

British Orthodontic Society, UTG session abstracts

Abstracts of Research Projects

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Predictors for demineralisation: A post-hoc analysis of RCT recruits

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Objective: To determine predictors for the presence and degree of demineralisation after orthodontic treatment.

Design: Post-hoc analysis of RCT recruits.

Setting: Liverpool University Dental Hospital

Subjects: 250 patients were screened for demineralization, at debond, using quantitative light-induced fluorescence to determine their eligibility for an RCT assessing the effectiveness of different toothpastes at reducing demineralisation during retention.

Methods: Data about patients' demographic details, treatment, oral hygiene and pre-treatment status of first permanent molars (6s) were extracted from case notes. Data on the presence and number of white spot lesions (WSLs) and degree of demineralisation were obtained from the trial's data base. Univariate analyses and multiple regression were undertaken to assess for associations between the factors and the presence and number of WSLs and degree of demineralisation.

Results: Mean number of WSLs/patient= 2.9 (95% CI 2.5, 3.3). 65 patients (28.3 %) had no WSLs and 165 (71.7%) had 1–12. Patients with WSLs were significantly younger ($p=0.002$). Boys ($p=0.001$) and participants with diseased 6s ($p=0.05$) had a significantly greater degree of demineralisation.

Conclusion: Gender, pre-treatment age and status of 6s may be used as predictors for the development and severity of WSLs during orthodontic treatment.

A Randomised Trial Comparing Three Methods of Delivering Orthodontic Education

M. Bains*, P. Reynolds, F. McDonald, M. Sherriff, T. Newton (Guy's Hospital, KCLDI).

Objective: To evaluate what effect the mode of education delivery has on students' learning outcomes and experiences by conducting a quantitative and qualitative comparison of face-to-face (F2FL), blended (BL) and e-learning (EL).

Design: Prospective cluster randomised trial comparing four parallel groups.

Setting: Guy's campus (KCLDI).

Materials and Methods: Eight firms of fourth year dental undergraduates were randomly allocated to one of four intervention groups (EL, F2FL, BL1, BL2). Two BL groups were used to evaluate the effect of the order of learning. Each group received the same cephalometrics tutorial. Baseline comparability was assessed before the tutorial. Effectiveness and acceptability were evaluated immediately afterwards using a MCQ and questionnaire respectively. This was followed by a focus group meeting.

Results: Ninety students completed the study. Pearson's χ^2 test found no significant difference between F2FL and BL but EL alone was less effective ($p<0.05$) for four MCQ questions. Overall students were positive towards each method but a one-way ANOVA found BL was the most and F2FL the least accepted ($p=0.002$). EL was the least preferred ($p=0.028$). The order of BL had no significant effects.

Conclusions: BL is the ideal mode of delivering undergraduate orthodontic education with F2FL timetabled and supportive EL freely accessible.

Randomised controlled trial of mandibular alignment with two pre-adjusted appliances

P. S. Fleming*, A. T. Dibiase, R. T. Lee (Royal London Dental School).

Objective: To compare mandibular arch alignment with SmartClip™ and Victory™ brackets in non-extraction cases.

Design and Setting: A prospective randomized controlled clinical trial based in the Royal London Dental School and Kent & Canterbury Hospital.

Subjects and Methods: Sixty-six participants were randomly allocated to two parallel groups. A 0.016 inch NiTi wire (3M Unitek) was placed in all subjects. Irregularity in three dimensions was measured on pre-treatment reference models and on models taken 8 weeks after placement of the appliances. Transverse dimensional changes and labial segment inclination were analysed after passive engagement of a .019 X .025" SSW after 30 weeks of treatment using reference model and cephalometric data, respectively.

Results: Following adjustment for pre-treatment differences by ANCOVA, bracket type had little influence on alignment efficiency in the mandibular arch overall ($P=0.08$), in the buccal ($P=0.173$) or in the labial segments ($P=0.528$). More significant intermolar expansion arose with SmartClip™ ($P=0.009$). Otherwise no statistically significant differences in arch dimensional changes were observed between subjects treated with the appliance systems.

Conclusions: The efficiency of alignment in the mandibular arch in non-extraction cases is independent of bracket type and determined primarily by the degree of irregularity initially. There was little difference in the pattern of arch alignment and leveling related to the 2 pre-adjusted appliances.

Craniofacial features of transgenic mice over-expressing sonic hedgehog

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(¹King's College London; ²Imperial College London).

Objective: To analyse the craniofacial characteristics of transgenic mice over-expressing Sonic Hedgehog (*Shh*).

Design: Histological and skeletal analysis of transgenic mouse embryos.

Materials and methods: Transgenic mice were generated using pronuclear injection of a DNA construct consisting of the mouse *Shh* gene under control of a human Keratin-14 (K14) promoter. This construct drives high expression of *Shh* in early epithelium of the epidermis and craniofacial region, including the jaws. Skeletal and histological sections of transgenic mutant mice were compared with control littermates for differences in their craniofacial characteristics.

Results: Mutant mice demonstrated skin anomalies, polysyndactyly and spina bifida. In addition, significant variation in the craniofacial characteristics of mutants were observed compared to controls. The main features that distinguished mutants included profound exencephaly, an absence of the cranial vault skeletal apparatus, fusion of the frontal, temporal and zygomatic bones and a bifid secondary palate. In addition, mutants had a marked skeletal open bite associated with a flattened cranial base angle and diminutive mandibular condyle.

Conclusion: This investigation demonstrates the importance of *Shh* signalling activity in the developing craniofacial region. Whilst it is established that reduced levels of *Shh* activity can lead to severe anomalies of craniofacial development, here we show that increased activity can also have important consequences for normal development of this region.

Orthodontic Referral Behaviour of General Dental Practitioners in West Sussex

O. A. Jackson*, S. J. Cunningham; D. R. Moles, J. R. Clark
(St. Richard's Hospital; UCL Eastman Dental Institute).

Objective: The aim of the study was to determine whether dentists were able to make orthodontic referrals at the appropriate time and to the most appropriate provider for particular malocclusions; and to determine the level of use of the Index of Orthodontic Treatment Need (IOTN) when making orthodontic referrals.

Design: Postal questionnaire survey with picture tests of a variety of malocclusions.

Setting: West Sussex Primary Care Trust (PCT) during 2006.

Subjects and Methods: All dentists (349) on the PCT database who undertook orthodontic referrals.

Results: A 70% response rate to the questionnaire was achieved. 52% of dentists made the correct decision in choosing the appropriate orthodontic provider in all cases, and overall 80% of the decisions made about where to refer patients for orthodontic treatment were appropriate. 20% of dentists made the correct decision on the timing of referral for orthodontic treatment in all cases. 77% of dentists do not routinely use IOTN when making orthodontic referral.

Conclusions: There is evidence that West Sussex dentists need further training regarding the correct timing of making an orthodontic referral. If dentists are to act as gatekeepers of orthodontic provision based on IOTN further training in its use is required.

The Psychosocial Impact of Hypodontia in Children

E. R. Laing *, S. J. Cunningham, S. P. Jones, D. Moles, D. S. Gill (Eastman Dental Hospital, UCL).

Objective: To determine (i) the psychosocial impact of hypodontia in children as compared with children having orthodontic treatment for malocclusions of a similar IOTN category (ii) the influence of the severity of hypodontia and number of retained primary teeth on psychosocial status.

Design: Cross-sectional study

Materials and Methods: In accordance with the sample size calculation, 123 children were recruited to (1) a hypodontia group or (2) a 'routine orthodontic' group (IOTN DHC 4/5). The outcome measures were the Child Perceptions Questionnaire (CPQ) and two visual analogue scales (VAS) to assess appearance and function.

Results: There were no statistically significant differences between the hypodontia and 'routine orthodontic' groups. When the hypodontia group was looked at in isolation, there was little statistical evidence that the extent or location of hypodontia affected the CPQ or VAS scores. However, the functional limitations domain was significantly affected when fewer primary teeth were retained ($P=0.030$).

Conclusions: In the population studied, hypodontia did not affect the psychosocial status of patients more than other features of a DHC 4/5 malocclusion. Patients with hypodontia had more functional difficulties when the associated primary teeth had been shed, which highlights the possible importance of retaining primary teeth in cases of severe hypodontia.

In vitro remineralisation of carious lesions by Tooth Mousse™

S. F. Lovel*, S. M. Higham, N. Pender (University of Liverpool).

Objectives: To compare remineralisation (R) of subsurface carious lesions by Tooth Mousse (TM), GC Corporation, Tokyo and fluoride toothpaste slurries.

Design and Setting: Randomised controlled in vitro study

Materials and Method: Sixty bovine incisor sections were exposed to a demineralising solution (pH 4.5) for 18 hours. Sections were imaged with quantitative light induced fluorescence (QLF) following demineralisation (D). The slabs were randomised into four groups: W distilled water (control); X artificial saliva; Y TM in artificial saliva; and Z 1000 ppmF NaH_2PO_4 in artificial saliva. Samples were stored in artificial saliva for 84 days with a total of 10 hours test time and were analysed with QLF and transverse micro-radiography (TMR.)

Results: Only the toothpaste group was shown to have a significant effect on ΔF ($p=0.000$) demonstrating a linear increase in mineral content. Some remineralisation was seen in the other test groups but neither saliva ($p=0.470$) nor TM ($p=0.320$) had significant effects on final ΔF of the samples. QLF and TMR analyses showed a correlation coefficient of $r=-0.56$.

Conclusions: The remineralising potential of Tooth Mousse™ has yet to be realised and refinements in the *in vitro* model are required. Toothpaste was found to be an effective remineralising agent *in vitro*.

Evaluation of clinicians methods of archform selection

C. McNamara*, J. R. Sandy, A. J. Ireland (University of Bristol).

Objectives: To determine clinicians theoretical and clinical practice with regards to adjustment of working archwires and the subsequent effect on archform.

Design and setting: The study consisted of a questionnaire followed by laboratory based measurement studies at Bristol Dental Hospital during 2005–2007.

Materials and methods: 108 orthodontists were asked to complete a questionnaire assessing theoretical practice. 30 were then asked to adapt working archwires to 3 sets of study models, as per normal clinical practice and the archwire intercanine and intermolar widths were recorded. Finally, the arch dimensions of 50 pre- and post-treatment study models obtained from a subsample of clinicians were measured.

Results: The questionnaire (response rate 92.6%) demonstrated a large variation in the arch width landmarks considered important for archform.

However, few clinicians (28%) used study models routinely in selecting archform. Measurements from the adapted archwires showed a wide variation in upper and lower intercanine widths. Data from the 50 treated cases also showed that in most cases there was a wide variation in intercanine and intermolar width between pre- and post-treatment models.

Conclusions: Although the majority of clinicians aim to maintain pre-treatment archform, this study shows that this is often not transferred to clinical practice.

Efficiency of SmartClip self-ligating brackets compared to brackets using conventional ligation

L. A. O'Dwyer*, S. J. Littlewood, S. Rahman, R. J. Spencer (Leeds Dental Institute, Leeds, UK).

Objective: To determine whether using a self-ligating bracket system (3M SmartClip) increases the efficiency of orthodontic treatment as compared to a conventional ligation system (3M Victory).

Design and Setting: Prospective multi-centre randomised controlled clinical trial undertaken at three hospital-based orthodontic departments in Yorkshire.

Materials and Methods: 114 Subjects (mean age 15.3 yrs) were recruited from all patients commencing dual arch fixed appliance orthodontic treatment with either one of two first year Specialist Registrars. Patients were randomly allocated to receive treatment with either bracket system, with stratification for operator and centre. Both operators followed a protocol regarding bracket bonding procedure and archwire sequence. Efficiency was determined by the time taken in days and number of visits to reach working archwire (0.019 x 0.025ss), in addition to the total time spent in the chair.

Results: There were no significant differences in the number of days and number of appointments taken to reach working archwire, or in total chairside time between the bracket systems.

Conclusions: The results of this study suggest that there is no difference between a self-ligating bracket system (3M SmartClip) and a conventional ligation system (3M Victory) in terms of treatment efficiency up to the working archwire.

Soft tissue effects of Twin-Block and Dynamax appliances following 15-months treatment

U. M. Qureshi*, R. Govender, A. T. DiBiase, R. T. Lee (Royal London Dental School).

Objective: To compare the soft tissue effects following 15-months treatment, and in the

immediate post-treatment period with Twin-Block and Dynamax appliances.

Design and Setting: A prospective clinical trial based in the Royal London Dental School and Kent & Canterbury Hospital.

Subjects and Methods: One hundred and fourteen participants with Class II division 1 malocclusions were randomly allocated to treatment groups. Active treatment lasted 15-months and soft tissues were measured using cephalometric and 3-dimensional laser scan records taken at the start and end of active treatment. Appliances were then withdrawn and subjects observed in the immediate post-treatment period for a further 3-months, using laser scans.

Results: Following adjustment for pre-treatment differences by ANCOVA, appliance type had an influence on soft tissue effects following 15-months treatment. Cephalometric data revealed significant differences for soft tissue effects at pogonion (P=0.000), lower sulcus (P=0.000) and for lower anterior face height (P=0.01), with greater effects noted in the Twin-Block group. No statistically significant differences in the soft tissues were measured by laser scan following active treatment. During the immediate post-treatment period all changes were small, however no significant differences were noted between appliances.

Conclusions: Soft tissue effects may be influenced by appliance type following 15-months treatment with greater effects observed in the Twin-Block.

SmartClip versus a conventional pre-adjusted edgewise appliance - Is there a difference in pain and breakages?

S. Rahman, R. J. Spencer, L. A. O'Dwyer, S. J. Littlewood (Leeds Dental Institute).

Objective: The aim of this study was to compare discomfort during treatment and bracket failure rates up to working archwire, using conventional ligating Victory APCTM and self-ligating SmartClip APCTM pre-adjusted edgewise bracket systems.

Design & Setting: This study was a prospective randomised controlled clinical trial undertaken at Leeds Dental Institute, Pinderfields General Hospital, Wakefield and St. Luke's Hospital, Bradford during 2005–2008.

Materials & Methods: Seventy-one control and sixty-six test subjects were recruited with a mean age of 15.28 years (SD 4.04). Subjects were randomly

allocated to receive either bracket system. Block randomisation was carried out for each centre. Two clinicians bonded up all cases using a standardised bonding procedure along with the recommended archwire sequence for each bracket system. Questionnaires were given to patients after every archwire change and recorded discomfort during the appointment, at 24 hours, 3 days and 5 days using a Likert scale. Breakages and ARI scores were recorded separately.

Results: No significant difference was noted in discomfort or bracket failure rates between the two systems.

Conclusions: There was no evidence to suggest that self-ligating SmartClip™ brackets were more comfortable or less prone to breakages than conventional Victory™ brackets.

Supporting Agency: 3M Unitek

Orthognathic patients' perceptions of referral to a psychiatrist

F. S. Ryan*, J. Shute, S. J. Cunningham (Eastman, UCL).

Objective: A recent survey revealed that orthodontists are often reluctant to refer patients for psychological evaluation due to fear that they will be offended. The aim of this study was to assess orthognathic patients' perceptions of such referrals.

Design: A prospective qualitative questionnaire study.

Setting: A teaching hospital.

Subjects and Methods: The first phase of the study involved in-depth interviews with 10 orthognathic patients and 20 clinicians. These were analysed using a grounded theory approach and a questionnaire was then developed using the key themes from the interviews. Following a pilot study, the questionnaire was distributed to 63 patients (100% response rate).

Results: Overall, patients viewed referral to a psychiatrist positively. Patients would prefer the referral to be made by the clinician they are most familiar with (usually the orthodontist – 38% of respondents) and to see the psychiatrist on a one-to-one basis (79.4%), in an environment they are familiar with. The main perceived drawback was the inconvenience of an additional visit (34.9%) and taking time off work (42.9%).

Conclusions: Fear of the patient reacting badly to being referred to a psychiatrist appears to be unfounded in this cohort of patients and should not prevent clinicians making such referrals where necessary.

The development of a prototype aesthetic orthodontic archwire

H. V. Shah*, B. Su, A. J. Ireland, J. R. Sandy (Bristol Dental School, Bristol).

Objective: To produce a prototype aesthetic orthodontic archwire.

Design and Setting: Laboratory based study undertaken at Bristol Dental School during 2006–2008.

Materials and Methods: A method was developed by which novel silica nanofibre mats were produced by the electrospinning of an organic solution of silica. The elemental and dimensional characteristics of the fabricated nanofibres were determined using energy dispersive analysis (EDX), X-ray diffraction (XRD) and scanning electron microscopy (SEM). The nanofibre mats were embedded into a Bis-GMA/TEG DMA resin matrix to produce a 0.021" X 0.025" straight length prototype aesthetic orthodontic archwire. The elastic modulus of the prototype wire was determined using a 3-point bend test.

Results: SEM analysis revealed that the nanofibres produced by electrospinning were approximately 300nm in diameter. EDX confirmed the fibres to comprise silicon and oxygen and XRD revealed them to be fibres of crystalline silica. The elastic modulus of the prototype aesthetic archwire was measured as 7246 MPa, approximately 1/12 that of NiTi wire and 1/35 that of steel.

Conclusions: A reproducible method of producing silica nanofibre mats using electrospinning was developed. A prototype aesthetic orthodontic archwire was produced, but further work is required to improve the mechanical properties of these novel wires.

Effectiveness Of Decontamination Procedures On Tungsten Carbide Orthodontic Debonding Burs

Z. Sheriteh*, P. Riley, T. Hassan, M. Sherriff, M. T. Cobourne (GKT Dental Institute).

Objectives:

1. To assess the proportions of single-use and re-use of tungsten carbide orthodontic debonding burs (TCDBs) within the UK.

2. To investigate the effectiveness of decontamination procedures on TCDBs.

Design:

1. Questionnaire-based study
2. In-vitro microbiological study

Setting: St. George's Hospital NHS Trust, London.

Materials and Methods:

1. Questionnaires were sent to 217 orthodontic departments to establish patterns of use of TCDBs.
2. A total of 240 TCDBs were artificially contaminated by removing residual composite from extracted teeth contaminated with *S. mutans*. The burs were randomly allocated to 6 groups: one control group and five different decontamination groups. Microbiological analyses were

used to detect viable bacterial growth on the burs. Data was analysed using the Kruskal-Wallis test (significance level $P=0.05$).

Results:

1. The rates of single-use and re-use of TCDBs were 55% and 43% respectively. Re-used burs were correctly decontaminated by 96% of departments.
2. *S. mutans* was not recovered from any of the decontamination groups ($P=0.001$). No differences were found between the decontamination groups ($P=0.271$).

Conclusions: TCDBs are classified as re-usable, yet 55% of orthodontic departments discard them after single-use. All recommended methods are equally effective at decontaminating TCDBs, suggesting they can be safely re-used.