Micro-tensile bond strength of self-etching adhesives to air-abraded tooth

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Objectives
To compare micro-tensile bond strengths (MTBS) of self-etching adhesives to air-abraded enamel and dentin with or without phosphoric acid treatment.

Materials and Methods
Two self-etching bonding systems were used: AQ Bond Plus (AQP: Sun Medical) and Brush&Bond (B&B: Parkell). Thirty-six extracted human teeth were ground flat to enamel or dentin with #180 SiC paper under water irrigation. Sixteen ground tooth surfaces were air-abraded with 50-micrometer alumina (Micro Prep: Sunrise Technologies). Half of these specimens were treated with phosphoric acid (PA: Red Activator; Parkell) for 5-10s followed by water rinse. Each bonding system was applied to ground or air-abraded surfaces with or without the PA treatment and photo polymerized for 10 seconds. Resin composite (EPIC-TMPT, Parkell) was placed on the cured bonding layer and photo-polymerized. The specimens were then stored in 37˚C water for 24 hours. In the MTBS tests, the resin-bonded teeth were sliced into 0.8mm thick, and bonded surfaces were trimmed to obtain a bonded area of 1mm². Historically, it is common for a portion of MTBS samples to fail during preparation; however, 100% of these samples survived and were tested. The bond strengths were measured and statistically analyzed by ANOVA (p=0.05, n=6).

Evaluation of enamel surface after air-abrasion (Fig. 2)

(a) Air-abraded enamel surface (b) AQP (EPIC-TMPT) / air-abraded enamel interface (c) B&B (EPIC-TMPT) / air-abraded enamel interface

Evaluation of air-abraded and PA-etched enamel and dentin surface (Fig. 3)

(a) Air-abraded and PA-etched enamel surface (b) AQP (EPIC-TMPT) / air-abraded and PA-etched enamel interface (c) B&B (EPIC-TMPT) / air-abraded and PA-etched enamel interface

Values with same letters are not significantly different by Turkey’s test. The air-abrasion to enamel inhibited the bonding of both self-etching systems and PA treatment after air-abrasion enhanced MTBS of both bonding system (p>0.05).

Table 2: MTBS of self-etching adhesives to air-abraded tooth

<table>
<thead>
<tr>
<th>Evaluated Item / Materials</th>
<th>Enamel</th>
<th>Dentin</th>
<th>Enamel</th>
<th>Dentin</th>
</tr>
</thead>
<tbody>
<tr>
<td>#180</td>
<td>19.3 ± 2.1</td>
<td>41.8 ± 8.1</td>
<td>19.1 ± 3.3</td>
<td>42.4 ± 6.1</td>
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<tr>
<td>Air-abrasion</td>
<td>13.1 ± 2.8</td>
<td>35.0 ± 12.0</td>
<td>10.9 ± 3.1</td>
<td>36.1 ± 8.1</td>
</tr>
<tr>
<td>Air-abrasion + PA</td>
<td>40.5 ± 6.2</td>
<td>48.8 ± 7.2</td>
<td>41.3 ± 5.8</td>
<td>49.3 ± 6.1</td>
</tr>
</tbody>
</table>

Fig. 5 SEM images of air-abraded dentin (g) and air-abraded and PA-etched dentin surface (h), AQP (EPIC-TMPT) / air-abraded dentin interface (i), B&B (EPIC-TMPT) / air-abraded and PA-etched dentin interface (j). Some aluminum oxide particles stuck into the dentin but they were removed by PA treatment. Morphology of B&B (EPIC-TMPT) / air-abraded and PA-etched dentin interface showed the same as (i).

Conclusion
It was concluded that PA treatment should be used after air-abrasion when AQ Bond Plus or Brush&Bond was applied on the teeth.