A LABORATORY EVALUATION OF THE SHEAR BOND STRENGTH OF COMPOSITE RESIN TO DENTIN AND ENAMEL USING 'SELF-ETCHING' ADHESIVE SYSTEMS

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INTRODUCTION

Materials and techniques facilitating bonding resin composites to dentin have become an important part of modern clinical practice. A variety of dentin and enamel surface preparations have been used in combination with hydrophilic primers to increase adhesion and improve the seal of the resin to the tooth structure. More recently some adhesive systems have been developed which use a "self-etching" mechanism eliminating a rinsing step and removing the ambiguity about the clinical meaning of "moist dentin". The purpose of this laboratory study is to evaluate the shear bond strength of composite resin to dentin and enamel using several no-rinse self-etching systems.

METHODS AND MATERIALS

Flat bonding sites were prepared on the buccal surfaces of 168 extracted human teeth by grinding the teeth on a water-cooled abrasive wheel (Ecomet III Grinder, Ltd., Lake Bluff, Ill. 60044) to a 600 grit surface exposing dentin on 84 specimens and enamel on 84 specimens. The prepared specimens were divided into 7 groups of 12 teeth prepared in dentin and 7 groups of 7 prepared in enamel. The adhesives used were:

Group 1: Prima 1 (lot 4118P1)
Group 2: Xeno III (lot 0512000738)
Group 3: PRIMA Quick (lot 4114PQB)
Group 4: i-Bond (lot 010082)
Group 5: Xeni IV (lot 060411)
Group 6: Clearfil SE Bond (lot 41460)

After the application of the adhesive system, cylinders of composite resin (Spectrum TPH Shade A2, lot 0603001197) were bonded to each dentin and enamel bonding site. A gelatin capsule technique in which a resin cylinder 4.5 mm in diameter is formed using a gelatin capsule as a matrix was used. Composite was loaded in the capsules approximately 2/3 full, then cured in a Triad 2000 curing unit (Trubyte Division, Dentsply International, York PA 17405) for one minute. Additional composite was added to slightly overfill the capsules. The capsules were firmly seated against the bonding sites and excess resin removed with a dental explorer. The resin was visible light cured with three 20-second curing sequences each from opposite sides of the capsule at an angle of 45 degrees to the tooth surface.

The specimens were stored in distilled water at 37° C for 24 hours. Each bonded assembly was thermocycled between water baths of 5° C and 55° C for 1800 cycles (dwell time 20 seconds) and then mounted in with acrylic. The specimens were placed in an Instron Testing Machine (Model 1123, Instron Corporation, Canton, Mass.) equipped with a chisel-shaped rod to deliver a shearing force. The specimens were aligned with the shearing rod against and parallel to the bonding sites. Each cemented cylinder was placed under continuous loading at 5 mm per minute until fracture occurred. High and low values form each group were dropped using an n = 10 for mean shear bond strength (SBS) calculations. Shear bond strength was calculated in megapascals units (MPa). ANOVA and LSD post hoc test was performed for statistical analysis for the dentin and enamel groups using a confidence interval of 95% to determine pair-wise group comparisons.

RESULTS

Mean Shear Bond Strength (SBS) values for each group are reported below in MegaPascals (MPa):

Material	Mean SBS-Dentin
SE Bond	24.1 ± 3.0^{a}
Xeno III	$18.9 \pm 2.9^{a,b}$
PRIMA Quick	13.6 ± 3.5^{b}
Xeno IV	23.3 ± 2.2^{a}
i-Bond	$20.0 \pm 3.1^{a,b}$
PRIMA 1	16.0 ± 2.4^{b}

Material	Mean SBS-Enamel
SE Bond	25.8 ± 2.7^{a}
Xeno III	22.0 ± 3.3^{a}
PRIMA Quick	5.5 ± 2.0
Xeno IV	18.9 ± 2.2^{a}
i-Bond	$15.6 \pm 3.0^{a,b}$
PRIMA 1	12.4 ± 2.6^{b}

A one-way ANOVA was done for the dentin and enamel groups in each catergory (6th and 7th generation. For dentin the $p<0.0001$ and for enamel $p<0.0001$. A post-hoc LSD test was done for pair-wise comparison. Groups with the same letter were statistically similar ($p>0.05$).

DISCUSSION/CONCLUSIONS

Significant differences were observed for both enamel and dentin adhesion values in this study.

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