

Clinical Evaluation of Bond Failure Rates with a New Self-Etching Primer

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Traditional orthodontic bonding systems use a 37% phosphoric acid etchant, a bonding agent, and composite resin cement.^{1,2} More recent fourth-generation bonding systems such as All-Bond 2* utilize a separate acid etchant, primer, and adhesive. Fifth-generation bonding systems such as Prime & Bond NT** also require an acid etchant, but combine the primer and adhesive into one step. With the introduction of the sixth-generation adhesive Prompt L-Pop,*** etching with phosphoric acid was eliminated. A new product called Transbond Plus Self Etching Primer**** was the first sixth-generation adhesive designed for orthodontic use.

The bonding method involves a pumice prophylaxis, followed by application of the Transbond Plus Self Etching Primer for three seconds, a quick blast of air to thin the material, and direct attachment of the bracket to the tooth with a light-cured composite resin. The manufacturer advertises that chairtime is reduced by combining the etching and priming steps and eliminating the rinsing step. The company also suggests that teeth will be less prone to demineralization because the depth of penetration of the acid and the monomers is identical, and that the product will allow bonding in areas that are difficult to isolate.

Several investigators have evaluated the bond strengths of self-etching primers. A study by Bishara and colleagues found that acidic primers can produce clinically acceptable³ shear bond strengths of 10 MPa when used with highly filled composites.⁴ In another study, however, Bishara and colleagues found bond strengths to be inadequate when the acidic primer Clearfil Liner Bond 2† was used with Transbond XT**** composite resin.⁵

Rueggeberg and colleagues determined that Prompt L-Pop without acid etching produced similar bond strengths as with conventional bracket placement techniques.⁶ Hitmi found no significant difference between Prompt L-Pop and a control adhesive, which used a 37% phosphoric acid etchant.⁷ Bergeron and colleagues concluded that the resin-enamel bond strength of seven different self-etching primers, including Prompt L-Pop, was similar to or better than that of multiple-step systems.⁸ Fritz and colleagues found that bonding with three self-etching

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primers (Clearfil SE Bond,[†] Clearfil Liner Bond 2V[‡], and Novabond[‡]) was as effective as bonding with phosphoric acid etchants.⁹ In a recent study, Bishara and colleagues showed that a self-etching primer produced a significantly lower, but clinically acceptable, shear bond strength compared to acid etching when used with Transbond XT composite resin.¹⁰

Although these laboratory studies indicate that brackets can be successfully bonded with self-etching primers, there are no published clinical studies. The present investigation was designed to clinically evaluate bond failure rates using Transbond Plus Self Etching Primer.

Materials and Methods

Twenty patients from the Dental Branch, University of Texas at Houston, took part in this study. The residents and assistants in our clinic are all familiar with the procedure involved with Transbond Plus Self Etching Primer. Dr. Asgari was the primary operator, but five other operators, supervised by Dr. Asgari, bonded brackets for this study. The same dental assistant helped with each patient.

The bonding protocol in each patient followed a contralateral quadrant pattern to eliminate operator bias (Fig. 1). One quadrant was randomly selected to receive the new self-etching primer, along with the contralateral quadrant in the opposing arch. Teeth in the other two quadrants were treated with a 37% phosphoric acid etchant and conventional primer. An effort was made to bond the same number of teeth on each side of each arch in any one patient and to bond the same total number of brackets with each of the two techniques.

Bonding began with a pumice prophylaxis of all teeth in both the experimental and control quadrants. The teeth were rinsed and isolated with retractors. Teeth in the control quadrants were etched with 37% phosphoric acid for 15 seconds, rinsed with copious amounts of water,

Experimental Quadrant	Control Quadrant
Control Quadrant	Experimental Quadrant

Fig. 1 Contralateral quadrant pattern.

and dried completely. One control quadrant was bonded completely before proceeding to the other control quadrant in the opposing arch. A thin layer of primer from the Transbond XT resin bonding system was applied to all the control teeth in the arch and light-cured for 10 seconds per tooth. The brackets were then placed on the teeth from posterior to anterior. The flash was removed, and the resin was light-cured for 20 seconds each on the mesial and the distal sides of each tooth.

Next, teeth in the experimental quadrants were bonded one quadrant at a time. The assistant prepared the Transbond Plus Self Etching Primer by popping the first two wells in the foil packet and thoroughly mixing the material in the third well with the brush. The operator applied the mixture to the surface of each tooth by rubbing vigorously for three seconds, rather than simply brushing the enamel, taking care to keep the primer from contacting the oral mucosa and gingiva. A thin blast of air was then applied to all the teeth in that quadrant to thin the material. If any of the teeth did not appear glossy, more primer was applied to the tooth surface for another three seconds, followed by another burst of air. The brackets were bonded directly to the teeth from posterior to anterior. Flash was removed, and the resin was light-cured for 20 seconds each on the mesial and the distal sides of each tooth. The teeth in the other experimental quadrant were bonded using the same procedure, but a new packet of Transbond Plus Self Etching Primer.

After checking to make sure there was no occlusal interference with any of the brackets, the appropriate archwire was tied into the brack-

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TABLE 1
BOND FAILURES

	Experimental		Control		Total
Total teeth bonded	174		174		348
No bond failures	173	99.43%	166	95.40%	339
Bond failures	1	0.57%	8	4.60%	9*

*p = .037.

et slots with either wire or elastomeric ligatures, according to the patient's treatment plan. Each patient was instructed as usual in oral hygiene and in caring for the braces. The patients were scheduled for follow-up visits every four weeks, when routine adjustments were made. Oral hygiene was also evaluated at these visits, and instructions were reinforced if needed.

Bond failure rates were recorded over a six-month period. Debonded brackets were rebonded using conventional procedures.

Results

The total number of teeth bonded using each method was 174 (Table 1). Over a period of six months, eight bond failures occurred in the control quadrants (4.60%) vs. only one failure in the experimental quadrants (.57%). The Fisher's Exact Test was used to analyze the data instead of the chi-square test because the expected value in one of the cells (number of experimental failures) was less than 5. The "p" value of .037 indicated that the bond failure rate using Transbond Plus Self Etching Primer was significantly less than the bond failure rate in those quadrants where a 37% phosphoric acid etchant was used.

Conclusion

Preparing one tooth for bonding with the traditional acid-etch technique requires 15 seconds to etch and another 15-20 seconds to rinse the tooth. Primer is then applied and light-cured for 10 seconds. With Transbond Plus Self Etching Primer, all these steps are combined into one

three-second application. Additionally, as the present study shows, bracket retention using this technique is superior to that with the traditional method. Other self-etching primers available in dentistry may perform equally well and should also be clinically tested.

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REFERENCES

1. Buonocore, M.G.: A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces, *J. Dent. Res.* 34:849-853, 1955.
2. Phillips, H.: JCO Interviews Paul Gange on the present state of bonding, *J. Clin. Orthod.* 29:429-436, 1995.
3. Powers, J.M.; Kim, H.B.; and Turner, D.S.: Orthodontic adhesives and bond strength testing, *Semin. Orthod.* 3:147-156, 1997.
4. Bishara, S.E.; Gordan, V.V.; Von Wald, L.; and Olson, M.E.: Effect of an acidic primer on shear bond strength of orthodontic brackets, *Am. J. Orthod.* 114:243-247, 1998.
5. Bishara, S.E.; Gordan, V.V.; Von Wald, L.; and Jakobsen, J.R.: Shear bond strength of composite, glass ionomer and acidic primer adhesive systems, *Am. J. Orthod.* 115:24-28, 1999.
6. Rueggeberg, F.A.; Fortson, W.M.; and Mettenberg, D.J.: Orthodontic bracket retention strength using a self-etching primer (abstr.), *J. Dent. Res.* 79:282, 2000.
7. Hitmi, L.; Attal, J.P.; and Degrange, M.: Evaluation of acidic adhesive for orthodontic bonding (abstr.), *J. Dent. Res.* 79:507, 2000.
8. Bergeron, C.; Vargas, M.A.; Gelinias, P.; and Van Meerbeek, B.: Bond strength of self-etching adhesives to enamel (abstr.), *J. Dent. Res.* 79:442, 2000.
9. Fritz, U.B.; Diedrich, P.; and Finger, W.J.: Self-etching primers: An alternative to the conventional acid etch technique? *J. Orofac. Orthop.* 62:238-245, 2001.
10. Bishara, S.E.; Von Wald, L.; Laffoon, J.F.; and Warren, J.J.: Effect of a self-etch primer/adhesive on the shear bond strength of orthodontic brackets, *Am. J. Orthod.* 119:621-624, 2001.