

## INTRODUCTION

Traditionally, the bonding procedure for restoring a dental cavity involves the steps of (1) etching the tooth structure with phosphoric acid gel etchant to remove the smear layer; (2) priming the etched tooth structure with a primer; and (3) applying an adhesive to the primed tooth structure. 5th generation adhesives were developed by combining the primer and the adhesive into a single component (or “one-bottle”) to simplify the bonding procedure by reducing the number of steps required. Unlike most newer generation (6<sup>th</sup> and 7<sup>th</sup>) dental adhesive systems, the 5<sup>th</sup> generation adhesive systems provide not only a simplified bonding procedure, but also superb bond strengths to both dentin and enamel substrates. As a result of their simplicity, superior bonding performance, and versatility (direct and indirect applications), the 5<sup>th</sup> generation adhesives are currently the most widely used adhesives among all generations of adhesives.

Optibond Solo (Kerr Corporation) was the first among 5<sup>th</sup> generation adhesive systems to incorporate fillers into the adhesive for enhanced bonding performance. Since then, many filled 5<sup>th</sup> generation adhesives were introduced.

## OBJECTIVE

To measure and compare the shear bond strength to dentin of several commercial 5<sup>th</sup> generation dental adhesives: Optibond Solo Plus (Kerr), One-Step Plus (Bisco), Prime&Bond NT (Dentsply), Single Bond Plus (3M ESPE), XP Bond (Dentsply).

## MATERIALS

OptiBond Solo Plus	Kerr
One-Step Plus	Bisco
Prime&Bond NT	Dentsply
Single Bond Plus	3M ESPE
XP Bond	Dentsply

## METHOD

Extracted human teeth were embedded in cold-cure acrylics. A set of six specimens were prepared for each material. A low speed diamond saw was used to remove the crown and expose the occlusal dentin. The dentin substrates were polished with 240-grit and then 600-grit SiC paper. The dentin substrates were then etched with 37% H3PO4 gel etchant (Kerr) for 15 seconds, rinsed thoroughly with water, and air dried briefly. Each adhesive was then applied to the dentin surface according to the manufacturer’s instructions, air dried, and light-cured. The adhesive covered substrate was then held securely by a bonding jig (Ultradent Inc.) with a cylindrical mold ( $\Phi = 2.38$  mm). The mold was then filled with Herculite XRV composite (A2 shade, Kerr) and the composite was light-cured. The prepared specimens were then stored in de-ionized water at 37°C for 24 hours before being subjected to debonding under shear force. The specimens in each set were tested on an Instron mechanical tester (Model 4467, Instron Corporation) in shear mode 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 ( $p < 0.05$ ).



Figure 1: Bonding Jig



Figure 2: Shear Bond Test Set-Up

## DISCUSSION

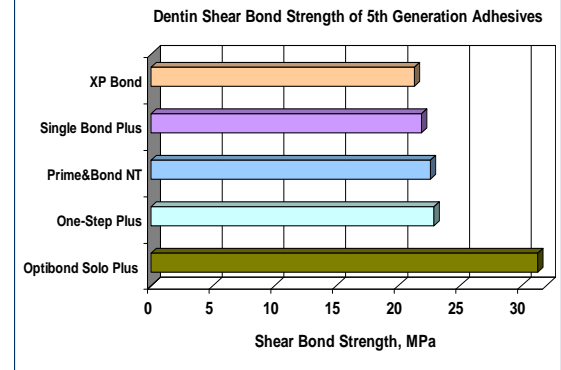
Shear bond strength to dentin data are shown in the table and also in the figure. Optibond Solo Plus had the highest SBS ( $31.3 \pm 2.7$  MPa) among the adhesives used in this study. ANOVA analysis revealed that Optibond Solo Plus provided significantly ( $p < 0.05$ ) higher bond strength than the other four adhesives. ANOVA analysis also showed that the other four adhesives had no significant differences ( $p > 0.05$ ) in bond strength among each other.

The excellent dentin bond strength of OptiBond Solo Plus could be attributed to following contributing factors: (1) it has highest filler loading (15%) among all 5<sup>th</sup> generation adhesives for enhanced strength, and (2) it has ethanol as its carrier to make the adhesive less sensitive to the wetness of the acid etched dentin surface and therefore less technique sensitive.

## RESULTS

Adhesive System	Dentin SBS(MPa)
OptiBond Solo Plus	$31.3 \pm 2.7^a$
One-Step Plus	$22.9 \pm 6.5^b$
Prime&Bond NT	$22.6 \pm 1.9^b$
Single Bond Plus	$21.9 \pm 3.6^b$
XP Bond	$21.3 \pm 1.7^b$

\*Means with different letters are statistically different at  $p < 0.05$



## CONCLUSION

OptiBond Solo Plus adhesive had the highest dentin bond strength among the 5<sup>th</sup> generation dental adhesives tested in this study.