Bond Strength of One-Component Self-Etching Adhesives

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INTRODUCTION

The conventional form of dental adhesives requires three steps with successive applications of 1) an acid etchant, normally phosphoric acid, 2) an adhesion promoting agent or primer, and 3) a bonding resin or adhesive. Between the first and second steps, water rinsing and drying are generally required. Between the second and third steps, drying is required. After all three steps, light-curing is generally required to polymerize and harden the adhesive. This procedure is complex and, hence, technique-sensitive.

Efforts have been directed toward developing new types of dental adhesives to simplify the above dental adhesive application procedure. During the past several years, self-etching adhesives (the 7th generation) were commercialized that combine etching, priming and adhesive into one component. OptiBond All-In-One (Kerr) is a single component, self-etching and self-priming dental adhesive.

OBJECTIVE

To evaluate shear bond strength (SBS) to dentin and uncut bovine enamel of OptiBond All-In-One and several commercial one-component self-etching adhesives, including iBond Self-Etch, AdheSE One VivaPen, GO and Adper Easy Bond.

METHODS

Extracted human teeth (second or third molar) and bovine were embedded in cold-cure acrylics for dentin and enamel bonding, respectively. Sets of six specimens were prepared for each material. For dentin, a low speed diamond saw was used to remove the crown and expose the occlusal dentin. All dentin substrates were polished with 240-grit and then 600-grit SiC paper. For enamel substrates, the surfaces of bovine were exposed and cleaned with pumice.

The prepared substrates were dried for about 3 seconds by oil-free compressed air, but not desiccated. Manufacturers' instructions were followed to apply adhesives on tooth substrates and cured with Optilux 501. A composite, Herculite XRV, was then applied on top of the adhesives using bonding jigs (Ultradent) with a cylindrical mold (Φ = 2.38 mm), followed by light curing for 30s. Prepared specimens were stored at 37ºC in water for 1 day before being subjected to debonding under shear force on an Instron mechanical tester (Model 4467) using a notched (semi-circular) edge at a crosshead speed of 1.0 mm/min. Shear bond strength values in MPa were calculated by dividing the peak load by the bonding area. Statistical analysis was performed using One-way ANOVA and Bonferroni's method for pair-wise comparison to determine significant differences among groups ($p<0.05$).

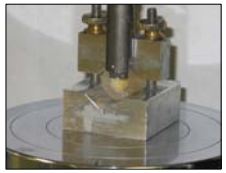
Table 1. Shear bond strength (with STDEV, in MPa) of one-component self-etching adhesives

	OptiBond All-In-One	iBond Self-Etch	AdheSE One VivaPen	GO	Adper Easy Bond
Human Dentin	31.4 ± 3.4 [a]	18.2 ± 3.9 [b]	22.1 ± 2.2 [b]	22.7 ± 3.0 [b]	29.6 ± 3.7 [a]
Uncut Bovine Enamel	26.0 ± 3.7 [c]	18.5 ± 3.5 [d]	23.8 ± 3.3 [c,d]	23.1 ± 4.1 [c,d]	19.5 ± 2.3 [d]

[a, b, c, d] Means with the same letter within the same row are not statistically different at p>0.05.

Figure 1. Bonding Jig

Figure 2. Shear Bond Test Set-Up



MATERIALS

OptiBond All-In-One (Kerr)
iBond Self-Etch (Heraeus-Kulzer)
AdheSE One VivaPen (Ivoclar Vivadent)
GO (SDI)
Adper Easy Bond (3M-ESPE)
Herculite XRV (A2 shade, Kerr)

RESULTS

Figure 1 shows a bonding jig and Figure 2 shows shear bond strength testing set-up. Shear bond strength (SBS) and results of ANOVA analysis are summarized in Table 1.

It is clear that a one-component adhesives generate effective bonding to both dentin and uncut bovine enamel. For dentin, the SBS of All-In-One and Easy Bond are not significantly different ($p>0.05$) from each other, but are significantly higher ($p<0.05$) than the other materials evaluated. For uncut bovine enamel, the SBS of All-In-One, VivaPen and GO are not significantly different ($p>0.05$) from each other, but are significantly higher ($p<0.05$) than the others.

CONCLUSION

The bonding efficacies of OptiBond All-In-One are comparable to or better than other commercial one-component self-etching adhesives.