

Ask the Expert: An Interview with Nate Lawson, DMD, PhD on Universal Adhesives



Nate Lawson
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Dr. Lawson is the Director of the Division of Biomaterials at the University of Alabama at Birmingham School of Dentistry and the program director of the Biomaterials residency program. He graduated from UAB School of Dentistry in 2011 and obtained his PhD in Biomedical Engineering in 2012. His research interests are the mechanical, optical, and biologic properties of dental materials and clinical evaluation of new dental materials. He was the 2016 recipient of the Stanford New Investigator Award and the 2017 3M Innovative Research Fellowship both from the American Dental Association. He served on the American Dental Association Council of Scientific Affairs and is on the editorial board of The Journal of Adhesive Dentistry and Compendium. He has lectured nationally and internationally on the subject of dental materials. He also works as a general dentist in the UAB Faculty Practice.

What is a universal adhesive?

A A “universal” adhesive is not a technical term but rather a clinical term. It implies that an adhesive can be used with or without phosphoric acid on dentin or enamel. In scientific writing, these adhesives are sometimes referred to as mild self-etch adhesives because they have a slightly less acidic pH (around 3) than typical self-etch materials (around 2). Another implication of a “universal” is the addition of monomers that allow bonding to indirect restorations, namely the monomers silane (for glass-based ceramics) or 10-MDP (for zirconia and some metals). Universal adhesives are typically single-bottle systems.

Should dentin and/or enamel be etched with phosphoric acid before bonding?

A It is my belief that enamel should be etched prior to use of any universal adhesive for several reasons. First, the pH of universal adhesives (around 3) is less acidic than previous self-etch primers (around 2) and phosphoric acid (less than 1). Second, universal adhesives do not provide a good etch pattern on enamel when observed under scanning electron microscopy. Finally, we performed a clinical trial with a common universal adhesive and reported that there was less marginal discoloration and less restoration debonding when enamel was etched.

Regarding dentin, we typically measure a high bond strength with universal adhesives in our laboratory when dentin is self-etched. When performing self-etch, it is important to agitate the adhesive, adequately evaporate all solvent from the adhesive, and adequately cure the adhesive.

My preferred bonding technique is the selective etch method, in which enamel is etched with phosphoric acid and dentin is self-etched using a universal adhesive.

Why is over-etching dentin a problem?

A When dentin is etched with phosphoric acid, the mineral content of the dentin (hydroxyapatite) is removed, and demineralized collagen is left behind. To bond to dentin, an adhesive is applied, and it infiltrates into the demineralized collagen to form a hybrid layer. If dentin is over-etched, more mineral is removed, and the depth of demineralized collagen increases. Now, the mostly hydrophobic adhesive does

not want to fully infiltrate the somewhat wet collagen. Therefore, there are voids at the bottom of the hybrid layer. These voids are more susceptible to hydrolytic or enzymatic degradation.

What function does a dual-cure activator play, and what are the advantages/disadvantages of using a dual-cure activator?

A With some combinations of materials, using a self-etch adhesive will prevent the chemical set of a dual- or chemical-cure material overlying it. A clinical example would be using a self-etch universal adhesive on a prepared tooth that is light-cured and then covered by dual-cure core material that is allowed to chemically-cure. The incompatibility could cause a debond between the tooth and the core material. To prevent this situation, a dual-cure activator could be mixed with the universal adhesive before being applied to the tooth. Dual-cure activators contain salts (i.e., arylsulfonate salts), which when mixed with a self-etching adhesive, make the adhesive compatible with self- and dual-cure core materials or cements. A dual-cure activator does not make the adhesive itself capable of a chemical-cure.

How is a universal adhesive used in a post and core technique?

A The use of a universal adhesive in a post and core technique would be no different from its use in any clinical scenario, except for the unique difficulty of light polymerization in the post space and the potential use of a dual- or self-cure material as the post cement and core material.

There are several methods to address the first clinical challenge of adequately curing the adhesive in the post space beyond aiming the light into the dark abyss of an often 6+ mm post space. First, a dual-cured adhesive may be used. These are typically 2-bottle systems, and they are not common. Second, the adhesive may be used with a dual-cured cement, which contains initiators to chemically-cure the adhesive, sometimes referred to as “contact cure.” Third, the adhesive may be co-cured with the post cement through a light-transmitting fiber post.

The issue with using a universal adhesive with a dual- or chemical-cured core material is that the acidity of universal adhesive can inhibit the amine-based chemical set of a core material. Therefore, some manufacturers recommend using a dual-cure activator with their universal adhesive if it will be used with any dual- or chemical-cured core material.

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