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Stress Distribution In A Provisional Resin Crown Restoration Using Finite Element Analysis. D. Ehrenberg, S. Weiner (UMDNJ-NJDS Newark, NJ, USA)

Provisional crowns fabricated from methyl methacrylate materials may develop marginal gaps after extended service in the oral cavity. An evaluation of the stress distribution (SD) is necessary to determine whether the material's physical properties are being exceeded. To test the hypothesis that stress within the marginal area may exceed the elastic limit of resin, a 2-D finite element analysis (FEA) was done to calculate the deformation in the crown as a result of occlusal loads. The shape of a PC along with the prepared tooth's dimensions and the cement space was defined. Using established values for Young's modulus and Poisson's ratio, a 40 N vertical loading force was applied at six positions along the PC's occlusal surface, and a 2-D FEA was performed. This analysis revealed SD similar to results found with cast crowns. The observed S D ranged between 13 to -9.7 MPa within the buccal marginal area of the PC. The S D in the lingual marginal area ranged between 0.4 to -21 MPa. As the applied loading force was directed laterally toward either the lingual or buccal cusp area, corresponding to a lateral jaw movement, the magnitude of the stress concentration at the margin increased. Fabrication of a proper sized occlusal table for a provisional crown, along with reduced occlusal contact during mastication may prevent overloading of a material's physical properties leading the premature deterioration of its marginal adaptation.

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Etching time evaluation on the shear bond strength of the adhesive systems in primary teeth. A. S. CALDO-TEIXEIRA; R. M. PUPPIN-RONTANI; M .A .C .SINHORETI; L .C. CORRER-SOBRINHO. Áreas de Odontopediatria e Materiais Dentários. FOP/UNICAMP.

The objective of this study was to evaluate the effect of etching time of two adhesive systems (Scotchbond Multipurpose Plus - SB and Prime & Bond 2.1 - P&B) on the shear bond strength (SBS), in the primary dentin. 48 extracted deciduous teeth were used. They were divided in agreement with the etching time and adhesive system used into 6 groups as follows: 15 sec and SB (Group 1); 20 sec SB (Group 2); 7sec and SB (Group 3); 15 sec and P&B(Group 4); 20 sec and P&B (Group 5); 7 sec and PB (Group 6). The teeth were restored using a teflon mold with Z100 composite resin (3M Dental Products). The specimens were stored in distilled water for 72 hours in 37oC and submitted to SBS in a Instron machine using a crosshead of 0.5 mm/min. The data were submitted to a ANOVA test and Tukey test at 5%. Considering the etching time studied (7, 15 and 20 sec) the values found (MPa) was respectively: 3.36, 2.40, 1.7 for P&B and 2.80, 2.25, 2.08 for SB. It was observed that the SBS was higher for 7 sec time, independent of the material used (SB or P&B). However, no statistical difference was observed when SB was used. The P&B system showed the higher values of SBS at 7 and 15 sec ($p<0.05$). The failure sites analyzed showed that the more frequently was the failure adhesive (86,5%). It can be concluded that to the primary dentin etching the best results were obtained to the 7 and 15 sec. As much the higher etching time as lowest is the SBS in primary teeth, independent on the material used.

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Effect of Etching Time on Microtensile Dentin Bond Strengths. J. PERDIGÃO[1], S. GERALDELI[1], and G. GOMES[2]* ([1]Division of Operative Dentistry and MDRCBB, University of Minnesota, Minneapolis, MN; [2] Private Practice, Lisbon, Portugal).

Some authors have suggested that over-etching dentin may result in an area of vulnerable collagen fibers that may weaken the bonding. This study was designed to evaluate the effect of etching time on the μ-tensile bond strengths (μTBS) of three adhesives. The null hypothesis was that an increase in etching time would not decrease μTBS. The occlusal third of 24 extracted human molars was removed to form a flat dentin surface. Specimens were randomly divided into four etching times: (A) 15 sec (B) 15 +15 sec (C) 30 sec (D) 30 + 30 sec. After etching with the proprietary acid gel, crowns were built-up with Excite (ethanol-based)+Tetric Ceram (EXC), One Step (acetone-based)+Renew (ONS), Scotchbond Multi-Purpose (water-based)+Z250 (SBMP). After storage in water at 37°C for 24h, teeth were cut in 2 perpendicular directions to obtain sticks (n=24, N=288) with a cross section of 0.5±0.2 mm². Sticks were fractured in tensile mode at a crosshead speed of 1 mm/mm. Statistical analysis was performed with ANOVA and Duncan's test (superscript letters, $p<0.05$). Results in MPa (Mean±SD):

	15 sec	15 sec - rinse-15 sec	30 sec	30 sec- rinse -30 sec
EXC	17.4^{d}+13.1	16.2^{d}+11.8	23.5^{d}+17.8	15.4^{d}+12.3
ONS	34.9^{c}+14.4	39.5^{c}+15.6	55.8^{a}+15.7	36.5^{c}+
SBMP	49.1^{ab}+ 8.8	51.6^{ab}+19.4	49.3^{ab}+16.8	43.4^{bc}+13.0

For the conventional 15 sec etching time, SBMP resulted in statistically higher μTBS than the other two adhesives. EXC resulted in statistically lower bond strengths than the other two adhesives for all etching times. For ONS, an etching time of 30 sec resulted in statistically higher bond strengths than the other etching times. Variation in etching time did not affect μTBS of SBMP and EXC. For each adhesive, a 15 sec etch resulted in statistically similar μTBS tan a 30+30 sec etch. Microtensile bond strengths may not depend on the extent of etching for the adhesive systems tested in this project, regardless of the solvent included in the adhesive system.

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Effect of 1 or 2-Layer Application of an All-in-one Adhesive on Bond Strength and Ultrastructure. EL PASHLEY[1]*, KA AGEE[1], DH PASHLEY[1], FR TAY[2] ([1]Medical College of Georgia, USA; [2]The Univ of Hong Kong, Hong Kong, China).

All-in-one adhesives that etch, prime and bond simultaneously are gaining popularity. However, there are anecdotal reports that dentin specimens bonded with Prompt-L-Pop (ESPE) failured during preparation for microtensile bond strength (μTBS) testing. This study evaluated the μTBS and interfacial ultrastructure of this adhesive following 1 or 2-layer application. Mid-coronal dentin surfaces of 8 extracted human third molars were abraded with 180-grit SiC. In group I, a blister pack was activated and the mixed adhesive was liberally applied to each dentin surface for 15 s, and then light-cured for 10 s. In group II, after light-curing of the first layer, the remaining adhesive was applied as a second layer and then light-cured as before. Resin composite buildups were made, storaged in water for 24 h, and then vertically sectioned into an array of 0.9 x 0.9 mm composite-dentin beams for μTBS evaluation. Representative fractured beams were prepared for SEM and TEM examination of the intact resin-dentin interfaces. Results: μTBS for Group I (n=24): 14.2 ± 7.2 MPa (with 3 premature failures); Group II (n=23): 29.7 ± 5.7 MPa (no premature failures). Student's t-test indicated a significant difference between the two groups ($p<0.001$). TEM revealed that although 5 μm thick hybrid layers were observed in both groups, due to thinning of the adhesive layer in group I, the composite was in contact with the surface to the hybrid layer in some areas. It is concluded that the μTBS of this unfilled adhesive to dentin may be reasonably improved by repeated application of the adhesive to ensue that exposed dentin is adequately covered.

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Effect of Vacuum vs Air Thinning on Immediate SBS of Adhesives. N.JESSOP*, J.R. DUNN, C.A. MUNOZ, K. CARAMBOT. Loma Linda University, Loma Linda, CA.

There is a concern over the amount of dentin bonding agent left on the tooth after air thining the preparation. This study evaluated the effect of various methods of adhesive thinning on SBS using 1) high volume vacuum and 2) air thinning at various times and pressures. Adhesives used: One Step, Bisco (OS), Excite, Ivoclar (EX), Prime & Bond NT, Dentsply Caulk (NT), PQ1, Ultradent (PQ), Single Bond, 3M (SB), Solo Plus, Kerr (SP). 292 human molars were ground to expose dentin, etched w/ 37% H3P04 and adhesive applied. Treatment groups: air thinning @ 5mm distance for 1, 3, and 5, seconds and at 18 and 38psi; high volume vacuum for 1-2 sec. The adhesive was cured, composite placed and cured for 40 sec., and tested at 5 minutes for SBS. Results were analyzed with ANOVA & Newman Keuls used to identify any differences ($p>0.05$). Means with same letters and in the same row are statistically the same.(N = 7)

	1Sec/18psi	3Sec/18ps	5Sec/18psi	1Sec/38psi	Vac 1-2 Sec	Careful	Dynamic 24hr
OS	23.7(6.3)a	22.6(4.6)a	24.3(4.7)a	18.4(3.5)a	33.1(3.4)b	30.9(1.8)b	42.5(4.9)
EX	14.8(6.2)a	11.6(3.9)a	10.7(2.1)a	4.1 (1.5)c	22.5(7.3)b	20.7(4.9)b	46.7(8.5)
NT	23.5(5.2)a	21.4(5.3)a	25.0(4.4)a	18.8(7.6)a	26.4(5.1)a	26.3(2.4)a	33.0(9.8)
PQ	37.1(3.6)a	34.7(9.6)b	31.9(9.1)b	23.6(5.3)c	37.2(4.8)b	32.5(4.3)b	54.3(4.7)
SB	20.1(7.9)a	18.1(8.6)a	16.9(9.4)a	17.7(9.7)a	21.2(6.4)a	24.1(1.6)a	49.6(8.2)
SP	30.3(8.5)a	28.8(7.5)a	28.8(7.5)a	31.1(6.9)a	37.1(5.7)a	33.6(3.4)a	50.6(4.3)

Results of this study shows that high volume vacuum resin thinning is as effective as air thinning using different times and pressures and might yield positive clinical results.

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Dentin Bond Strength of Single Bond Adhesive With Different Applications. B.S. Ber, M. B. LaHaye*, J. O. Burgess. (LSUHSC-School of Dentistry, New Orleans, LA).

Single component bonding systems provide inconsistent results. This study measured dentin shear bond strength of Single Bond and Z100 when the dentin surface or method of adhesive application changed. 105 teeth were ground on a polisher grinder to expose dentin. Teflon tape defined the dentin bonding area which was etched with 37% H_3PO_4 for 20 sec., rinsed for 5 sec., and dried to a moist or dry (surface blotted and air dried for 20 sec,). Single Bond was applied & light cured (Optilux 501-670 mw/cm) for 10 sec. Z100 was applied over the Single Bond and light-cured for 40 sec. Specimens were thermocycled for 1000 cycles from 6 to 60°C, placed into an Instron and loaded in shear until failure. Data were analyzed with ANOVA and Tukey B tests. Significance =.05. Agitation produced significantly greater shear bond strength than all other groups ($p<.05$). No other intergroup differences were found. (N=15). Applying one coat of Single Bond with agitation produces significantly greater dentin shear bond strengths than all other methods tested.

Dentin	Application method	SBS (MPa)	Dentin	Application method	SBS (MPa)
Dry	one coat, one cure	11±5	Wet	three coats, 3 cures	13±3
Wet	one coat, 1 cure	12±7	Wet	one coat, stirred, 1 cure	14±3
Wet	two coats, 2 cures	12±4	Wet	one coat, agitation, 1 cure	20±3

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Effect of Primer Penetration Time on Microtensile Bond Strength to Dentin. R. FRANKENBERGER*, H. MATTONET, U. LOHBAUER, N. KRÄMER, and A. PETSCHELT (Policlinic of Operative Dentistry, University of Erlangen, Germany)

The aim of the present study was to investigate the effect of different primer penetration times on dentin bond strengths of adhesive systems representing different generations. Fourty eight freshly extracted, caries-free human third molars were flattened and restored using the adhesive-composite combinations **SY** (Syntac Classic / Tetric Ceram), **ST** (Syntac Classic Total Etch / Tetric Ceram), **EB** (EBS Multi / Pertac II), **PB** (Prime & Bond NT / Tetric Ceram®), **PR** (Prompt L-Pop without light-curing / Pertac II), and **PX** (Prompt L-Pop exp. LP3 with light-curing / Pertac II) with primer penetration times of **A:** 50% of the recommended time as per manufaturers' instructions, **B:** according to the manufacturers' instructions, **C:** 60 s, and **D:** 120 s. The specimens were stored in distilled water for 24 hours at 37°C and then sectioned to receive resin-dentin beams with a cross-sectional area of 0.5 mm². 20 specimens for each group revealing a distance to the pulp of 2.0 ± 0.5 mm were loaded in tensile at a crosshead speed of 1 mm/min until fracture. The mean bond strengths [MPa](S.D.) were:

	SY	ST	EB	PB	PR	PX
A	13.2 (4.2)	6.7 (2.2)	11.0 (2.3)	12.6 (4.2)	7.8 (4.6)	6.3 (4.5)
B	16.8 (2.0)	16.6 (3.1)	20.1 (3.0)	16.3 (2.7)	9.4 (3.3)	14.7 (4.9)
C	22.4 (5.9)	20.3 (2.2)	9.5 (4.2)	13.5 (4.0)	15.6 (2.9)	16.7 (4.9)
D	7.4 (2.7)	18.7 (3.1)	14.5 (5.0)	11.3 (1.7)	12.9 (2.1)	11.9 (6.6)

SY and PR showed the highest values after 60 s penetration time ($p<0.05$, Mann-Whitney U test). The total etch systems EB, PB and the exp. self-etching PX, however, resulted in highest bond strengths when used as per manufacturers' recommendations ($p<0.05$).

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Omitting the Curing Step - a New Adhesion Concept for Composites. T. LUCHTERHANDT*, O. FREY, M. HANSEN, (ESPE Dental AG, Seefeld).

The new, single-dose application systems for bonding materials differ in many properties from conventional ones. The aim of this study was to compare these bonding systems with one having a new adhesion concept. The hypothesis to be tested was achieving a similiar bond strength using Prompt-L-Pop (PP), the only all-in-one adhesive that allows omitting the curing step. Three commercially available bonding systems were used for tensile bond strength (Tbs) measurements[1], each on five bovine teeth with exposed dentin and enamel, using the appropriate composite: Excite (Ex) + Tetric Ceram (TC), [Vivadent, Schaan], Opti Bond Solo (OBS) + Herculite XRV (XRV), [Kerr, Orange] and PP + Pertac II (P II) [ESPE, Seefeld], TC and XRV. For each procedure the steps necessary until the composite can actually be applied (steps to application, Sta) were measured in time (sec.) and number.

	Tbs dentin [MPa]	Tbs enamel [MPa]	Sta in number	Sta in time [sec.]
Ex / TC	1.2 ± 0.5^{a}	7.5 ± 1.5^{c}	7	84 ± 7^{F}
OBS / XRV	4.4 ± 1.2^{b}	7.4 ± 1.9^{c}	6	86 ± 6^{F}
PP/ P II	4.9 ± 2.1^{b}	10.0 ± 1.9^{cd}	3	28 ± 3^{G}
PP / XRV	4.7 ± 2.4^{b}	13.4 ± 2.7^{de}	3	26 ± 3^{G}
PP / TC	5.4 ± 1.4^{b}	14.8 ± 4.4^{e}	3	29 ± 4^{G}

Statistics (Mann-Whitney-U-test, 95% confidence level) revealed similar or better tensile bond strength values and a significantly shorter time for the bonding application, when Prompt was used.

[1] Tensile test method of abstract number 2397 (IADR 1997) was used. Luchtert@ESPE.de