What's next after "universal" adhesives, "bioactive" adhesives?

Dear Readers,
It should be said that today's adhesives perform well! Three-step bonding protocols, either combining selective enamel-etching (etch-and-rinse) with a 2-step self-etch bonding mode or a full 3-step etch-and-rinse bonding mode are considered to perform best. Scientific evidence has proven their superiority based on consistent and aging-resistant laboratory performance as well as clinical service longer than 10 years in the mouth of patients. Nevertheless, a clear product depencency cannot be fully ignored, so it is hoped that general dentists will choose adhesives with proven laboratory and clinical performance.

The newest generation of adhesives comprise so-called universal adhesives. "Universal" means that the adhesive can be employed for both direct and indirect restorations, while the dentist also can choose either an etch-and-rinse or self-etch bonding mode using one and the same adhesive. The latter is advantageous, as one should no longer select either an etch-and-rinse or self-etch adhesive a priori; depending on the cavity conditions and/or the dentist's preference, a fully self-etch or etch-and-rinse bonding protocol, or a combined selective enamel etch-and-rinse with a self-etch bonding protocol can be employed to adhesively restore the tooth. It is noteworthy that most of these universal adhesives contain the functional monomer 10-MDP, renowned for its strong and durable chemical interaction potential with hydroxyapatite, which involves the formation of stable monomer-Ca salts and even self-assembly into structurally stable nanolayers, at least when applied in a self-etch mode. With a mainly diffusion-based micromechanical bonding mechanism, the function of 10-MDP is not entirely clear when universal adhesives are used in an etch-and-rinse mode. There have been some reports on chemical interaction with collagen, but this definitely requires further in-depth research to confirm the relevance of these findings with regard to the durability of the adhesive interface. Although most universal adhesives contain 10-MDP, differences in performance among 10-MDP-based adhesives may still exist, as the 10-MDP concentration and quality (purity) have been shown to significantly affect bonding effectiveness. Today, data on monomer concentration and quality are commonly not released by manufacturers and thus remain unknown. Another concern exists regarding the effectiveness and stability of an incorporated silane functional monomer in some universal adhesives for indirect bonding purposes of ceramic restorations; the separate use of silane primers is thus still recommended.

Have adhesives reached a clinical performance level that hardly can be improved? Have we reached a success rate well above 90% of what can be achieved with dental adhesion, as has been reported for osseointegration of dental implants? To clinically distinguish adhesives in terms of bonding performance, a much longer follow-up is needed today to observe differences in clinical performance for the newest adhesive generations, even compared to traditional gold-standard multi-step adhesives. In addition, many current lecturers and papers stress that factors such as the patient and operator may have a higher impact on the restoration longevity than the actual adhesive materials employed. Nevertheless, further research and development remain needed to make adhesives less technique sensitive in conditions of suboptimal field control and eventually to develop economic, easy-to-place and hopefully self-adhesive "true" amalgam alternatives.

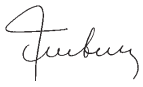
In current research, the hype is to develop adhesive materials that do more than just bond to tooth tissue. We all desire materials that have additional therapeutic

potential, to be able to make our cavity preparations even less invasive and to prevent early restoration replacement due to bond degradation and even caries recurrence. Such a therapeutic effect is generally known as "bioactivity". Bioactivity may involve anti-bacterial, anti-enzymatic, and/or re-mineralization effects, all highly desirable material properties. Nevertheless, while it may not be that difficult to design and develop bioactive adhesive materials, combining "bioactivity" with mechanical "stability" may pose the greatest challenge.

JAD looks forward to receiving your manuscripts on the newest dental adhesive challenges.

Sincerely yours,

Bart Van Meerbeek



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