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Dimensional stability of addition cured silicone impressions following autoclave sterilisation. BJ MILLAR* (Conservation Department, GKT Dental Institute, King's College, London)

The aim of this study was to evaluate autoclaving as a means of sterilising addition cured silicone impressions. 120 impressions were recorded of brass dies (height 7.9mm; base diameter 9.5mm; taper 6°) using combinations of President Putty (P), President Heavy (H), President Plus Light (L+), President Light (P-) and President Monobody (MM)[1]. 12 impressions from each group (P/L+, P/L-, H/L+, H/L-, or MM) were allocated equally to a control group or were autoclaved at 134°C. Dies were poured and master brass caps tried on each die. 4 readings were taken from each die of the vertical gap between the lower edge of the cap and the shoulder of the die using a digital micrometer. Readings were compared to values recorded from the same brass caps placed on the master brass dies and the change in die diameter calculated. The dies obtained from autoclaved impressions were smaller in diameter than the master dies (P/L+ 0.31%, P/L- 0.24%, H/L+ 0.17%, H/L- 0.07%, MM 0.07%.) and they were also smaller than the dies from the control impressions. The dies from the control impressions were larger than the master dies. The difference between the autoclaved and control groups were: P/L+ 0.34%, P/L- 0.23%, H/L+ 0.30%, H/L- 0.13%, MM 0.16%. The results indicate that the autoclaved dies are smaller than the control dies due to impression expansion, which is greater for the hydrophilic material (L+) than the hydrophobic silicone (L-); the use of die spacer may be used to compensate for this. The results suggest that autoclaving is a potential method for sterilising President impressions.

1 President, Coltene-Whaledent, CH-9450

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An *in-vitro* assessment of a condensation silicone as an alternative to alginate impressions. A KUMAR* & BJ MILLAR (Conservation Department, GKT Dental Institute, King's College, London)

This study aims to assess the dimensional stability of *Orthogum*[1] (fast setting condensation cured silicone) as an alternative to *Hydrogum*[1]. (alginate). 60 impressions were recorded of brass dies (height 7.9mm; base diameter 9.5mm; taper 6°) using these two materials. Impressions were allocated to: a control group poured within 30min, a group which were poured after 24h, or they were disinfected by immersion and then poured after 24h. 10 impressions were allocated to each group. 8 readings were taken from each die of the vertical gap between the lower edge of a master brass cap and the base of the die determined by a digital micrometer. Readings (in mm) were compared to values recorded from the same brass caps on the master brass dies and the difference used in calculations (+0.1mm is equivalent to 0.1% linear shrinkage of impression). The mean (±sd) difference between the dies poured from *Hydrogum* impressions and master dies were: control – 0.14±0.20, overnight 0.04±0.13, disinfected 0.14±0.14 (ANOVA P=0.002). The alginates shrank such that a 24h delay and disinfection results in statistically significant difference from the control group. For *Orthogum* the values were: control 0.14±0.27, overnight 0.40±0.31, disinfected 0.25±0.29 (ANOVA P=0.164, not significant). Higher values for *Orthogum* are due to the greater viscosity resulting in a higher incidence of surface irregularities and a less close fit of the cap to the die. These results suggest that the effect of delayed pouring and disinfection on *Orthogum* is less detrimental on dimensional stability than for *Hydrogum*. Orthogum can be considered a suitable alternative to alginate to better resist the effect of disinfection and if delayed pouring is anticipated.

1. Zhermack SpA, Italy; Ivoclar-Vivadent, Leicester, UK

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The role of cuspal flexure and occlusal amalgam restorations in the development of abfraction lesions: A finite element study. J S REES (Dept. of Oral & Dental Science, University of Bristol, UK)

A tooth flexure mechanism has been proposed to explain non-carious cervical tooth loss. The aim of this study was to investigate the effect that an occlusal amalgam restoration would have on the stress profile in the cervical region of a lower second premolar using 2-dimensional finite element stress analysis. A finite element model of the tooth, periodontal ligament and alveolar bone was developed. The width and of the occlusal amalgam restoration was varied from 2.1-3.7 mm and the depth was varied from 1.7-3.7 mm. The model was loaded with a 100N eccentric occlusal load applied 0.4 mm inside the buccal cusp tip. The peak tensile and shear stresses were sampled along two horizontal planes; the first was at the level of the amelo-cemental junction and the second was 0.3 mm coronal to this. Peak tensile stresses of up to 65 MPa and peak shear stresses of up to 104 MPa were found, which exceed the known failure stresses for enamel. Increases in the depth of the occlusal cavity were found to increase cervical stresses more than increases in cavity width. It was concluded that the weakening effect of cavity preparation may contribute to the development of non-carious cervical tooth loss.

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Polishing of resin based restorative materials
S MAKHANI* and JF McCABE (Dental School, University of Newcastle, UK)

The surface roughness (Ra) after polishing using two types of polishing instrument (Soflex, 3M Co and Rainbow, Shofu) were compared using 6 resin matrix restorative materials: Dyract AP (D, Dentsply), Experimental Product (Exp, Shofu), Prodigy (P, Kerr), Silux Plus (S, 3M Co), Solitaire (Sol, Kulzer) and Z100 (Z, 3M Co). 6 samples (3 for each of the 2 kits) of each material were prepared in cavities (10 mm dia x 1.3 mm deep) cut in Perspex. Materials were light cured according to manufacturers recommendations. When set, each specimen was roughened (180 grit) and then polished using increasingly fine discs from each kit in a contra-lateral handpiece following manufacturers guidelines. Each disc was discarded after 30s use. Ra was measured using profilometry involving 2 scans of each specimen resulting in 60 values of Ra for each material. Values of Ra (μm x 10^{-3} (sd)) for each material / polishing kit combination were:

	D	Exp	P	S	Sol	Z
Soflex	48 (20)	55 (23)	44 (22)	36 (14)	36 (15)	41 (18)
Rainbow	22 (9)	36 (12)	23 (13)	23 (14)	18 (10)	37 (14)

With the exception of Z, the Ra for each material is significantly lower with Rainbow than with Soflex ($p<.05$, t-test). The reason is thought to be the absence of a protruding mandrel in the Rainbow polishing discs.

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Fracture resistance of light activated resin composites.
A ELLAKWA*, A C SHORTALL, and P M MARQUIS (School of Dentistry, The University of Birmingham, UK)

Fibre reinforcement of dental resins has been reported since the 1960's but it is only within the last few years that they have been marketed for use with short span fixed partial dentures. Continuous fibre-reinforced composites have a number of applications in restorative dentistry including splinting, restoration of endodontically treated teeth and bridgework. Many factors affect the efficiency of reinforcement. One of these variables is the position of the fibre reinforcement relative to the point of loading. The purpose of this study was to evaluate the effect of polyethylene fibre[1] position on the flexural strength of a hybrid composite restorative[2]. Four test groups (n=10 per group) of composite were prepared for flexural strength testing at 0.05mm/min. Groups A to C had fibre reinforcement. Group D was a composite control. Groups A and B had fibre reinforcement midway between upper and lower specimen surfaces and group C had fibre reinforcement on the lower surface (tension side). Samples were stored for 2 weeks at 37°C before testing at room temperature. Group A was stored dry and the other 3 groups in distilled water. Mean flexural strengths ranged from 78.78 MPa (S.D. 25.05) to 305.45 MPa (S.D. 57.94). Data was analysed by ANOVA and paired Tukey test comparisons ($P<0.05$). Incorporation of polyethylene fibres significantly improved mean flexural strength of composite samples and placement of fibre on the tension side of the specimen was more efficient.

Connect / Kolor Plus[1] ; Herculite XRV[2] (Kerr Co. UK)

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Colour Stability of Resin-CompositeRestoratives. A. EL-HEJAZI* and D.C. WATTS (The University of Manchester Dental School, UK)

The aim was to investigate the effect of Xenon light (ageing) on colour stability of light-cured [VLC] resin-composites. Four materials were selected (Tetric, Lite-Fil II, Palfique & Z100). 6 sample discs /material, (φ 5 x 1.5 mm), were prepared in a metal mould, light cured according to manufacturers' instructions and divided into two groups (A & B): of 3 samples. Group A (control) specimens were kept in darkness and exposed to water at 37 °C Group B (test) discs were exposed to a xenon light source (150 kLux; Suntest 150 pcs Hanau Quartzlamper GmbH, Germany) and 37 °C water. All samples were measured at 0, 2, 4, 24, 48 and 96 h. Three readings were taken /disc /condition /time. Measurements were made centrally with a small-area colorimeter (CR221, Chroma Meter, Minolta (U.K.) Ltd). Colour parameters were recorded in L* a* b* space (CIE 1978). Results: the colour stabilities of the four materials were different ($p < 0.01$) from the initial measurements with positive ΔE_{ab}*, which expresses discolouration of the materials, in water and darkness. For Group B, ΔE_{ab}*was greater than for Group A (control) ($p < 0.01$). ΔE* values for all the materials tested exceeded 3.02. These high values indicate that the samples were discoloured and therefore potentially clinically unacceptable.
Almost all the materials had a small colour change as detected by the colorimeter, although they could not be readily detected by the naked eye. All materials discoloured towards more yellowness except LFP, which discoloured more to blueness.

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Confocal Imaging of Microtensile Testing. S. K. SIDHU[1], P. PILECKI [2]*, B M GRIFFITHS[2] and T. F. WATSON[2]. ([1] University of Newcastle Dental School, Newcastle, UK, & [2] Guy's, King's and St Thomas' Dental Institute, London, UK).

Microtensile testing of specimens is said to introduce a more uniform distribution of stress to the specimen (Sano *et al*, 1994). Microtensile studies normally require post-testing microscopic examination of fractured surfaces to elucidate failure mechanisms. The aim of this work was to develop a technique of imaging microtensile specimens before, during and after loading/failure, using confocal microscopy. Wedge-shaped cervical cavities in extracted human molar teeth were cut and restored with a variety of composite resins and resin-modified glass-ionomer materials. The teeth were longitudinally sectioned through the restorations to produce two 1.5 mm thick sections. The sections were carefully trimmed to localise potential failure within a specific region of the sample. The stage of a confocal microscope (TSM, Noran Instruments, USA) was modified to accept a miniature microtensile straining device for dynamic imaging of the fracture event. The specimens were attached to the brass plates of the microtensile loading device with cyanoacrylate adhesive. The whole assembly was placed on the stage of the TSM and imaged using a x20/0.8 NA/oil objective. Images were recorded via a CCD camera and stored on computer hard disk. For each specimen, images were captured before loading it, during loading (at a cross-head speed of 0.2 mm/min) and after failure occurred. It was possible to image component failure of the materials under examination. Most importantly, it was possible to relocate precisely the fractured parts of each specimen to their pre-fracture relationship and to examine this microscopically without any further sample disruption due to the microscopic technique.
In conclusion, confocal imaging of microtensile testing gives important information regarding the failure mode of adhesive materials.

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Interfacial fracture toughness of three commercially available luting cements.
CA MITCHELL*[1], AK RYAN[2] and JF ORR[2]. ([1]Dept Restorative Dentistry, [2]Dept Mechanical and Manufacturing Engineering,The Queen's University of Belfast.

In recent years there has been a shift in traditional methods of investigating dental materials to a fracture mechanics approach. Fracture toughness is an intrinsic material property and is a measure of a materials resistance to crack propagation. The objectives of this study were to measure the integrity of the interface between three types of commercially available luting cements and bovine dentine and also to assess the plane of failure using experimental work, computational mathematics and fractography. The cements tested were A, a conventional glass-ionomer cement, B, a resin-modified glass-ionomer cement and C a compomer. Ten mini short bar chevron notch specimens were manufactured for each group containing a 40 μm thick chevron of cement, within two 1.5 mm blocks of bovine dentine, supported by composite resin. After one weeks storage at 37°C and 100% r.h., the specimens were tested to failure at 0.24 mm/min. The interfacial fracture toughness K_{IC} results MPa.$m^{1/2}$ (S.D.) were cement A, 0.15 (0.02), B, 0.33 (0.04) and C, 0.31 (0.05). SEM examination of the fractured specimens depicted clearly the advancing crack along the cement-dentine interface. However an energy dispersive analysis suggested that the failure was cohesive.
It was concluded that cements B and C had significantly higher interfacial fracture toughnesses than cement A and that elements of all cements remained adherent to both sides fo the fracture plane.

A = Fuji I, GC International Corporation.
B = Fuji Plus, GC International Corporation.
C = Dyract Cem, De Trey Dentsply.