CLINICAL BRIEFS

Quick considerations for treatment success.

The Adhesive Class IV Design: Minimal Preparation and Biomodification

Douglas A. Terry, DDS, and Ronit Antebi, DMD

Douglas A. Terry, DDS
Assistant Professor
Department of Restorative Dentistry and Biomaterials
University of Texas Health Science Center, Dental Branch
Houston, TX

Adjunct Faculty
University of California, Los Angeles, Center for Esthetic Dentistry

Private Practice, Esthetic and Restorative Dentistry
Houston, TX
Email: dterry@dentalinstitute.com

Ronit Antebi, DMD
[Author: Please fill in affiliation information for Dr. Antebi.]

During the last half of the twentieth century, adhesive surface preparation of the enamel and dentin (ie, acid etching, self etching) and composite resin technology have been introduced, which allow minimal invasive procedures without a standard geometric preparation form.[1] Currently, the concept "prevention of extension" seeks to minimize the biologic cost to the natural tooth[2] by combining prevention, remineralization, and minimal intervention for the replacement of natural tooth structure and/or restorations. This new philosophy has three objectives: to preserve the maximum integrity of the natural dentition, to conserve tooth structure during preparation of a restoration, and to increase the longevity of a restoration between replacements. These three modern dental strategies (preservation, conservation, and longevity) can be applied to the Class IV composite restoration of a fractured anterior tooth. The purpose of this article is to describe a conservative technique for restoring a fractured incisor using a minimal Class IV preparation design with a new-formulation single-component self-etch adhesive system (G-Bond™, GC America, Alsip, IL) and a small-particle composite resin (Gradia® Direct, GC America, Alsip, IL).

SELF-ETCH TECHNIQUE

During the past several years, efforts have been made to eliminate the need for acid etching the cavity preparation before application of the dentin bonding agent. Two types (or categories) of bonding agents are used with the self-etching strategy: a two-component system (combined etching/priming solution and a bonding agent) or a single-component system (etching, priming, and bonding material).

The self-etching primer strategy leaves the smear layer in place. These dentin bonding systems are based on the infiltration and modification of the smear layer by an acidic monomer. The objective is to reinforce the bonding of the smear layer to the underlying dentin. These slightly acidic, hydrophilic primers penetrate the smear layer and achieve micromechanical and chemical bonding of the smear layer to the underlying dentin. This technique allows the simultaneous infiltration of the collagen fibers and decalcification of the inorganic component to the same depth in dentin, thereby minimizing the risk of not reinforcing part of the demineralized dentin. Additionally, this prevents the collapse of the collagen fibrils after conditioning and drying. The resin may slightly (0.1 μm to 0.5 μm) [Author: Is microns here correct?] infiltrate the smear layer and the dentin and copolymerize.[3]

EMPIRICAL DATA

Self-etch materials have been evaluated in numerous studies.[4] [Author: You mention numerous studies, but cite only one. Please either edit the text or add additional references.] Some of these studies indicate that enamel bonding with self-etch adhesives is as effective as enamel bonding after conventional phosphoric acid etching.[4] Evidence of enamel leakage has been reported clinically in Class II and Class V composite restorations and in vitro in Class I and Class V restorations when a self-etch adhesive was used as a dentin-enamel adhesive.[4] Other studies demonstrate that self-etch adhesives are effective on ground enamel, but less effective on intact enamel.[4] [Author: "Other studies" are mentioned here, but it is the same reference.] A study by Perdigao and Geraldeli reported that commercial self-etch adhesives performed better on prepared enamel than on unprepared enamel. This study suggests that for all-in-one self-etch adhesives, instrumentation of unprepared enamel may be critical for their ability to bond to enamel.[4] The authors suggest that it may be prudent to acid etch any peripheral

Figure 1 Preoperative facial view of a horizontal fracture in the maxillary right lateral incisor (tooth no. 7). [Author: Correct?]

Figure 2 A single-component self-etch adhesive was applied to the entire cavity surface and allowed to dwell for 10 seconds.

Figure 3 The self-etch adhesive was air dried under maximum air pressure for 5 seconds in the presence of vacuum suction.

Figure 4 The self-etch adhesive was light cured for 10 seconds with a halogen light curing unit (Coe Lunar TA, GC America, Alsip, IL). [Author: Please verify product. Could not be confirmed.]

Figure 5 To disguise the silhouette of the cavity form, an artificial dentin core was developed with an opaque [Author: Edit here okay?] A02-shaded hybrid composite resin.

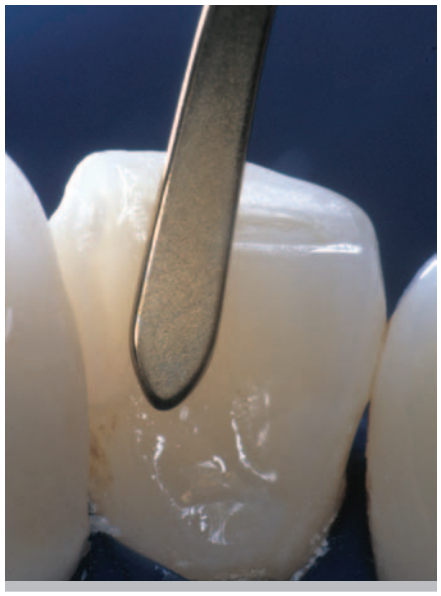

Figure 6 A translucent-shaded hybrid composite resin was applied, sculpted, and smoothed to the lingual aspect with a curved instrument and light cured for 40 seconds.

Figure 7 The first artificial enamel layer, an A-1 shaded hybrid composite resin was applied to the facial aspect and contoured with a long-bladed composite instrument.

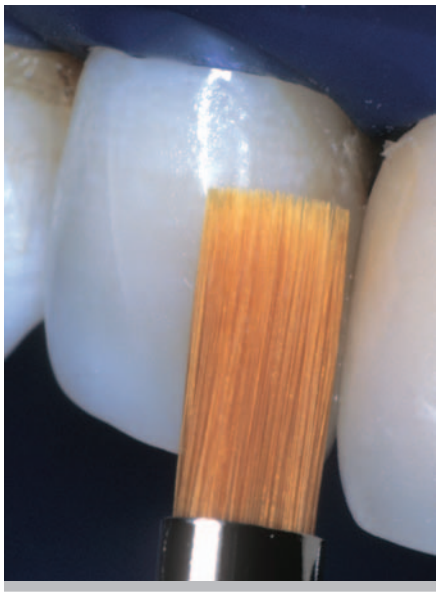

Figure 8 The final artificial enamel layer, a translucent-shaded hybrid was applied, adapted, and smoothed into an ideal anatomical contour with a sable brush.

THE CLINICAL ADVANTAGES OF A SELF-ETCH A CONVENTIONAL ADHESIVE TECHNIQUE INCLUDE THE FORMER'S SIMPLICITY AND REDUCED POSTOPERATIVE SENSITIVITY.

Figure 9 The facial contouring was performed with a 30-fluted needle-shaped finishing bur.

Figure 10 The postoperative result achieved with the use of this direct composite resin reflects the harmonious integration of natural tooth structure with restorative material and color.

enamel margins to minimize the potential of microleakage and enhance bond strength to enamel; however, it is important not to etch the dentin.

SELECTING AN ADHESIVE STRATEGY

The clinical advantages of a self-etch adhesive versus a conventional adhesive technique include the former's simplicity and reduced postoperative sensitivity. Self-etch systems do not require acid etching or the washing off of acid. The self-etch adhesives are also less technique sensitive than acid-etch adhesives, and this can be seen in four categories.

First, because water is a fundamental ingredient of self-etch systems (allowing ionization of the acidic monomers for demineralization of hard dental tissues), the technique sensitivity associated with substrate hydration is eliminated.[5] Second, in comparison to acid-etch adhesives, self-etch adhesives do not allow a discrepancy between the depth of demineralization and depth of resin infiltration because both processes occur simultaneously.[4] Third, since the smear plugs are not removed before the application of the adhesive, the potential for postoperative sensitivity is less than with total-etch adhesives.[4] Finally, the use of a dentin primer on enamel, which is required of multi-bottle total-etch adhesives used with the moist bonding technique, is not required for self-etch adhesives.[4]

The goals for future adhesive systems are simplicity of application as well as quality of adhesion. Because clinicians desire restorative materials that are "user friendly," these simplified self-etch dentin adhesives offer another option. Clinical efficacy and simplicity of application, however, must not be confused with the demands required of the operator's attention to meticulous detail when considering diagnosis, treatment planning, and the balance of the associated aspects of restorative care.

RESTORATIVE PROCEDURE

A 53-year-old woman presented with an oblique, vertical fracture on the maxillary right lateral incisor (tooth no. 7) [Author: Correct?]. A previsualized composite mock-up was made with the proper selection of composite restorative materials. The orientation of the restorative materials was charted so that the definitive restoration could be visualized before completion. A 0.5-mm bevel was placed in enamel around the entire margin. The enamel margin was etched for 15 seconds with 37.5% phosphoric acid, rinsed for 5 seconds, and gently air dried for 5 seconds. (The etch should extend several millimeters beyond the bevels.) A single-component self-etch adhesive (G-Bond) was applied to the entire cavity preparation according to the manufacturer's recommendation and light cured. The tooth was restored using an incremental layering technique with a small particle composite resin (Gradia Direct). This procedure demonstrates that by using a conservative adhesive preparation design in combination with proper adhesive techniques and a methodological protocol of incremental application of composite resins, the clinician can transform a Class IV fracture into a final restoration with an esthetic natural appearance (Figures 1 through 10).

CONCLUSION

Knowledge and a desire to create are limited by the products available to clinicians for restorative procedures. Advancements in restorative materials and adhesive technology have enabled the development of direct bonding techniques that allow the provision of conservative treatment while allowing clinicians to combine form, function, and esthetics for predictable restorative success.

REFERENCES

1. Osborne JW. Extension for prevention: is it relevant today? *Am J Dent.* 1998;11(4):189-196.
2. Mount GJ, Ngo H. Minimal intervention: early lesions. *Quintessence Int.* 2000;31(8):535-546.
3. Eick JD, Robinson SJ, Chappell RP, et al. The dentinal surface: its influence on dentinal adhesion. Part III. *Quintessence Int.* 1993;24(8):571-582.
4. Perdigao J, Geraldeli S. Bonding characteristics of self-etching adhesives to intact versus prepared enamel. *J Esthet Restor* Dent. 2003;15(1):32-42.
5. Pashley DH, Tay FR. Aggressiveness of contemporary self-etching adhesives. Part II: etching effects on underground enamel. *Dent Mater.* 2001;17(5):430-444.