

FEATURES SECTION

British Orthodontic Society, UTG session abstracts

Abstracts of Research Projects

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1st Prize winner

Alignment efficiency/comfort of Damon 3 versus a standard pre-adjusted edgewise appliance

P Scott (GKT Dental Institute, Kings College London, UK).

Objective: The aim of this study was to compare clinical effectiveness and comfort of tooth alignment during initial orthodontic tooth movement using Damon 3 self-ligating and Synthesis conventional ligating pre-adjusted edgewise bracket systems.

Design and setting: The study was a prospective randomized controlled trial undertaken at Guy's Dental Institute and Kent and Canterbury Hospital.

Materials and methods: Sixty-two subjects were recruited, mean age 16.27 years (SD 4.47) with lower incisor irregularity between 5 and 12 mm and a prescribed extraction pattern including lower first premolar teeth. These subjects were randomly allocated for treatment with either bracket system. Fully ligated Damon 0.014-inch Cu NiTi archwires were used for initial alignment in both groups. Study casts were taken to record irregularity at the start and first review appointment. Discomfort was recorded by a 100 mm visual analogue scale (VAS) at 4 hours, 24 hours, 3 days and 1 week.

Results: No significant difference was noted ($P > 0.05$) in the initial rate of alignment or discomfort for either bracket system. The amount of initial irregularity was shown to influence rate of movement, but gender and age were shown to be statistically insignificant.

Conclusions: This investigation found no evidence to suggest that Damon 3 self-ligating brackets are more efficient or comfortable than conventional pre-adjusted brackets during initial tooth alignment.

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2nd Prize winner

Use of panoramic radiographs to assess mesio-distal root angulation

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Objective: To assess the accuracy of the panoramic radiograph in determining mesio-distal root angulation.

Design and setting: This was a laboratory based study.

Materials and methods: A typodont dentition was set-up into an ideal occlusion. Wire struts were placed on the buccal surface of each tooth to represent their long axes. The dentition was fixed into a natural skull and standardized panoramic radiographs were taken. The radiographic and true mesio-distal angulations of each tooth to a horizontal reference plane were measured. The mesio-distal root positions were then altered to a more mesial and then more distal position and the measurements were repeated.

Results: Greatest variation in the upper arch occurred in the canine–premolar area where the roots were projected as being more divergent. Greatest variation in the lower arch occurred in the lateral incisor–canine region where these roots were projected as being more convergent. 26.7% of the radiographic angulations were within a range of clinical acceptance ($\pm 2.5^\circ$).

Conclusions: There is a clinically significant variation between the radiographic and true root angulations recorded from the panoramic radiograph.

3rd Prize winner

The effectiveness of sterilization of tried-in molar bands

M. E. Browne*, D. O. Morris (Leeds Dental Institute, Leeds, UK)

Objective: To examine the efficiency of current sterilization protocols undertaken on tried-in orthodontic

molar bands in the Yorkshire region. Currently, no national cross-infection guidelines exist with respect to this aspect of clinical orthodontic practice.

Design: The study was a prospective observational study. Five sterilization variables were chosen on the basis of their clinical relevance. The design entailed a quantitative and qualitative microbiological analysis of sterilization procedures. A sample size of 170 bands was calculated.

Setting: This was a 'real world' multi-centre study involving 16 participating sites: nine hospital units and seven specialist orthodontic practices.

Materials and methods: Three hundred and twenty consecutively 'tried-in' molar bands were subjected to microbiological analysis to investigate the presence of aerobic and anaerobic bacteria.

Results: Nineteen out of 320 molar bands from different units had positive bacterial growth (5.6%). No anaerobic growth was found. The findings from two participating units gave some cause for concern.

Conclusions: Current sterilization practices would seem to be successful in eliminating most bacteria on tried-in molar bands as long as a strict sterilisation protocol is being maintained.

Effects of presurgical orthopaedics on archform in UCLP

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Objective: To identify archform dimensional change in unilateral cleft lip and palate (UCLP) infants treated with presurgical orthopaedics (PSO), compared with those not receiving PSO, up to age six months.

Design: Longitudinal case series.

Setting: Great Ormond Street Hospital for Children, in 2006.

Subjects and methods: The study included 75 consecutive study model sets of patients with complete UCLP (PSO=14, non-PSO=61), treated over 10 years by one surgeon and orthodontist. Each set comprised study models taken close to birth, pre-lip repair/vomer flap (3 months), pre-palate repair (6 months).

Thirteen landmarks were measured three-dimensionally using the reflex microscope and COMP3D software, in a single blinded analysis. Sixteen variables were computed to describe the archform in transverse, anteroposterior, vertical dimensions, and arch circumference. The groups were comparable at birth in all variables.

Intraoperator repeatability tests and Repeated Measures Hierarchical ANOVA (significance level $P<0.01$) were performed.

Results: Repeatability tests showed good measurement precision. There were no statistically significant mean changes in any archform variable between the groups. The power of the study was 93%.

Conclusions: PSO treatment had no effect on archform. Lip repair had a greater impact on archform than PSO. The study was limited by the smaller PSO group and retrospective design.

Sonic hedgehog pathway gene expression during development of the mouse molar tooth root

M. S. Khan (GKT Dental Institute, London, UK)

Introduction: An understanding of root development at the molecular level bears direct relevance to clinical orthodontics in relation to the management of root resorption. Sonic hedgehog (*Shh*) is a secreted protein that is active in the developing tooth but little is known about its role in root development.

Objective: To investigate if *Shh* and component members of its signalling pathway are expressed during mouse molar tooth root development.

Design and setting: A gene expression study undertaken at Guy's Dental Institute; 2005–7.

Materials and methods: Whole heads were dissected out from new born mice pups at 10 and 20 days old. Serial sections were obtained and *in situ* hybridization using ³⁵S-UTP radio-labelled riboprobes was performed. Antisense riboprobes were generated from mouse cDNA clones and identified by the presence of silver grains on the sections.

Results: The study revealed the presence of *Shh* transcripts in the epithelium of Hertwig's epithelial root sheath. Expression of *Shh* receptors and antagonists were also identified.

Conclusions: *Shh* signalling is involved in post-natal molar tooth root development. Its precise

regulation is required for proper tooth root formation.

Acknowledgement: Based upon work published as M. Khan *et al. Gen Expr Patterns* 2007; 7(3): 239–43.

Use of intra-oral photographs with the CLP 5-year-old index

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Objective: To determine that intra-oral photographs may be used instead of dental study models to assess outcome of primary surgery using the 5-year-old index (N. Atack *et al., Eur J Orthod* 1997; 19: 165–70) in children born with complete unilateral cleft lip and palate. To determine intra- and inter-examiner reliability when applying the 5-year-old index to photographs.

Design and setting: Multicentre retrospective method analysis of records from five UK cleft units.

Materials and methods: Records of 96 5–6-year-old children born with complete unilateral cleft lip and palate were used. Dental study models, photographs including an overjet measurement taken from the most prominent tooth, and photographs including an overjet measurement taken from both the most prominent and retrusive tooth in each case were scored using the 5-year-old index on two separate occasions by four consultant orthodontists calibrated in the use of the index.

Results: Intra- and inter-examiner reliability was similar whether photographs or study models were used. Moderate to very good agreement was found between these methods using weighted kappas.

Conclusion: Provided consistent examiners use the 5-year-old index, agreement between the use of photographs and study models with the index is largely comparable.

Supporting agency: British Orthodontics Society Consultant Orthodontists' Group (BOS COG).

An RCT comparing pain associated with two fixed appliance systems

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Objective: The aim of this study was to compare the pain levels of patients treated with two fixed appliance systems

Design and setting: The study comprised a multi-centre randomized clinical trial undertaken in two orthodontic clinics within separate Trusts between July 2005 and April 2006.

Subjects and methods: Sixty-six patients were randomly allocated to either a conventional twin bracket (Tru Straight, ORMCO) or a self-ligating bracket (Damon 3, ORMCO). Pain intensity was recorded twice daily over seven days using 10 cm visual analogue scales. Maximum pain intensity was analysed with multivariable linear regression and pain intensity was analysed with a general linear model univariate analysis of covariance.

Results: Patients in the Damon 3 group reported lower mean maximum pain intensity ($P=0.053$) and significantly lower mean pain intensity ($P=0.012$) than Tru Straight patients. Patients who consumed analgesics reported significantly higher maximum pain intensity and mean pain intensity than those who did not take analgesia ($P<0.001$).

Conclusions: The Damon 3 appliance resulted in lower pain intensity for the first seven days when compared with the Tru Straight appliance. However the Damon 3 appliance is more expensive.

Supporting agency: Oxfordshire Health Services Research Committee (OHSRC) Ref 852.

Validation of enamel erosion *in vitro*

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Introduction: Erosion is an increasing problem in adolescents, the primary source of orthodontic patients. Assessment of tooth surface loss is difficult to perform *in vivo*. The gold standard for *in vitro* quantification of erosion is transverse microradiography (TMR).

Objective: To compare the use of non-contact surface profilometry (NCSP), quantitative light-induced fluorescence (QLF) and TMR to quantify dental erosion.

Setting: A laboratory based study.

Materials and methods: Sixty bovine incisors with exposed 5 × 3 mm enamel windows, baseline imaged with QLF and NCSP, were subjected to an erosive

solution (pH 3.4) for up to 36 hours. The lesions were imaged using NCSP and QLF, sectioned, and analysed with TMR.

Results: A range of lesion severities resulted. Mineral loss, measured as ΔQ (QLF) and lesion depth (NCSP), was recorded and confirmed by TMR. A correlation was found between ΔZ and NCSP lesion depth of $r=0.648$ ($P<0.001$). A poorer correlation was found between ΔZ and ΔQ : $r=0.206$ ($P=0.0574$).

Conclusions: Lesion depth and ΔZ correlated significantly. QLF correlated poorly with ΔZ . Transverse microradiography is valuable but is destructive and can only be used *in vitro*. Currently only QLF can be used *in vivo*. Advances in these technologies may allow development of non-destructive in-treatment measurements of mineral loss.

Structured abstracts: do they improve citation retrieval from dental journals?

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Dynamic sensory changes of oro-facial tissues during orthodontic treatment

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Objective: To assess sensory changes in permanent maxillary incisors and surrounding skin of the upper lip induced by inflammatory responses during orthodontic tooth movement.

Design and setting: An observational, prospective, longitudinal, cohort study carried out in two centres within separate trusts.

Subjects and method: After sample size estimation, 30 patients attending for fixed appliance treatment (19 females, 11 males aged 11–27 years) were assessed using von Frey hairs and light touch, in which a visual analogue scale (VAS) was completed at baseline, three months and six months into treatment.

Results: The mean pressure threshold of the upper incisor teeth decreased as treatment progressed and this was highly significant ($P<0.001$). The quality of sensation towards light touch on the upper lip using a single stroke remained constant and was not significant ($P>0.05$). However, the quality of sensation reported using the light touch continuous stroking increased as the treatment progressed and this was highly significant ($P<0.001$).

Conclusions: A primary hyperalgesic response was shown by the upper incisors and a secondary hyperalgesic response was demonstrated in the skin of the upper lip during the first six months of fixed orthodontic treatment with no signs of recovery in sensation at this stage.

Temporomandibular joint dysfunction (TMD) in orthognathic surgery patients

R. A. Muwahid*, S. J. Cunningham (UCL Eastman Dental Institute, London, UK)

Objective: The aims were to establish the prevalence of TMD in a group of orthognathic patients and to compare clinical findings and quality of life (QoL) in those with, and without, TMD.

Design and setting: A cross-sectional study undertaken at the Eastman Dental Hospital during 2005–6.

Subjects and methods: Thirty-one new patients were recruited from the joint orthodontic/orthognathic surgery clinic over an eight-month period. The study involved: (i) a non-invasive clinical examination investigating pain in the TMJ and surrounding muscles and also the range of mandibular motion, and (ii) a questionnaire investigating QoL (Oral Health Impact Profile-14). The presence of TMD was classified according to the European Academy of Craniomandibular Disorders (EACD).

Results: The percentage of orthognathic patients suffering from TMD was 35.5%. There were only a small number of significant differences in the clinical findings between the TMD and non-TMD groups, but this may well be due to the sample size. However, results from the OHIP-14 showed that TMD patients reported significantly poorer quality of life ($P=0.005$) than those without TMD.

Conclusions: Over a third of orthognathic patients in this study presented with TMD. Therefore, careful assessment using a structured method for classification (i.e. EACD) is essential.

Which factors affect information retention in orthodontic patients?

J. H. Patel*, S. J. Cunningham (UCL Eastman Dental Institute, London, UK)

Objective: To determine the factors which affect retention of information provided in different formats.

Design: A questionnaire based study carried out at the Eastman Dental Hospital during 2005–6.

Materials and methods: Eighty patients attending new patient clinics were randomly allocated into one of two groups. The first group was given a BOS leaflet about orthodontic treatment, and the second group a visual computer program incorporating the same information. Both groups were given additional verbal information. Short and longer term retention (eight weeks later) of information was assessed using a questionnaire. Age, gender, ethnicity, postcode and the time taken to view/read the information provided was recorded. Linear regression analysis was undertaken to assess the relationship between retention of information and the variables mentioned above.

Results: The mode of information provision was found to be the only statistically significant factor affecting information retention.

Conclusion: Computer based visual information was shown to enhance information retention. Consequently, consideration should be given to providing information to orthodontic patients in a more visual format if it is to be retained more effectively.

Social perceptions of adults wearing orthodontic appliances

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Objective: To ascertain the influence of orthodontic appliances upon subjective ratings of personal characteristics, specifically social competence, intellectual ability, psychological adjustment and attractiveness in adult patients.

Design and setting: Cross-sectional questionnaire undertaken at King's College London, 2006.

Materials and methods: A sample of 130 undergraduates looked at a single randomly assigned photograph of an adult female and then made judgements about her personal characteristics. Five photographs of the same adult were used, each with a different dental state: 1. unmodified appearance; 2. steel brace; 3. ceramic brace; 4. gold brace and 5. clear colourless positioner appliance. Judgements were scored using Likert scales.

Results: Greater perceived intellectual ability was associated with the appearance of no brace (mean 7.56) rather than steel (6.67) and ceramic braces (6.65) but similar to the gold (7.35) and positioner appliances (7.08). No significant differences between the different appliances were found for social competence and psychological adjustment. A trend existed where non-visible or clear positioner appliances were considered more attractive than visible appliances.

Conclusions: In the absence of other information, judgements individuals make are influenced by orthodontic appliance design.

Self-organizing human masseter muscle-derived constructs

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Objective: The aim of this study was to investigate the use of human masseter muscle-derived cells (HMMDC) to engineer self-organizing three-dimensional muscle constructs on fibrin gels.

Design and setting: This study was a laboratory based tissue engineering study undertaken at the Eastman Dental Institute during 2005–6.

Materials and methods: A technique previously described by Huang *et al.* (*J Appl Physiol* 2005; 98: 706–13) was reproduced. This involved plating rat limb muscle-derived cells (RLMDC) on a fibrin gel, attached at either end to frayed sutures on top of a non-stick layer of sylgard. The inherent contractility of the muscle cells causing the gel to roll up and self-organize into a three dimensional muscle construct termed a myooid. This technique was reproduced using RLMDC and HMMDC.

Results: RLMDC aligned in an ordered manner on the fibrin gels and after seven days caused them to roll up into myooid-like structures. HMMDC also aligned on the fibrin gel causing the gel to roll. However, at day four the gels started to break down detaching from the anchoring sutures and losing their cellular orientation.

Conclusions: RLMDC seeded gels form myooid-like structures. HMMDC seeded gels break down and fail to form myooid-like structures.