

**FEATURES  
SECTION**

# University Teachers Group abstracts 2009

The abstracts submitted for the University Teachers Group Session at the British Orthodontic Conference – September 2009.

## **In-vitro bond strength testing using a modified debonding instrument**

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*Objectives:* The aim of this study was to validate the use of a modified Lift-Off Debracketing Instrument (LODI) for *in-vitro* bond strength measurement and to determine the influence of crosshead speed on bond strength.

The null hypothesis was that the speed at which bracket removal occurs is not a significant variable in bond strength determination.

*Design and setting:* This was an *in-vitro* laboratory-based study undertaken at Heriot-Watt University during 2006–2008.

*Materials and methods:* 60 extracted premolar teeth were bonded with MBT Victory series APC Plus® precoated brackets and divided into two groups. 30 teeth were debonded at a crosshead speed of 2 mm/s and 30 at 0.2 mm/s. The pattern of bond failure was determined using a modified Adhesive Remnant Index (ARI).

*Results:* All brackets were successfully debonded using the LODI. The mean bond strengths at speeds of 2 mm/s and 0.2 mm/s were 6 MPa (SD1.4 MPa) and 5.7 MPa (SD1.4 MPa) respectively. No statistical significance was found ( $P>0.05$ ).

*Conclusions:* The LODI was effective at measuring bond strength and found no significant difference between the crosshead speeds used in this study. The LODI could be an effective instrument for the standardisation of *in-vitro* and *in-vivo* universal bond strength testing.

## **Are social judgements made by children in relation to orthodontic appliances?**

A. J. Patel\*, H. D. Rodd, S. Baker, Z. Marshman, P. G. Robinson, P. E. Benson, (University of Sheffield).

*Objective:* To assess how children view other children with fixed orthodontic appliances.

*Design:* Cross-sectional, self-completed questionnaire.

*Setting:* A state secondary school in London.

*Participants and methods:* Year 7 (aged 11–12 years) and year 10 (aged 14–15 years) schoolchildren were invited to look at colour photographs of one girl and one boy and to make social judgements about them. Participants were randomly allocated pictures of the two children smiling either with or without fixed orthodontic appliances. Using a previously validated questionnaire, participants rated subjects using a four-point Likert scale for three negative and six positive attributes. MANOVA was used to test if the independent variables of school class, year, gender rater and presence or absence of the orthodontic appliance had a significant effect on the total attribute score.

*Results:* 322 children completed the questionnaires (response rate 69%). There was a significant effect of class ( $P=0.030$ ), year group ( $P=0.003$ ) and gender of the participant ( $P=0.031$ ) on the attribute score. There was no effect according to the presence or absence of an orthodontic appliance ( $P=0.791$ ).

*Conclusion:* Children do not make social judgements about other children purely on the basis of wearing a fixed orthodontic appliance, which suggests that orthodontic appliances are accepted as constituting a normal dental appearance in adolescence.

## **Early class III orthopaedic treatment and the soft tissue profile**

A. Ahmad\*, N. A. Mandall, (University of Manchester).

*Objective:* To investigate the effectiveness of early class III protraction facemask in producing a change on the soft tissue profile after 15 months. To assess opinions

between lay and orthodontic professionals on the class III soft tissue profile.

*Design and setting:* Seventy five, 8–10 year olds participated in a multicentre randomised control trial on protraction facemask. Changes were assessed by panels of 10 consultant Orthodontists, 10 parents and 10 children.

*Method:* Silhouettes were made from the baseline (T0) and 15 month (T1) profile photographs. A PowerPoint slideshow was constructed and the silhouettes were randomly arranged. Twenty profiles were randomly repeated. A (1–9) Likert scale was used to record the severity of the class III profile by the 3 panels.

*Results:* Early class III protraction facemask was effective in producing a positive and detectable effect on the soft tissue facial profile. This was statistically significant for the orthodontic consultants ( $P<0.001$ ) and parents ( $P=0.035$ ) but not for the child panel ( $P=0.25$ ).

*Conclusions:* This study has shown protraction facemask was effective in producing a positive and detectable effect on the soft tissue facial profile, after 15 months. There are different opinions on the class III soft tissue profile between panels.

### Further development of a psychological questionnaire for orthodontic patients

A. T. Shelton\*, D. O. Morris, N. Y. Houghton, G. Latchford, H. L. Becker, (Leeds Dental Institute).

*Objective:* To amend the condition specific psychological questionnaire developed by Houghton (2005) for prospective clinical use. To test the reliability, validity and responsiveness of the final questionnaire.

*Design and setting:* This validation study involved the development of a condition specific measurement tool. The multi-site study was conducted at Leeds Dental Institute, Seacroft Hospital and St Lukes Hospital.

*Materials and method:* Questionnaires were completed by 112 patients pre-operatively and 74 patients post-operatively. 23 patients completed the same questionnaire within 4–6 weeks to test the reliability. 22 patients completed the questionnaire both pre-operatively and post-operatively to test the responsiveness. Rasch analysis was used to validate the questionnaire.

*Results:* The response rate was 98.4%. Both pre-operative and post-operative questionnaires were found to be valid, reliable and responsive.

*Conclusions:* These validated, condition-specific, psychological questionnaires have the potential to provide patient-orientated outcome data for future clinical trials.

### Do RCTs published in orthodontics comply with the CONSORT statement?

H. E. Flint\*, J. E. Harrison, (Liverpool University Dental Hospital).

*Objectives:* To determine compliance of RCT reports, published in four orthodontic journals, with the CONSORT statement and assess whether compliance changed over time.

*Design:* Retrospective, observational study.

*Setting:* RCTs published in American Journal of Orthodontics and Dentofacial Orthopedics, Angle Orthodontist, European Journal of Orthodontics and Journal of Orthodontics at three time periods: 1995–6 (pre-CONSORT), 2000–1 (post-CONSORT), and 2005–6 (post revised-CONSORT).

*Method:* Reports of RCTs were identified from the Cochrane Oral Health Group's database. The reports were scored using a 36 point checklist developed from the CONSORT guidelines. The score was calculated as a percentage.

*Results:* 151 reports were included. The mean score was 41.5% (95% CI 39.8%, 43.1%). The mean post-CONSORT and post revised-CONSORT scores were significantly higher than pre-CONSORT ( $P=0.01$ ). The mean post revised-CONSORT score, for RCTs published in the JO, was significantly higher than for the other journals ( $P<0.001$ ). The mean post revised-CONSORT scores for RCTs published in the EJO and the JO, which adopted the CONSORT statement were higher than in the AJODO and Angle, which did not ( $P<0.001$ ).

*Conclusions:* On average, reports of RCTs in the orthodontic literature include less than half of the items required by the CONSORT statement. Compliance with the CONSORT statement has improved over time in journals which have adopted the CONSORT statement.

### Bullying in orthodontic patients and its relationship to malocclusion, self-esteem and OHRQoL

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College London; <sup>3</sup>Queen Victoria Hospital, East Grinstead).

*Objective:* The aims of this study were to: (1) measure the self-reported frequency and severity of bullying, (2) investigate whether there is a relationship between bullying, malocclusion and need for orthodontic treatment and (3) investigate the relationship between bullying, malocclusion, self-esteem and oral health related quality of life (OHRQoL).

*Design and setting:* Cross-sectional study undertaken at four hospitals.

*Materials and methods:* 450 participants aged between 10–14 yrs were recruited. Questionnaires were used to measure the self-reported frequency and severity of bullying, self-esteem and OHRQoL. Orthodontic treatment need and malocclusion severity were assessed using IOTN.

*Results:* The incidence of bullying is reported at 12.3%. Being bullied is significantly associated with incompetent lips ( $P=0.03$ ), increased overbite ( $P=0.02$ ) and increased overjet ( $P=0.014$ ). Bullied participants also reported lower levels of social competence ( $P<0.001$ ), athletic competence ( $P<0.001$ ), physical appearance related self-esteem ( $P<0.001$ ) and general self-esteem ( $P<0.001$ ). Higher levels of oral symptoms ( $P=0.002$ ), functional limitations ( $P<0.001$ ), emotional ( $P<0.001$ ) and social impact ( $P<0.001$ ) from their oral condition, resulting in a negative impact on overall OHRQoL ( $P<0.001$ ) was reported.

*Conclusions:* A significant relationship exists between peer victimisation, certain occlusal traits, self-esteem and OHRQoL.

### Importance of age in orthodontics: a study of craniofacial muscle maturation

K. Proczek\*, M. Lewis, R. Shah, N. P. Hunt, (UCL Eastman Dental Institute).

*Objective:* The aim of this project was to investigate the effect of age on the response of rabbit masseter muscle derived cells within a three dimensional (3D) environment.

*Design and setting:* This study was laboratory based and carried out between November 2006 and May 2008 within the Division of Biomaterials and Tissue Engineering (BTE) at the UCL Eastman Dental Institute.

*Materials and methods:* Cells were studied in a 3D model consisting of a collagen gel suspended in a chamber slide on metal floatation bars. Cells were also observed in a two dimensional (2D) milieu over a similar time period. As primary muscle precursor cells aligned and proliferated in the collagen gel, increasing tension within the model resulted in bowing of the gel. The level of bowing within collagen gels of young and mature rabbit was recorded over time and compared.

*Results:* The mean of the gel bowing culture of young muscle-derived cells was statistically significantly higher than that of mature muscle-derived cells at all times, ( $P<0.001$ ).

*Conclusions:* There are statistically significant differences in the behaviour of young and mature masseter muscle-derived cells, which may have clinical implications.

### The diagnostic value of the Orthopantomogram and the influence of malocclusion

M. L. Hayes\*, A. S. Johal, (Barts and the London).

*Objective:* To determine the diagnostic value of the dental panoramic radiograph in relation to the upper incisor teeth.

*Design:* Laboratory based study, supported by a prospective clinical audit.

*Setting:* The Orthodontic Department, The Royal London Hospital.

*Materials and method:* A Gold Standard outlining the features of an ideal radiograph in the upper labial segment was defined following a literature review.

Four previously extracted maxillary incisors were set up in a dry human skull with a complementary acrylic dentition. The maxillary base was modified to facilitate A–P movement allowing the simulation of nine malocclusions based on skeletal I, II and III patterns with varying upper incisor inclination. For each malocclusion, an OPG, an upper standard occlusal and four long cone periapical radiographs were taken. Each radiograph was scored against the Gold Standard.

A clinical audit involving 100 new orthodontic patients determined if *in vivo* findings mirrored the *in vitro* results.

*Results:* The Orthopantomogram provides low levels of diagnostic value in the upper incisor region. Diagnostic values for skeletal I skull set-ups ranged from 57% (OPG), 71% (USO), 86% (PA).

*Conclusion:* The Orthopantomogram showed poor diagnostic value in the premaxilla. The Long cone periapical is recommended for examination of upper incisor root morphology.

### **An investigation into the use of debonding microspheres in electrothermal debonding**

M. S. Swinburne\*, D. R. Wilmott, D. G. Patrick, (Charles Clifford Dental Hospital, Sheffield).

*Objective:* To investigate if debonding microspheres will enhance electrothermal orthodontic debonding. Specifically to evaluate if the addition of debonding microspheres, in varying concentrations, to the orthodontic adhesive process, will affect the bond strength.

*Design and setting:* An experimental *in vitro* controlled study was undertaken at Charles Clifford Dental Hospital during 2007 and 2008.

*Materials and methods:* Four test groups of three preparations of primer with debonding microspheres and a control were examined. The tensile bond strengths on bovine incisors were measured *in vitro* on an Instron machine and recorded as debonding force (N). Differences between the groups were statistically analysed and repeatability assessed.

*Results:* The mean debonding force of the control group was statistically significantly greater than all the other groups to which debonding microspheres had been added ( $P < 0.001$ ). Comparison of the mean debonding forces of 1%, 2.5% and 5% concentrations of debonding microspheres revealed no statistically significant difference between the groups.

*Conclusions:* Addition of debonding microspheres to the orthodontic adhesive process produces a highly statistically significant reduction in debonding force. There is no statistical difference in the debonding force between varying concentrations of debonding microspheres.

### **Adolescent experiences, consent and compliance in orthodontic treatment**

N. S. Wright\*, J. M. Battagel, J. M. King, (Institute of Dentistry QMUL).

*Objectives:* To investigate whether provision of additional information has an effect on the orthodontic experience.

*Design:* Prospective randomised study.

*Setting:* Royal London Dental Hospital.

*Subjects and method:* 76 adolescents (12–16 years) due to start orthodontics were randomly allocated. Both groups received verbal informed consent and in addition the intervention group received a leaflet. Adolescent experiences were assessed using a questionnaire completed on 3 separate occasions.

To assess compliance a Basic Periodontal Examination (BPE) was carried out at each stage and a record kept of appointment and casualty attendance.

*Results:* 60 participants completed the study (Control group  $n=31$ ; Intervention group  $n=29$ ).

Between stages 1 and 2: No statistically significant difference between groups was noted for anxiety ( $P=0.412$ ) or apprehension ( $P=0.530$ ). Motivation demonstrated a statistically significant difference ( $P=0.049$ ) with the intervention group showing positive changes.

Between stages 1 and 3: Anxiety, apprehension and motivation scores reduced in both groups. The intervention group showed better appointment attendance ( $P=0.732$ ), fewer casualty appointments ( $P=0.525$ ) and improved BPE scores ( $P=0.065$ ).

*Conclusion:* Supplementation of verbal with written information during the consent process did not have a sustained statistically significant effect on adolescent experiences and compliance during the early stages of orthodontic treatment.

### **Occlusal effects of digit sucking habits amongst children in Northamptonshire**

P. Mistry\*, D. R. Moles, J. O'Neill, J. H. Noar, (Eastman Dental Hospital and Kettering General Hospital).

*Objectives:* To quantify the effects of digit sucking on the occlusion.

*Design and setting:* Cross-sectional study based in Kettering, Northamptonshire.

*Materials and methods:* In accordance with the sample size calculation, 39 digit suckers were compared to 36 non-suckers, all aged between 7–13 years. Subjects were recruited from a cohort of digit suckers identified in a previous study and from local general dental practitioners. Subjects were invited to attend a short appointment where upper and lower alginate impressions were taken, and the resultant study models were used to measure occlusal differences between the two groups.

*Results:* The prevalence of reduced overbites were significantly higher in the digit sucking group compared

to the non-suckers (OR 5.61, 95% CI 1.55, 20.76). The prevalence of anterior open bites was 36% higher in the digit suckers ( $P < 0.001$ ) and there was also a tendency to an increased overjet in the habit group. No significant differences were seen in the presence of posterior crossbites, buccal segment relationships or asymmetric open bites between the two groups.

**Conclusions:** The orthodontic management of reduced overbites can involve prolonged, complex treatment. Early intervention to eliminate digit sucking habits is therefore recommended on both oral health and health economic grounds.

### Characterization of the mechanical properties of the periodontal ligament

R. M. Tohill\*,<sup>1</sup> L.-K. Chung,<sup>1</sup> R. L. Reuben,<sup>2</sup> M. R. Hien,<sup>2</sup> N. J. P. McGuinness,<sup>1</sup> (<sup>1</sup>Edinburgh Dental Institute; <sup>2</sup>Heriot-Watt University).

**Objective:** The periodontal ligament (PDL) plays a significant role in initiating orthodontic tooth movement. With optimal orthodontic force magnitudes not yet known, further knowledge of PDL mechanical properties may increase our understanding of responses to long term orthodontic loading. The aim of this study was to characterise PDL mechanical properties using a novel device.

**Design:** *In vitro* pilot study

**Setting:** Heriot-Watt University, 2006–2008.

**Materials and methods:** A device was specifically developed for this study to apply controlled tipping displacements to lower second premolars in four porcine mandibular segments, while measuring the forces generated against the tooth. Lingually directed displacements of 70 to 245 micrometers were sustained for five to 35 seconds.

**Results:** Each test produced a stress relaxation curve, confirming PDL viscoelasticity. The peak forces and relaxation curves were reasonably consistent between specimens. The stress relaxation curves were modelled by a three parameter mechanical model. These three parameters were fairly consistent between specimens with predictable variation.

**Conclusions:** The new device is able to demonstrate PDL viscoelasticity, including stress relaxation and hysteresis. It is simple, cheap and clinically deployable. The stress relaxation curves have been accurately modelled, producing consistent parameters between specimens. Further human *in vivo* studies may aid our understanding of optimal force systems for orthodontic patients.

### A radiographic study of tooth development in hypodontia

E. V. Ruiz-Mealin, D. S. Gill, S. Parekh, S. P. Jones, D. R. Moles, (UCLH NHS Foundation Trust/UCL Eastman Dental Institute).

**Objectives:** To investigate the radiographic development of permanent teeth in patients with hypodontia.

**Design and setting:** A retrospective cross-sectional study of dental panoramic tomographs (DPTs) within a dental hospital.

**Subjects:** 139 patients (aged 9–18 years) were recruited to either a hypodontia (mild, moderate or severe) or non-hypodontia control group.

**Interventions and main outcomes:** The stages of dental development were scored using the Haavikko and Demirjian methods. For each tooth scored, the mean age was derived using the Dental Age Assessment method (Roberts *et al.*, 2008) and an estimated dental age derived using meta-analysis.

**Results:** A significant delay in dental age was found in the hypodontia group ( $P < 0.01$ ). The Haavikko method showed a delay of 1.20 years (SD: 1.74) the Demirjian method a delay of 1.64 years (SD: 1.75). There was a significant association between the severity of hypodontia and the delay in dental age ( $P < 0.01$ ). For every additional missing tooth the dental age was delayed by 0.13 years.

**Conclusion:** Dental development is delayed in those affected by hypodontia and the delay is affected by the number of missing teeth. This may be important in orthodontic treatment planning and for legal, immigration, archaeological and forensic purposes.

### The distribution of stress on a quadrant of maxillary teeth with a custom-made mouthguard

S. K. Sinha\*, D. G. Patrick, (University of Sheffield).

**Objective:** To determine the distribution of stress on a quadrant of maxillary teeth with a custom-made mouthguard.

**Design:** An *in vitro* laboratory study using two-dimensional photoelastic method, with a circular polariscope.

**Setting:** Dental Materials Laboratory and Stress Laboratory in the mechanical engineering department, Sheffield University, Sheffield, UK.

**Materials and method:** Two sets of two-dimensional photoelastic model were fabricated using gelatine and acrylic teeth. Eight different types of custom-made mouthguards were tested, by two different loads. Five of the custom-made mouthguards were in different thickness from 1 mm to 5 mm. Remaining three had hard, soft and hard+soft liner inserts placed in the custom-made mouthguard. The fringe patterns were photographically recorded for analysis.

**Results:** The number of fringes decreased with increasing thickness of mouthguard. With 5 mm thickness showing the least number of fringes, with both loads. The mouthguard with the soft liner insert had the best result. This showed the least number of fringes, at both loads.

**Conclusions:** Photoelastic analysis is a good method to study stress distribution around teeth with and without mouthguards. Gelatine is a good photoelastic material. A custom-made mouthguard does reduce stress around teeth compared to no mouthguard.

## Motivation and psychological profile of adult orthodontic patients

S. Pabari\*, S. J. Cunningham, D. M. Moles, (UCL Eastman Dental Institute).

**Objectives:** The aims of this study were to investigate the motives and psychological characteristics of adult orthodontic patients. This will enable clinicians to better understand this growing group of patients and thus enhance the patient's experience of treatment delivery, increasing the potential for a successful treatment outcome.

**Design and setting:** This research involved 'mixed methods' and was undertaken at the Eastman Dental Hospital (2008/9).

**Subjects and methods:** The initial qualitative phase involved conducting interviews to develop a valid patient-centred questionnaire to assess motivating factors. The second quantitative phase involved distribution of the developed questionnaire, together with a further questionnaire to investigate psychological characteristics.

**Results:** A desire to straighten teeth and improve 'a smile' were the key motivating factors. Benefits of orthodontic treatment included improved appearance and self-confidence. With respect to the psychological characteristics, the adult orthodontic group was comparable with members of the general public.

**Conclusions:** The motives for adult patients to seek orthodontic treatment are numerous. By questioning

and listening to the patient, the clinician can gain an understanding of the patient's motives and psychological characteristics. The evidence suggests that if these steps are taken, the likelihood of a mutually satisfying treatment outcome is likely to increase.

## A comparative *in-vitro* investigation into the relative bond strength of Damon® 3, Damon® 3MX and APC™ II brackets using various primers and adhesives

M. Izadi\*, M. Sherriff, M. T. Cobourne, (Kings College London).

**Objectives:** The Damon® system recommends the use of specific adhesives with its constituent brackets. The aims of this study were to compare shear bond strengths of several Damon® bracket and adhesive combinations; with each other, with an alternative commercially available adhesive and with a conventional bracket-adhesive system.

**Methods:** Shear bond strengths of the following combinations were investigated: (1) Damon® 3 brackets bonded with OrthoSolo™ primer/Blugloo™ adhesive (D3/B) with Damon® 3 brackets bonded using Transbond™ XT primer/adhesive (D3/T); (2) Damon® 3MX brackets bonded with Grengloo® adhesive/OrthoSolo™ primer (D3MX/G) with Damon® 3MX brackets bonded with Transbond™ XT primer/adhesive (D3MX/T); (3) APC™ II Victory Series™ brackets bonded with Transbond™ XT adhesive/primer (APC/T) with D3/T and D3MX/T. In addition, the effect on bond strength by pre-curing Transbond™ XT primer for 10 seconds followed by curing adhesive and primer for 20 seconds (APC/T/C) was compared with curing adhesive and primer in one step (APC/T) for APC™ II brackets.

**Results:** Significantly higher bond strengths were found with D3/B compared with D3/T ( $P=0.015$ ) and also for APC/T/C compared with APC/T ( $P=0.018$ ). There was no significant difference between the bond strength of D3MX/G and D3MX/T ( $P=0.96$ ) or that of APC/T, D3/T and D3MX/T ( $P=0.36$ ). Comparison of ARI scores showed no significant difference between the seven groups ( $P=0.55$ ).

**Conclusions:** Significantly higher bond strengths were obtained for Damon® 3 brackets when using OrthoSolo™ primer and Blugloo™ adhesive compared with Transbond™ XT and also when pre-curing Transbond™ XT primer for APC™ II brackets.