ABSTRACT (September 25, 2008)
Bond Strength Testing of Six Self-Etch Adhesives on Both Enamel & Dentin
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OBJECTIVE: To evaluate bond strengths of six different self-etching adhesives in comparison to a 35% Phosphoric Acid etch when used on Enamel & Dentin.

METHOD: Seventy-five extracted multi-rooted teeth (premolars and molars) were collected and temporarily stored in 5% sodium azide solution for 24 hours. Thirty-five teeth were sectioned longitudinally to create two dentin slices resulting in two specimens from each tooth. Each sample was embedded in methyl-methacrylate with the buccal/lingual surfaces exposed so that a flat dentin surface could be obtained from wet-abrading with 600-grit SiC paper to create a standardized smear layer. Dentin samples were randomly divided into seven experimental groups (six self-etch adhesives and control). The other forty teeth were embedded in methyl-methacrylate upright, exposing the anatomical crowns which were wet-abraded to expose rough enamel. Initially, the forty enamel samples were randomly divided into four experimental groups and then were re-used after wet-abrasion and further randomly divided into the other 3 experimental groups:

Group 1 = Pentron
Group 2 = Adhese Pen
Group 3 = G-Bond
Group 4 = Adper L-Pop
Group 5 = Opti-Bond
Group 6 = Clearfil
Group 7 (control) = 35% Phosphoric Acid + Excite

Each enamel and dentin sample was roughened with wet-abrasion and the respective self-etch adhesive system was placed on each (according to each group’s manufacturer’s instructions). All samples had composite posts bonded to the adhesive using an Ultra-dent system. Each group was placed in a water bath of 37°C for 24 hours. Bond strength testing on each specimen was applied with an Instron machine, using a 5.0mm/min crosshead speed until the composite posts were debonded from each tooth.

RESULTS:

<table>
<thead>
<tr>
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<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
<th>Group 6</th>
<th>Group 7</th>
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</thead>
<tbody>
<tr>
<td>Avg Enamel Bond Strength</td>
<td>12.626</td>
<td>8.5499</td>
<td>15.9935</td>
<td>12.789</td>
<td>22.014</td>
<td>19.564</td>
<td>24.747</td>
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</tbody>
</table>

A one-way ANOVA analysis showed that Group 1 had the highest average bond strength in dentin while Group 5 had the highest average bond strength in enamel of self-etching adhesives. Group 1 resulted in a statistically significant difference (p<0.05) in dentin bond strength from the other self-etching adhesives. Group 5 resulted in a statistically significant difference (p<0.05) in enamel bond strength from the other self-etching adhesives, except for Group 6 (p>0.05).

CONCLUSION: Overall, some self-etching adhesives appeared to have clinical relevance for the use of bonding composites on both enamel and dentin. However, further testing of these newer adhesives are needed.
**Detailed Results with Stats:**

**For Dentin:**
- Pentron had $p<0.05$ (0.00, 0.01, 0.06, 0.021, 0.00) compared to Adhese, G-bond, L-pop, Opti-bond, Clearfil respectively BUT $p=0.179$ compared to Control
  - This represented that Pentron was the BEST self-etching adhesive in Dentin, even better than the control
  - Since there is a significant difference with all other self-etching adhesive, there really wasn’t a close 2nd in dentin bonding
- The worst was Adhese, but not to a statistically significant difference in dentin ($p>0.05$)
- For the most part, if you take out Pentron’s data, there was no statistically significant difference between any of the groups, including the control $\rightarrow$ meaning they all produced about the same bond strength in dentin

**For Enamel:**
- Pentron had $p>0.05$ (0.713, 1.00, 1.00) compared to weak bonding enamel adhesives Adhese, G-bond, L-pop BUT $p<0.05$ compared to the good bonding enamel adhesives Opti-bond, Clearfil and Control
  - This represented that Pentron was in the bottom half of enamel bonding
- The best was Opti-bond with $p<0.05$ to all groups (4) except Clearfil
  - Clearfil was a close 2nd ($p<0.05$ to all groups (3) except Opti-bond & G-bond)
- The worst was Adhese again, but this time a statistically significant difference in enamel in a bad way (vs. G-bond $p=0.004$, Opti-bond $p=0$, Clearfil $p=0$)

**Conclusion:**
- If we have to bond to Dentin, we should only use Pentron
- If we have to bond to Enamel, we can use Opti-bond, Clearfil or the Control
- It appears that bonding to Enamel produces greater bond strengths than Dentin, with the exception being Pentron