Clinical Recipe for Durable Dental Bonding: Why and How?

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IAAD WORKING INSTRUCTIONS

Current dental adhesive technology involves either an etch-and-rinse or self-etching approach.[8] Evidence of clinical durability exists for both approaches, albeit depending on the specific brand.[4,5] Today, enamel still requires phosphoric-acid etching and thus an etch-and-rinse approach to obtain a durable bond. The adhesive-enamel bond seals the cavity and even protects the more vulnerable bond to adjacent dentin.[3] Although functional monomers in self-etching adhesives are designed to chemically interact with hydroxyapatite (HAp), the structure, size, and orientation of enamel HAp crystals appear to provide insufficient chemical bonding sites to achieve durable bonding to enamel. As a rule, the micromechanical interlocking provided by the etch-and-rinse step remains necessary. For dentin, phosphoric acid may be less preferable, as adhesives generally cannot envelop the exposed collagen tightly enough to make the relatively thick hybrid layer resistant to hydrolytic and enzymatic degradation processes.[2] Ethanol wet bonding[6] and biomimetic repair[7] by remineralization of etch-and-rinse hybrid layers have proven to be effective. However, these techniques are rather time consuming, which makes their applicability questionable for routine clinical practice. Moreover, the use of MMP inhibitors applied separately or mixed with the primer/adhesive appeared to retard rather than prevent bond degradation.[1,6] Another strategy employed in the attempt to improve bond durability to dentin involves chemical interaction of functional monomers with HAp following a “mild” self-etching approach.[9] Among the current functional monomers investigated, the phosphate monomers 10-MDP and more recently also MF8P were documented to bond durably to hydroxyapatite.[9,12] In addition, correlative chemical (XRD, NMR) and high-resolution (TEM) structural interfacial analysis revealed that both monomers self-assemble into nanolayers, consisting of two monomer molecules joined by stable monomer-Ca salt formation.[10,11] The stable bond formed to HAp along with interfacial nanolayering is thought to be the basis for the more biodegradation-resistant adhesive interface. Strategies to intensify nanolayering need to be explored further.

Do	Why
Selectively etch enamel for 15 s minimum with phosphoric acid and rinse.	Enamel requires microretention; attempt to avoid etching dentin, but realize that this is not crucial.
Rub a 10-MDP-based self-etching primer for 15 s minimum onto the etched enamel and unetched dentin, and air thin until the primer film no longer moves.	10-MDP ionically bonds to HAp and self-assembles into nanolayers.
Apply a solvent-free adhesive resin, air thin, and light cure separately prior to the first layer of composite.	To seal and stabilize the adhesive interface; in case of indirect bonding, employ the ‘immediate sealing’ (multi-visit treatment) approach or air thin (no pooling) the adhesive prior to light curing (one-visit treatment) in order not to impair the restoration fit.

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