

**FEATURES
SECTION**

Abstracts of Research presented at the British Orthodontic Conference 2002

University Teachers Group

In Vivo Expression of Matrix Metalloproteinases in Human Masseter Muscle

L. K. DODGSON (Eastman Dental Hospital, UCL)

Objective: Previous work has suggested that ECM turnover may be disrupted in patients with extreme vertical facial deformity. Key regulators of ECM turnover are the family of matrix metalloproteinases (MMPs). The aim of this study was to investigate the relative expression of MMP-2 and MMP-9 in the masseter muscle of adults with normal (NFF) and long facial forms (LFF).

Design and Setting: This study was an investigative, biopsy based study undertaken at the Eastman Dental Hospital and Institute during 2000-2001.

Materials and Methods: Masseter muscle biopsies were obtained, in accordance with ethical approval, from patients undergoing orthognathic surgery under general anaesthesia. The subjects were all categorised, according to a cephalometric analysis, and allocated to a NFF or LFF group.

Expression of MMPs -2 and -9 was investigated using gelatin substrate gel zymography. A computer based image analysis system was used to quantify the activity of MMPs in each gel based on its optical density.

Results: 1) Expression of MMP-2 and MMP-9 was very low in most samples. 2) 3 of the NFF and 1 of the LFF samples showed increased levels of MMP-2 and MMP-9.

Conclusions: This study confirmed the expression of MMP-2 and MMP-9, albeit at low levels, in the human masseter muscle. Further work is required in order to establish the causative mechanisms for the increased expression of MMPs in particular subjects.

A Prospective Clinical Trial Comparing the Dento-Skeletal Effects of Two Functional Appliances.

D. S. GILL, A. SHARMA, R. T. LEE (The Royal London Hospital)

Objective: To compare the dento-skeletal effects of a conventional Twin block (TB) and a modified appliance, named the Mini block (MB), with progressive man-

dibular advancement and a maxillary incisor torquing spring.

Design and Setting: Prospective trial conducted in a teaching hospital.

Materials and Methods: The appliance groups were age and sex matched. Sixty patients completed this study (TB n = 30; MB n = 30). Active treatment lasted 9 months. Final cephalometric records were taken after 12 months (± 1 m).

Results: Both groups tested for pre-treatment equivalence for all variables. The TB group experienced a significantly greater reduction in overjet (Median = -8 mm) compared to the MB group (Median = -4 mm). This was associated with significantly greater retroclination of the maxillary incisors (Median change: MB = -1.9°; TB = -5°; $p = 0.04$) and forward repositioning of Pogonion (Median change Pog to S-Vert: MB = 2.1 mm; TB = 3.3 mm; $p = 0.019$). There were no significant differences between the two groups in lower incisor inclination (Median change LI-Mand. Pl: MB = 2.4°; TB = 1.3°) and facial height changes (Median change TAFH: MB = 4.3mm; TB = 4.4mm).

Conclusions: Progressive mandibular advancement was not associated with greater mandibular growth or less lower incisor proclination compared to large single step advancement.

Homocysteine and oral clefting: mechanisms for a potential prevention strategy.

T. A. HARTRIDGE, N. L. BROWN, L. KNOTT. (Dept of Child Dental Health, University of Bristol)

Objective: There is increasing evidence for the protective effect of periconceptional folic acid on oral clefting. Homocysteine (Hcy) levels correlate with serum folate levels. The aim of this study was to investigate the effects of Hcy on cells and tissues involved in palatogenesis and to determine potential mechanisms for cleft formation.

Design: Controlled cell and organ culture experiments.

Setting: Craniofacial research laboratory.

Subjects and Methods: Investigation of the effects of homocysteine and copper on human embryonic palatal

mesenchyme cells (HEPM) and the fusion of murine palatal explants using standardised cell and organ culture techniques.

Results: Hcy at clinically relevant concentrations, when combined with physiological levels of copper, causes apoptosis of cultured HEPM cells in a dose dependant manner. Cell apoptosis is due to the copper catalysed auto-oxidation of Hcy to form hydrogen peroxide. Matrix metalloproteinase-2 production by HEPM cells is not affected by concentrations of Hcy that do not affect HEPM cell number. Hcy caused a reduction in the fusion rate of cultured murine palatal explants that was not significant.

Conclusions: Hcy has the potential to disrupt cells involved with normal palatal development. The role of Hcy in the development of cleft palate may have been previously overestimated.

Comparing the accuracy between Direct and Indirect Bracket Placement

T. M. HODGE (School of Dentistry, University of Birmingham)

Objective: To determine whether there are any differences in terms of accuracy between direct and indirect bracket placement.

Design: Prospective; randomised; controlled, clinical trial.

Materials and Method: A power calculation determined that a minimum of 22 subjects were required. Twenty-six consecutive patients requiring upper and lower MBT™ pre-adjusted edgewise appliances had their labial segments bonded directly or indirectly according to a split mouth system of allocation. Indirectly bonded brackets were first positioned on casts before being transferred to the mouth in a vacuum-formed tray. Before and after bond-up all brackets were photographed and traced to determine positional differences from the ideal. The photographic and tracing techniques were confirmed as being reproducible.

Results: Using ANOVA vertical errors were found to be statistically greater than those in the horizontal plane, which in turn were greater than angular errors, $p < 0.05$. Errors were greater for brackets placed on maxillary teeth. The overall means of combined errors for the two methods were almost identical, but the standard deviation for indirect bracket placement errors was only 41% of that of direct placement errors.

Conclusions:

- Mean bracket placement errors were similar with both techniques.
- Neither technique yielded ideal bracket placement.

Are Facial Expressions Reproducible?

D. J. JOHNSTON, D. T. MILLETT, A. AYOUB, and M. BOCK

(Glasgow Dental School, University of Glasgow).

Objectives: To determine the reproducibility of five facial expressions

Design: Prospective cohort study

Setting: 3D imaging laboratory Canniesburn Hospital, Glasgow

Subjects and Methods: Thirty volunteers had 20 landmarks highlighted on the face with a fine eyeliner pencil. Subjects were asked to perform a sequence of five facial expressions, which were captured by a three-dimensional camera system (C3D). Each expression was repeated after 15 minutes to investigate intra-session expression reproducibility. To investigate inter-session expression reproducibility, each subject returned on a second occasion 2 weeks later. A single operator identified 3-dimensional co-ordinate values of each landmark. A Partial Ordinary Procrustes Analysis adjusted for differences in head posture between similar expressions. Statistical analysis was undertaken using ANOVA (linear mixed effects model).

Results: Intra-session expression reproducibility was greatest between rest positions (0.74 mm) and least between cheek puffs (1.12 mm). The reproducibility of facial expressions was not statistically different within each of the two sessions, except for lip purse ($p = 0.035$). Rest position was most reproducible followed by lip purse, maximal smile, natural smile and cheek puff. Maximal smile was more reproducible in females than in males ($p = 0.036$)

Conclusions: Intra-session expression reproducibility was high and variation in expression reproducibility between sessions was minimal.

The Twin Block in the Treatment of Obstructive Sleep Apnoea

H. LAWTON (Royal London Hospital)

Objective: To test the effectiveness of the twin block against the Herbst MAS, which has already been proved effective in the treatment of patients with OSA.

Design: A prospective, randomised cross-over study.

Subjects and Methods: 16 patients were fitted with a twin block and Herbst MAS in a random order. Questionnaires and visual analogue scales were used to determine differences in snoring, daytime sleepiness, quality of life, side effects and patient preference. Overnight domiciliary sleep recordings were carried out prior to and after fitting each appliance in order to objectively assess sleep quality by means of an apnoea hypopnoea index (AHI) score, snoring frequency and arterial blood oxygen saturation.

Results: There was no difference in the treatment performance of the twin block and Herbst MAS in terms of apnoea hypopnoea index ($p = 0.7064$), snoring ($p = 0.4845$), arterial blood oxygen saturation ($p = 0.969$), quality of life and side effects. The twin block was less effective at reducing daytime sleepiness ($p = 0.039$). The Herbst MAS proved to be the more popular appliance amongst the patients.

Conclusions: The twin block is as effective as the Herbst MAS in improving the signs and symptoms of OSA except for daytime sleepiness. The twin block MAS represents a viable alternative to the Herbst MAS in the treatment of patients with OSA.

Polyalkenoate adhesives in-vitro bond strengths and effects of laboratory variables

G. RAHILLY, D. WOOD, N. BUBB (Leeds Dental Institute, Leeds)

Objectives: 1) To evaluate the shear bond strength of two new resin-modified polyalkenoate cements in comparison to a widely used composite adhesive. 2) To investigate the effect of the following variables involved in bond-strength testing: sterilisation, disinfection and different rates of cross-head speeds.

Design: Controlled in-vitro investigations.

Subjects and Methods: Debonding standard Edgewise brackets bonded with: Fuji Ortho LC, a new experimental resin modified polyalkenoate and Transbond XT, to extracted human premolars using a Universal Testing Machine. The effects of sterilisation, disinfection and different cross-head speeds on shear bond strength of Fuji Ortho LC was investigated.

Results: There was a significant difference between all three adhesives. Transbond XT exhibited the highest mean bond strength. Fuji Ortho LC had a clinically acceptable mean bond strength and was the most

dependable according to Weibull analysis. The new adhesive had inadequate bond strength.

Autoclaving premolars prior to bonding with Fuji significantly increased the bond strength, disinfection did not. There was a significant difference with 0.1 mm/min cross-head speed compared with 0.5, 1 and 5 mm/min cross-head speeds.

Conclusion: 1) Fuji Ortho LC has acceptable bond strength for clinical use and is dependable. 2) The new experimental adhesive should be rejected. 3) Teeth autoclaved prior to in-vitro testing with polyalkenoate cements produce significantly higher bond strengths. 4) In-vitro testing with different cross-head speeds produces different results.

Longitudinal 3-D changes of child cleft face with growth and after ABG

S. RASHID (Whipps Cross/Eastman, London)

Objective: To compare the soft tissue facial dimensions of cleft lip and palate (CL(P)) children with unaffected children and determine the changes in facial morphology which occur after a two-year period and after ABG.

Design: A prospective longitudinal study.

Setting: Subjects were scanned at Great Ormond Street Hospital, two years after the initial study (Duffy, 1997).

Subjects (Materials) and Methods: In total, 32 CL(P) subjects (aged 10–13 years) from the original 39 participated in the study and were compared with a control group matched for age and sex. Those requiring alveolar bone grafts (ABG) were assessed a minimum of three months post-operatively. All subjects were assessed using an optical surface scanning technique.

Results: The ANOVA and Scheffé tests showed the alar base ($p = 0.001$), nostril floor widths ($p < 0.01$) and lateral lip lengths ($p < 0.05$) were increased in the cleft sample. These dimensions were greater in the BCLP subgroup in comparison to other cleft subjects ($p = 0.05$). Over the two-year period, the mid and lower thirds of the face of UCLP and BCLP subjects became more retrusive and the CP and UCLA subjects showed changes similar to the controls. Non-significant, favourable changes in nasal morphology were identified post ABG.

Conclusion: Significant differences in the facial morphology of CL(P) subjects were found in comparison to control subjects and unfavourable facial growth occurred in the UCLP and BCLP subjects. Clinically favourable but not significant changes occurred in nasal morphology post ABG.

The development and validation of a dental computerised expert system

F. P. J. SCRIVEN (Bristol Dental School, University of Bristol)

Objective: To complete the development and validation of a computerised expert system to guide general dental practitioners in the management of the developing dentition.

Subjects and Methods: The performance of the expert system was compared with that of ten general dental practitioners and ten specialist orthodontists using the records of 24 patients who represented a range of normal occlusions, malocclusions and anomalous development. The recommendations of these three groups was assessed by a panel of three hospital specialists who had not participated in the study up to this point.

Results: The expert system outperformed both the general dental practitioners and the specialists in the recognition of anomalies in the sample of cases used. The treatment plans generated by the expert system were judged to be no better than either the general dental practitioners or the specialists.

Conclusion: The program tested seems able to diagnose and treatment plan the developing dentition successfully, however more extensive validation is now needed.

Soft tissue treatment changes produced by two types of twin block appliances.

A. A. SHARMA, D. GILL AND R. T. LEE (Royal London Hospital)

Objective: To compare 2-D and 3-D soft tissue (ST) changes produced by a conventional twin block (TB) and a mini block (MB), which is a gradually activated appliance with reduced block height, and relate them to the hard tissue changes.

Design: Part of a twin prospective randomized clinical trial.

Setting: Royal London Hospital (RLH) 2000–2001.

Subjects and Methods: 70 Class II Div. 1 patients meeting set inclusion criteria were matched by age and gender. The matched pairs were randomly allocated to treatment with either the TB or MB. Appliances were worn full time for 9 months (Phase I) followed by a 3-month observation phase (Phase II) of no appliance wear. Lateral cephalograms were taken at 0 & 12 months and laser scans were taken at 0, 3, 9 and 12 months.

Results: The TB produced greater forward movement of S.T. Pog. (4.0 mm vs. 1.8 mm) during Phase I, followed by a negative change of –1.0 mm (TB) and –0.9 mm (MB) during Phase II. The lower anterior face height increased in both groups (3.2 mm TB vs. 3.9 mm MB). These changes were not statistically different. There were also no significant transverse changes.

Conclusions: The TB produced greater improvement, although all changes were subject to large inter-patient variability. There were clinically significant negative changes in Phase II.

Development of a patient based outcome measure of orthognathic treatment.

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Objective: To develop a patient based outcome measure of the process and outcome of combined orthodontic orthognathic treatment.

Design: Development of the measure took place in 3 stages: generation of items, design of outcome measure and testing the properties of the outcome measure.

Subjects and Methods: All patients who had received orthognathic treatment over a 5 year period in the South West region were identified. Twenty-five of these participated in 4 focus group discussions aimed to identify patient perceptions of the process of care and outcome of treatment. Analysis and coding of the focus groups formed the basis of an outcome measure. The questionnaire was tested on 15 patients for ease of administration and readability and a further 30 patients for test-retest reliability. When completed questionnaires were returned, participants were contacted by telephone to ascertain the validity of their responses.

Results: A 62 item questionnaire was developed to assess the process and outcome of joint orthodontic orthognathic treatment. Questions were grouped under 9 aspects of treatment. Extensive property testing showed good levels of test-retest reliability and concurrent validity.

Conclusions: A new measure of patient perceptions of the process and outcome of orthognathic treatment has been developed. This is a useful adjunct to clinical measures for auditing the outcome of patients undergoing combined orthodontic and orthognathic surgical treatment.

Supported by BOS, Grant no. CHDH RJ3363