**15** **Oxalate-type dentin desensitizers affect bonding to dentin before but not after acid-etching.** [1]YF MAK*, [1]FR TAY, [2]DH PASHLEY, [3]RM CARVALHO, [1]SCN LAI ([1]Univ of Hong Kong, China; [2]Medical College of Georgia, USA; [3]Univ of Sao Paulo, Brazil)

Bonding to vital, deep, acid-etched dentin may be hampered by the increase in hydraulic conductance after the removal of smear plugs. As the adhesive solvent evaporates, transudation of dentinal fluid underneath the immiscible resin layer before the latter polymerizes can result in the entrapment of water blisters (The overwet phenomenon - Tay *et al., Am J Dent* 1996). Oxalate-type dentin desensitizers (DD) form an insoluble calcium oxalate precipitate on calcified dentin, obturate exposed dentinal tubules and reduce sensitivity caused by rapid water movement. However, this insoluble layer reduces the efficacy of subsequent bonding procedures. This study examined the microtensile bond strength and ultrastructure of the application of two DD, Oxagel (OX; At Dent - non-resin-containing) and MS Coat (MS; Sun Medical - resin-containing) to dentin. An acetone-based adhesive (One-Step; Bisco) was used on acid-etched sound dentin without oxalate desensitizers (C; control), and on dentin surfaces treated with OX or MS for 2 min before (B), and after (A) acid-etching. For TEM examination, OX or MS was applied to fractured dentin, and abraded dentin before or after acid-etching, followed by adhesive application. Kruskal-Wallis ANOVA and Dunn's test analyses of bond strength results (MPa) were: C ($50.5\pm8.4$)$^{A}$; OX-B ($13.3\pm7.4$)$^{C}$; OX-A ($48.7\pm6.4$)$^{A}$; MS-B ($8.7\pm3.0$)$^{C}$; MS-A ($37.3\pm7.0$)$^{B}$ [$P<0.001$]. TEM revealed the presence of an insoluble precipitate layer on the dentin surface and around tubular orifices when OX and MS were used before acid-etching. In OX, this layer was present beneath the demineralized collagen matrix and 7-10 μm away from dentinal tubular orifices when applied after acid-etching. In MS, dispersion of precipitates within the hybrid layer after acid-etching accounted for the lower bond strength, and was probably caused by the incorporation of resinous components in this DD. It is concluded that application of non-resinous oxalate-type desensitizers to acid-etched dentin provides a viable means to reduce hydraulic conductance without compromising bonding results.

**16** **Single-step adhesives are semi-permeable membranes. IV. Osmotic blistering evidence.** *KM CHAN[1], DH PASHLEY[2], BI SUH[3], SCN LAI[1], YF MAK[1], FR TAY[1], ([1]Univ of Hong Kong, China; [2]Medical College of Georgia, USA; [3]Bisco, Inc., USA)

Single-step adhesives behave as permeable membranes after polymerization, due to the higher concentration of hydrophilic and ionic resin monomers in these adhesives, their low film thickness and the lack of a more hydrophobic coupling resin layer. We have previously presented nanoleakage and fluid conductance evidence (*J Dent Res* 2002; 81:A-468), morphologic and bond strength evidence (J Dent Res 2002; 81:A-469), and fluoride-releasing evidence (*J Dent Res* 2002; 81:A-469) of this phenomenon. This study provided additional osmotic evidence that these adhesives are semi-permeable membranes. Extracted human premolars and molars were ground flat to create bonding surfaces that consisted of enamel and dentin. They were bonded with Prompt L-Pop (3M ESPE), One-Up Bond F (Tokuyama), Xeno CF2 Bond (Dentsply-Sankin) or FuturaBond (Voco). The bonded teeth were immersed in distilled water or 4.8 M $CaCl_2$ (control). Additional bonded teeth were coupled with bonding resin (D/E bonding resin, Bisco) prior to immersion in these solutions (control). Water blisters were observed in bonded enamel but not in bonded dentin when uncoupled adhesives were immersed in distilled water and they gradually increased in size with time. Blisters were absent in the $CaCl_2$ controls. Osmotic blistering is well recognized in the paint industry. In the presence of dissolved salts within a resin-coated substrate, water permeation through the resin-coating creates an osmotic cell that consists of the coating as a semi-permeable membrane, separating a solution of high concentration (the microdroplets inside the coating) from a solution of low concentration (the water outside the coating). It is further hypothesized that osmotic blistering of the bonded enamel is caused by the presence of a layer of concentrated, dissolved calcium and phosphorus ions within the acidic adhesive that is created by continuous etching of the highly mineralized enamel after polymerization of the adhesives.

**17** **Three year results of a comparative study on ART and resin fissure sealants.** X.P. FENG[2]*, E.C.M LO[1], H.Z. CAO[2] ([1]Faculty of Dentistry, University of Hong Kong, [2]Dept. of Preventive Dentistry, Shanghai 2nd University of Medical Sciences)

Objective: The aim of this study was to evaluate longitudinally the cost-effectiveness of ART and resin fissure sealants placed in permanent molars under field conditions in Chinese school children. Method: All grade two students, mostly aged 7-8 years, in two primary schools in Shanghai, China with at least one contra-lateral pair of sound permanent first molars were invited to participate in this study. In one of the molars, predetermined randomly, a resin fissure sealant (Concise, 3MESPE) was placed after etching with phosphoric acid. A portable dental unit with suction was used. The engine-driven handpiece were used to carry out prophylaxis of the teeth prior to etching and placement of sealant. In the molar in the contra-lateral side, a glass ionomer sealant (Ketac-Molar, 3MESPE or ChemFlex, Dentsply determined randomly) was placed according to the ART technique using hand instruments only. In both cases, only cotton rolls were used for moisture control. All treatments were done in a room in the schools. The sealants were examined annually for 3 years by two calibrated examiners. Sharp explorers and an intra-oral fibre-optic light were used in the examinations and the retention of sealants and presence of new caries were recorded. Results: A total of 361 pairs of sealants were placed in 195 children at baseline. The rate of failure of resin sealants was 69 % after 3 years and those of the Ketac-Molar and ChemFlex sealants were 65% and 89 % respectively ($p<0.01$). Results of survival analysis showed that the 3-year cumulative retention rate of the resin sealants was 31% while those of the Ketac-Molar and ChemFlex sealants were 34% and 11% respectively ($p<0.001$). Despite the differences in retention rates, the caries prevention rates of the 3 types of sealants were similar, 94% to 98%. Conclusion: Although the ART and resin sealants differed in retention rates, their effectiveness in caries prevention was similar.

**18** **Nanohardness of a bonding agent using four curing light units.** M YAMAUTI*, T NIKAIDO, N HARADA, P SENAWONGSE, M OTSUKI, J TAGAMI (Cariology & Operative Dentistry, Tokyo Medical & Dental University)

Different light sources have been used to cure composite materials. The purpose of this study was to evaluate the nanohardness of a bonding agent cured with four light curing units at different distances. The bonding agent used in this study was Clearfil SE Bond (Kuraray Medical, Japan). Four curing units were used: Halogen lamp (Candelux, Morita, Japan)/10 sec, LED (Lux-O-Max, Akeda Dental, Denmark)/10 sec, Xenon (Arc-light, Air Techniques, USA)/3 sec and Metal Halide (Rayblaze, Moritex, Japan)/3 sec. Discs of SE Bond (4.0x0.36 mm) were made using vinyl molds. The discs were photocured at the top surface at three different distances from the light-curing tip (contact, 2 and 4 mm). After 24 hours of storage in tap water at 370C, the specimens were cut into halves, embedded in epoxy resin and polished up to 1μm diamond paste. The nanohardness of this bonding agent was measured using a nanoindentation tester (ENT-1100, Elionix, Japan) under a load of 5 gf. The data was statistically analyzed using Two-Way ANOVA and Tukey post hoc test at 95% of level of confidence. N=6, Mean (Kgf/mm2) + SD. Same letters indicate no significant differences.

| | Candelux | Lux-O-Max | Arc-Light | Rayblaze |
|---|---|---|---|---|
| Contact | 23.49 ± 0.31 a | 19.93 ± 2.09 b | 20.55 ± 0.71 b,c | 23.59 ± 0.32 a |
| 2 mm | 21.78 ± 0.95 a | 18.42 ± 1.32 b | 18.71 ± 1.51 b,c | 20.99 ± 0.35 a |
| 4 mm | 20.89 ± 0.23 d | 17.48 ± 0.68 e | 18.97 ± 0.58 e | 22.35 ± 0.05 a |

The nanohardness of SE Bond was affected by light source and distance; however there was no interaction between them. In general, the hardness was higher when the curing unit tips were maintained as close as possible to the irradiated surface. Increasing the distance between the curing unit tip and the irradiated surface decreased the hardness of SE Bond. Candelux and Rayblaze showed the highest values of nanohardness.

**19** **Outcome of endodontic therapy with thermafil and lateral condensation technique.** C.H. CHU*, E.C.M. LO and G.S.P. CHEUNG (Faculty of Dentistry, The University of Hong Kong, Hong Kong)

Objective: This study aimed to evaluate the outcome of root canal therapy (RCT) using either Thermafil (TF) or Lateral Condensation (LC) as obturation technique.

Materials and method: All patients required first time, non-surgical RCT and attending the University dental Service from September 1996 to August 1997 were invited to participate in the study if the tooth was periodontally sound. Seventy-nine patients with 85 teeth were root canal treated and finally obturated with TF or LC. Patients were recalled some 36 months after treatment and the teeth examined both clinically and radiographically. The effects of obturation technique (LC or TF), as well as patient age, tooth type, preoperative periapical condition and type of post-endodontic restoration on the endodontic treatment outcome were studied by regression analysis.

Results: Sixty-four patients attended the recall; the response rate was 81%. A total of 71 teeth were examined, of which 34 teeth were obturated with LC and 37 with TF. Failure was observed in 7 teeth (21%) of the LC group; 3 of them were extracted due to tooth fracture. Seven teeth (19%) in the TF group failed; 3 of them were extracted because of fracture. Excluding these fractured cases, the failure rate was 12% and 11% for LC and TF, respectively. There was no significant difference in the amount of failures, with or without tooth fracture included, between the two groups. Teeth restored with extracoronal restorations had a higher success rate than those with simple intracoronal restorations ($P=0.046$).

Conclusion: Using TF and LC in the obturation phase of root canal therapy did not result in significant difference in the treatment outcome.

**20** **Compatibility of self-etch adhesives with chemical/dual-cured composites - two-step *vs.* single-step systems.** [1]C CHEONG*, [1]FR TAY, INM KING, [2]DH PASHLEY, [3]M FERRARI, [4]M TOLEDANO ([1]Univ of Hong Kong, China; [2]Medical College of Georgia, USA; [3]Univ of Siena, Italy, [4]Univ of Granada, Spain)

Self-etch adhesives are classified into two-step, self-etching primers that require the use of a bonding resin to couple composites to the primed dentin, and single-step systems that etch, prime and bond simultaneously. Tay *et al.* (*Am J Dent*, in press) reported that the microtensile bond strengths (μTBSs) produced by single-step, self-etch adhesive-bonded dentin to chemical-cured (cc) composites were inferior to light-cured (lc) composites. This study tested the null hypothesis that two-step, self-etch adhesives exhibit no difference in μTBS when a chemical/dual-cured (c/d-c) composite is activated using lc or cc mode. Flat hydrated dentin from human third molars were bonded using two two-step systems (Clearfil SE Bond [SE], Kuraray; and Tyrian/One-Step Plus [TO], Bisco) and a single-step system (Xeno CF2 Bond [X2], Dentsply-Sankin). For TBS evaluation, a c/d-c composite (Bis-Core, Bisco) was coupled to bonded hydrated dentin using lc or cc mode, with the former hand-mixed in the same manner as the latter. For TEM, a lc microfilled composite (Metafil CX, Sun Medical) and an experimental cc composite of the same composition (Sun Medical) were used. Specimens were immersed in an ammoniacal silver nitrate tracer before TEM processing and examination of unstained, undemineralized sections . One-way ANOVA and Tukey's test of the μTBS results (MPa; $P<0.001$) were: SE-lc ($54.9\pm8.0$)$^{A}$; SE-cc ($55.0\pm5.7$)$^{A}$; TO-lc ($53.0\pm7.7$)$^{A}$; TO-cc ($49.8\pm7.4$)$^{A}$; X2-lc ($48.8\pm9.3$)$^{A}$ and X2-cc ($7.1\pm7.0$)$^{B}$. Premature failures were only observed in X2-cc during beam preparation for μTBS testing. TEM revealed the presence of silver deposits along the adhesive-composite interface that were responsible for the low bond strength in X2-cc. Unlike single-step systems, two-step, self-etch adhesives are compatible with c/d-c composites, due to the presence of a thicker coupling bonding resin layer that is probably less permeable and comparatively more hydrophobic than interfaces bonded with a single-step system.