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Letter to the Editor

Evaluation of Shear Bond Strength of Giomer in Comparison with Two Dentin Adhesive Systems

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Dear Editor-in-Chief

Restorative dentistry is mainly based on good adhesion between restorative materials and dental substrates; while adhesion to enamel is generally reliable, adhesion to dentin is less predictable (1) because of the presence of dentinal tubulis and the perfusion of liquids from it.

Adhesion to dentin requires demineralization of peritubular and intertubular dentin to replace the demineralized layer of dentin with monomers.

The main role of adhesive materials is to insure good adhesion between tooth tissues and restorative materials while maintaining good marginal seal.

Formation of hybrid layer between adhesive material and dentin depends on penetration of monomers through collagen fibers, this can be seen with total etch adhesive techniques.

The obstacle with this technique is the collapse of collagen fibers due to rinsing and air drying procedures after the application of acid which makes the use of total etch adhesive technique sensitive and results in poor penetration of monomers to the full depth of the demineralized layer of dentin.

Because of the complexity and sensitivity of total etch adhesive technique, a new generation of dental bonding was needed and self-etch adhesive was introduced.

Evaluation of shear bond strength is performed using a shear stress machine (e.g. Testometric; (Testometric Company Ltd, Lancashire, UK) on prepared samples by considering multiple factors that affect this evaluation (Fig. 1).

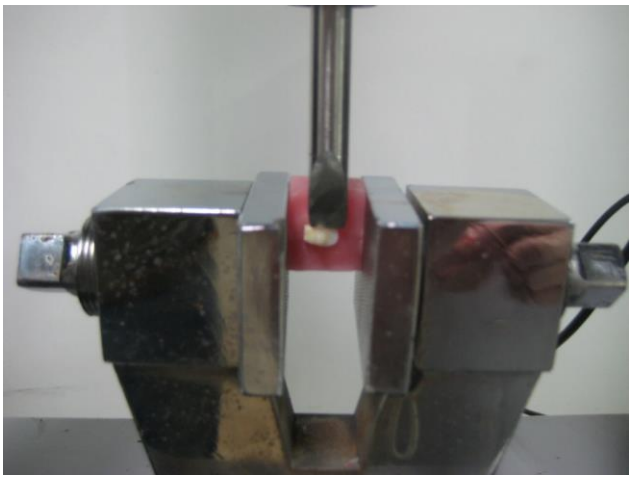

Fig. 1: Application of shear stress on specimen by a universal testing machine

The main objective of shear bond strength evaluation is to assess the quality of adhesion to dental substrates in order to help dental practitioners to choose amongst many types of adhesives and restorative materials (2).

For this purpose we compared shear bond strength of two dentin adhesive generations used with two types of restorative materials.

Total-etch adhesive and self-etch adhesives did not perform equally, whereas both self-etch adhesives did not show significant differences.

One of the main factors affecting shear strength is the elasticity of adhesive material and its ability to resist stresses before failure occurs, thus the adhesive layer should act as an elastic buffer against stresses (3).

There are many factors affecting the stiffness of hybrid layer such as modulus of elasticity of its components, thickness of hybrid layer and degree of interaction amongst its contents (4).

One of the main factors affecting elasticity of adhesive material is the type of monomer composing it. The presence of bisphenol A-glycidyl methacrylate (BIS-GMA) makes the adhesive more stiff because of its high molecular volume comparing to other monomers like urethane dimethacrylate (UDMA) and triethylene glycol dimethacrylate (TEGDMA) which make the adhesive more elastic.

The absence of (BIS-GMA) inside the adhesive makes it more elastic and more able to tolerate stress comparing to adhesive which has more content of (BIS-GMA).

Other factor may interfere is the depth of demineralization when using aggressive etching used with total etch. If high molecular volume (BIS-GMA) is used in adhesive, monomers cannot infiltrate through the demnineralized dentin layer which will lead to formation of collagen unbounded area below the hybrid layer and that could lead to liquid perfusion from tubulis which undermines the integrity of hybrid layer.

Weak demineralization used with self-etch adhesive results in the formation of thin hybrid layer of collagens, monomers, and mineralized salts without any porous space below the hybrid layer (5) .

Besides, presence of hydrophilic substance in the adhesive system like (HEMA) deteriorates the quality of adhesion. More there are polar groups in the adhesive substance more it is hydrophilic, which means adhesive material absorbs much water that will lead to decomposition of the hybrid layer and finally failure of the adhesion.

Failure mode could be divided in; adhesive if failure occurred between dentin and restorative materials, cohesive if occurred inside the restorative material, or mixture if surface showed combination of restorative materials and dentin.

Adhesive failure was mostly observed in group where total etch adhesive was used, this could be explained by low adhesion force between dentin and adhesive material.

Cohesive failure is rare because of two reasons; the flexibility of the tooth-restorative complex and the inability to separate adhesive from restorative materials due to their chemical composition similarity.

Shear bond strength is superior in groups restored with self-etch adhesives free of (HEMA) & (BIS-GMA). Simple application techniques, moderate etch aggressiveness and low sensitivity beside its good performance make the clinical choice of sixth generation's adhesives an advantage.

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