



Opinion Piece Articles

Evolution of dentin bonding agents

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ABSTRACT

Dentin bonding agents are resin materials that provide stable and long-lasting bond strength to make a dental composite filling material adhere to both dentin and enamel. They have myriad applications in the field of dentistry but are still being improvised. The purpose of this article is to discuss the evolution of dentin bonding agents and current concepts on routine adhesion techniques.

Keywords: Dentin bonding agent, Adhesion, Primer

INTRODUCTION

Adhesive bonding to tooth structure has been a fundamental part of the contemporary restorative practice that has been proved to improve the biomechanical and esthetic outcomes of restorations. Effective bonding seals dentinal tubules and restoration margins which would prevent microleakage and the adverse consequences such as post-restoration hypersensitivity, recurrent caries, discoloration of restorative margins, and detrimental effects on the pulp. In addition, it would eliminate the necessity for undercuts, thereby preserving the tooth structure.

In the past two decades, there has been a rapid evolution in the field of adhesive dentistry. Efforts have been taken to improvise bond strength and simplify the restorative procedure.

The most cited reasons noted for the failure of adhesive restorations are loss of retention and marginal adaptation.^[1,2] A viable method to prolong the clinical life of dental adhesives is to emphasize improvising the long-term stability of the bond strength of these biomaterials to hard tissues, especially dentin.

While many advances have been made in adhesive dentistry, the bond interface remains challenging.^[3] Water sorption is believed to be the core factor destabilizing the bond between adhesive and tooth, although the actual interfacial degradation mechanisms are not completely understood.^[4,5] Moreover, the other aspects to consider are the chemical and mechanical challenges intrinsic to the oral environment, such as moisture, masticatory stress, temperature changes, pH of the oral cavity, diet, and chewing habits.^[6]

One of the major developments has been to abridge the bonding process by use of all-in-one adhesives, but according to the review published by Van Meerbeek *et al.*, “the conventional three-step etch and rinse adhesives and two-step self-etch adhesives are still the benchmarks for dental adhesion in routine clinical practice.”^[7] All-in-one adhesives have certainly enhanced

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over the past decade, and the development of functional monomers with strong and stable chemical affinity to hydroxyapatite crystals has aided in the contribution of adhesion technology.^[8]

Despite adhesives reaching an acceptable level of bond strength,^[9] efforts have been taken on reducing the number of application steps since the use of multi-step denting bonding agents was time-consuming.

The two-step 5th generation bonding agents which use simultaneous enamel and dentin etching systems have shown favorable clinical efficacy. A radical innovation in dentin bonding agents was the use of acidic adhesives which enables the simultaneous application of acid, primer, and bonding agent altogether as seen in 6th and 7th generation bonding systems.^[8] Apart from the ease of application, the mechanism of action of the 6th and 7th generation is surface demineralization of dentin and concurrent penetration of monomers into the porosities.^[10] The one-step system shortens the bonding process and is advantageous for use.^[11]

Development in nanotech dentistry has led to the progression of nanocomposites and nanoadhesives which chiefly contain nanosized fillers. They are principally solutions that contain nanofiller particles to yield better enamel and dentin bond strength, stress absorption, and increased shelf life.^[12] It has been pragmatic that filled bonding agents resulted in higher *in vitro* bond strength.^[13]

A recent advancement has been introduced by GC which is the nanofilled 8th generation dentin bonding agent (G-Premio Bond).^[14] To date, there have been limited studies comparing the shear bond strength of this newly introduced 8th generation bonding agent (G-Premio Bond) with the 5th, 6th, and 7th generation bonding agents.^[15]

APPLICATION FOR EACH GENERATION

5th generation: Adper single bond 2

The adhesive system was applied according to the manufacturer's instructions for each test group.

Etchant was applied to dentin for 15 s and then rinsed for 10 s. The excess water was blot dried using a cotton pellet. After blotting, 2–3 consecutive coats of adhesive were applied to etched dentin for 15 s with gentle agitation using a fully saturated applicator. Gentle air-drying was done for 5 s to evaporate solvents and light-cured for 10 s.

6th generation: Clearfil SE (Kuraray)

In this group, 6th generation primer (Clearfil SE, Kuraray) was applied to the dentin surface and left for 20 s and air-dried mildly, then bonding agent was applied and evenly distributed with airflow and light-cured for 10 s.

7th generation: Single bond universal (3M)

The 7th generation bonding agent (Single Bond Universal, 3M) was applied to the dentin surface by scrubbing action for 20 s, air drying of adhesive was done for 5 s followed by 10 s of light curing.

8th generation: G-Premio Bond (GC)

The 8th generation bonding agent is compatible with total-etch, self-etch, and selective etch techniques. It provides excellent versatility and perfectly adapts to all direct restorations and can also be used to repair indirect restorations without the use of a primer, and also in combination with a silane when repairing glass or hybrid ceramic and is also ideal for hypersensitivity.

A unique combination of three functional monomers (4-MET, MDP, and MDTP), notably excluding HEMA, confirms its excellent stability and good bond strengths not just to tooth tissue but to all indirect substrates, including composites, precious and non-precious metals, zirconia, and alumina for all repair cases.

The 8th generation bonding agent was applied to tooth structure using a micro brush and left undisturbed for 10 s after application, followed by thoroughly air drying for 5 s under maximum air pressure and light-cured for 10 s.

CONCLUSION

Dentin bonding agents have dramatically improved in recent years. These adhesive systems have the ability to decrease or eliminate postoperative sensitivity, and reduce microleakage and enhance the bond strength.

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Conflicts of interest

There are no conflicts of interest.

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