On our way towards self-adhesive restorative materials?

Dental adhesive technology continues to evolve at a rapid pace. We learned to bond effectively and durably to enamel more than 50 years ago. Bonding to dentin has always been more challenging and has slowed down our adhesive endeavors for a long time. Nevertheless, adhesively restoring teeth in a reliable, predictable, and durable way can today be considered a reality. Dentin adhesion now implies using one of two approaches, namely the etch-and-rinse (E&R) or self-etch (SE) bonding mode. The E&R technique necessitates phosphoric-acid etching to produce deep etching pits in the hydroxyapatite-rich enamel and dentin demineralization to a depth of a few microns to expose a hydroxyapatite-free collagen network. Alternatively, the SE approach simplifies dentin adhesion by bypassing the etching process through incorporation of specific monomers with acidic functional groups, which simultaneously condition and chemically bond to calcium in the hydroxyapatite-rich hybrid layer. Both bonding modes have their pros and cons in terms of bonding effectiveness and long-term bond durability. Product dependency and clearly better bonding performance of the multistep than the simplified single-step adhesives has been scientifically documented. In the most recent generation of universal adhesives, both E&R and SE bonding modes have been combined, enabling the practicing dentist to choose the bonding mode depending on his/her personal preference/conviction or to vary the bonding mode depending on the actual cavity and tooth conditions.

While the mechanisms responsible for bonding reliably and durably to enamel and dentin are very well known, much R&D effort today is devoted to further simplifying clinical bonding procedures. One typical example is the most recent Japanese R&D move towards “quick” bonding technology. Such “superglue” adhesives with instant adhesive power are applied, dried, and cured with no need to wait, rub in thoroughly or apply in several coats. They allegedly guarantee optimal bonding through a simple procedure for all direct and indirect restorations when using them “universally” as the operator wishes, in “full” SE, “selective” enamel etching with SE, or “total” E&R mode.

One further simplification involves the development of self-adhesive restorative materials that no longer need separate pre-application of an adhesive. They are the logical advancement of self-adhesive luting composites, obviously for restorative procedures requiring a higher level of self-adhesiveness. While the first self-adhering restorative composites were released quite some years ago, their well-documented inferior performance, both in laboratory and clinical research, did not lead to a true breakthrough. However, it seems that a new era of self-adhesive restorative materials is just around the corner, as new self-adhesive dental restoratives are being developed and marketed by different companies.

When producing self-adhesive restoratives, some companies (first) target developing countries and position their new product on the dental market as an amalgam replacement, in part also in response to the global initiative of the United Nations Environment Program (UNEP) to reduce mercury consumption. Even though UNEP has questioned the environmental safety of amalgam, amalgam indeed remains the posterior restorative material of choice in many developing countries, where access to modern esthetic and more expensive dental composites is difficult. Specially developed for these markets, such self-adhesive filling materials can nevertheless be a cost-efficient substitute for amalgam with a much better esthetic outcome. They are commonly instructed to be placed in bulk, like amalgam, without any additional adhesion-promoting means in retentive “amalgam” cavities, while a separate prior etching step or adhesive application remains recommended to restore teeth that do not provide much macroretention. They are often powder-liquid formulations that claim to combine the simplicity of glass-ionomer cement with the stability of conventional composite without sacrificing the esthetic outcome. When dentists can fill a cavity without an adhesive in just one bulk layer, the filling procedure is definitely more efficient, in particular when such compromise materials are applied in less demanding cases where clinical time or financial aspects also have to be considered.

Other self-adhesive formulations claim additional bioactive properties, for instance, the American product that included a bioactive claim in its product name. According to the product specifcations, this material is a “highly esthetic, bioactive composite that delivers all the advantages of glass ionomers in a strong, resilient resin matrix, while it chemically bonds to teeth, seals against microleakage, releases calcium, phosphate and fluoride, is more bioactive than glass ionomers, and is more durable and fracture resistant than composites”. According to the origi-

nal instructions for this product, it was to be applied in a nearly self-adhesive mode, solely requiring brief etching in retentive cavities, while an adhesive was additionally recommended in non-retentive cavities. A recently published randomized clinical trial investigating this material for posterior restorations when applied according to manufacturer's instructions was discontinued already at one year due to an "unacceptable very high one-year failure frequency".[1] The authors concluded that further studies investigating this product should be conducted using a bonding agent, which obviously means that not only can the material no longer be considered self-adhesive, the alleged bioactive interaction with the surrounding tooth tissue is also highly questionable as the material no longer directly contacts the tooth tissue. Fortunately, the company adapted the material's instructions for use, now instructing not only to etch, but also to apply an adhesive of choice.

This example emphasizes the great remaining need for sound laboratory and clinical research on newly developed self-adhesive restorative materials, for which we hope that authors will choose the *Journal of Adhesive Dentistry* as the journal in which to publish their research findings and reach readers.

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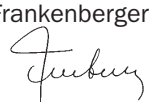

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