Total-etch vs. Self-etch adhesives a case-dependent choice

By Dr. Walter G. Renne, USA

Adhesive dentistry with direct and indirect restorations has advanced tremendously since the first etch-and-rinse technique introduced by Buonocore for enamel-only adhesion. Enamel and dentin are both now routinely etched and bonded, procedures that have been proven in multiple studies to be safe and reliable when proper technique is followed. As the procedures advanced, we now have adhesive systems that offer either etch-and-rinse (also known as total-etch) and self-etch options. The total-etch technique is still considered the gold standard for bond strength to enamel, and self-etch adhesive systems have been compared to these to assess the relative bond strength with each. Adhesion is the most important step in all procedures associated with adhesive dentistry and with so many options—enamel or dentin or enamel and dentin bonding; total-etch or self-etch; and multi-bottle or one-bottle systems—there is much to consider before selecting one. Both total-etch and self-etch adhesives offer reliable and repeatable results when properly selected, and the fewer steps required, the more efficient the procedure. This saves chairside time for the clinician and the patient, reducing the possibility for error. Since the appropriate technique is case dependent, the type of case must be the first consideration. If there is a large area of enamel available for bonding and only a small area of dentin, the total-etch technique is often preferred, as it has been shown to result in stronger bonding to enamel than a self-etch technique. Conversely, if a preparation has a substantial area of dentin available for bonding and a lesser area of enamel (such as a large Class II), then self-etch is more frequently used. Whatever adhesive system is chosen, it must provide for high bond strength, durable marginal integrity, and be compatible with the restorative material. The cases below show the use of universal adhesives for direct composite and indirect restorations.

Case report 1 Direct Class II Restoration

The patient in this case presented with approximal carious lesions in teeth 12 and 13, which breached the enamel-dentin junctions on the radiographs. Old preventive resin restorations were also present occlusally. It was decided that direct composite restorations would be placed to restore the 2 bicuspids. At the treatment appointment, after giving the patient local anaesthesia, a rubber dam was placed to isolate the teeth before preparation and provided a dry field during placement of the adhesive and composite restorations (Fig. 1). In this case, a total-etch technique was selected.

During preparation of the teeth, minimal width boxes were created that extended sufficiently for caries removal but no further and the old preventive restoration removed. Since adhesion would provide for retention of the bonding agent, there was no requirement to ensure a retentive preparation form. For this case, I chose OptiBond Solo Plus (Kerr) as the adhesive. It consists of a phosphoric acid gel etchant and a separate primer/adhesive that contains a filler to help strengthen the bond at the hybrid zone level, giving very high bond strengths with just 2 steps. After etching the enamel and dentin for 15 seconds, the etchant was rinsed off and the enamel and dentin gently dried without desiccating the dentin. Next, the bonding agent was applied and light-cured for 20 seconds (Fig. 2) before the composites were placed as bulk fills using the SonicFill System (Kerr) and light-cured. The composites were then checked for occlusion, the margins checked for any excess, and the composites were finished and polished using Prolgloss (Kerr) (Fig. 3).

Case report 2 Indirect Ceramic Inlay

In this case, a new patient presented with failed, old patchy composite restorations in tooth 20 (Fig. 4). Several areas of different composites were present that had been placed at various times. On presentation, the patient complained of sensitivity in this tooth when eating or drinking anything cold. On examination, the bond between the restorations and the tooth had failed and the composites were found to lack marginal integrity. In addition, the tooth was found to have marginal leakage, staining, and recurrent caries in the mesial box. This could have been due to the technique used, poor bond strength, or lack of compatibility between the adhesive systems and composite systems used at various times.
Fig. 8. Application of the bonding agent to enamel and dentin after primer had been used.

Fig. 9. Moderately air-drying the bonding agent.

Fig. 10. Applying bonding agent to the inlay’s intaglio surface.

After discussing the alternatives, the patient opted for an indirect ceramic inlay. At the treatment visit, after anesthetizing the area, the old composites were removed and the tooth prepared to remove recurrent caries and staining at the old margins (Fig. 5).

A digital impression was taken of the preparation (Fig. 6) and opposing arch using an E4D digital scanner, the proposed inlay form examined (Fig. 7), and the scans transferred to the laboratory where the ceramic inlay was fabricated using CAD/CAM. At the patient’s seating appointment, the fit of the inlay was assessed. In this case, I selected OptiBond XTR (Kerr) 2-bottle self-etch universal adhesive with separate etch/primer and bonding agent, which is suitable for direct composite and all types of indirect restorations. I chose this adhesive system for 2 main reasons. Due to its unique chemistry, the high bond strength obtained with this adhesive is as high as that obtained with a traditional total-etch adhesive, and it offers high shear bond strength with both enamel and dentin. The OptiBond XTR adhesive system primer etches enamel and dentin, and its hydrophilic nature lets it better penetrate the dentin to help provide increased bonding to dentin. OptiBond XTR also has a thin film thickness, allowing for proper seating of the final restoration.

A distinct consideration in choosing OptiBond XTR, particularly since the preparation was large and deep, was the lack of post-operative sensitivity found with this adhesive. Post-operative sensitivity is a relatively frequent occurrence following restoration placement, and some studies have found this more likely to occur with a total-etch adhesive than with a self-etch adhesive.1 Although this may be due to overlying of the dentin and its desiccation leading to transient sensitivity, self-etch adhesives inherently leave less room for sensitivity to occur. OptiBond XTR has a mild pH of around 4 (versus a pH of around 2 for phosphoric acid etchants); it does not remove the smear layer or open dentinal tubules, instead preventing tubule exposure while still allowing for hybridization. OptiBond XTR contains proprietary chemistry that helps to prevent sensitivity, and its hydrophilicity ensures that the primer and adhesive can penetrate well into the dentin and seal off the surface of the dentin, helping to prevent sensitivity. Before placement of the ceramic inlay (LAVA Ultimate), it was first air-abraded at 15 psi and ultrasonically cleaned. It was then put aside while the preparation was treated.

The primer was applied to the enamel and dentin for 20 seconds with a gentle scrubbing motion then air-dried for 5 seconds to remove the solvent. Next, the bonding agent was applied (Fig. 8), agitating the brush gently over the enamel and dentin surface for 15 seconds. The adhesive was then gently air-dried (Fig. 9) and light-cured for 10 seconds. The bonding agent was then applied to the intaglio surface of the indirect ceramic inlay (Fig. 10) and gently air-dried for 5 seconds and light-cured for 10 seconds. NX3 Nexus (kerr) resin-based cement was then applied to the intaglio surface, the inlay carefully seated, and excess cement removed before light-curing all surfaces for 20 seconds each. NX3 Nexus resin-based cement is fully compatible with OptiBond XTR, making it a superior choice compared to other resin-based cements. The interproximal areas were checked for any residual cement, and the occlusion was checked before the patient left. The result was an aesthetic, durable restoration with excellent marginal integrity, excellent bond strength, and a satisfied patient (Fig. 11).

Summary
Our current adhesive system options are total-etch and self-etch variants. Without a patent and durable bond with high bond strength, restoration failure will occur with the breakdown of the bond even if all other aspects of the restoration are sound. Selecting a clinically proven adhesive ensures that you are choosing a material capable of performing under real-life conditions.

The adhesives used in the cases presented offer reliable, durable high-strength bonds, marginal integrity, easy clean-up, and ease of use.

Reference

About the Author
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Dr. Walter runs the CAD/CAM clinic at MUSC in addition to treating patients in faculty practice where Dr. Renne maintains an active general dentistry practice utilizing both the CEREC AC and E4D systems.