An Expedited Indirect Bonding Technique

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Three new products can greatly expedite light-cured indirect bonding:

1. Quick Cure*—a composite adhesive with a photoinitiator catalyst that is highly sensitive to a broader range of blue light than with conventional composites. In fact, the material is so sensitive that it must be protected from ambient light, which can initiate polymerization. Quick Cure is available in a package with etchant and sealant or in individual syringes of composite (Fig. 1).
2. Power Slot*—a curing light tip that concentrates the beam of visible light and thus reduces polymerization time. While most light wands emit a beam that spreads out to as many as three teeth, this new plastic tip is shaped to concentrate the light onto one tooth (Fig. 2). Four different chucks are available to fit all 3M Unitek lights, L.D. Caulk Maxlites, the Vivadent Heliolux GT or DLX, the Demetron 401 series and above, or the Reliance Ortho 2000. When both Quick Cure and the Power Slot are used, the manufacturer says the composite will set with only three seconds of curing per tooth. If the tip is used with a different adhesive, the company recommends the light be applied for 10 seconds.
3. Prompt L-Pop**—a water-based, all-in-one, self-etching adhesive supplied in a disposable single-application unit. The etchant and sealant are combined, and no rinsing is required after application (Fig. 3).

Extensive tests have shown that Prompt will bond with compomers such as Dyract AP*** and Hytac** or with light-cured composites such as 3M Filtek Z250,† Herculite XRV,‡ TPH Spectrum,†† and Pertac II.**[1-3] Compomers were the first step toward simplification of bonding, but their self-conditioning primers produced an unsatisfactory etch pattern on the enamel. Prompt's mechanism is based on the presence of methacrylated phosphoric esters

*Reliance Orthodontic Products, P.O. Box 678, Itasca, IL 60143.
**Registered trademark of ESPE America, Inc., 1710 Romano Drive, P.O. Box 2000, Plymouth Meeting, PA 19462.
***L.D. Caulk Division, Dentsply International, Milford, DE 19963.
†3M Dental Products, P.O. Box 33600, St. Paul, MN 55133.
‡Kerr Division, Sybron Dental Specialties, 1717 W. Collins Ave., Orange, CA 92867.
††Dentsply International Inc., York, PA 17405.

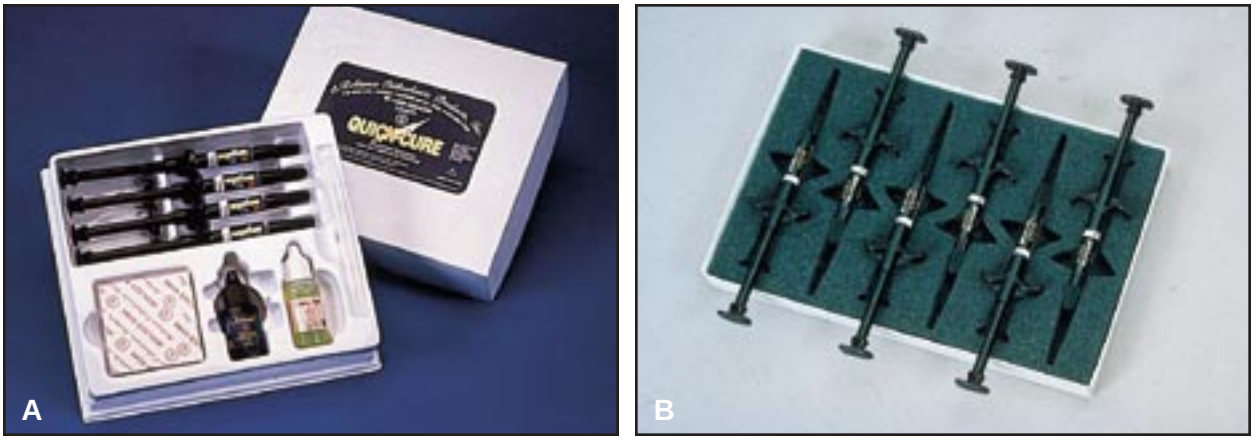

Fig. 1 Quick Cure composite. A. Complete kit with composite, etchant, and sealant. B. Package with only composite-filled syringes.

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with a low pH that ensures etching as thorough as that of phosphoric acid.[4] Studies at the University of North Carolina have confirmed that the etch pattern produced by phosphoric acid and that of Prompt L-Pop are essentially the same.[5]

As the etching progresses, the pH of the phosphoric esters rises due to neutralization of the acidic monomers, and this stops the demineralization. The depth of the demineralized zone corresponds to the depth of penetration of the monomers to be polymerized; hence, there is no nanoleakage due to insufficient penetration of the adhesive. The remaining monomers cannot be removed from the demineralized zone, and are either blown away in the drying process or incorporated into the bonding composite matrix.

In addition to the mechanical attachment between the enamel and composite, a chemical bond occurs between the calcium hydroxyl apatite and the phosphoric esters of Prompt L-Pop. This permits either an ionic or covalent bond between the esters and the calcium ions of the apatite. Subsequent curing with visible light polymerizes the adhesive.

A previously published article described a technique for improving the delivery of indirect-bonded brackets using matrices made with a hot glue gun (Surebonder DT- 200‡‡).[6] The hot glue, a molten polymer of ethylene vinyl acetate, is FDA-approved, non-carcinogenic, non-toxic, and dimensionally stable in its solid form. These matrices, which have proven their efficacy and accuracy in clinical use over the past two years, have now been combined in my practice with the

Fig. 2 Power Slot tip concentrates light beam for faster composite curing.

‡‡FPC Corporation, Wauconda, IL 60084.

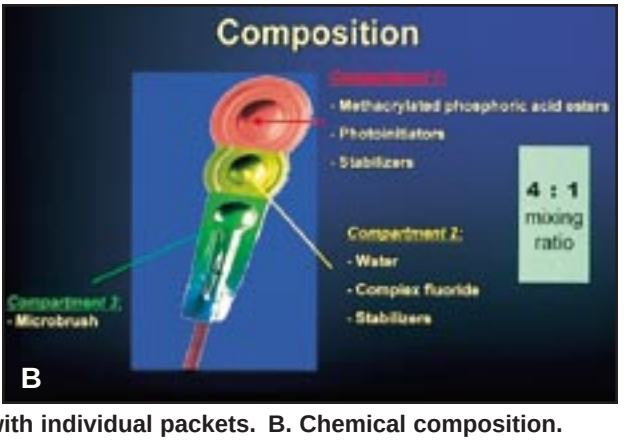

Fig. 3 A. Prompt L-Pop etchant-sealant package with individual packets. B. Chemical composition.

new materials listed above.

Laboratory Procedure

1. Pour stone casts from alginate impressions, and remove any imperfections that might interfere with the placement of brackets or fabrication of the indirect bonding matrices.
2. Apply two coats of a separating medium to the casts, and allow them to dry fully.

Fig. 4 A. Axial midline marked with pencil. B. Ormco lead-tipped bracket gauge. C. Bracket positions scribed with bracket gauge.

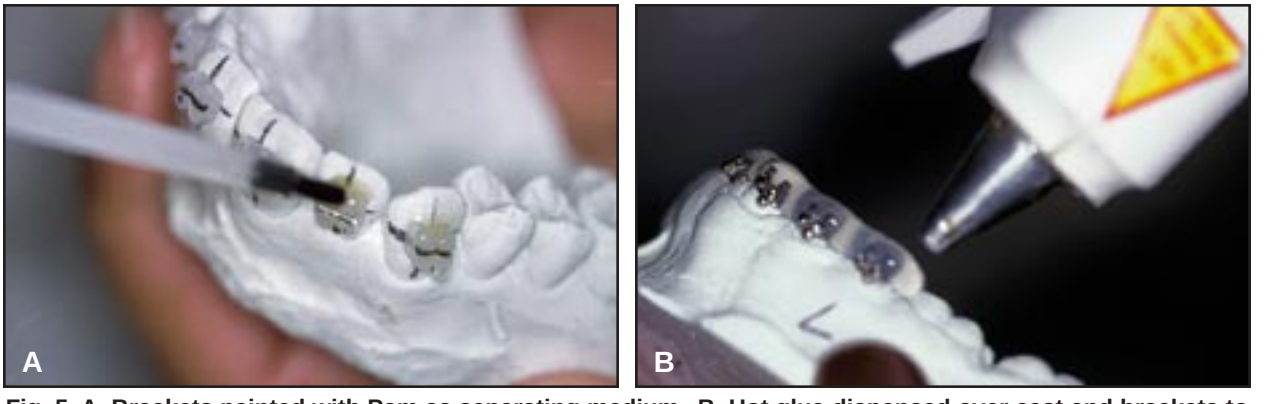

Fig. 5 A. Brackets painted with Pam as separating medium. B. Hot glue dispensed over cast and brackets to form matrix.

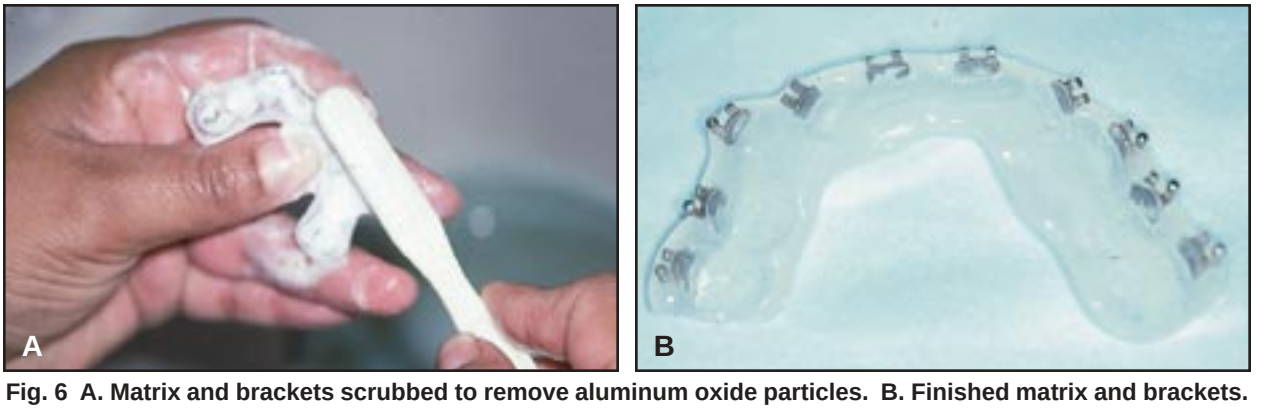

Fig. 6 A. Matrix and brackets scrubbed to remove aluminum oxide particles. B. Finished matrix and brackets.

3. Draw vertical and horizontal bracket placement reference lines on the stone teeth with a pencil and a lead-tipped Ormco bracket gauge§ (Fig. 4).
4. Glue the brackets to the casts with a water-soluble cement, Aleene's Tacky Glue,§§ which firmly attaches the brackets to the stone, but allows repositioning as needed. Recheck placement accuracy with a bracket gauge.
5. After painting the brackets with Pam cooking spray or a silicon separating medium, form the bonding matrix by covering the entire lingual and occlusal surfaces of the teeth and part of the brackets with hot glue (Fig. 5). When the glue has hardened, submerge the casts with the brackets and matrices in water for at least 30 minutes to dissolve the Tacky Glue. The matrices can then be easily removed from the stone models. Scrub the brackets thoroughly but lightly with soap and water and a soft-bristle toothbrush to remove any Tacky Glue.
6. Dry the brackets, then microetch them to enlarge and enhance the surface areas of the screen mesh. Lightly scrub the brackets again with soap and water to remove all vestiges of the aluminum oxide particles from the microetching (Fig. 6).
7. Store the matrices and brackets on the working casts until they are needed for bonding. This keeps any temperature changes from altering the dimensions of the plastic matrices.

Clinical Comparison

Two patients with 10 teeth to be bonded in each arch were selected for a comparison of indirect-bonding techniques. The tooth surfaces were prepared by the same clinician with the usual procedure, including microetching of fluorosed enamel[7] (Fig. 7).

One patient received a traditional enamel preparation: 20-second etch with 37% phosphoric acid, water rinse, warm-air drying (using a hot-air gun to avoid water and oil contamination from compressed air), and sealant application (Assure*). The adhesive was Ultra Band Lok,* a compomer designed as a light-sensitive banding adhesive, but whose strong adhesion to metal makes it unusually effective for brackets as well.

Fig. 7 Fluorosed enamel surfaces microetched prior to bonding. Moist paper towel covers patient's face for protection from aluminum oxide powder.

Fig. 8 Amber protective plate prevents premature polymerization of composite-loaded brackets and matrices.

The hot-glue matrices of both patients were kept under amber protective plates to prevent premature polymerization of the light-cured composites from ambient light (Fig. 8). Once the first patient's matrices were in place, each tooth was cured briefly with a Caulk Maxlite*** and a conventional tip to start the polymerization process and avoid saliva contamination of the compomer. Each tooth was then cured for 30 sec-

§Ormco/"A" Company, 1717 W. Collins Ave., Orange, CA 92867.
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***L.D. Caulk Division, Dentsply International, Milford, DE 19963.

onds. The matrices were removed, and light round .014" nickel titanium wires were tied in immediately without incident.

The second patient was bonded with the expedited indirect technique. The Prompt L-Pop ingredients, which are separated in a lollipop-shaped aluminum foil packet, are mixed after the first compartment is popped and folded over the second. A cotton-tipped microbrush in the third chamber is used to rub the mixture over the enamel of each tooth for a few seconds (Fig. 9). The teeth were then air-dried (Fig. 10), and the matrices were positioned in both arches.

The curing light with the Power Slot tip was quickly passed over the teeth in both arches to initiate polymerization and avoid saliva contamination. Each tooth was then cured for only five seconds (Fig. 11). Round .014" nickel titanium archwires were tied in immediately without any bracket breakage.

The first patient required 20 minutes to bond the maxillary and mandibular arches, but the second patient needed only seven minutes for complete bonding of both arches—a 65% saving in time.

Conclusion

New orthodontic materials continue to take advantage of chemical and physical advances in other fields. Cost is always a consideration, but the new materials illustrated here compare favorably with existing products. A Prompt L-Pop package that can etch and seal 20-24 teeth costs as little as 62 cents; ordinary etchants and sealants cost at least this much, without the convenience, time saving, and waste reduction. Furthermore, my chairside assistants have discovered that an activated Prompt packet can be used with multiple patients if the applicator tips are changed. The Power Slot tip sells for $219, but is as effective as laser lights that cost about $5,000.

Although conventional bonding works well when done correctly, it is a multi-step, complex procedure that is susceptible to error at many stages. Every step that is eliminated reduces the possibility of critical errors. This expedited tech-

Fig. 9 Prompt L-Pop brushed onto enamel surface.

Fig. 10 Prompt L-Pop dried with hot-air gun.

Fig. 11 Composite cured with visible light.

nique has improved our bracket placement, saved a significant amount of chairtime, and increased patient comfort. The ultimate test of any clinical procedure is its acceptance by chairside assistants. My assistants not only endorse this new technique, but complain vigorously when they have to use more traditional bonding methods.

REFERENCES

1. Li, D. and Powers, J.M.: Bond strength of compomers with acidic primers to human enamel (IADR abstr.), J. Dent. Res., 1999.
2. Manhart, J.; Li, D.; Powers, J.M.; and Hickel, R.: Bond strength of VLC, GICs, compomers, and composites, DMG-Meeting, 1998.
3. Rosa, B.T.; Perdigao, J.; and Nunes, M.F.: The effect of conditioner, adhesive, and restorative material on shear bond strengths (IADR abstr.), J. Dent. Res., 1999.
4. Reinhardt, K.J.: Einsatz von Phosphorsaureestern als Dentinhaftvermittler, Phillips J. 15:335-342, 1998.
5. Breschi, L.; Perdigao, J.; Mazzotti, G.; Nunes, M.F.; and Gobbi, P.: Ultramorphology and shear bond strengths of self-etching adhesives on enamel (IADR abstr.), J. Dent. Res., 1999.
6. White, L.W.: A new and improved indirect bonding technique, J. Clin. Orthod. 33:17- 23, 1999.
7. Miller, R.A.: Bonding fluorosed teeth: New materials for old problems, J. Clin. Orthod. 24:424-427, 1995.