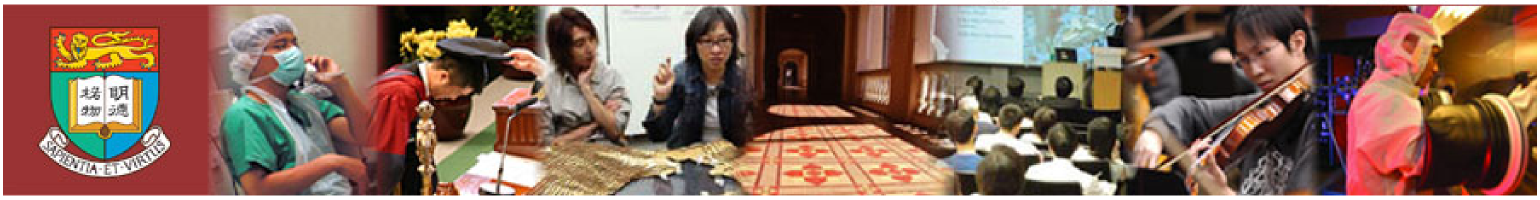

2465 Pulse-delay light cure on marginal adaptation of compomer. Y. LUO*, F.R. TAY, E.C.M. LO, S.H.Y. WEI. (Faculty of Dentistry, The University of Hong Kong)

This *in vitro* study aimed to investigate the effects of 'pulse-delay cure' technique on the marginal adaptation of a compomer under different conditioning methods. Cylindrical cavities prepared in extracted teeth were restored with Dyract AP (Dentsply, DeTrey) using three conditioning and bonding systems: Conditioner36/Prime&Bond NT (group I, n = 10), NRC/Prime&Bond NT (group II, n = 10) and Prime&Bond NT only (group III, n = 10). The samples were light-cured initially for 4 sec at 100 mW/cm^2. They were allowed to relax for 3 min. This was followed by a post light-curing at 400 mW/cm^2 for 39 sec ('pulse-delay cure'). Equal number of samples exposed for 40 sec at 400 mW/cm^2 were used as control. The total energy of exposure was the same for both polymerization techniques. The restoration-dentin interfaces in resin replicas obtained from longitudinal sections of the specimens were examined with scanning electron microscopy. The amount of contraction gaps as a percentage of the resin-dentin interface was measured by computer-assisted image analysis. A two-way ANOVA showed that both conditioning method and light-curing technique significantly affected the marginal adaptation of Dyract AP compomer ($p < 0.01$). With the conventional curing technique, pre-treating the cavity with Conditioner36 significantly improved the sealing ability of Prime&Bond NT compared to no-etch technique (the percentage of gap reduced from 30% to 2%). With the 'pulse-delay curing technique', no marginal opening was found in the resin-dentin interface in groups I and II, and more than 90% of the total margin length was excellent. It was found that 'pulse-delay cure' technique significantly improved the marginal integrity of Dyract AP compomer. Using this technique, both NRC/Prime&Bond NT and Conditioner36/Prime&Bond NT significantly improved bonding of compomer restorations to sound dentine. Supported in part by Dentsply DeTrey.

2466 Class II Composite Restorations: microleakage using three different curing systems K. NAIDU*, G. KUGEL, C. HABIB (Tufts Univ. Sch. Of Dental Medicine, Boston, Mass).

The purpose of this study was to compare the sealing ability of Class II composite restorations, both occlusal and gingival to the CEJ, cured with three different curing systems. Sixty extracted molars were mounted in acrylic blocks. Specimens were randomly divided into six groups of 10 each (A→ F). Class II cavities (4 x 2 x 2 mm) were prepared using carbide burs No. 56 and 245, with the gingival floor 0.5 mm occlusal to the CEJ (groups A, C, E) and 1.0 mm gingival to the CEJ (groups B, D, F). All teeth were restored using the Pyramid stratified aggregate system (BISCO). Gps A and B were cured with the Pyramid Variable Intensity Polymerizer curing unit according to the manufacturer's specifications and Gps C and D with the Dentsply Spectrum 800 curing unit according to the manufacturer's specifications. Gps E and F were cured with the HGM 200 argon laser according to the Texas Institute for Advanced Dental Studies specifications. All specimens were polished using a 3M Sof-Lex kit. Specimens were thermocycled for 500 cycles between 5 and 55 °C. The roots and apices of all specimens were coated twice with nail polish and sealed with acrylic. Specimens were stained in a 1% methylene blue solution for 24 hours at 37 °C. All teeth were sectioned mesio-distally through the restoration using an Isomet (Buehler) slow speed saw. Specimens were scored for microleakage, based on the extent of dye penetration with reference to the axial wall, under a stereomicroscope. (0 = no penetration, 1 = penetration to the enamel/cementum, 2 = penetration at the axial wall, 3 = penetration beyond the axial wall). Statistical analysis of the data indicated that no difference in microleakage scores for the three different systems tested, however, a statistical difference was noted between groups C (Dentsply 800) and E (HGM Dental 500) at 0.5 mm above the CEJ (Mann-Whitney U Test, $p < 0.05$). These results indicated that there was no difference among the curing systems 1.0 mm below the CEJ, however, there was significantly more microleakage in group E (HGM 200 argon laser) at 0.5 mm was noted above the CEJ. Supported in part by the NIDCR T35 DEO7268 and BISCO.

2467 Effect of Delayed Light Activation on Cervical Gaps in Sandwich Restorations. P.C. PORTERA*, R.D. DAVIS, J.D. OVERTON, K.S. VANDEWALLE (Keesler Medical Center, Keesler AFB, MS USA)

This *in-vitro* investigation compared the cervical marginal opening of Class II composite resin open sandwich restorations using immediately light polymerized resin-modified glass ionomer cement (RMGI) versus those in which the polymerization of the RMGIC was delayed. Forty extracted human molar teeth were divided into four groups (n=10). The occlusal surfaces were reduced to produce a standard 4mm height from the CEJ. All teeth received class II cavity preparations 5 mm in height, 3mm in width, and 2 mm in depth. Each prepared tooth was mounted in a silicone mold adjacent to a molar tooth which was mounted in stone. The four groups were restored with hybrid composite resin (Z100) as follows: Group 1) control, composite resin and dentin adhesive (Prime&Bond2.1) only; Group2) open sandwich, with immediate light activation of the 1mm RMGIC base (Fuji II LC); Group3) open sandwich, light activation of the 1 mm RMGIC was delayed 2 minutes after mixing; Group 4) open sandwich, no light activation of the 1 mm RMGIC. After finishing, specimens were thermocycled (1000cycles at 5-55°C) and stored in distilled water for 1 week, polyvinylsiloxane impressions were made and replicas of each restoration were cast in epoxy resin and examined using a SEM at 2000x magnification. For each specimen 25 measurements of the cervical gap were accomplished and a mean marginal opening and percentage of gap free margins were determined.

Results: Mean cervical marginal gap and percent of gap free margins (+/-SD)

	Group 1	Group 2	Group 3	Group 4
Mean Gap	0.97μm (0.23)	0.93μm (0.11)	0.48μm (0.13)	0.63μm (0.14)
% Gap Free	53.6 (5.7)	54.8 (4.7)	68.4 (8.1)	63.6 (5.8)

In the one way ANOVA both the mean and the gap free percentage were significantly different with p<0.001. In the Student-Newman-Keuls test, Groups I and II and also Group III and IV were not different from each other, but the combinations were different. Conclusion: Delaying the light activation of RMGI results in reduced cervical marginal gaps in open sandwich restorations.

2468 **Effect of High-powered Curing Lights on Dentin Bonding of Composites.** A.KOIWA*, H.TERANO, M.OKUDA, R.KISHIKAWA, N.INAI, M.OTSUKI, J.TAGAMI (Tokyo Med. & Dent. Univ., Dept. of Operative Dent, Tokyo, Japan)

High-powered curing lights could reduce curing time for composite restoration. The purpose of this study was to evaluate the effect of two high-power curing lights on dentin bonding of resin composites. Lingual enamel of extracted bovine teeth were removed and flatten dentin surfaces were obtained with #600 silicone carbide paper for adhesive area. Each surface was treated with one of the six bonding systems; Clearfil Linerbond 2V (LB, Kuraray), Clearfil SE Bond (SE, Kuraray), Tokuso Mac Bond II (MC, Tokuyama), Imperva Fluorobond (FB, Shofu), Unifil Bond (UB, GC), Single Bond (SB, 3M), and restored with composite. Optilux 500 (Kerr) and two high-powered curing lights; ARC light (Air Technologies), Apollo95E (DMD) were used for curing. After immersed in tap water at 37℃ for 24 hrs, tensile bond test was performed at 2mm/sec of cross head speed. Results were analyzed statistically. Results showed the table.

	LB	SE	MC	FB	UB	SB
ARC light	11.8(3.4)	16.5(9.9)	14.3(7.4)	14.4(7.4)	9.9(3.3)	10.1(4.0)
Apollo95E	11.2(5.7)	9.4(4.1)	10.9(6.8)	8.0(6.5)	6.3(2.8)	8.7(3.3)
Optilux 500	19.5(6.6)	18.2(5.2)	11.6(5.0)	11.5(6.7)	10.4(3.3)	10.9 (4.1)

mean (SD) MPa vertical lines mean statistically differences

There were signifficant difference between LB,SE-Apollo95E and Optilux, SE,FB-Apollo95E and ARC light, LB-ARC light and Optilux. It was concluded that the curing time of high-powered curing light suggested by manufacturer might not be enough for some bonding systems.

2469 **The effect of composite resin polymerization on dentin-composite resin microtensile-bond-strength.** G. SENNA*, S. R. ARMSTRONG, M. R. BOUSCHLICHER, M. A. VARGAS, G. E. DENEHY (U. of Iowa, Iowa City, IA)

The purpose of this study was to measure the dentin bond strength in the gingival wall of a Class V cavity preparation as influenced by three different composite resin polymerization rates. The buccal enamel of six teeth was thinned and class V cavity preparations (5 mm x 2 m x 2 mm in depth) were made with a 55 carbide bur in the U. of Iowa Microspecimen Former. The cavities were restored with Single Bond dental adhesive and one increment of Z100 (3M) A2 composite resin. A custom-modified Spectrum 800 light curing unit (Caulk) was used to apply an equivalent energy density [12 J] for composite resin polymerization as follows: Slow: 120 sec @ 100 mW/cm^2. Medium: 30 sec @ 400 mW/cm^2, Fast: 12 sec @ 1000 mW/cm^2. Two sticks were sectioned from each restoration with a slow speed diamond saw and tensile test specimens were made in the U. of Iowa Microspecimen Former with a cylindrical cross-sectional area (0.33-0.45 mm^2). Although, well-established laboratory techniques were followed, a high number of failures occurred during specimen preparation steps (Slow: 4/4, Medium 1/4, Fast 2/4) not allowing a difference between groups to be tested by bond strength measurement, therefore, test and no-test categories were used in a 2-tailed Fisher's Exact Test at a 95% confidence level. No difference was demonstrated between the three polymerization rates (p = 0.21). The results of this study parallel those of Kinomoto and Tori (1998) who, utilizing the same cavity preparation as this study, were unable to use photoelastic stress analysis due to gap formation at the cavity wall. This preliminary project, as well as a pilot utilizing occlusal Class I preparations, failed to demonstrate a difference in dentin bond integrity after different rates of composite resin polymerization.

2470 Light guide distance from curing surface and bond strength. S. DANT*, J.O. Burgess, X. XU. (LSUHSC-School of Dentistry, New Orleans, LA)

There are times when the curing light guide does not contact the adhesive and composite surface being cured such as in the proximal box of a class two composite resin preparation. In this situation the adhesive covering the gingival floor of the cavity preparation is 2 to 8 mm from the light guide depending upon the depth of the box. This study measured the bond strength of composite resin to dentin when the light guide was 0, 2.3, 4.5 and 6.8mm away from the surface being cured. In addition it examined the bond strength produced when at 4.5 mm the exposure time was increased to 40 and 60 sec. The dentin of 60 recently extracted non-carious molar teeth was exposed to establish a bonding surface in superficial dentin. Teflon tape with a 2.66 mm hole to delineate the bonding area was placed over the dentin. One bonding agent (Single Bond) was placed onto the dentin following manufacturer's directions and cured with a 20 sec cure. Groups of 10 teeth were cured by placing a spacer between the dentin and light guide to produce a 2.3, 4.5 and 6.8 mm space between the surfaces. After placing and curing the adhesives with a Coltolux 4 curing unit, a thin layer of Z-100 composite resins (shade A-2) was placed over the adhesive and polymerized at the same distance as the adhesive. After the specimens were stored in water for 24 hours, the specimens were placed into an MTS machine and a shear load applied until failure. The loads were converted to MPa. The data were analyzed using ANOVA and Tukey B post-hoc tests with significance set at .05. (n=10) MPa

0mm@20s.	2.3mm@20s.	4.5mm@20s	6.8mm@20s.	4.5mm@40s.	4.5 mm@60s.
18.5(2)	9.7(2)	6(1)	3.4(1)	15.3 (2)	18.2(2)

Shear bond strength decreases significantly as distance increases (p<.05). Increased cure time compensates for curing distance. Increase cure time when curing deep proximal boxes.

2471 Microleakage of Class V Composites Using Different placement Techniques. A.J. ST-GEORGES*, A.D. WILDER, Jr., J. PERDIGÃO, and E.J. SWIFT, Jr. (Univ. of North Carolina at Chapel Hill, Chapel Hill, NC; Univ. of Minnesota, Minneapolis, MN).

Despite advances in dentin bonding, microleakage remains a problem. The purpose of this study was to evaluate microleakage at enamel and dentin margins of two composite resins, using bulk and incremental placement techniques and facial-to-lingual curing methods. One hundred standardized Class V cavity preparations were made on the facial surface of extracted human premolars and randomly assigned to 10 groups. Single Bond (3M Dental) was used as the dentin/enamel adhesive. A hybrid (Z-250, 3M Dental) and a microfilled (Silux Plus, 3M Dental) were inserted using four different methods (see table). The specimens were thermocycled, stained with 1% methylene blue, sectioned, and evaluated for leakage (0-4 scale) by two examiners. Leakage ranks were analyzed with the Median and Mann-Whitney Tests (p≤0.05, superscripts).

Insertion/Curing Technique	*Z-250*						*Silux Plus*					
Facial curing (-F)	*Enamel*			*Dentin*			*Enamel*			*Dentin*		
Lingual curing (-L)	M	>M	≤M	M	>M	≤M	M	>M	≤M	M	>M	≤M
Incremental (INC-F)	0^{a}	0	10	0.4^{b}	4	6	0^{a}	0	10	0.2^{ab}	2	8
Incremental-Rebonding (IR-F)	0^{a}	0	10	0.5^{b}	5	5	0^{a}	0	10	0.4^{ab}	3	7
Bulk (B-F)	0.1^{ab}	1	9	0.6^{b}	5	5	0^{a}	0	10	0.5^{b}	4	6
Bulk+Rebonding (BR-F)	0^{a}	0	10	0.3^{ab}	3	7	0^{a}	0	10	0.4^{ab}	3	7
Incremental (IL-L)	0.2^{ab}	2	8	0.8^{b}	7	3	0.2^{ab}	2	8	0.6^{b}	6	4

Medians with same superscript are not statistically different (p≤0.05) There was no significant difference in microleakage between the composite resins. Dentin margins leaked significantly more than enamel margins (p<0.0001). When leakage was pooled for "insertion technique", IL-L resulted in significantly greater leakage than INC-F (p<0.006), than BR-F (p<0.009), and than IR-F (p<0.036). Marginal leakage may depend upon the insertion technique but does not seem to be material dependent. *This study was supported by 3M Dental Products.*

2472 Effect of Multiple Bonding Resin Application on Bond Strength of Composite. M.F. AYAD and M.A. BAHABRI* (University of Tanta, Egypt and Elite Medical and Surgical Center, Riyadh, KSA).

The aim of this in vitro study was to evaluate the effects of multiple application of adhesive bonding resin (All-Bond 2 universal adhesive system) on shear bond strength (SBS) of composite resin. The occlusal surfaces of fifty extracted human molars were sectioned with a diamond saw, ground wet with 600-grit silicon carbide paper to expose the superficial dentin surface. Samples were etched with 10% phosphoric acid for 15, followed by water rinse. The primers A and B were applied in 5 consecutive coats as directed by the manufacturer. Bonding resin was cured for 20, to the primed dentin after 1 to 5 increments with 10 samples in each group. Composite resin (Charisma) cylinders were formed against the dentin surfaces with teflon mold. After thermocycling for 500 cycles between 5°C and 55°C with 1-minute dwell times, the composite resin was fractured off using an Instron testing machine in the shear mode with cross head speed of 0.5 mm/min. Results are in mean ± SD.

Increments	One	Two	Three	Four	Five
SBS (MPa)	17.3±4.1	16.1±3.9	14.7±5.9	13.4±4.1	13.1±4.4

Avova revealed no statistically significant differences between the groups bonded to dentin (p=0.204). This study suggest that adhesive layers have no effects on shear bond strength of composite resin.