COMMENTARY

INFLUENCE OF DIFFERENTLY ORIENTED DENTIN SURFACES AND THE REGIONAL VARIATION OF SPECIMENS ON ADHESIVE LAYER THICKNESS AND BOND STRENGTH

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Bonding to dentin is still very challenging because of its heterogeneous nature, with variations in type, depth, location, and intrinsic wetness. In addition, dentin bonding systems contain a complex chemistry, with hydrophilic and hydrophobic components with the intent to bond to dentin and provide hydrolytic stability. Current adhesive systems bond very well to dentin in the short term; however, they lack hydrolytic stability, showing a dramatic decrease in long-term bond strength. Studies have reported that adhesive resins are permeable membranes, permitting fluid movement because of the osmotic pressure gradient across the cured adhesive layer. This results in microscopic water droplets along the adhesive layer, which may lead to failure over time.¹

Drs. Pazinatto and Atta reported that Single Bond (3M ESPE, St. Paul, MN, USA) generated a thicker adhesive layer as compared with Prime and Bond 2.1, which is well understood as Single Bond is slightly more viscous than Prime and Bond 2.1 (Dentsply Caulk, Milford, DE, USA). Single Bond did not spread much when applied to the dentin surface perpendicular to the gravitational force, indicating that it can pool on the pulpal wall and line angles of cavity preparations. Pooling of simplified adhesive systems has been shown to impair adhesion because of excessive solvent trapped within the adhesive layer.² Therefore, the importance of proper air-thinning should be noted.

Three-step etch-and-rinse bonding systems contain separate bottles for the primer and adhesive resin; therefore, it is very important to gently, but thoroughly, air-dry the primer prior to the application of the adhesive resin. Although a thin layer of adhesive is preferred, it is not a major concern if there is an accidental pooling of the adhesive in the line angles of the preparation because the adhesive of three-step systems does not contain solvents. However, problems do occur with two-step etch-and-rinse bonding systems, which are very technique-sensitive. The primer and adhesive resin are included in a single bottle. Dentin must be visibly moist prior to the application of the primer/adhesive solution, which in turn needs to be thoroughly and continuously applied to the preparation walls to ensure that they are well primed and bonded. The primer/adhesive should be gently, but thoroughly, air-dried to evaporate the solvents. For two-step adhesive systems, a thin layer of adhesive resin is essential to assure a solvent-free resin layer.

This study has also shown that there was no correlation between thickness of the adhesive layer and bond strength. However, it is important to note that these were the results for Single Bond and Prime and Bond 2.1 tested at 24 hours post-bonding. Results may vary with other adhesive systems, with those that contain fillers in their composition, and if tested at longer storage periods.

Durability of dentin-bonded interfaces is still a major concern, and as well stated in this article, thick adhesive layers of simplified adhesive systems may be detrimental to the long-term stability of bonds produced by these adhesives.

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