

Self-etch adhesives: Beyond the quest for low post-operative sensitivity

With the advent of self-etching adhesives in the 1990s, dentists now have an option for bonding dentin and enamel without the need for a separate etchant. This innovation simplifies the bonding procedure and reduces the potential for patient sensitivity.

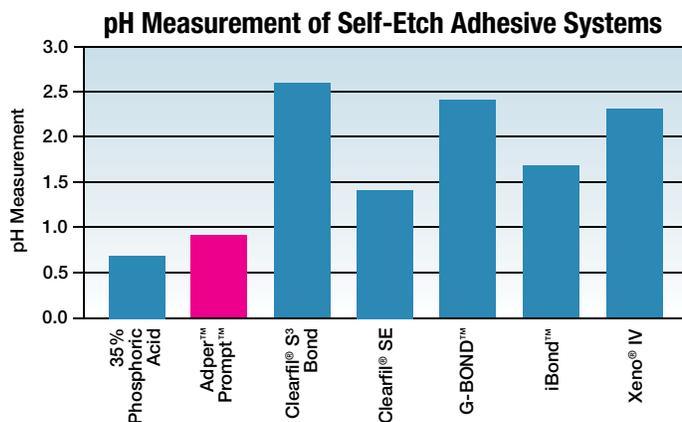
That reduction in sensitivity has been the primary appeal of these materials to date. Recently, however, researchers have begun to focus attention on the real adhesion performance of these materials on dentin and enamel – particularly intact enamel.

Self-etch adhesives rely on the use of phosphorylated methacrylate monomers that become acidic when combined with water. These acidic adhesives demineralize, or "etch," tooth surfaces while simultaneously penetrating into the tooth, forming a strong micromechanical bond.

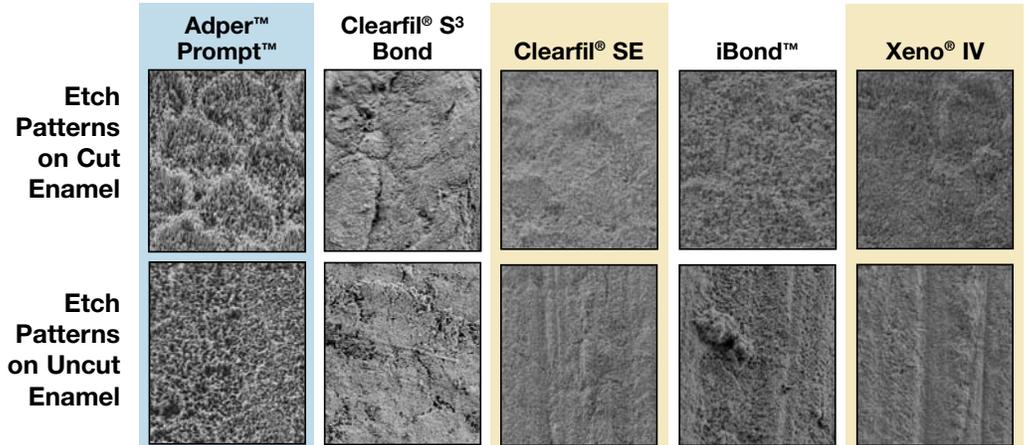
On dentin, this simultaneous etching and penetration, without rinsing, helps reduce the potential for sensitivity because dentinal tubules are more likely to remain sealed.

Virtually all self-etch systems offer reduced sensitivity. Where they differ is in their pH levels. To provide an adequate etch, particularly on uncut enamel, an adhesive must maintain a strong acidity. Without a low pH, a self-etch system may lack the ability to sufficiently etch and penetrate enamel surfaces.

The lower the pH, the deeper the etch. The pH of a typical phosphoric acid etchant is about 0.7. Most self-etch adhesives measure significantly higher.



Adper Prompt maintains a lower pH because its adhesive and etch components are not combined until the moment of application. The competing self-etch adhesive systems in this study all recommend uncut enamel be treated with an etching gel prior to adhesive placement.



The lower pH of Adper Prompt adhesive provides a more pronounced etch than other self-etch adhesives, allowing for use on UNCUT enamel without a separate acid-etch step.

5,000X magnification of uncut surfaces [3M ESPE Internal Data]

Single-bottle self-etch adhesives may seem convenient – but research shows that their higher pH makes them less effective on uncut enamel.

3M™ ESPE™ Adper™ Prompt™ Self-Etch Adhesive, with its pH of 0.8, can provide a deep etch pattern on enamel surfaces, as indicated in the SEM images.

Less acidic self-etch adhesive systems cannot provide as deep an etch pattern. In fact, most of these products actually require that a separate phosphoric acid etch be performed on uncut enamel surfaces prior to adhesive placement.

These products are often specifically designed to be less acidic to prolong shelf life. Once phosphorylated adhesive components are combined with water, their

acidic characteristics are activated. This causes the methacrylate monomers to become prone to hydrolytic degradation, resulting in decreased performance and shorter shelf life.

Systems like Adper Prompt adhesive avoid degradation by delaying the mixing of water and adhesive until just prior to use. As a result, they can be formulated at a lower pH.

Some manufacturers prefer to combine water and adhesive components to eliminate the need for mixing. To prevent hydrolysis, the adhesive is formulated to a higher pH. Even so, many still require mandatory daily refrigeration to reach the stated shelf life.

Newer single-bottle self-etch products and the acidic-based primers of two-component systems fall into this second category. As a result, they are less effective on uncut enamel surfaces and generally require a separate phosphoric acid treatment on enamel prior to placement of the adhesive.

Conclusion

The first wave of self-etch adhesives were driven by the desire to reduce patient sensitivity. Now, the bigger challenge is to find a self-etch adhesive that can also form a strong bond consistently to uncut enamel, prepared enamel and dentin surfaces, but maintains the benefits of a longer shelf-life.

For the time being, only self-etch adhesives that maintain a low pH, like Adper Prompt Self-Etch Adhesive, can offer strong bond performance on intact enamel surfaces without a separate etch step. That makes them the best choice for true convenience and versatility.

For more product information or testing details, please call 1-800-634-2249, or visit www.3MESPE.com/clinprosealant.