clinical trial involved 354 debracketed enamel surfaces from 20 patients, who had completed their orthodontic treatment. All teeth received the same bonding procedures. Debonding was performed by two investigators independently, using either Weingart or

bracket-removing pliers, randomised and assigned to either quadrants of the upper and lower jaw in each patient. The residual adhesive on the enamel surface was evaluated with a modified Adhesive Remnant Index (ARI). The effect of tooth position and patient's comfort while debonding were also obtained. In addition, the enamel surface structure was evaluated by scanning electron microscopy (SEM).
RESULTS: It was found that there was a non-significant trend for the Weingart debonding technique according to the ARI scores as well as patient's comfort level. The tooth position revealed no significant differences. The SEM revealed microlesions within exposed enamel surfaces in both groups.
CONCLUSIONS: There is only a minimal difference in the amount of residual adhesive using Weingart or the bracket-removing pliers. However, debonding with the Weingart pliers appears to be more comfortable for patient and orthodontist.

28 SHEAR BOND STRENGTH OF A NEW SELF-ETCHING FLUORIDE-RELEASING BONDING SYSTEM.

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AIMS: Damage to the enamel surface during bonding and debonding of orthodontic brackets is a clinical concern. Alternative bonding methods that minimize enamel surface damage while maintaining a clinically useful bond strength is an aim of current research. The aim of the study was to compare the effects of bond strength and bracket failure location of two adhesives (Degufill® mineral, Degussa, and Transbond®XT, 3M/Unitek) and two enamel conditioners (37 per cent phosphoric acid and Etch&Prime® 3.0, Degussa).
MATERIALS AND METHOD: Forty-eight freshly extracted human premolars were divided in to four groups. Metal orthodontic brackets were attached to the enamel surface by one of four protocols: (1) Degufill mineral and phosphoric acid, (2) Transbond and phosphoric acid, (3) Degufill mineral and Etch&Prime, and (4) Transbond and Etch&Prime. The teeth were stored in deionized water at 37°C for 48 hours. A Zwick universal testing machine was used to determine shear bond strengths. The residual adhesive on the enamel surface was evaluated with a modified Adhesive Remnant Index. Analysis of variance was used to compare the four groups with significance predetermined at $P < 0.05$.
RESULTS: No significant differences in bond strength were found among the four groups. The results of the Chi square test, evaluating the residual adhesives on the enamel surface, revealed significant differences among the four groups. A Duncan multiple range test showed the differences between the phosphoric acid and Etch&Prime groups, with Etch&Prime having bond failure at the enamel-adhesive interface.
CONCLUSION: The use of Degufill mineral and/or Etch&Prime does not affect bond strength. However, the use of Etch&Prime resulted in a controversially discussed failure location concerning the effect on the enamel surface.

29 CLASS II CORRECTION IN PATIENTS TREATED WITH CLASS II ELASTICS AND THE HERBST APPLIANCE— A COMPARATIVE STUDY

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AIM: To compare the skeletal and dental effects of Class II elastics with the changes obtained by the Herbst telescope mechanism.
SUBJECTS AND METHOD: Thirty-six male Class II division 1 subjects were analysed. Eighteen subjects were treated with fixed appliances (*ad modum* Begg) and Class II elastics, and 18 subjects with the Herbst appliance. Lateral radiographs in centric occlusion were analysed at the start and after 12 months of treatment.
RESULTS: The only significant difference between the two groups before treatment was, on average, a larger overjet in the group treated with the Begg appliance. During treatment the skeletal jaw base relationship improved more in the Herbst group than in the Begg group. The overjet reduction was, however, larger in the Begg group. The skeletal part of the overjet reduction was 51 per cent in the Herbst group and 4 per cent in the Begg group. The molar correction was almost similar in both groups, but the skeletal component was 66 per cent in the Herbst group and 10 per cent in the Begg group. The overbite correction and the increase in anterior lower facial height were larger in the Begg than in the Herbst group (1.7 and 1.1 mm, respectively). The mandibular plane angle increased on average by 1.3 degrees in the Begg group but remained unchanged in the Herbst treated group.
CONCLUSIONS: The changes that contributed to the sagittal Class II corrections in Herbst and Begg therapy were skeletal and dental. The skeletal changes were, however, larger in the Herbst treated group. Favourable and unfavourable vertical changes on the other hand, were more pronounced in the group treated with Class II elastics.

30 CRY ANALYSIS: A NEW NON-INVASIVE DIAGNOSTIC TOOL IN CLEFT LIP AND PALATE INFANTS

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AIMS: Variability of the cry melody and the melody spectrum in infants have previously been shown to be possible indicators of certain central nervous system (CNS) disorders. The aim of this prospective study was to examine the influence of therapeutic interventions on cry melody and on neurological development in cleft lip and palate (CLP) patients.
METHOD: One hundred and eight cry sounds of five CLP infants were recorded from birth until 12 months of age.

Different cry characteristics were analysed (e.g. melody spectrum, modulation, intonation). The modulations of frequency were illustrated by spectrograms.
RESULTS: The following preliminary results were found: (1) In four of the five patients cry analysis indicated temporary regression of neurological development after lip closure and paracentesis tympani, followed by a period of recovery and improved quality of sound production. (2) One patient exhibited no improvement of neuromuscular dysfunction (i.e. increased fundamental frequency) after the period of regression.
DISCUSSION: In the majority of the patients, postoperative catch-up of pre-speech vocalisation could be found. This finding can possibly be explained by (1) the normalized morphology of the anterior oral cavum and/or (2) the improved auditory feedback by paracentesis tympani. In one patient the period of regression was not followed by an improved quality of sound production. Initiated evaluation of the neurological developmental status confirmed mental retardation.
CONCLUSIONS: The preliminary findings of the study revealed that cry sound analysis may be a useful clinical instrument in evaluating the influence of therapeutic interventions on the neurological development in CLP patients. Based on these findings, an early paracentesis tympani may be indicated and has to be discussed. In addition, this new method provides the possibility of early recognition of associated neurological anomalies in CLP infants. Further investigations will be necessary to confirm these first results.

31 CLINICAL RELEVANCE OF TOOTH SIZE DISCREPANCY

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AIM: It remains questionable whether tooth size discrepancy (TSD) might affect the final orthodontic treatment outcome. This study attempted to answer the following questions:
1. How accurately are we able to measure T.S.D.?
2. To what extent does T.S.D. affect occlusion?
3. What is the effect of levelling the curve of Spee?
4. Does extraction therapy create T.S.D.?

MATERIAL AND METHOD: Bolton's anterior and overall ratio of a male patient with ideal occlusion at the end of treatment was established. A duplicate silicone of both upper and lower dental casts was made. The mesio-distal width of each tooth was measured on the duplicated model in total as well as on the separated teeth. Inter- and intra-observer reliability was tested. Different amounts of T.S.D. were created by interproximal slicing epoxy resin copies of each tooth. An artificial T.S.D. of 2, 4 and 6 mm was created by slicing equal amounts of tooth material in the upper and lower labial areas and in the upper and lower buccal segments. From each situation three set-ups were made using the original teeth with 3 variations in the curve of Spee (0, 3 and 6 mm). Finally different combinations of extraction therapies were then simulated in 8 set-ups. The PAR-index of each set-up was scored twice by 10 different observers.
RESULTS: The reproducibility of T.S.D. measurements was found to be very high (90 per cent). The PAR-index, in all cases, varied between 0.05 and 6.95, indicating that only minor malocclusions were found. Excessive T.S.D. (4–6 mm) and excessive curve of Spee (6 mm) yielded the poorest results. Extraction therapy was found to have only a minor influence on the final occlusion.
CONCLUSION: Only in severe situations of T.S.D. will the outcome of the final occlusion, evaluated on set-ups, be affected to some extent. Therefore the clinical significance of T.S.D. is limited.

32 CHANGES IN NASAL RESPIRATION AFTER SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION

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Improvement of nasal respiration in juvenile patients is a known benefit following rapid maxillary expansion (RME). This study was planned to examine changes after surgically assisted RME in adults.
SUBJECTS AND METHODS: From January to December 1997, 17 patients (ϕ 27.5 years) with maxillary constriction underwent a subtotal Le Fort I osteotomy which was followed by RME. In all patients acoustic rhinometry and rhinoresistometry was performed pre-operatively and in intervals afterwards before and after decongestion with oxymetazoline. Rhinoresistometry is an improved active anterior rhinomanometry measuring hydraulic diameter and flow characteristics apart from flow and resistance. Acoustic rhinometry allows the evaluation of actual cross-sections of the nasal cavity and of volume segments. Here the least cross-section is of special interest because of its flow limiting characteristic.
RESULTS: Eleven patients could be evaluated after 5.9 months showing a significant improvement of all parameters with and without decongestion. Total inspiratory flow at 150 Pa changed from 627 ml/s to 1022 ml/s before, and from 832 ml/s to 1172 ml/s after decongestion. Simultaneously hydraulic diameter and least cross-sectional area increased (hydr. diameter: 5.5 mm pre-operatively, 6.2 mm post RME; least cross-section: 0.39 cm^2 before and 0.47 cm^2 after). Flow characteristics such as turbulence also improved. Patient evaluation on a visual analogue scale resembled the positive change in nasal respiration (3.9 before and 2.6 after RME, 0 = most content, 10 = most discontent).
DISCUSSION: Novel methods for the measurement of nasal respiration showed a significant improvement following surgically assisted RME in adults. From the surgical point of view this method proved to be a safe operation facilitating RME.

33 BRACKET BONDING ON PRIMARY TEETH. AN *IN VITRO* EXPERIMENT

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AIMS: To investigate direct bracket bonding on primary tooth surfaces. Of special interest was the examination of shear bond strength values and the amount of residual adhesive left on the tooth surfaces after debonding.
MATERIALS AND METHOD: Three bonding materials were used and the effects on different conditioned surfaces of deciduous teeth were revealed. The following materials were used: 1. Glass polyalkenoate cement and Fuji Ortho™ LC (GC Corporation); 2. Dyract® compomer (De Trey GmbH); 3. Concise orthodontic bonding composite (3M Company, USA). For uniformity, lingual buttons (EP-082 N and EP-082 DB) were always used.
RESULTS: 1. The lingual button EP-082 N is not suitable for shear bond tests because of the unstable junction between the button and the retentive net base. 2. Fuji Ortho™ LC and Dyract® did not produce orthodontic bond values without etching the tooth surfaces. 3. Etching of primary tooth surfaces for 30 or 60 seconds resulted in orthodontic shear bond strength values for every adhesive. When comparing the adhesives Concise and Dyract® there was a statistically significant difference. 4. Etching for 60 seconds did not increase shear bond strength values. 5. After removal of the buttons the failure fracture was localised primarily in the adhesive layer or in the borderline adhesive button.
CONCLUSION: Bracket bonding can also be applied to the deciduous teeth if necessary.

34 INFLUENCE ON TENSILE STRENGTH OF LASER WELDED JUNCTIONS IN WIRES

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INTRODUCTION: Next to electrostatic welding and soldering, laser welding offers another modern linking technique. The tensile strength of laser welded junctions is supposed to be assessed on orthodontic stainless-steel wires.
MATERIAL AND METHOD: Cold-hammered FeCrNi-wire Remanium® (Dentaurum) with a diameter of 0.8 mm was examined. The wires were welded with the Heraeus Haas Laser 44 P (Nd:YAG) using a wave length of 1064 nm. During welding 115 different combinations of the parameters focus size, pulse duration, and pulse intensity were tested. The junctions were examined by tensile testing. Additionally, starting material with or without laser bombardment was examined.
RESULTS: It was shown that only certain sizes of focus were suitable. During the tensile test for every pulse duration an optimal pulse intensity was found in those sizes of focus regarding the resistance to tearing. Thus the maximal measured tensile stress was approximately the same size (800–900 N/m^2), but smaller than that of the starting material (1949 N/m^2). After laser bombardment, uncut wire showed a reduction in the maximal tensile stress of 54.1 per cent to 849.9 N/m^2. The ultimate elongation was reduced from 2.62 to 1.46 per cent. A correlation was recorded between the visual appearance of the welding seam and the tensile strength. In 10 repeated measurements the coefficient of variation of the measuring values, dependent on the quality of the welding seams, was 0.0426–0.1174.
CONCLUSIONS: It was shown in this study that only with a correct combination of the parameters focus size, pulse duration, and pulse intensity can optimal welding results be expected. The thermal influence of laser welding leads to microstructural changes in the melting range of the weld mark which induces a noticeable reduction of tensile strength.

35 TREATMENT SUCCESS AND DURATION IN CONSIDERATION OF THE PAR-INDEX

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INTRODUCTION: The Peer Assessment Rating (PAR) Index determines the treatment need by assessing the model and allows the estimation of the success of orthodontic treatment. The aim of this study was to evaluate the influences on the effect of orthodontic treatment in consideration of this index.
SUBJECTS AND METHOD: A study population of 152 patients was examined; the age at the beginning of treatment varied from 4.4–48.6 years (mean 17.3 ± 8.8 years). The subjects were treated with removable and fixed appliances or by a combination of both. The PAR Index was determined at the beginning and end of treatment. The influence of the PAR Index and age at the beginning of treatment, the diagnosis according to Angle's Class, and the form of therapy with regard to changes in the PAR Index, as well as treatment duration, was assessed by covariance analysis.
RESULTS: The analysis of the treatment success by absolute changes of the PAR Index revealed a significant influence of the PAR Index and the age at the beginning of treatment, as well as the form of therapy. With a growing PAR Index the success of treatment increased, while with growing age the success of treatment decreased. The combined treatment, with 16.3 points, was significantly more successful than the therapy by removable appliances (9.7 points). An influence of the Angle's Classes on the treatment success could not be verified. The analysis of treatment duration showed a significant influence of age at the beginning of treatment and the form of therapy. The treatment duration decreased with increasing age. Significant differences were detected between combined (3.2 years), fixed (2.4 years) and removable therapy (3.0 years), respectively. An influence on the treatment duration by the PAR Index starting values and the Angle's Classes was not detected.

CONCLUSION: It was shown that the success is dependent on the severity of the malocclusion at the beginning of treatment. While the Angle's classification had no influence, increasing age led to shorter treatment duration, but also to reduced success in therapy. By a slightly extended treatment time on average, the combined treatment resulted in a noticeable improvement of the treatment success.

36 VERTICAL SKELETOFACIAL MORPHOLOGY IN CLASS II DIVISION 1 AND CLASS II DIVISION 2 MALOCCLUSIONS

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AIM: Anterior facial height parameters in large samples of Class II division 1 and Class II division 2 malocclusions were investigated using lateral headfilms. Reference data from a cephalometric standard (Bhatia and Leighton, 1993) were used for comparison.
SUBJECTS: One hundred and seventy five female and 114 male Class II division 1 and 156 Class II division 2 subjects (69 females, 87 males) divided into two age groups (8–10 and 11–13 years) were analysed.
METHOD: On the lateral headfilms upper facial, lower facial, and total facial heights were measured and compared with the cephalometric standard values. Unpaired *t*-tests were performed to assess differences between malocclusion groups as well as between age and gender groups.
RESULTS: Class II division 1 subjects had larger upper and total facial heights than Class II division 2 subjects. In both malocclusions these two variables were smaller in the younger than in the older group. Compared with the reference data, the upper facial height was, on average, larger and the lower face height smaller. The total facial height did not differ from the standard value.
CONCLUSIONS: A small lower facial height in combination with a large upper facial height. and a normal total facial height is a consistent finding in Class II division 1 and Class II division 2 malocclusions.

Bhatia S N, Leighton B C 1993 A manual of facial growth. Oxford University Press, Oxford

37 BIOMECHANICAL EVALUATION OF SKULL DEFECTS THREE-MONTHS AFTER IMPLANTATION WITH OSTEOPROMOTIVE SUBSTANCES

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AIMS: The aim of this study was to compare the mechanical strength of experimental calvarial defects in rats filled with different osteopromotive substances or left untreated three months after implantation.
MATERIAL AND METHODS: Trephined bilateral critical size bone defects were created in the posterior part of the parietal bone of 20 adult male Wistar rats. The defects were filled either with hydroxyapatite (HA), endochondral demineraliszed bone matrix (DBM), endochondral autogenous bone chips (BC), or remained unfilled (controls). Biomechanical evaluation three months post-surgery was performed using a three-point bending test to destruction. Statistical analysis of the data was carried out using an analysis of variance and a modified LSD (Bonferroni) test.
RESULTS: The results showed that the maximum load in the group implanted with endochondral DBM (49.64 N) was statistically significantly higher than the groups implanted with BC (30.53 N), HA (12.91 N), and unfilled control (18.1 N). Even though the maximum load in the BC group was higher than in the HA and the control group, there was no statistically significant difference.
CONCLUSIONS: The biomechanical strength of a calvarial bone defect in rats three months post-surgery was significantly stronger when implanted with endochondral demineralised bone matrix than with the other osteopromotive substances. The defects filled with hydroxyapatite had a lower maximum load to failure than the control group. These results may indicate a significant fragility of the biomechanical resistance in the interface between bone and hydroxyapatite. This material might not be suitable for use in orthognathic surgical procedures.

38 EFFECTS OF VARIOUS MEANS OF ISOLATION AND SURPLUS REMOVAL ON THE ADHESIVE STRENGTH OF RESIN-MODIFIED GLASS-IONOMERS ON ENAMEL

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AIMS: The purpose of this *in vitro* study was to examine the influence of different isolation and surplus removal methods on the shear bond strength between steel, a variety of resin-modified glass-ionomer cements (GIC), and enamel.
MATERIALS AND METHOD: Five resin-modified and light-cured glass-ionomers were examined (Fuji Ortho LC/GC, Fuji Duet/GC, Unitek multicure GIC/3M Unitek, Band-Lok/Reliance, and Vitremer/3M Medica). When using Fuji Ortho LC and Fuji Duet, the enamel was first conditioned for 20 seconds with polyacrylic acid. For preparing the enamel specimens, bovine teeth were embedded in polyurethane-resin, ground flat and subsequently polished with SiC-paper. Before cementation, 50 per cent of the specimens were moistened for one minute with the aerosol of an inhalation device. The other half of the specimens were dried for 20 seconds with compressed air. A custom-made device was used to perpendicularly bond cylinders (ø 5 mm) made out of CrNi-steel 18 10 on the enamel. During the setting reaction, the cylinders were topped with a constant pressure (0.25 MPa). After cementation different barrier

coatings were applied (Cacaobutter/GC, Final Varnish/VOCO, Dryfoil/Jalenko, Fuji Coat LC/GC, Ketac-Glaze/ESPE, or without coating). Ten specimens were prepared per group. Eight minutes after the end of mixing, the surplus was removed, with a scaler. The specimens were kept for 24 hours in deionized water at 34ºC and then were subjected to 1000 thermocycles between 5 and 55ºC with a dwell time of 30 seconds. Afterwards the shear bond strength was determined according to ISO draft TC 106/SC2/WGI6. Only the barrier coatings with the greatest mean shear bond strength per cement were further examined in a subsequent study by treating the specimens ultrasonically for 20 seconds 8 minutes after the end of mixing.
RESULTS: ANOVA plus Bonferroni tests as *post-hoc* procedures revealed significant differences ($P < 0.05$) with respect to the mean shear bond strength among the following cement groups ranking from highest to lowest: Fuji Duet, Unitek > Fuji Ortho LC > Vitremer. All cylinders bonded with Band-Lok had already fallen off during thermocycling. Ketac-Glaze altogether proved to be the most effective barrier coating, only Vitremer showed better results when using Dryfoil. Unlike the other investigated GICs, Unitek showed a greater shear bond strength when bonded on moist enamel. Surplus removal with ultrasound did not cause a significant loss of bond strength.
CONCLUSIONS: The use of Ketac-Glaze as a barrier coating is recommended in order to reduce the frequency of loosened molar bands.

39 HARD AND SOFT TISSUES OF THE ASYMPTOMATIC TEMPOROMANDIBULAR JOINT IN GROWING PATIENTS

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AIMS: To analyse temporomandibular joint (TMJ) anatomy in children and juveniles in different age groups in order to gain age specific means and ranges for evaluating pathological processes.
SUBJECTS AND METHODS: The study was undertaken on two different groups of patients: (1) 19 patients between 8 and 19 years of age who had suffered from unilateral condylar fractures 3 to 10 years previously, and (2) 21 patients aged between 3 and 16 years having sustained unilateral condylar fractures at least six months before the study. Immediately after the trauma all patients were treated functionally with an activator for 9 to 12 months, and examined by continuous, spiral scanning of the TMJ. From the axial scans, parasagittal images were obtained using the standard Siemens reconstruction. software. The mediolateral and anteroposterior condylar dimensions and shape, and the condylar angle were measured on the axial images, and condylar neck length was recorded on the parasagittal reconstruction. Soft tissue CT-sections were used to assess volumes and densities of the lateral pterygoid muscle. Means and standard deviations of the parameters of the contralateral asymptomatic condyles were calculated and compared with each other in four age groups: 3–6, 7–10, 11–14 , and 15–19 years.
RESULTS: The mediolateral condylar dimension, increasing during growth, ranged from 1.3 mm in the youngest age group to 1.9 mm in the adults. The condylar neck length and the volume of the lateral pterygoid muscle also showed an age dependency and increased from 2.1 to 2.6 mm respectively, from 3.2 to 5.6 mm^3.
CONCLUSIONS: The lack of quantitative data on TMJ morphology of normal growing patients does not allow a comparison with a control sample. However, normalized TMJ function in both functionally treated patient groups allows presentation of means and ranges of condylar size, shape, and position, as well as muscle volume and density from asymptomatic condyles presumed to be normal.

40 DENTAL ARCH CHARACTERISTICS AND SKELETAL/SOFT TISSUE PROFILE CHANGES FOLLOWING TREATMENT OF CLASS III MALOCCLUSIONS USING A FRÄNKEL APPLIANCE

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AIMS: To study dental arch characteristics and skeletal/soft tissue profile changes following treatment of Class III malocclusions by means of a Fränkel III appliance.
SUBJECTS AND METHOD: Seventeen schoolchildren (9 boys, 8 girls) with Class III malocclusions in the mixed dentition were registered by means of dental casts and lateral cephalometric radiographs before and after the correction of their malocclusion. Their treatment started at a mean age of 9.2 years, was performed exclusively by a Fränkel III appliance, which was used on average 14–16 hours per day, and lasted approximately 1.7 years. The pre- and post-treatment dental casts were studied by means of 13 parameters dealing with dental arch widths, lengths and depths as well as palatal height. The pre- and post-treatment lateral cephalograms were traced, digitized and studied by means of 58 parameters dealing with sagittal and vertical skeletal and soft tissue profile relationships, dental relationships, soft tissue thickness and lip morphology. A paired *t*-test was utilized in order to evaluate the presence of significant changes ($P < 0.05$). The error of the method for the radiographic study was assessed by means of double tracing and digitization of 17 cephalograms according to the formula of Dahlberg.
RESULT: Maxillary widths between first permanent molars, first premolars and permanent canines, maxillary arch length and palatal height were found to be significantly increased ($P < 0.05$) post-treatment. In relation to the mandibular dental arch, only its depth was found to be significantly decreased ($P < 0.01$) at the end of treatment. Significant post-treatment increases were noted with regard to the total as well as the upper and lower anterior skeletal and soft

tissue facial heights. Following treatment the skeletal and soft tissue profiles became less concave and the thickness of the lips increased.
CONCLUSIONS: Treatment of Class III malocclusions during mixed the dentition period by means of a Fränkel III functional appliance seems to be associated with important dentoalveolar changes and several significant skeletal and soft tissue profile changes.

41 FUNCTIONAL STRAIN AND BONE MASS IN THE MANDIBLE OF GROWING HYPOCALCAEMIC RATS

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AIMS: Metabolic bone disease can cause disturbances in the growth of the craniofacial skeleton. The aim of this study was to elucidate the influence of masticatory muscle function on the bone mass in various functional units of the mandible of growing rats with metabolic bone disease (MBD). The MBD studied was hypocalcaemia experimentally induced by feeding the animals a low-calcium and vitamin D-deficient diet. An alteration in the masticatory muscle function was induced by changing the consistency of their diet.
MATERIAL: Forty-two growing male albino rats were randomly divided into three equal groups. The first group received a deficient hard diet, the second a deficient soft diet, while the third group was fed the normal hard diet and served as a control group. The experimental period started just before the rats' pubertal growth spurt (28 days old) and its duration was 28 days.
METHODS: Lateral radiographs of the mandibular halves were taken together with an aluminium step-wedge and then analysed by a computer-assisted image analysis system. Radiographic bone mass at 10 standardized areas with different functional demands was measured in the transverse plane as 'aluminium equivalent thickness' in millimetres.
RESULTS: The bone mass in all 10 mandibular regions was found to be less in the two deficient diet groups when compared with the normal one. In the deficient hard diet group a greater bone mass in comparison with the deficient soft diet group was measured in the following regions: alveolar region of incisor and molars, condylar process, and anterior lower border of the ramus (area related to muscle insertion). No statistically significant differences could be found between the two deficient diet groups at the insertion of the digastric muscle and in the angular process.
CONCLUSIONS: Less bone mass was found in the mandible of growing rats with induced hypocalcaemia. Masticatory function was a significant factor, influencing bone mass at certain areas of the mandible even under metabolic bone disturbance, possibly due to alteration in bone strain.

42 ANTEROPOSTERIOR FORCES DURING ACTIVATOR TREATMENT

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AIM: The mode of action of the activator appliance is still unclear. Apart from a possible mandibular growth enhancing effect, some investigators believe that orthopaedic forces may be applied to the maxilla, contributing to Class II correction by inhibition of maxillary growth. Additionally, orthodontic forces may arise that produce dento-alveolar changes. The purpose of this study was to measure the magnitude of anteroposterior intermaxillary forces during wear of the activator appliance.
SUBJECTS AND METHODS: Ten consecutive patients presenting with a Class II dental and skeletal relationship, were treated using a modified activator appliance. The appliance had maxillary and mandibular segments that could be detached from each other during the measuring session. A force transducer was placed at the anterior part of the maxillary segment and the anteroposterior force exerted by the mandibular segment was measured. At each visit measurements were taken every 15 seconds. In the upright position, measurements were collected for 5 minutes (20 measurements), and in the reclined posture, for 10 minutes (40 measurements). Mean, median and standard deviation values were calculated for each measurement session. Every patient was measured at monthly intervals for a period of six months.
RESULTS: The median intermaxillary force values over all patients and measurement sessions were 100 g in the upright position and 123 g in the reclined position. A wide variation in force levels was noted, both between patients and for the same patient during the experimental period. No statistically significant change in force levels was observed during the six-month period and no difference was noted between the upright and reclined posture.
CONCLUSIONS: The results indicate that the intermaxillary forces were generally in the orthodontic range. Any orthopaedic effect of the activator appliance on the maxilla can not be supported by the results of this study.

43 VERTICAL POSITION OF MOLARS WITHOUT ANTAGONISTS

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AIMS: There has been a general belief that permanent teeth without antagonists over-erupt, creating, after a certain period, a considerable clinical problem. However, very few studies in the literature deal with this problem. Thus the purpose of this investigation was to examine the position of molars that had been unopposed for long periods, and test the hypothesis that over-eruption does occur on each single tooth without an antagonist.
SUBJECTS AND METHODS: Fifty seven individuals were clinically examined and evaluation of the position of

unopposed molars (M1 and/or M2) was performed on dental cats. There were 89 molars (64 in the maxilla, 25 in the mandible) with a documented period of at least 10 years without antagonists. Among these teeth 26 molars had neither an antagonist nor an adjacent tooth. A qualitative assessment was used to evaluate the position of the molars in a vertical direction. The teeth were classified as: a) teeth with no sign of over-eruption, b) teeth with slight over-eruption (<2 mm), and c) teeth with moderate to severe over-eruption (>2 mm). The method was tested through double evaluation of 20 casts by two observers with a 3 month difference. A high reproducibility could be found in the classification of the molars (96.7 per cent).
RESULTS: Of the 89 molars examined, 11 teeth had no signs of over-eruption, 54 teeth had slight over-eruption (<2 mm), and 19 teeth showed moderate to severe over-eruption (>2 mm). Different patterns were found in the position of unopposed molars in the mandible and maxilla. The presence of adjacent teeth was important for the position of the unopposed molar in a mesiodistal or buccolingual direction.
CONCLUSIONS: Over-eruption does not necessary occur in all teeth without antagonists. Further studies are required to analyse the factors influencing the vertical position of teeth without antagonists.

44 OCCLUSAL PATTERNS OF MALOCCLUSION USING THE OCCLUSAL FORCE MEASURING SYSTEM

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AIMS: The diagnosis associated with occlusal contacts is the key to evaluating the efficacy of orthodontic treatment. Recently a novel occlusal diagnostic system (Dental Prescale Occluzer System) has been developed. The aim of this study was to determine treatment results by evaluating occlusal patterns, especially the occlusal contact areas and pressures in orthodontic patients using the measuring system.
MATERIALS AND METHODS: This study was designed to investigate occlusal contact areas and pressure in occlusion using this system in 103 subjects with normal occlusion and malocclusion. The system consists of pressure sensitive sheets (Dental Prescale), an analysing computer (Occluzer) and a data saving computer.
RESULTS: When the occlusal patterns of the subjects with normal occlusion were compared with those with malocclusions, it was found that the occlusal contact area was widest at 8.48 mm^2 and occlusal force was highest at 423.27 N. The average occlusal pressure per 1 mm^2 was 7.71 MPa, this value was in the middle of all groups.
In occlusal patterns of the malocclusion, mandibular protrusion was widest at 7.60 mm^2 in occlusal contact area, and highest at 348.91 N in occlusal force. The occlusal contact area and occlusal force of the other malocclusion groups were in the following descending order from crowding, maxillary protrusion (less than 5 mm overbite), lateral crossbite, maxillary protrusion (greater than 5 mm overbite), by open bite.
CONCLUSIONS: This system provides reliable results and data for measuring occlusal patterns.

45 THE OBJECTIVE AND SUBJECTIVE NEED FOR ORTHODONTIC TREATMENT, AND THE TREATMENT DECISION

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AIM: To evaluate whether the professionally assessed and self-perceived need for orthodontic treatment correlates with the frequency of treatment at a time of its easier accessibility.
SUBJECTS AND METHODS: The sample consisted of 371 school children (201 boys, 170 girls) aged 11–12 years. The objective need for orthodontic treatment was defined after thorough examination of occlusal conditions by specialists in orthodontics. The children answered questions concerning satisfaction with dental aesthetics and subjective desire for treatment. From the interview it was known how many children had received treatment. The possible correlation between objective and subjective need, self-assessment and treatment decision was analysed statistically by the Chi-square test.
RESULTS: An objective need for orthodontic treatment was found in 45.78 per cent of children. Treatment was decided in 40.97 per cent. Whilst 38.00 per cent of children felt that they needed treatment, only 28.25 per cent of them were dissatisfied with the position of their teeth. Differences between treatment frequency, and percentage of objective and subjective need were insignificantly statistically significant. A significant difference was found in the frequency of treatment and dissatisfaction with dental appearance. A high correlation existed between perceived need and treatment decision.
CONCLUSIONS: The results indicate that perception of need among children is the most important reason for treatment. The findings can be used for orthodontic service planning and can serve as reference point for comparative studies in the future. The results of this study are of special interest at time when access to treatment has become easier due to an increase in orthodontic manpower in Poland.

46 THREE-DIMENSIONAL EXAMINATION OF THE DISPLACED ALVEOLAR STUMPS AND THE INCISAL POINTS IN CLEFT PATIENTS

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AIMS: To metrically define the deviation of the alveolar stumps and the incisal points with angle examinations, and to determine transversal changes of the alveolar crest in cleft patients.

MATERIALS AND METHOD: An examination was carried out on maxillary plaster models of patients with unilateral (44) and bilateral (28) cleft lip, alveolus and palate (CLP), using a three-dimensional and non-contact measurement system. The angle between the canine point and the intertuberosity-distance, and the angle between the incisal point and the intertuberosity-distance were investigated. The intercanine-distance and the intertuberosity-distance was also measured to show transversal changes. All investigated diameters were measured six times in the period between the birth and the age of seven years.
RESULTS: In UCLP a decrease of the angle values on the alveolar stumps was found in the period between birth and seven years of age. At the same time the intercanine-distances were reduced and the intertuberosity-distance increased. The incisal point came near to the midline of the jaw (75.69 degrees at birth and 88.31 degrees at seven year of age).
In BLCP the angles between the canine points and the intertuberosity-distance increased in the period of pre-surgical therapy. At the same time the jaw was widened anteriorly and posteriorly in the transverse dimension. The incisal point did not show any significant change (91.87 degrees at birth and 91.02 degrees at seven years of age).
CONCLUSIONS: The influence of growth and development on the alveolar stumps and the incisal point can be portrayed when angular measurements are included in diagnostics. This method shows transversal changes and deviations of alveolar stumps and the midline.

47 REGULATION OF MMPs/TIMPs IN AN *IN VITRO* MODEL OF HUMAN MASSETER MUSCLE

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AIMS: Remodelling of muscle fibre extracellular matrix (ECM) in relation to craniofacial form has not previously been investigated *in vitro*. Matrix metalloproteinases (MMPs) and the tissue inhibitors of metalloproteinases (TIMPs) are essential in the physiological regulation of ECM turnover, but it remains unclear if masseter muscle ECM is regulated by these proteins.
MATERIALS AND METHODS: Primary cultures of cells from human masseter consist of a heterogeneous population of satellite cells and fibroblasts in which the former proliferate, migrate and fuse to form multinucleated myotubes. Cells were prepared from outgrowths of masseter muscle biopsies obtained following elective oral surgery and satellite cells identified by their immunoreactivity to an anti-desmin antibody. Their proportions (relative to the total mononuclear cell population) were determined throughout culture, whilst total RNA was harvested from parallel cultures and the corresponding conditioned medium (CM) was collected. Gelatin zymography was performed on CM to determine MMP activity, whilst Western blotting determined the presence of MMP protein. Total RNA was Northern blotted and the resulting filter hybridised in solution to a radio-labelled probe to allow determination of TIMP-1 mRNA levels.
RESULTS: Pre-fusion both MMP-2 and MMP-9 activity was present. Activity of the inducible MMP-9 was down-regulated in post-fusion cultures due to total loss of MMP-9 protein expression. Constitutive MMP-2 activity increased with time in culture in parallel with TIMP-1 mRNA expression.
CONCLUSIONS: Using cells derived from the masseter, it has been shown that regulation of matrix turnover via MMP-9 is involved in the events leading to myotube formation (regeneration) but that, once established, the myotubes are stable in terms of matrix remodelling.

48 DENTAL OCCLUSION AND ARCH DIMENSIONS IN CHILDREN WITH CLEFT PALATE

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AIMS: To study changes in the occlusion and in the dimensions of the maxillary dental arch from the deciduous to the permanent dentition in a group of children with cleft palate (CP) only.
SUBJECTS AND METHODS: Thirty-eight consecutive children with CP who had undergone surgery at the Department of Plastic Surgery, University Hospital, Linköping, Sweden, participated. The palatal closure had been performed according to the Wardill-Kilner procedure. Casts made when the patients were between 6 and 19 years of age were used for the study. The occlusion score was estimated according to Huddart and Bodenham (1972). The dental arch dimensions were compared with mean normal values of arch dimensions for males and females according to Moorrees (1959).
RESULTS: At 6 years of age, 40 per cent of the children had a normal occlusion (≤0); at puberty, 40 per cent; and at 19 years, 40 per cent. The decrease in the occlusal score from puberty to 19 years was related to changes in the buccal regions. The mean value for maxillary dental arch length was, in relation to the normal data, 3.8 mm shorter at 6 years of age and 3.5 mm at 19 years of age. The intercanine width did not differ from that of the controls. The differences in width in the premolar regions gradually increased from –2.6 mm at 6 years of age to –4.4 mm at 19 years of age. The correspondence differences in the molar region were 0.5 and –2.6 mm, respectively.
CONCLUSIONS: The dental occlusion in the late mixed and early permanent dentitions improved, probably as a result of orthodontic treatment. In the anterior segment, the improvement was relatively stable up to 19 years of age, while the occlusion tended to relapse in the buccal regions. Long-term retention is needed if good buccal occlusion is to be maintained after orthodontic treatment.

49 PERIORAL ELECTROMYOGRAPHY AND PRESSURE MEASUREMENTS DURING TRUMPET PERFORMANCE

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AIMS: Analysis of the effect of ascending pitch and increasing loudness on the mouthpiece force (force between mouthpiece and lips), the activity of seven perioral muscles, as well as on the pressure on the upper and lower incisors.
SUBJECTS AND METHOD: A group of nineteen professional trumpeters served as the subjects for the study. The myoelectrical activity was recorded with miniature surface electrodes specially designed for the perioral area. In order to evaluate dental strain, all eight incisors were separately equipped with sensors. A special measuring system allowed the determination of the vertical inclination of the trumpet. In addition, a model cast analysis was performed.
RESULTS: The statistical evaluation of the EMG signals showed that orbicularis oris are the most relevant muscles for producing the tone. During trumpet playing almost twice as much pressure was applied on the upper compared with the lower incisors. The difference between the central and lateral incisors was larger in the upper than in the lower jaw. The results prove that the percentage of mouthpiece force cushioned by the lips decreased greatly with ascending pitch. Trumpeters with a high palate and lingually tipped upper centrals held their instruments in a more downward direction.
CONCLUSIONS: The high level of dental strain, combined with the finding that most pressure is exerted on the upper centrals, could explain the reduction in overjet in children playing the trumpet (Herman, 1981; Brattström *et al*., 1989). Myofunctional exercises for trumpeters should focus on the training of those perioral muscles that play the main role in trumpet performance and/or should be aimed at the correct co-ordination of the affected musculature.

Herman E 1981 Influence of musical instruments on tooth position. American Journal of Orthodontics 80: 145–155

Brattström V, Odenrick L, Kvam E 1989 Dentofacial morphology in children playing wind instruments. A longitudinal study. European Journal of Orthodontics 11: 179–185

50 MANDIBULAR GROWTH AFTER EXTRACTION OF LOWER FIRST MOLARS. A LONGITUDINAL STUDY

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AIMS: To evaluate mandibular growth after early extraction of the lower first molars.
SUBJECTS AND METHOD: The study group, EX6, consisted of the lateral cephalograms of 20 individuals. The first registration was obtained before extraction of the lower first molars and prior to the adolescent growth spurt. The second registration was obtained seven years later. Lateral cephalograms of two age-matched control groups were selected. One group of 24 individuals, EX4-5, had two premolars extracted in the lower jaw along with orthodontic treatment. The second group of 40 individuals, NONEX, had neither extractions nor orthodontic treatment. The control groups had lateral cephalograms taken at the same ages as the study group. The cephalograms were digitised, linear and angular variables were calculated, and the groups compared statistically for evaluation of mandibular growth discrepancies.
RESULTS: The first registration, prior to extractions and the adolescent growth spurt, showed significantly reduced alveolar proclination (CL/ML) in the EX6 group compared with the EX4-5 group. At the second registration no significant differences between the two groups were found. At the first registration the NONEX group showed a significantly shorter mandibular length (cd-pgn) and lower facial height (ans-gn). The mandibular rotation (NSL/ML) and the jaw angle (RL/ML) was decreased and the alveolar proclination (CL/ML) increased compared with the EX6 group. At the second registration only the angular differences (NSL/ML, RL/ML, CL/ML) remained, i.e. differences in shape.
CONCLUSION: Early extraction of the lower first molars does not seem to influence mandibular growth.

51 POTENTIAL AND LIMITS OF GROWTH PREDICTION LOGISTIC REGRESSION AND ROC CURVES

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AIMS: Former approaches to the prediction of craniofacial growth based mainly on correlation and linear regression analyses using explanatory variables from a given morphology clearly show their limits in clinical application. Within the frame of this project it was explored if, through the restriction of the growth to be predicted to its direction, improved clinically exploitable correlations can be shown by means of statistical methods.
MATERIAL AND METHOD: The lateral cephalograms of 30 male orthodontically untreated cases with Class II malocclusions (Belfast Growth Study) were examined within a retrospective study. Growth was determined at four-year intervals in the age groups 7–11, 9–13 and 11–15. The transferability of the hypotheses based on the three groups given above was to be verified by selecting additional control groups made up of treated Class II malocclusion cases. By means of logistic regression models and ROC curves the statistical possibilities for predicting the direction of mandibular growth rotation (dependent variable) were explored.
RESULTS: The research conducted clearly points out the prognostic limitations of the lateral cephalogram. However, initial results seem to demonstrate the prognostic superiority of the angles which describe the shape of the mandible rather than its position relative to the cranial base.

DISCUSSION: Through the reduction of the variables to be predicted to a clinically meaningful extent, i.e. in this case the direction of mandibular rotation only, logistic regression models can be used to determine correlations between the explanatory and dependent variables. The ROC curves have a certain potential when it comes to the evaluation of the quality of the predictor variables discovered. This quality is important in cranial growth prediction since in this field prognoses have previously been vague.

52 FHL AND MYOSIN EXPRESSION IN PRIMARY CULTURES OF HUMAN MASSETER MUSCLE

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The LIM-proteins FHL-1 and FHL-3 are expressed in skeletal muscle. Their precise function is unknown but FHL-1 expression has been associated with muscle growth and a preliminary study suggests that the expression of FHL-3 is unregulated in the masseters of subjects with short face syndrome compared with normal subjects (Madgwick *et al*., 1996). Primary cultures of satellite cells will proliferate to confluence at which time they can be induced to fuse into small myotubes that hypertrophy with the fusion of additional satellite cells. Fusion is promoted by the manipulation of the growth factor and hormonal environment *in vitro*, reflecting the importance of these factors in muscle formation and phenotypic development *in vivo*. Phenotypic change is typically marked by changes in myosin heavy chain (MyHC) gene expression where cell fusion marks the point of transition from embryonic MyHC to the expression of adult MyHC isoforms.
AIMS: To determine the pattern of expression of FHL-1 and FHL-3 mRNAs using the expression of MyHC mRNAs as molecular markers of development.
MATERIALS AND METHODS: Replicate cultures of satellite cells derived from the human masseter were grown in 20 per cent fetal calf serum (FCS) in DMEM. Satellite cell fusion was induced by switching to DMEM containing either 2 per cent FCS or insulin (10 $\mu g\ ml^{-1}$) and transferrin (100 $\mu g\ ml^{-1}$).
RESULTS: FHL-1 was expressed at relatively low levels during satellite cell proliferation and followed the pattern of embryonic MyHC expression, achieving maximal expression at the time of cell fusion. Conversely, FHL-3 was maximally expressed during the proliferative phase and declined after myotube formation. The substitution of insulin for 2 per cent FCS in the culture protocol resulted in a three- to five-fold increase ($P < 0.01$) in the levels of MyHC expression post fusion. However, insulin had no effect on the pattern or level of expression of FHL-1 and FHL-3.
CONCLUSIONS: The observed expression of FHL-1 and FHL-3 and their insensitivity to insulin-driven myotube hypertrophy suggest that they may play an important role in early myogenic events.

Madgwick A J A, Morgan, M J, Hunt N P 1996 Differential expression LIM-domain proteins in the masseter muscles of patients with vertical facial deformity. Journal of Muscle Research and Cell Motility 18: 234

53 EVALUATION OF A MODIFIED SURGICALLY ASSISTED ORTHODONTIC MAXILLARY EXPANSION TECHNIQUE

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AIMS: The purpose of this study was to evaluate treatment effects and stability after modified surgically assisted maxillary expansion in non-growing individuals.
SUBJECTS AND METHODS: The sample consisted of 13 patients (mean age 28.8 years, range 20.1–46.2 years) who were expanded in the maxilla with a fixed orthodontic Hyrax expanded for two to three weeks. The surgical part of the technique was minor, comprising lateral corticotomies of the zygomatic buttress and canine area, and was performed under short sedation. Dental study casts were taken prior to treatment, post-expansion, at debanding and 1 year post retention. Measurements were made of the buccal tipping of the anchor teeth and net transversal expansion in the molar and premolar areas. The change in the vertical dimension was assessed from lateral head films before treatment and after retention.
RESULTS: After an initial phase of over-expansion and buccal tipping of the anchor teeth, the transversal distances were reduced during treatment with fixed appliances to the planned expansion, and tooth tipping normalised. The median and mean values of achieved expansion were 7.60 and 6.81 mm post-expansion, 6.00 and 5.65 mm post-treatment, and 5.50 and 5.58 mm after retention for 1 year. The results were stable 1 year post-retention The average increase of the vertical dimension was low, between 0 and 2 degrees for the mandibular plane.
CONCLUSION: The combined orthodontic-surgical technique is simple and allows good and stable transverse orthopaedic skeletal expansion up to 8 mm. The initial over-expansion and tipping were reduced during the following fixed appliance treatment and the surgical part of the treatment can be undertaken with local anaesthesia under short sedation.

54 CRANIOFACIAL PATTERN AND SOFT TISSUE MORPHOLOGY IN PATIENTS WITH OBSTRUCTIVE SLEEP APNOEA

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AIM: To investigate the craniofacial morphology, the airway depth, the soft tissues morphology and the hyoid bone

position in a group of patients with Obstructive Sleep Apnoea (OSA).
SUBJECTS AND METHOD: Standard lateral skull radiographs of 64 adults (50 males, 14 females) with a polysomnographic diagnosis of OSA, aged to 35 to 74 years (mean age: 41.44 years), were examined. The control group consisted of 55 non-snoring subjects (20 males, 35 females) aged to 16 to 30 years (mean age: 23.29 years) with ideal occlusion.
The following variables were measured: SNA, SNB, ANB, ML-^NSL, NL-^NSL, ML-^NL, NSBa, N-Sp', Sp'-Gn, ANS-PNS, MxUL (Maxillary Unit Length), Cd-Go, Go-Gn, MdUL (Mandibular Unit Length), PSN-E (pharynx length), pawl-PNS, paw2-t, paw3-tb (pharynx width at three different levels), TT-E (tongue length), TgH (tongue height), PNS-P (soft palate length), WT (maximum palate thickness), h-ML (vertical position of the hyoid bone). Statistical comparison using a two-tailed *t*-test was performed.
RESULTS AND DISCUSSION: In the OSA group SNA and SNB were significantly smaller ($P < 0.001$), ANB was slightly increased ($P < 0.05$), ML-^NSL and ML-^NL were larger ($P < 0.001$), and N-Sp' and Sp'-Gn were longer ($P < 0.001$) than in the controls. The OSA patients showed a lower degree of maxillary and mandibular prognathism; the mandible seemed to be posteriorly displaced: this is a characteristic for mouth breathers and mouth breathing can be found in a group of OSA patients that are heavy snorers. ANS-PNS and MxUL were decreased ($P < 0.001$), and Cd-Go, Go-Gn and MdUL were slightly reduced ($P < 0.05$). Significant differences were also found with respect to the soft tissue morphology: the pharynx was lengthened (PNS-E: $P<0.001$), the soft palate and the tongue were elongated and thickened (SNP-P: $P < 0.001$; MPT: $P < 0.001$; TT-E: $P < 0.001$; TgH: $P < 0.05$). The hyoid bone showed a lower position ($P < 0.001$), reflecting a low tongue position.
CONCLUSIONS: Cephalograms are useful in identifying skeletal disharmonies and hyoid bone position in OSA patients and may be a guide in examination of soft tissue structures. Magnetic Resonance Imaging should, however, be used to accurately investigate airway patency.

55 COMPUTER-AIDED SIMULATIONS FOR THE DIAGNOSIS OF MAXILLOFACIAL ANOMALIES

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AIMS: Computer-aided simulation techniques are widely used for a number of tasks in the pre-operative planning of orthognathic surgery. However they often fail to integrate the morphological characteristics and functional information. A new computer software which includes: 1) visualization of jaw movement and its motion analysis, 2) an indication of the mechanical force in the temporomandibular joint generated by masticatory muscle loading and 3) automated Finite Element Modelling (FEM) from CT data has been developed. The purpose of this study was to evaluate the malfunctions in patients with maxillofacial anomalies using these new methods.
SUBJECTS AND METHODS: Twelve subjects with maxillofacial anomalies aged 12 to 29 years were studied. The data from bi-plane cephalometrics (or CT scan), biting pressure detecting sheets, and the digital jaw movement analyser were used for calculation. Co-ordinates were transformed for unification of each data, and biomechanical analysis was then performed in a 32-bit computer system. The software program was written in C++ language.
RESULTS: Using these applications, the cephalometric traced image (or 3D-CT image) of the mandible was displayed as a motion picture. The acceleration of movement in both condylar head and the mechanical forces generated by mastication were determined. Automated FEM indicated accurate information concerning stress distribution.
CONCLUSIONS: From these results, malfunctions of the neuromuscular system in anomalies were able to be evaluated clearly with their individual structures. These computer-aided biomechanical simulations can be used to derive clinically useful information and to improve the combined evaluation of both static characteristics and dynamic function.

56 CONGENITAL PALSY OF FACIAL NERVE: INFLUENCE ON DENTOFACIAL DEVELOPMENT AND GROWTH

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AIMS: Regarding the influence of orofacial dysfunction on dentofacial growth, the consideration of facial musculature becomes an integral part of any orthodontic diagnosis. The purpose of this study was to clarify the role of muscle dysfunction on facial morphology in patients affected with congenital palsy of the facial nerve, or the rare Moebius syndrome.
SUBJECTS AND METHOD: Ten patients, aged 4 to 23 years, affected with Moebius syndrome or congenital cerebral paralysis were examined and their photographs, dental casts and lateral cephalograms were analysed. The measurements obtained were compared with dentoalveolar and cephalometric standard values.
RESULTS: The dentofacial morphology of the patients showed some deviations from the standard values due to the location of palsy. The upper incisors were slightly proclined. A reduced arch width and an anterior open bite existed in patients with hypotonic masticatory muscles. Both skeletal Class II and Class III were found. The main deviation of skeletal morphology from standard values occurred in the vertical plane. The palatomandibular plane angle was increased in every patient, however some showed an extreme skeletal open bite. The morphology of the mandible varied due to the muscle tone of masticatory musculature. An average gonial angle but a marked antegonial notch occurred in patients with normal masticatory muscles.
CONCLUSIONS: Palsy of the facial nerves influences skeletal growth and in particular the vertical dimensions more

than the dentition. Hypotonic facial musculature results in various types of skeletal open bite. This variation can be caused on the one hand by muscle tonus of musculature not innervated by the facial nerve, or on the other by genetic influence.

57 THE PATTERN OF MYOSIN HEAVY CHAIN EXPRESSION IN THE HUMAN MASSETER MUSCLE

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A molecular understanding of functional activity in the orofacial muscles is required if we are to understand their role in the development of craniofacial dysplasias. The myosin heavy chains (MyHC) are a family of contractile proteins that largely determine the speed and fatigue resistance of skeletal muscle contraction. Thus the distribution of MyHC isoforms between individual fibres will reflect a given muscle's functional activity. The adult masseter expresses both adult and developmental isoforms and their precise distribution may vary between different regions of the muscle.
AIM: To characterise the distribution of MyHC isoforms in fibres from the anterior deep portion of the human masseter muscle.
MATERIALS AND METHODS: Cryostat sections from the masseter were analysed immunocytochemically. Monoclonal antibodies against MyHC were used to determine the expression of type I (ß-cardiac), type IIa, total type II (types IIa and IIx), α-cardiac MyHC and the neonatal and embryonic developmental isoforms.
RESULTS: Fibres expressing only type I MyHC were most prevalent, comprising up to 70 per cent of the total fibre population. Five per cent of fibres expressed only type IIx MyHC. The remaining fibres contributed to hybrid populations and expressed a total of 12 different isoform combinations. A population expressing both type I and type IIx MyHC was found in 9 per cent of fibres. Embryonic MyHC was not detected in fibres from any subject. α-cardiac MyHC was not expressed in all subjects of the present study, although previously published reports have suggested that α-cardiac MyHC is consistently expressed in the human masseter.
CONCLUSION: There is a high proportion of fibres that express a combination of two or more MyHCs in the anterior deep portion of the masseter. The distribution of MyHC isoforms was wide in this region of the masseter, however the fibres containing exclusively type I MyHC were always the most prevalent fibre population.

58 INTERDISCIPLINARY CO-OPERATION IN THE EARLY SCREENING OF MALOCCLUSION

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AIMS: To assess the level of agreement between paediatricians and orthodontists in identifying patients presenting a high need of treatment at an early stage.
SUBJECTS: One thousand and eighty nine patients were examined in the Orthodontic Department in 1994–1995. Two hundred and ninety eight had been referred by their paediatrician (experimental group A), while 791 had independently asked for an examination (control group B). The age range was 3–15 years.
METHODS: The basic methods of diagnosis and the use of IOTN were illustrated during an interactive seminar. Paediatricians were instructed to refer their patients as soon as any sign of malocclusion could be observed, filling in a referral form where a number of traits could be indicated and checked by the orthodontist.
RESULTS AND CONCLUSIONS: A difference was observed in the mean age of the two groups, 7.7 in A and 9.8 in B ($P < 0.01$). A high need of treatment was present in 89.2 per cent of group A and in 68.2 per cent of group B. Of the subjects, 10.8 per cent in group A and 31.8 per cent of B were in the no/moderate need of treatment categories. The most frequently observed abnormal occlusal traits were: increased overjet, crossbite and dentoalveolar discrepancy. Eighty eight forms properly filled in by the paediatricians were examined to assess the level of agreement in the diagnosis. Hypothesis testing was carried out on the assumption that the variable 'presence of malocclusion' is normally distributed within the population and on the value of the 'normal distribution of the mean'. No difference in the identification of the trait was observed in some variables, such as the presence of crossbite, dentoalveolar discrepancy, increased overjet, open bite (NS). A statistically significant difference existed ($P < 0.05$) in the diagnosis of traits such as mandibular prognathism, deep bite, habits and mandibular displacement. The average sensibility was 74.81 per cent (S.D. 6.8) where no difference was present, while the sensibility was only 51.4 per cent (S.D. 14.6) where a difference in evaluation existed. A better relationship among specialists could lead to earlier observation and correction of malocclusions. The low level of agreement observed in the identification of some occlusal traits would, however, suggest that further information and calibration of non-specialists might still be indicated.

59 PREVENTIVE DENTISTRY AND ORTHODONTICS: SOCIAL IMPLICATIONS

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AIM: To investigate the amount of unmet need of primary dental care and orthodontic treatment in a group of young adults in two different socio-economic categories, thus providing a database to local health authorities in organizing new services.
SUBJECTS AND METHODS: One hundred and eighty four 18-year-old students and workers living in the same area were examined in their schools or in the local factories where

they worked. Workers had attended school until they were 13 years of age. Caries and periodontal conditions were evaluated according to the World Health Organisation methods, while the unmet orthodontic treatment need was assessed with the IOTN (Index of Orthodontic Treatment Need) as described by Brook and Shaw (1989).
RESULTS: Sixty per cent of the workers experienced generalized soft deposits, while this was the case in only about 10 per cent of the students. The DMFT score was found to be 9.1 among the young workers and 6.3 among the students. Interesting was the evaluation of the different components of the DMFT; the workers showed an average of 2.6 decayed teeth, while 1.1 was the value found in the student group. The percentage of filled teeth was 6.3 per cent in the workers' sample and 8.1 per cent among the students. In the analysis of the IOTN, 74 per cent of the students did not need treatment, compared with only 50 per cent of the working population in the same age group. Even more striking was the difference in cases presenting moderate or borderline need of treatment: only 15 per cent of the students, while among the workers the percentage increased to 34.5 per cent. The aesthetic component of the IOTN showed only slight differences between the two groups, with both groups tending to underestimate their malocclusion and showing a high degree of self-acceptance.
CONCLUSIONS: The results suggest the need for greater concern in the lower socio-economic groups. The young workers seem to show the greatest unmet need of both primary dental care and orthodontics, associated with the lowest perception of their oral and occlusal conditions. This could be due to the different expectations and level of information and education, and possibly some differences in nutritional habits in the families of the two groups of young adults examined. Thus a change in the perception of the problem appears to be necessary.

60 SELF-PERCEPTION OF OCCLUSAL CONDITIONS IN 18-YEAR-OLD SUBJECTS

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AIMS: In suggesting orthodontic treatment the orthodontist has to consider not only objective signs of a patient's malocclusion, but also subjective symptoms (treatment need and demand, and relative patient's expectation) and social acceptability (what type of aesthetic disharmony is able to create a social problem to the patient). With regard to subjective symptoms, the orthodontist has to consider what malocclusion means for the patient or, in other words, patient awareness of their occlusal conditions.
The aim of this study was to evaluate the ability of a population of 18-year-old subjects to perceive their own occlusion. The sample (132 subjects) was selected randomly among all students attending the last year of the high schools in L'Aquila. The IOTN was used to record treatment need concerning dental health, and photographs and a questionnaire to record student's perception of their own occlusion.
RESULTS: Eighty two per cent of students were able to recognize their own occlusion and 86 per cent were able to identify their own smile. These results seem to confirm those of other authors where similar methods were used (Espeland and Stenvik, 1991a,b).
CONCLUSIONS: These results show that 18-year-old subjects are highly aware of their occlusal conditions.

Espeland L V, Stenvik A 1991a Orthodontically treated young adults: awareness of their own dental arrangement. European Journal Orthodontics 13: 7–14

Espeland L V, Stenvik A 1991b Perception of personal dental appearance in young adults: Relationship between occlusion, awareness, and satisfaction. American Journal of Orthodontics and Dentofacial Orthopedics 100: 234–241

61 A LONGITUDINAL STUDY OF BITE FORCE MAGNITUDE, NASAL AIR FLOW RESISTANCE AND DENTOSKELETAL MORPHOLOGY IN AN EGYPTIAN SAMPLE

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AIMS: To study the relationship between the bite force magnitude, nasal air flow resistance and dentoskeletal morphology, as well as to assess the changes attributed to specific occlusal and skeletal variations.
SUBJECTS AND METHODS: The study was carried out on an Egyptian sample composed of 120 subjects with malocclusion (60 male, 60 female) subdivided into four age groups ranging from 6 to 22 years. Anamnesis, study models, panoramic radiographs and lateral cephalograms were taken and assessed, and measurements of bite force magnitude and nasal air flow resistance were recorded annually. All parameters were compared with measurements obtained from a control group composed of 80 subjects with normal occlusion matched for sex and age.
RESULTS: Significant correlations were found between the bite force magnitude, nasal air flow resistance and presence or absence of tonsils on the one hand and the mandibular plane angle, gonial angle, anterior face height and palatal height on the other. Higher values of bite force magnitude were related to a decreased mandibular plane angle, lower gonial angle, diminished anterior face height and shallower palatal vault.
CONCLUSIONS: The results of this study suggest an aetiological relationship between masticatory and respiratory function and dentofacial morphology.

62 LONGITUDINAL MOVEMENTS OF THE FIRST MOLARS AND THE ANTERIOR DENTITION IN ABORIGINES

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AIM: Changes in the permanent dentition according to growth in traditional Australian Aborigines have been reported by Barrett *et al*. (1965) and Brown *et al*. (1983–1992). A study of the longitudinal changes in the size of the permanent dentition of Aborigines using a different method from that of the above-mentioned researchers was undertaken.
MATERIALS AND METHODS: Intra-oral plaster moulds of 50 male and 50 female Aborigines were collected, and the lengths and widths of the upper and lower dental arch triangles connecting the central fossae of the right and left molars and the contact points of both central incisors of the subjects at around the ages of 8, 11, 15 and 19 years were measured.
RESULTS: 1) Longitudinally, the lengths of the upper and lower dental arches decreased antero-posteriorly. On average, the decrease in the upper arch was –1.9 mm for males and –2.8 mm for females, and the decrease in the lower arch was –3.4 mm for males and –3.8 mm for females. 2) Longitudinally, the widths of the upper and lower dental arches increased outwards. On average, the increase in the upper arch was +2.8 mm for males and +1.0 mm for females, and the increase in the lower arch was +2.0 mm for males and +0.9 mm for females.
CONCLUSIONS: 1) The length from the first molars to the central incisors decreased antero-posteriorly in the upper and lower arch in males and females during the growing period of between 8 and 19 years of age. 2) The first molars and the anterior permanent dentition migrated outwards in the upper and lower arch in males and females during the growing period. These trends were clearly borne out by the data.

63 DOES OCCLUSION DETERMINE PERINATAL MYOSIN HEAVY CHAIN EXPRESSION IN MASSETER MUSCLES?

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The myosin heavy chain (MyHC) is the molecular motor which drives muscle contraction. Six different MyHC isoforms have been characterized in human muscle, all of which are expressed in the adult masseter. The expression of perinatal MyHC, a developmental isoform, is significantly increased in the masseter muscle of subjects with Long Face Syndrome (LFS) while the IIx MyHC, a fast isoform, has been found to be significantly decreased compared with normal subjects. Subjects with LFS have a tendency towards an anterior open bite which reduces the number of static occlusal contacts made in the intercuspal position.
AIMS: To investigate the relationship between the expression of the MyHC isoforms in the masseter muscle and the number of static occlusal contacts.
MATERIALS AND METHODS: Masseter muscle biopsies were obtained from 15 patients, LFS (n = 9) and controls (n = 6), undergoing orthognathic surgery. The expression of the MyHC isoforms was quantified using Northern analysis. Pre-treatment study casts were analysed and the number of static occlusal contacts noted for each patient. These were compared with the expression of each MyHC using one-way ANOVA, with specific differences between groups being identified by Tukey's test.
RESULTS: The expression of perinatal MyHC increased exponentially as the number of static occlusal contacts decreased, the differences in expression reaching significance at $P < 0.05$ when the number of occlusal contacts became less than five. There was no relationship between the number of static occlusal contacts and other MyHC isoforms.
CONCLUSIONS: The expression of perinatal MyHC in the human masseter increases as the number of pre-treatment static occlusal contacts decreases.

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

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AIM: The investigation of the occurrence of genetically determined disturbances of tooth development in patients with cleft lip and palate
MATERIAL: Radiographs and data sheets of 263 children with cleft lip and palate.
METHODS: Panoramic and occlusal radiographs together with plaster casts and oral photographs were examined with respect to occurrence of a disturbed development of the dentition. In comparison, the records of 1600 non-cleft-cases with guiding orthodontic treatment wire were examined.
RESULTS: In 97.7 per cent of the cleft-cases at least one symptom of a genetically determined disturbance was found, but most of the cases displayed more than one symptom per case. With increasing severity the number of symptoms increased. As anticipated, in the cleft patients there were increased disturbances outside the cleft region**.** In 16.7 per cent of all cases retardation of eruption was found, and in 11.4 per cent late development of teeth. Abnormal shaped roots were found in 7.6 per cent; 7.6 per cent had pyramid roots or taurodont teeth, and infrapositions were seen in 7.2 per cent.
CONCLUSIONS: Patients with cleft lip and palate are more often affected by disturbances in the development of the dentition than comparable patients without cleft lip and

palate. One reason could be a predetermined weakness of the involved tissues.

65 THREE-DIMENSIONAL CHILDHOOD FACIAL GROWTH, MEASURED BY OPTICAL SURFACE SCANNING

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AIMS: To study the three-dimensional changes of the growing face and compare male and female facial morphology.
SUBJECTS AND METHODS: One hundred and thirty two Caucasian children aged 5 to 10 years were measured using the optical surface scanning system (Arridge *et al*., 1985). Average scans were constructed by computer for each age and sex group. The averages were superimposed by the scanning software to assess the differences between different ages and sexes.
RESULTS: Males were generally larger than females in all dimensions. The greatest differences were between the facial heights, and the least in the mid-facial dimensions. The face height of both sexes increased by an average of 3–4 mm each year. Mid-face prominence and width altered little with age. Mandibular prominence and width increased. The increases in width were greatest at the more inferior parts of the mandible and were greater than the purely hard tissue changes reported by cephalometric studies. The nasal dimensions increased with age, except the width of the dorsum, which changed little. The lips increased in prominence at a variable annual rate that averaged 1–2 mm.
CONCLUSIONS: The optical surface scanner is suitable for three-dimensional investigation of the faces of children. Male children are generally larger than females for all the age groups studied. The degree to which the face enlarges with age varies upon the region studied. Growth in facial height is greatest. Growth of the mid-face in both prominence and width is minimal at most stages. The exception to this is the nose, which enlarges in prominence and width at most of the ages studied.

Arridge S. Moss J P, Linney A D, James D R 1985 Three dimensional digitization of the face and skull. Journal of Maxillofacial Surgery 13: 136–143

66 MASTICATORY MOVEMENT CHANGES IN CHILDREN WITH DISTAL OCCLUSION, TREATED WITH AN ACTIVATOR

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AIMS: To determine whether changes in masticatory movements occur in children with Angle Class II division 1 malocclusions treated with functional appliances.
SUBJECTS AND METHODS: Thirty children with Angle Class II division 1 malocclusions treated with an activator have been followed for 4.5–6 years. Forty-seven children with Angle Class I occlusions followed for 6 years served as a control group. All children were free from signs and symptoms of craniomandibular disorders.
Oral motor function with respect to mandibular displacement, duration and velocity, was monitored three-dimensionally with an optoelectronic method at the start and end of the follow-up period. Recordings were made on the opening, closing, and occlusal phases of the chewing cycle. Changes in occlusion (overjet, overbite and molar sagittal relation) and body height, were also recorded. The results were evaluated with multiple regression analysis.
RESULTS: Based on the changes that occurred during the follow-up period, it was found that in the treated Angle Class II division 1 group the total duration of the chewing cycle seemed to be stable and the opening velocity decreased. The closing time increased and the time in the occlusal phase decreased. The closing path as well as the maximal lateral movements of the chewing cycle increased, while the maximal vertical movements and amplitude were decreased.
CONCLUSION: In individuals with distal occlusion treated with functional appliances changes occur in the chewing envelope towards normal values.

67 PAIN REPORTED DURING ALIGNMENT USING VARIOUS NICKEL TITANIUM WIRES

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AIM: Discomfort experienced during orthodontic alignment was assessed comparing the use of three different nickel titanium wires. A total of 103 subjects with a mean age of 15.6 years were enrolled and randomly allocated to one of three groups treated with either 0.014″ round austenitic active wire, 0.016″ round austenitic active wire, or 0.017 × 0.025″ rectangular martensitic active nickel titanium wire.
SUBJECTS AND METHODS: Prior to treatment, anxiety levels were assessed using standardized psychometric questionnaires. Clinicians bonded only one arch and ligated the archwires fully where possible. Subjects recorded their level of discomfort immediately following archwire ligation on a visual analogue scale (VAS) and used a pain diary with a verbal rating scale for the following seven days.
RESULTS: Anxiety levels of the subjects prior to treatment were not statistically significantly different from those reported for similarly aged individuals in the general population, and were similar in all three groups. For the different groups, no statistically significant differences were observed between VAS scores obtained following archwire ligation. Compared with the subjects in the two austenitic round wire groups, statistically significantly ($P < 0.02$) higher levels of mean pain scores were reported by the subjects in the rectangular 0.017 × 0.025″ martensitic active wire group. There appeared to be no difference in mean pain scores reported when comparing subjects in the 0.014″ and 0.016″ diameter austenitic active wire groups.

CONCLUSIONS: Immediate levels of pain were similar for all subjects regardless of the type of wire used. Significantly higher levels of pain were reported when a 0.017 × 0.025″ rectangular martensitic active wire was used for initial alignment.

68 ORTHOPAEDICALLY INDUCED DISTRACTION OF THE MANDIBLE

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INTRODUCTION: Human TMJ condyles are primarily formed through costachondral ossification. Therefore, condyles posses the capability to change morphology during Herbst treatment by bone modelling. This effect has been detected during Herbst treatment using CT-scanning and standardized radiographs of the TMJ condyles (Paulsen, 1994; Paulsen *et al*., 1995).
AIM: To describe morphological changes in condyles and profiles of patients treated repeatedly with the Herbst appliance, and changes in mandibular rotations.
SUBJECTS AND METHOD: One hundred consecutive patients treated with the Herbst appliance in the period of puberty to adulthood; three patients were treated repeatedly. Changes in the profiles of patients were described from lateral cephalograms taken in occlusion and during maximal opening using Björk's method. Skeletal ages were calculated using the Tanner-Whitehouse-2-method, modified for the Danish population. Radiographs were taken before and after Herbst treatment and yearly thereafter until cessation of growth. Lateral cephalograms and images of the dental arches were digitized with computer data analysis using a special computer program (TIOPS™).
RESULTS: During the first treatment the analysis revealed a significant increase in the length of the mandible (pgn-cd) and in the height of the ramus (tgo-cd). The gonion angle (ML/RL,cd) had opened, and the mandibular alveolar process with incisors had tilted forwards. Changes were also registered in adulthood. The mandible showed total forward rotation. However, treatment elicited intramatrix rotation and impeded matrix rotation of the mandible, confirming previously found changes at the condyles. After treatment, the gonion angle recovered while the mandibular alveolar process with incisors recovered partly in balance with total forward rotation of the mandible and original interincisal angle. The mandibular alveolar process recovered in balance with forward matrix rotation and intramatrix rotation of the mandible ceased. In patients with a high facial angle the second treatment elicited forward matrix and backward intramatrix rotation of the mandible and closure of the gonion angle. After treatment matrix and intramatrix rotation were ceased.
CONCLUSION: The main treatment effect can be described as growth modification: biomechanically elicited changes in matrix and intramatrix rotation of the mandible with modelling of bone to adapt to the new forward position. Treatment repetition resulted in orthopaedically induced distraction of the mandible.

Paulsen H U 1994 Herbst treatment. The effect on TMJ condyles of 100 cases treated in the period of puberty to adulthood. European Journal of Orthodontics 16: 345 (Abstract)

Paulsen H U, Karle A, Bakke M, Herskind A 1995 CT-scanning and radiographic analysis of temporomandibular joints and cephalometric analysis in a case of Herbst treatment in late puberty. European Journal of Orthodontics 17: 165–175.

69 AESTHETIC COMPONENT OF THE IOTN IN THE ASSESSMENT OF OCCLUSAL APPEARANCE OF FINNISH YOUNG ADULTS

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AIMS: The aim of the study was to assess the feasibility of the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) as a tool in professional and self-evaluation of the acceptable occlusal appearance of young Finnish adults.
SUBJECTS AND METHODS: The subjects were 116 Finnish students aged 16–25 years (40 per cent males) from the towns of Jyväskylä and Varkaus. They were assessed by an orthodontist, who scored their occlusal views by using the total scale of the 10 pictures of the AC of the IOTN (1–4 no/slight need, 5–7 borderline need, 8–10 need for orthodontic treatment). The subjects were asked to give their own view on their dental appearance on a scale of 1–10 by means of picture 1 of the AC (most attractive) and picture 10 of the AC (least attractive). Further, the subjects were assessed if they had a previous history of orthodontic treatment and if they considered they were now in need of orthodontic treatment.
RESULTS: According to the orthodontist's evaluation the great majority of the students (92 per cent) did not need treatment for aesthetic reasons, and of the rest 8 per cent were in borderline need. In the self-evaluation 93 per cent of subjects categorised themselves in grades 1–4, and 7 per cent in grades 5–6. The agreement between orthodontist's and self-evaluation in these two categories was found in 91 per cent of cases. Forty four per cent of the subjects had a history of orthodontic treatment. Eight subjects (7 per cent; 2 males) considered they were now in need of treatment, and two of them had a history of orthodontic treatment. Six out of those eight perceiving treatment need, scored their dental appearance in grade 3 of the AC, while two scored in grade 5. One of the students perceiving treatment need was also scored by an orthodontist to be in borderline need for treatment.
CONCLUSIONS: The dental appearance of a group of young Finnish adults was, in most cases, acceptable when evaluated by the AC of the IOTN. Most subjects had a coherent view of their dental appearance when compared with the professional evaluation. The use of the first and

tenth picture of the AC of IOTN was a good tool in the self-evaluation of dental appearance, and the method can be used in the future as one part of self-evaluation of acceptable occlusion of young Finnish adults. However, the perceived need of orthodontic treatment did not concord with the aesthetic self-evaluation, and this indicates that perceived need and furthermore treatment desire, cannot be estimated only by the measurement of dental appearance.

70 CERVICAL HEADGEAR THERAPY AS A FACTOR IN OBSTRUCTIVE SLEEP APNOEA

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AIMS: To study possible associations between the use of cervical headgear and nocturnal cessations of airflow and the severity of the latter in children with obstructive sleep apnoea (OSA).
SUBJECTS AND METHOD: The subjects were 30 children (12 boys, 18 girls, with a mean age of 8.2, SD 1.61 years), divided into three groups: a group of 10 children undergoing headgear therapy and selected for this examination because of symptoms of OSA while using headgear, an age-matched control group of 10 healthy children, and a group of 10 with OSA. Standard cephalograms of the headgear group prior to orthodontic therapy and the corresponding cephalograms of healthy controls were analysed. A polysomnographic sleep evaluation was used to assess the tendency for OSA. All the subjects spent one night sleeping under laboratory conditions, those with orthodontic treatment spending the first half of the night with the headgear and the latter half without.
RESULTS: The position of the mandible was found to be slightly more posterior in the headgear group than in the control group. The children in the headgear group were found to have significantly more apnoea/hypoapnoea periods during the hours when the appliance was used, and the ODI-Index showed increased values in this group.
CONCLUSIONS: Based on the findings of this study, it is suggested that headgear therapy may contribute to the occurrence of sleep apnoea, when a strong predisposition, such as mandibular retrognathia, to the development of upper airway occlusion already exists.

71 ANTERIOR AND POSTERIOR FACIAL HEIGHT IN CLEFT LIP AND PALATE CHILDREN

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AIMS: The relationship between sagittal and vertical dimensions in 184 cleft lip and palate children was cephalometrically evaluated using the Sassouni method.
RESULTS: In girls and boys with UCLP the lower anterior as well as the posterior facial height was increased, while the total posterior facial height was significantly decreased. The maxilla was significantly retruded. In BCLP girls the lower anterior facial height was within normal limits and the lower posterior facial height was increased. In BCLP boys the lower anterior facial height was increased and the lower posterior facial height was within normal values. In both sexes the total posterior facial height was diminished and the maxilla and mandible were retruded. The total posterior facial height was significantly decreased.
CONCLUSIONS: The diminished total posterior facial height is an important factor in the backward and, to a lesser degree, downward rotation of the mandible in cleft lip and palate children.

72 FEATURES OF DISTAL OCCLUSION OF ADULT FEMALES

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AIM: To compare some dental and skeletal features between neutral and distal occlusion groups derived from an adult female sample with minimal orthodontic treatment.
MATERIALS AND METHODS: The material was collected at the beginning of the 1980s and consisted of lateral and postero-anterior head films, dental casts and questionnaires of 91 female dental students born in the 1950s and 1960s and studying at Kuopio University, Finland. The cephalometric angles were measured using the Pordios program. The linear dimension from PA-head films and dental casts were measured with a sliding calliper. Most occlusal characteristics were defined according to Björk. However, one occlusion group was added. Class I represented neutral occlusion with Angle I molar relationship on both sides. In Class II (1) the first lower molars on both sides were located distally about ½ a cusp behind the neutral position. In Class II (2) the lower molars on both sides were distally about 1/1 cusp behind the neutral position. Class II (3) consisted of cases with unilateral distal occlusion. Twenty five disto-occlusion cases represented 27.5 per cent of the whole material. The next variables were selected for statistical analysis: skeletal width of maxilla, distance between upper first molars, distance between lower first molars, SNA-, SNB- and NS/ML angles, and upper and lower dental arch crowding in millimetres.
RESULTS: The most stable dimension was the lower intermolar width, 41.08 mm in Class I and 41.15–41.86 mm in Class II categories. The distance between the upper first molars was 46.11 mm in Class I. It was smallest in Class II (2), 43.5 mm. The skeletal width of the maxilla was significantly smaller in Class II (1) than in Class I, the values being 62.78 and 65.50 mm, respectively. In neutral occlusion the mean value of SNA was 82.47, SNB 80.00 and NS/ML 30.23 degrees. Significantly differing means in distal occlusion groups were values of SNB in Class II (1) 76.88, SNB in Class II (3) 76.09 and angle SN/ML in Class II (3) 34.29 degrees.

Crowding of the upper dental arch was 1.69 mm in Class I and in distal classes, 5.90, 4.71 and 5.50 mm, respectively. Difference between means of the neutral occlusion and distal occlusion groups was highly significant.
CONCLUSIONS: The distance between the lower molars seems to be equal in neutral and distal occlusal categories. Narrow maxillary bases and the mildest forms of distal occlusion seem to coincide. Unilateral distal molar occlusion and facial type with high mandibular angle and small SNA and SNB angles seem to be related.

73 DENTOALVEOLAR COMPENSATORY MECHANISM IN OPEN BITE PATIENTS

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AIMS: To determine the constancy and extent of dentoalveolar compensation in subjects with disharmonious vertical jaw base relationships in comparison with eugnathic subjects.
MATERIALS AND METHODS: The study was performed on 37 lateral cephalograms of patients with an open bite and 35 eugnathic subjects aged 15 to 18 years. Each cephalogram was traced twice by two authors. The cephalometric analyses were performed using linear and angular measurements. The angular cephalometric variables were: n-s-gn, sp-pm:m-go, m-go-ar, the sum of the posterior angles according to Björk, l:sp-pm and 1:m-go. Linear cephalometric variables: oi, om oi/om, ui, um and ui/um were analysed using the method of Korkhaus. Statistical data analysis included descriptive statistics, method error, *t*-test and Pearson's correlation coefficient for associations between variables.
RESULTS AND CONCLUSIONS: Significant differences ($P < 0.001$) between the samples were found in all the investigated variables except l:sp-pm, oi/om and um. There were also significant differences in variables oi, om, oi/om, ui, um and ui/um between open bite patients with and without overbites, which indicates that dentoalveolar compensatory mechanism depends mostly on tooth eruption. A significant correlation was also found between the eruption of the lower incisors and molars and the mandibular angle.

74 TRENDS IN DENTAL CARIES AND MALOCCLUSION IN CHILDREN

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AIM: To monitor, in a longitudinal analysis, the dental health of a sample of children from 6 to 8 years age, to define the natural history of disease and to possibly quantify risks in a search for causal relationships. The assessment of oral health conditions and treatment needs are necessary to support regional policy decisions and to ensure visibility of dental issues.
SUBJECTS AND METHOD: After calibration of the examiners, 700 children (the whole population of that age in the area) have been examined every year and their oral hygiene, dmft, DMFT, the main occlusal variables and IOTN, according to Brook and Shaw (1989) noted.
RESULTS: In contrast with the decline of caries experience observed in other countries, a slight increase in both dmft (2.11–2.25) and DMFT (2.14–2.63) has been observed between the ages of 6 and 8. In evaluating IOTN, cases presenting a great need of treatment (grade 4–5) increased from 10.2 to 27.9 per cent, with a parallel decrease (73.6 to 49.9 per cent) in grades 1–2 (no need). Grade 3 (moderate need) also increased slightly from 16.2 to 22.2 per cent. At 6 years of age 70 per cent of the children did not need treatment, while at 8 years of age 50 per cent of the subjects appeared to need some therapy.
CONCLUSIONS: The increase in the prevalence of malocclusion is obviously related to the expression of the genetically determined individual growth potential, but it seems also to be related to environmental aetiological factors, such as the presence of habits or the early loss of deciduous teeth. The area examined in the survey shows a high prevalence of caries, suggesting the need to further emphasise the practice of oral hygiene, and the implementation of dental education, not only for the children involved but also for their families and educators.

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75 EARLY ARCH CHANGES IN CLEFT LIP AND PALATE CHILDREN TREATED WITH PRE-SURGICAL ORTHOPAEDICS

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The benefits of pre-surgical orthopaedic treatment of children with cleft lip and palate is a controversial question. The aim of the present study was therefore to evaluate changes in maxillary arch dimensions in children with unilateral cleft lip and palate treated with an early pre-surgical orthopaedic appliance.
Serial dental casts of 14 consecutive patients from the Department of Orthodontics, Postgraduate Dental Education Center, Örebro, were selected for the study. The stages represented were shortly after birth, before start of treatment, at 3 months of age, before lip repair at 12 months, before palatal surgery and at 5 years of age. All children were treated with an acrylic plate from shortly after birth until 12 months of age. The plate derived originally from that used by Hotz and Gnoinski (1976). For comparison data of 15 children from the Dentofacial Orthopedic Clinic, University Hospital, Linköping, who had not received pre-surgical orthopaedic treatment were used.

This follow-up study of complete unilateral cleft lip and palate children treated with a pre-surgical orthopaedic appliance shows a reduction of the alveolar cleft width from birth to 3 months of age, suggesting better alignment of the maxillary alveolar segments when compared with a control group. However, up to the age of 5 years no significant differences in growth and development of the maxillary alveolar arches between the groups were found. To evaluate the possible benefit of the early reduction of the width of the alveolar cleft further studies are needed.

76 OBSTRUCTIVE SLEEP APNOEA—SUBJECTIVE VERSUS OBJECTIVE TREATMENT RESULTS

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AIMS: The survey was undertaken to compare the subjective symptoms with the objective post-treatment polysomnography results in patients with obstructive sleeping apnoea (OSA).
SUBJECTS AND METHODS: During 1995 to 1997, 47 patients suffering from mild to moderate OSA (Apnoea/hypopnoea Index (AHI) < 30/h; pO_2 > 80%) were treated with a bimaxillary protrusion appliance. The OSA was diagnosed by polysomnography in a sleep laboratory. The sagittal mandibular protrusion ranged from 4 to 6 mm and the vertical opening from 8 to 12 mm. The patients completed a questionnaire and kept a sleep diary. Following 2–4 weeks acclimatization with the appliances, a post-treatment polysomnography was performed. Patients with upper airway respiratory symptoms or with snoring only were excluded from the study. The criteria for success was a 50 per cent or greater reduction in the AI (Apnoea Index) or the AHI.
RESULTS: A total of 47 subjects (mean age: 54.2 years SD ± 12.5 years, 89 per cent male, 11 per cent female) were eligible for the survey. Five patients did not tolerate the appliance and discontinued use. Subjectively, 81.6 per cent benefited from the use of the appliances. Initial symptoms of snoring and awakening disappeared. In 18.4 per cent there was no reduction of the symptoms and the patients preferred the nCPAP therapy. According to the polysomnographic results appliance treatment was successful in 83 per cent. In 6 per cent the sleeping parameters were raised suboptimally by about 25 per cent, and in 11 per cent of the patients no change could be registered.
CONCLUSIONS: OSA patients treated with an oral device may benefit from a protrusion appliance. Although subjectively the symptoms may be improved, objectively the polysomnographic parameters may not be improved by the appliance wear. Therefore, a patient's self-report of symptoms cannot be a valid parameter for assessing a treatment result. A polysomnographic control should routinely be carried out after appliance insertion. If this type of therapy is proved to be successful, it can be recommended as an alternative to nCPAP as a life-long treatment measure.

77 CONDYLE POSITION IS NOT DEPENDENT ON EMINENCE INCLINATION AND DISC POSITION

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AIM: The significance of both condyle fossa relationship and of normal condyle position in the temporomandibular joint (TMJ) has not yet been clarified. In addition, investigations are lacking on the correlation of condyle position and the inclination of the posterior slope of the eminence and the disc position in the TMJ, respectively. The aim of the present study was to determine whether the condyle position in the human TMJ is correlated with the inclination of the posterior slope of the eminence and/or the disc position in relation to the condyle.
SUBJECTS: Six hundred and eleven (443 female, 168 male) temporomandibular joints were selected from a sample of 1560 magnetic resonance images (MRI). The mean age of the patients was 28.8 years. For each joint two slices (medial and lateral section through the joint) were evaluated.
METHODS: The MRI analysis according to Bumann and a specific Software (FR-WIN 4.0, Computer Konkret, Germany) were used to calculate multiple parameters in 1222 MRT slices. These parameters described the disc position in relation to the fossa, the condyle position in relation to the fossa, the disc position in relation to the condyle, and the inclination of the posterior slope of the eminence. Based on these data disc displacements were classified in 3 stages.
RESULTS: A specific condyle position in physiological joints and in joints with different stages of internal derangement could not been found. In addition, there was no significant correlation between the steepness of eminence and the condyle or disc position. The condyles were randomly distributed in anterior, centric and posterior positions in the glenoid fossa, independent of any anterior disc displacement. However, the more the discs were anteriorly displaced the more the condyle position was found posteriorly. This effect was more defined in female joints (18 to 27 per cent posterior condyle position) than in male joints (12 to 23 per cent). No significant difference was found between the medial and lateral sections of the TMJ. Osseous changes (joints with versus joints without degenerative changes) had also no effect on the steepness of the posterior slope.
CONCLUSIONS: The results clearly suggest that there is no statistical correlation between the steepness of the eminence, the stage of disc displacements and a specific condyle position in the human TMJ.

78 'EFFECTIVE' TEMPOROMANDIBULAR JOINT CHANGES IN YOUNG ADULTS AND ADOLESCENTS DURING HERBST TREATMENT

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AIM: To assess the 'effective' temporomandibular joint (TMJ) changes (= the sum of condylar remodelling, fossa remodelling and condyle-fossa relationship changes) during Herbst therapy of young adults and adolescents.
MATERIALS: Lateral head films of 14 young adult (mean age 16^{6} years) and 25 adolescents (mean age 12^{10} years) with Class II malocclusions treated with the Herbst appliance, were analysed. The radiographs were taken before and after an average treatment period of 7.6 months. Young adulthood was defined by the hand-wrist radiographic stages R-IJ and RJ, and adolescence by the stages MP3-E until MP3-G (Hägg and Taranger, 1980).
METHOD: The cephalograms from before and after treatment were evaluated by means of a modified method of Creekmore (1967). The 'effective' TMJ changes of the Herbst patients were compared with those of untreated subjects with ideal occlusion (Bolton Standards).
RESULTS: The horizontal and vertical 'effective' TMJ changes in both Herbst groups were larger than the changes found in the age-related Bolton Standards ($P < 0.01$). The horizontal changes especially were increased by Herbst therapy. In comparison with the Bolton Standards, the horizontal TMJ changes were 11 times larger for the young adult group and 6 times larger for the adolescent group.
CONCLUSION: The TMJ of young adults is capable of growth adaptation. In relation to the age-related Bolton Standards the 'effective' TMJ changes in the horizontal direction were larger in young adults than in adolescents treated with the Herbst appliance.

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79 LONG-TERM EFFECT OF ORAL HEALTH PROMOTION ON ARCH LENGTH DISCREPANCY

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AIMS: In order to achieve healthy development of the masticatory system and reduce dental disease, an eight-year promotion programme was carried out from 1984 to 1992, and then followed up for 5 years in a rural community. This programme consisted of dental examination, treatment of dental disease, and dietary instruction. A report on the short-term effect of dental caries and gingivitis has been published (Sakashita, 1993). The present study attempted to evaluate the long-term effect on occlusion.
SUBJECTS AND METHOD: The Arch Length Discrepancy (ALD = available arch length—required space) in 32 boys and girls enrolled in the programme from 2 to 10 years of age (mean age 15.7 ± 0.3 years) was compared with that of a control group of 17 boys and girls (mean age 15.7 ± 0.3 years) from a neighbouring village. The effect of the programme on ALD between the second molars, and between the second premolars, on both sides in the upper and lower jaws was tested by analysis of variance using general linear models, controlling for the sex factor.
RESULTS: The programme was found to have had a statistically significant effect in the upper second molar ALD ($P < 0.05$), in the upper second premolar ALD ($P < 0.01$) and in the lower second premolar ALD ($P < 0.05$) regions. The upper premolar ALD and the lower premolar ALD in the subject group were 2.1 ± 3.0 mm and 1.5 ± 3.0 mm, respectively. In the control group they were –1.7 ± 6.6 mm and –1.3 ± 5.3 mm, respectively.
CONCLUSION: The results suggest that this oral health promotion programme was effective in reducing arch length discrepancy.

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80 AN ANALYSIS OF CRANIOFACIAL RELATIONSHIPS IN SUBJECTS WITH OPEN BITE

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AIM: To determine the most frequent type of growth, variations of angle B, and characteristics and deviations of the cranial base in subjects with an open bite.
SUBJECTS AND METHOD: The study consisted of 89 patients of both sexes, with a mean age of 9–14 years. Growth types were determined by analysis of lateral cephalograms using Björk's method, and angle B by Schwartz's method. For analysis of the cranial base the following linear parameters were measured: S-N, N-Ar, and for angular parameters, BaSN, NBaS, SNBa, SN/MP.
RESULTS: In 66.2 per cent of patients with an open bite, growth was by backward rotation. Anterior growth type was found in 31.4 per cent, and 2.2 per cent of patients with skeletal open bite had a balanced type of rotation. The value of angle B was from 20 to 45 degrees. In the majority of cases with open bite, 33.7 per cent, the value of angle B was between 31 and 35 degrees. Values greater than 40 degrees for this angle were found in 5.6 per cent of patients. Increased values for SN and N-Ar as well as for SN/MP were found in the cranial base analysis, whilst those for BaSN, NBaS and SNBa showed wide variations. All the obtained results were statistically processed.

81 ORTHOPANTOMOGRAPHIC EXAMINATION OF THE AXIAL POSITION OF CLEFT ADJACENT CANINES IN CLEFT LIP AND PALATE PATIENTS AFTER SECONDARY OSTEOPLASTIC SURGERY

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AIM: Assessment of long axis cleft adjacent canines in cleft lip and palate (CLP) patients before and after secondary osteoplastic surgery. Spontaneous straightening and the results of treatment with multibracket appliance were evaluated.
MATERIALS AND METHOD: An orthopantomographic survey of 65 patients before secondary osteoplastic surgery and after completion of treatment with a multibracket appliance was undertaken. In a group of 40 patients an orthopantomogram was available, on average 2.7 years after osteoplastic surgery, but before treatment with multibracket appliance, so that the extent of dental straightening could be determined.
Measuring of the orthopantomogram. The line between the lowest points of the inferior orbital margins was used as a reference. The axial position of the canines was determined by the mesial angle of the reference line and the long axis.
RESULTS: After completion of treatment with a multibracket appliance, space closure was achieved in 30 per cent of patients, and a prosthesis was the treatment of choice in 35 per cent. After treatment with a multibracket appliance it became obvious that a mesioclination in a number of cases could not be prevented. However, with prosthetic closure the incidence of mesioclination was rare. As expected, the position of the long axis of the canines was most favourable in those 35 per cent of patients with post-operative retained canines. In 40 per cent of patients the spontaneous straightening of the cleft adjacent canine could be assessed. In their case the axial position improved, on average, by 5.2 degrees. In 60 per cent of all cases an improvement was observed, in 20 per cent a deterioration, and in 20 per cent no change was visible.
CONCLUSION: Orthodontic space closure with a multibracket appliance could not meet the expectations concerning the orthoaxial alignment of the canine.

82 APICAL ROOT RESORPTION OF TEETH ADJACENT TO ALVEOLAR CLEFTS DURING ORTHODONTIC ALIGNMENT

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AIM: It is well established that a few orthodontic patients experience severe apical root resorption. The explained variance of identified risk factors for resorption is low, suggesting a strong individual predisposition. However, few studies have explored the possible effect of anomalies. The purpose of this study was to test whether teeth adjacent to alveolar clefts are at increased risk of root resorption during orthodontic therapy, due possibly to the particular tooth movements that are required and the structural anomaly.
SUBJECTS AND METHOD: A group of 41 consecutive patients with unilateral alveolar clefts were examined following a full period of fixed appliance therapy. Pre- and post-treatment panoramic radiographs were evaluated simultaneously for changes in root length and contour. Scores were given to each anterior tooth according to a scale from 0 to 4. The length of each anterior tooth was measured on post-treatment periapical radiographs made according to a paralleling long cone technique. Wilcoxon signed-rank tests were used to test for differences in scores from before to after treatment and differences in tooth lengths after treatment between the teeth adjacent to the cleft (experimental teeth) and the contralateral (control) teeth.
RESULTS: The root resorption scores were higher both for the experimental central incisors ($P < 0.01$) and canines ($P < 0.01$) than for the contralateral control teeth (score: median central incisor cleft side 1, non-cleft side 2, median canine cleft side 1, non-cleft side 0.5). In addition, the post-treatment tooth lengths were shorter for the experimental central ($P < 0.001$) and lateral ($P < 0.01$) incisor than for the contralateral control teeth (length: median incisor cleft side: 23.45 mm, non-cleft side: 25.1 mm, lateral incisor cleft side; 20.0 mm, non-cleft side: 23.375 mm).
CONCLUSION: The results suggest that teeth adjacent to alveolar clefts are at increased risk of apical root resorption during orthodontic alignment.

83 CHANGES OF NEUROMUSCULAR GUIDANCE OF THE MANDIBLE AS A RESULT OF COMBINED ORTHODONTIC-SURGICAL TREATMENT

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AIM: To examine whether adult patients with mandibular retrognathism combined with a dental Class II relationship show a characteristic structure of mandibular movements caused by the neuromuscular system, compared with patients with neutral skeletal and dental relationships. The second aim was to investigate whether these characteristic structures are subject to change following combined orthodontic-surgical treatment.
SUBJECTS AND METHODS: In order to record three-dimensional movements of the whole mandible, an ultrasonic device and a specially designed computer software program were used to analyse the measured movements. The patients were asked to perform simple mandibular movements along the borders of its space of motion. The movement of the entire mandible can be described by simultaneous rotations around two axes: the fixed maxillary

axis, Max A, and the moveable mandibular axis, Mand A. They are neuromuscularly guided and are called neuromuscular axes. For graphic presentation of the movements of the individual mandible, the rotational angle, my, was used which represents the rotation around the maxillary axis, and the angle alpha, which is the rotational angle of the mandible with respect to the maxilla. The study contains my-alpha-diagrams of a group of adult patients with mandibular retrognathism combined with a Class II relationship (n = 40). Movements of the whole mandible were analysed following pre-surgical orthodontic treatment. Orthognathic surgery was carried out as a sagittal split ramus osteotomy with a condylar positioning technique. The same patients were examined again approximately one year after the end of the post-surgical orthodontic treatment. The data were compared with my-alpha-diagrams of patients with neutral skeletal and Class I relationships (n = 40).
RESULTS: From the pre-surgery my-alpha-diagrams it was found that the structure of mandibular movements was significantly different compared with patients with neutral skeletal and dental relationships, particularly after maximal occlusal guided protrusion and maximal anterior border opening. Remarkable co-ordination disturbances of the movements around the two axes were seen. In the my-alpha-diagrams after combined orthodontic-surgical treatment, the patients revealed a nearly ideal diagram resembling that of patients with neutral skeletal and dental relationships. A co-ordinated movement around the maxillary and mandibular neuromuscular axes was also found.
CONCLUSIONS: Individual cases and statistical data show that the structure of mandibular movements of patients with mandibular retrognathism combined with dental Class II relationships differs from those of patients with neutral alignment. Following orthodontic-surgical treatment, the examined patients showed a similar pattern in the structure of mandibular movements to subjects with no disturbances and neutral skeletal and dental relationships.

84 THE MANDIBLE IN CHILDREN WITH JUVENILE CHRONIC ARTHRITIS: A CEPHALOMETRIC STUDY

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AIM: To evaluate the cephalometric characteristics of the mandible in young patients with Juvenile Chronic Arthritis (JCA) in the Greek population.
MATERIALS AND METHOD: Cephalometric radiographs were taken of 66 patients (27 males, 39 females; initial age 11.9 years). Thirty suffered from pauciarticular and 36 from the polyarticular type of the disease. The control group consisted of 37 healthy children with a Class I occlusion. The cephalometric analysis was performed by means of a computerised cephalometric system. The presence of a systematic error was examined by double tracing of 20 randomly chosen cephalograms. The Student's *t*-test was used to determine the presence of significant differences between the study and control group, as well as between the various groups.
RESULTS: The cephalometric findings indicated that the facial angle was decreased in the JCA group, and especially in the polyarticular type (<N-Pg-/FH = 86.07 degrees, $P < 0.001$), The SNPg and SNB angles were also decreased in the polyarticular type, indicating a retrognathic mandible. A posterior rotation and a predominantly vertical growth of the mandible was confirmed in the JCA and especially in the polyarticular group (<S-Gn/FH = 59.89 degrees, $P < 0.01$; <ML-NL = 28.38 degrees, $P < 0.01$; S-Ar-Go = 143.44 degrees, $P < 0.001$). The mandible was shorter in the polyarticular group (Go-Pg = 68.7 mm, $P < 0.01$). The lower facial height increased in the JCA compared with the control group (ANS-xi-Pm = 44.54 degrees, $P < 0.001$).
CONCLUSIONS: The results of this study indicate that young patients with juvenile chronic arthritis present some special characteristics in the growth and development of the mandible.

85 SKELETAL AND DENTOALVEOLAR FINDINGS BEFORE AND AFTER RAPID PALATAL EXPANSION

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AIM: To investigate cephalometrically the type and extent of sagittal and vertical changes in the viscerocranium after rapid palatal expansion.
SUBJECTS AND METHOD: Thirty one patients (12 males, 19 females) who had undergone treatment at the Department of Orthodontics, University of Munich, were examined. All subjects had a small transversal maxillary base with uni- or bilateral crossbite of the posterior teeth and were treated with rapid palatal expansion. Lateral cephalograms taken before treatment and after rapid palatal expansion (approximately 8–12 months) were examined using the Munich analysis. To identify the effects of rapid palatal expansion, the subjects was compared with untreated groups (Janson; Riolo).
RESULTS: In the mandible and maxilla both sagittal and vertical changes in the dentoalveolar and the skeletal region were found. Comparison with the control groups emphasised the findings in the treated group. Rapid palatal expansion resulted in skeletal changes, sagittal as well as vertical, to varying extents, with a marked relationship between facial type and the vertical base relationship at baseline.
CONCLUSION: Rapid palatal expansion results in skeletal and dentoalveolar changes in the maxilla.

86 PATIENT CO-OPERATION IN ORTHODONTICS—AN ANALYSIS OF THE CONTRIBUTING FACTORS

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AIM: To examine to what extent the co-operation of patients can be relied on by the orthodontist and by what means motivation and co-operation of the orthodontic patient can be enhanced.
MATERIAL AND METHOD: The material comprised 150 questionnaires, which were prepared and distributed randomly among patients attending the orthodontic department. After six months 121 questionnaires were subjected to computer analysis. The data was then coded and computerised using the report-program. Data analysis was made via the program SPSS for Windows 6.13.
RESULTS: Of the patients with fixed orthodontic appliances, 60 per cent brushed their teeth twice, and 27.1 per cent three times a day. Their oral hygiene behaviour showed that the majority (66.1 per cent), cleaned their teeth using a toothbrush without any additional hygiene aid e.g. dental floss. No supplementary fluoridation was used by 62.7 per cent, although this was recommended by the dental hygienist. It was felt by 78.9 per cent of patients that their appearance suffered as a result of wearing headgear, and for 52.6 per cent of these this was a reason to reduce the wearing time.
CONCLUSION: The results indicate that oral hygiene behaviour has to be controlled and the instructions given frequently reinforced. When incorporating extra-oral appliances, the orthodontist should be aware of their lack of acceptance and consider the use of alternative intra-oral appliances.

87 EFFECTS OF AN ACTIVATOR ON MANDIBULAR GROWTH IN DIFFERENT FACIAL PATTERNS

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AIMS: The biting type activator accelerated mandibular growth in both subjects with short and long facial patterns (Suto *et al*., 1998). The aim of this study was to confirm the effect of the activator on the growth changes of the short (S), average (A) and long (L) facial patterns.
SUBJECTS AND METHODS: By cluster analysis of cephalometric variables, 79 pubertal girls with maxillary protrusion who were instructed to bite the activator 50 times before sleeping, were classified into the above three groups. Growth changes of their facial skeleton were analysed using two sets of cephalograms, with a one year interval, and compared using ANOVA.
RESULTS: In the both sets, Y-axis ∠MP-FH, ∠MP-SN, Gonial angle, N-Me and Ag to MP were significantly smaller, while facial angle, ∠SNA, ∠SNB, Cd-Go, Go-Pog', S-Go and S-Go/N-Me were larger in group S than in group L. During the interval, however, Cd-Gn, Cd-Go, N-Me and S-Go increased significantly in all groups, while Go-Pog' increased only in group L. In addition, Y-axis increased in groups S and A but decreased in group L, thus the difference between groups S and L decreased significantly.
CONCLUSIONS: Although the characteristics of both short and long facial patterns remained throughout the interval, the biting type activator's effect on these facial patterns was to bring them closer to the average facial pattern.

Suto M *et al*. 1988 Facial skeletal patterns of maxillary protrusion and effects of the biting type FKO on their growth changes in pubescent girls. Journal of Japan Orthodontic Society 57: 111–118

88 CEPHALOMETRIC ANALYSIS OF PATIENTS WITH HYPODONTIA

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AIM: To determine the cephalometric changes in patients with congenitally missing teeth (CMT) according to the severity of hypodontia.
MATERIAL: The material consisted of orthopantomograms and lateral cephalograms of 73 patients (43 girls, 27 boys), aged 6–23 years with CMT ranging from 1–13.
METHODS: The number and the type of missing teeth, excluding the third molars, was determined from the orthopantomograms. Cephalometric analysis comprised skeletal (sagittal and vertical), dental, and soft tissue measurements. The effect of increasing severity of hypodontia on particular measurements was examined and statistically verified using the Student's *t*-test with the significance probabilities: $P < 0.05$; $P < 0.01$; $P < 0.001$.
RESULTS: Group A comprised patients with 1–5 missing teeth (mean 2.46), and group B consisted of individuals with 6–13 missing teeth (mean 7.76). The skeletal sagittal measurements for group A demonstrated statistically significant lower SNB values and higher ANB and Wits values. In group B there were significantly lower SNA values, and lower ANB and Wits values. There was a strong statistically significant reduction in the skeletal vertical measurements for facial height in both groups. A significant retroclination of the upper and lower incisors was found in groups A and B. Analysis of the soft tissue profile showed a significant reduction in the protrusion of the upper and lower lip. A concave soft tissue profile was observed in both groups.
CONCLUSIONS: Hypodontia is associated with particular craniofacial patterns which alter with the degree of hypodontia. The most significant differences were found for the dental movements. Even in subjects with mild hypodontia cephalometric analysis revealed a characteristic soft tissue profile. These observations should be taken into consideration in orthodontic treatment planning.

89 MASTICATORY MUSCLE ACTIVITY IN CLASS I AND CLASS II DIVISION 1 MALOCCLUSIONS

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AIM: To analyse quantitatively the electromyographic (EMG) activity of the temporal and masseter muscles in children and adults with Angle Class I and Class II division 1 malocclusions.
SUBJECTS: Sixty children (30 Class I, 30 Class II division 1) and 44 adults (22 Class I, 22 Class II division 1) were surveyed. None of the subjects exhibited any signs or symptoms of TMJ dysfunction.
METHOD: The temporal and masseter muscle EMG activity during maximal clenching in intercuspal position and during chewing of peanuts was registered by means of bipolar surface electrodes. Additionally the skeletofacial morphology in each subject was evaluated by means of lateral headfilms.
RESULTS: In both malocclusions, as well as age groups, the EMG activity of the temporalis muscle was significantly smaller ($P < 0.01$) than the activity of the masseter muscle. During clenching the temporalis muscle activity in Class I children was larger than in Class I adults ($P < 0.05$). During chewing the temporalis muscle activity of Class I children exceeded that of Class I and Class II division 1 adults ($P < 0.05$). For males a higher temporalis clenching activity was found in Class I and Class II division 1 children compared with Class II division 1 adults ($P < 0.05$). In females the temporalis muscle activity of Class I children exceeded Class I adult activity, both during clenching and chewing ($P < 0.05$). The masseter muscle showed no difference in activity between the malocclusions or the age groups.
CONCLUSION: Independent of age and malocclusion, the masseter muscle activity exceeds temporalis muscle activity. Furthermore, independent of the type of malocclusion, the temporalis muscle activity seems to be higher in the younger than in the older age group.

90 THREE-DIMENSIONAL FORCE SYSTEMS GENERATED BY VERTICAL V-BENDS IN ARCH SEGMENTS OF DIFFERENT LENGTHS

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AIM: To describe the three-dimensional (3D) force system generated by V-bends, when placed at different interbracket positions in rectangular arch-shaped wires, made of different materials, and at different interbracket distances.
MATERIALS AND METHODS: The FSI (force system identification) system (Melsen *et al*., 1994) was used to determine 3D force systems in an experimental set-up. Second order V-bends were placed at different intervals in segments of an 0.017 × 0.025″ Orthos arch (Ormoco®), made of stainless steel, TMA® or NiTi™. The arch segments (14, 21 and 28 mm interbracket distance) were ligated in 0.022″ slot brackets (Ormoco®) attached to the sensors of the FSI.
RESULTS: Variation in the force system related to the placement of a V-bend in a preformed arch is the result of a combination of bending and torsion of the wire. Where the V-bend was located close to the molar bracket, a distal tipping moment and a lingual crown torque was produced to the molar. At the incisor level only minor change occurred in the second order, whereas a minor buccal root torque could be registered at the incisors. The point of disassociation was found to be closer to the molar bracket than to the incisor bracket. This was more pronounced when the interbracket distance increased and could be explained by the increasing role played by the torsion.
CONCLUSIONS: The results confirm that V-bends placed in 3D wires respond differently than V-bends placed in 2D wires (Burstone and Koenig, 1988; Isaacson *et al*., 1995). The clinician using V-bends in arch segments should be aware of this fact, and place the V-bends accordingly.

Melsen B, Topp L F, Melsen N M, Terp S 1994 Force systems developed from closed coil springs. European Journal of Orthodontics 16: 1–9

Burstone C J, Koenig H A 1988 Creative, wire bending—The force system for step and V- bends. American Journal of Orthodontics and Dentofacial Orthopedics 93: 59–67

Isaacson R J, Lindauer S J, Conley P 1995 Responses of 3-D arch wires to vertical V-bends: comparisons with existing 2-dimensional data in the lateral view. Seminars in Orthodontics 1: 57–63

91 ORTHODONTIC BONDING USING A SANDBLASTER FOR PRE-TREATMENT OF THE ENAMEL

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AIMS: To evaluate the shear bond strength of different prebonding and bonding techniques used for bonding orthodontic brackets that minimise the loss of surface enamel, and to investigate whether sandblasting of the enamel could be an alternative for the conditioning technique for bonding orthodontic brackets.
MATERIALS AND METHOD: The surfaces of bovine incisors (n = 10 per group) were sandblasted (50 µm $A1_2O_3$, pressure 0.1 MPa, exposure time 15 or 30 seconds), or etched with polyacrylic acid (GC conditioner or Crystal Lok), or etched with 37 per cent phosphoric acid. With the aid of a cylindrical Teflon mould (ø = 4.0 mm), adhesives (the resin composite Concise, or the glass-ionomer cement Fuji Ortho LC) were applied as cylinders on the pre-treated enamel surfaces. The teeth were stored in water for 24 hours. All teeth were exposed to shear loading in a tensilometer at a crosshead speed of 0.1 mm/min. ANOVA ($P < 0.05$) was used to analyse the statistical differences.

RESULTS: The results showed that the bond strength of the sandblasted groups was significantly lower.

Shear Bond Strength in MPa (sd)					
Pre-treatment → Adhesive↓	Phosphoric acid 30 seconds	Sand-blasting 15 seconds	Sand-blasting 30 seconds	GC conditioner 20 seconds	Crystal Lok 30 seconds
Concise	21.0 (3.8)	4.6 (1.0)			
Fuji Ortho LC	13.6 (2.4)	0.3 (0.4)	0.0 (0.0)	9.7 (2.0)	7.0 (1.7)

CONCLUSIONS: The results show that sandblasting cannot be regarded as an alternative for the acid etching technique currently used in orthodontic bonding.

92 ANTERIOR AND POSTERIOR VERTICAL FACIAL DEVELOPMENT IN NON-ORTHODONTICALLY TREATED INDIVIDUALS

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AIM: A descriptive and visual representation of the changes in anterior lower face height (ALFH) and posterior total face height (PTFH) in relation to the anterior total face height (ATFH) between the age of 9 and 16 years. Furthermore the relationship between the two face height ratios and the Nasion-Sella-Basion angle, the Gonial angle, the Sella-Nasion/Foramen magnum angle and the Wits were studied.
MATERIAL: Cephalograms of the longitudinal Groningen Elementary School Study. Only 9 landmarks were used in this investigation. A group of 56 individuals was selected from the original study, who had a cephalogram in both the 9 and 16-year age group.
METHOD: Box plots and paired samples tests show the changes in the ALFH/ ATFH ratio, the PTFH/ATFH ratio, the Nasion-Sella-Basion angle, the Gonial angle, the Sella-Nasion/Foramen magnum angle and the Wits in the seven-year time interval. A multiple linear regression analysis will show the relationships between the changes of the two face height ratios and the three above-mentioned angles and the Wits in both age groups.
RESULTS: There was a significant decrease in the Gonial angle and a significant increase in the ALFH/ATFH ratio, the PTFH/ATFH ratio and the Sella-Nasion/Foramen magnum angle (all $P < 0.0005$). The Wits increased only very slightly ($P < 0.1$) and the Nasion-Sella-Basion angle remained unchanged. The Nasion-Sella-Basion angle was the only independent variable that could predict the ALFH/ATFH ratio to some degree (beta coefficient –0.44, $P < 0.01$). The Gonial angle could predict the PTFH/ATFH ratio very significantly (beta coefficient –0.44 and –0.58, $P < 0.0005$).
DISCUSSION: Both the increase in anterior lower and posterior total face height dominate over the increase in anterior total face height. The mean Nasion-Sella-Basion angle remains unchanged for this group in a seven-year period.
CONCLUSION: Changes in the relative vertical dimensions are clearly demonstrated in this non-orthodontically treated group.

93 CHARACTERISATION OF PROLIFERATIVE CELLS IN THE RAT CONDYLE DURING GROWTH

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AIM: It has been well documented that the morphology and microanatomy of the mandibular condyle undergo changes during normal growth. Recently it has been reported that an age-related decrease occurs in the number of proliferative cells and that most mitoses are detected in the postero-superior area of the rat condyle (Peltomäki *et al*., 1996). Based on findings, mostly made on mature specimens, it was generally maintained that proliferative cells in the mandibular condyle are undifferentiated mesenchymal cells. The aim of the present study was to characterize proliferative cells in the mandibular condyle during normal postnatal growth.
MATERIALS AND METHODS: The material consisted of three Long-Evans/Turku strain rats in each of 12 age groups ranging from 1 to 70 days. In order to detect proliferative cells the animals were injected intraperitoneally with bromodeoxyuridine, killed two hours later, and prepared for immunohistological examination. Two mid-sagittal representative sections of the condylar area of each animal were selected for examination. One was used for labelling mitotic cells with anti-bromodeoxyridine, and the other for cell characterization using antibody to cartilage-specific type II collagen. The depth of the proliferative cell layer and the shortest distance of the type II collagen secreting cell layer were measured perpendicular to the articular surface in four areas of the condylar head. The measurements were performed with the aid of a microscope and a computerized image analysis system. The mean of five measurements of each area was used to indicate the depth of the mitotic layer and the state of the type II collagen secreting cell layer.
RESULTS: The measurements showed that there was considerable overlapping of the proliferative and the collagen type II layers in young animals, particularly in the postero-superior area. From 14 days of age the two layers no longer overlapped.
CONCLUSIONS: The results indicate that proliferative cells of the condylar cartilage seem to secrete type II extracellular matrix collagen during the first two postnatal weeks in rats. This finding can be interpreted to show that the mitotic cells are chondroblasts during early postnatal development, at variance to undifferentiated cells at later stages of growth and development.

Peltomäki T, Isotupa K, Häkkinen L 1996 Distribution of proliferative cells in the rat condyle during growth. Journal of Dental Research 75 (Special Issue): 123

94 THE LOCATION OF THE CENTRE OF RESISTANCE—A FINITE ELEMENT ANALYSIS

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AIMS: Calculating initial tooth mobility via Finite Element Analysis (FEA) requires exact knowledge of the mechanical properties of all materials involved. Though the parameters are well known for teeth and bony structures, a wide range of values for Young's modulus of the periodontal ligament (PDL) can be found in literature. In this study, the non-linear elasticity parameters of the PDL were determined. In a second experiment, different orthodontic load situations were simulated on the FE models; first a human upper canine, and second an idealised model in the shape of an elliptical paraboloid to precisely determine the location of a canine's centre of resistance (CR).
METHODS AND RESULTS: Using measured force/deflection diagrams and FE calculations, three parameters describing the non-linearity of the PDL were determined in an iterative procedure. The measurements were performed in segments of a pig's maxilla using a laser-optical set-up. From the specimens, FE models were generated semi-automatically and calculations were performed with the FE package COMSMOS/M 1.75a. Assuming a Poisson's ratio of $\mu = 0.3$ for the PDL, the ultimate strain was found to be $\varepsilon = 7.5$ per cent with Young's modulus of $E_1 = 0.05$ MPa and $E_2 = 0.22$ MPa. These parameters were used in the FE calculations of the CR on both models, the human canine and the idealized tooth. Loading both models with a rotating momentum of $M_y = 10$ Nmm resulted in a distal rotation of the bracket of $R_z = 0.63$ degrees (canine) and R_z 1.12 degrees (model), both having the CR on the tooth's long axis. Pure tipping moments of $M_y = 10$ Nmm resulted in a CR that was located 43 and 38 per cent of the root length below the alveolar crest for the canine and the idealized model, respectively. Following these results, pure translations were simulated applying a force system of F = 1 N of distalizing force, 5 Nmm of derotating moment and 10 Nmm of anti-tip moment. The idealized parabolic shaped model reacted as expected, with a centre of rotation in infinity. The FE model of the canine however, displayed a large amount of rotation (0.01 mm of distalization and 0.1 degrees of rotation) and the force system had to be changed to achieve a pure translation.
CONCLUSIONS: Idealized tooth models can be used in FE calculations to predict tipping movements within an accuracy limit of 10 per cent, while tooth rotations can only be described as unsatisfactory. As a result, a pure translation could rarely be achieved in the FE calculations for the canine.

95 THE MORPHOLOGICAL ELEMENTS OF OBSTRUCTIVE SLEEP APNOEA

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AIM: To test the assumption of the interdependence between the progressive development of obstructive sleep apnoea (OSA) and the alterations in upper airway morphology.
MATERIALS AND METHODS: Sixty cephalograms of patients with a diagnosis of OSA were selected on the basis of good radiographic quality. The patients were classified to four groups according to the polysomnography. The cephalograms were digitized twice and the measurements were statistically processed with the polysomnographic data.
RESULTS: Several measurements showed anatomical changes in agreement with previous reports in the literature. However, these tendencies were not statistically significant and the control group, i.e. the snorers' dimensions were not consistent with these tendencies. The only measurement in the control group in accordance with the negative correlation tendency was the posterior airway space.
CONCLUSIONS: This cephalometric study suggests that the physiological and neurological changes, rather than anatomical changes are substantial aetiological factors behind sleep apnoea, although the skeletal and soft tissue abnormalities can predispose for OSA. The morphological background seems to be a group of different anatomical upper airway conditions that allow the physiological changes to manifest the syndrome.

96 THE ORAL HEALTH OF 720 SCHOOL CHILDREN IN MAINZ, GERMANY

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Prevention of caries by means of education and dental care is essential in paediatric dentistry. Group prophylactics in schools and kindergartens play a decisive role in this. The aim of this epidemiological study was to obtain an overview of the oral health of school children in Mainz, Germany, and an assessment of the effectiveness of prophylactic measures already undertaken.
Extensive clinical examinations were performed of 720 school children between the ages of 6 and 12 years (DMFT-T, dmft-t, GI, traumas and orthodontic anomalies) and they were questioned regarding nutritional and oral-hygiene habits, and also concerning the origin and avoidance of caries. Finally, the need for dental hygiene, demonstration and practice of a systematic technique of tooth brushing and practice in fluoridation of the teeth was explained.
Thirty nine per cent of the children were free of caries and gingivitis was found in only 12 per cent. However,

orthodontic anomalies were present in 80 per cent of the children examined. Forty six per cent of the children were Class I, 50 per cent Class II and 4 per cent Class III. Forty six per cent of the children were already undergoing orthodontic treatment or had immediate need for such treatment. In 8 per cent of the children exfoliation was delayed or disturbed and 10 per cent suffered premature loss of teeth. Damaging oral habits were evident in 24 per cent of the children, and 15 per cent suffered from some dysfunction of the soft tissues. Most of the children were not aware of how fluoride treatment and a proper brushing technique help prevent caries.
In yearly follow-up examinations it was found that the degree of treatment need remained uniformly low, although the number of children with sealed fissures nearly doubled. Many of the children did not visit their dentists regularly and in consequence preventive treatments were rare. These points make it clear that group prophylactic measures in schools and kindergartens can have an enormous significance.

97 EFFECTS OF BISPHOSPHONATE ON BONE RESORPTION DURING TOOTH RELAPSE

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AIMS: To clarify the effects of systemic administration of bisphosphonate (BP) on the bone resorbing activity of osteoclasts during the relapse of rat molars following experimental movement using the Waldo method.
MATERIALS AND METHODS: An elastic band was inserted between the tip of the first and seconds molars of 7-week-old rats, and removed 21 days later. One day before elastic band removal, BP was administered via a tail vein. After elastic band removal, the rats were further maintained for 0, 5 or 10 days. The relapse process of the first molars was examined by means of light-, scanning-, and transmission-electron microscopy.
RESULTS: When the elastic band was removed, the mean interdental space between the first and second molars in the control rats was approximately 432 μm, but this decreased to 108 μm by day 5, and 7l μm by day 10. In the control rats, numerous osteoclasts appeared along the alveolar bone surfaces in the compressed side of the periodontal ligament (PDL) of the first molars. BP administration inhibited the prominent decreases in interdental spaces, which averaged 253 μm on day 5, and 139 μm on day 10, comparatively modest reductions from the 437 μm on day 0. In BP-treated rats, osteoclasts aggregated mainly in vascular canals of alveolar bones, but were occasionally observed along the alveolar bone surfaces facing the PDL. BP administration also induced structural changes, such as the disappearance of ruffled borders and cytoplasmic polarity, in osteoclasts. Degenerated osteoclasts were also observed in a BP-treated rat. However, BP induced no structural changes in osteoblasts, osteocytes or PDL fibroblasts.
CONCLUSIONS: These results suggest that a single systematic BP administration decreases the extent of relapse in experimentally-moved rat molars via a mechanism involving impairment of the structure, motility, and resorptive functions of osteoclasts.

98 MUSCULAR EFFECTS OF HEADGEAR-HERBST APPLIANCE ACTIVATED STEP-BY-STEP

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AIMS: To investigate the changes in electromyographic (EMG) muscular activity before and during treatment in Class II division 1 patients treated with a modified Herbst appliance.
SUBJECTS: The experimental group consisted of 10 consecutive Southern Chinese subjects, aged 10–15 years with a Class II division 1 malocclusion treated with a splinted headgear-Herbst appliance for 6 months.
METHODS: The Herbst appliance was activated step-by-step at 2 mm per 2 month. The peak and average muscular functions of the superficial masseter and anterior portion of the temporal muscles were recorded with the K6-I Craino-Mandibular Diagnostic System (Myotronics Inc. Seattle, USA), with regard to maximum bite force at retruded mandibular position, at an inter-incisal separation of a 3 mm thick bite plate. Measurements were taken pre-treatment, 1 week, and 2, 4 and 6 months during treatment.
RESULTS: After one week of treatment the EMG activity for both muscles was reduced, the reduction being statistically significant for the masseter only. For the temporalis the EMG activity had returned to its pre-treatment value after 2 months and remained at that level during the observation period. For the masseter, EMG activity returned to its pre-treatment value at 2 and 4 months and exceeded its pre-treatment value at 6 month (NS).
CONCLUSIONS: During initial treatment EMG activity was reduced for both muscles, but they returned to their pre-treatment values within 2 months. For the masseter there was a tendency for a further increase of EMG activity, indicating that it increased its strength during treatment.

99 PSYCHOLOGICAL ASPECTS IN ORTHOGNATHIC PATIENTS WITH CLASS III MALOCCLUSIONS

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AIMS: To investigate the motivations for seeking surgical correction of Class III malocclusions.
SUBJECTS: One hundred and forty Chinese patients with skeletal Class III malocclusions who had been treated with a combined orthodontic and surgical approach at the Faculty of Dentistry, University of Hong Kong. Patients with CLP, craniofacial anomalies and syndromes were not included. Ninety-four subjects (40 males, 54 females, 68.6 per cent)

aged 14-41 years (mean 23.4 years; SD 5.9 years) returned completed questionnaires.

METHOD: A retrospective study based on questionnaires with numerical scale ranked answers (0 = not at all; 1= little; 2 = moderately; 3 = quite a bit; 4 = extremely). Diagnosis: 54 per cent had two jaw deformity, 32 per cent mandibular hyperplasia and 14 per cent maxillary hypoplasia. Surgical procedures: 77 per cent had two jaw surgery, 15 per cent maxillary advancement and 8 per cent mandibular setback.

RESULTS: Pre-treatment: (1) nearly half of the patients had nicknames related to their dentofacial problems (8 out of 10 felt embarrassed/angry about their nickname); (2) 93 per cent wanted improvement of the facial appearance, 75 per cent of their dental appearance, and 73 per cent of chewing ability; (3) 95 per cent had concerns about surgical risks and 85 per cent about possible pain. Post-treatment: (1) 57 per cent experienced a markedly positive change in personality; (2) 96 per cent noted a marked change of the facial appearance, 92 per cent in dental appearance and 65 per cent of chewing ability; (3) 57 per cent experienced less pain than expected.

CONCLUSIONS: The vast majority Class III patients undergoing orthognathic surgery had psychological problems related to their appearance prior to the treatment. After treatment almost all patients were satisfied with the outcome. However, potentially one out ten patients will not be satisfied or will even regret having undergone treatment.