AN EVALUATION OF THE ADHESIVE/DENTIN INTERFACE OF A PROTOTYPE PRIMER/ADHESIVE USING SCANNING ELECTRON MICROSCOPY

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Modern dental adhesives are engineered to seal the dentin surface and to penetrate and bond to the dentin substrate to retain resin restorations and prevent fluid and bacterial microleakage. While the chemistry of modern adhesives differ, the microstructure mechanism leading to effective bonding and sealing is related to the creation of a "hybrid layer" in the dentin surface. This acid resistant modified dentin is formed by first decalcifying the surface layer of dentin and then penetrating the altered dentin with the resin primer or primer/adhesive. The depth and effectiveness of this penetration is highly dependent on the solvent system used in the adhesive and the degree of moisture left in the dentin surface.

The purpose of this study was to determine if a prototype adhesive from B.J.M. Inc. formed a "hybrid layer" when used to place a composite restoration.

Methods and Materials

Recently extracted premolar teeth were prepared classic Class I cavity preparations using a water cooled high speed handpiece with a standard carbide bur. After a 15 second 34% phosphoric acid treatment on enamel and dentin, the tooth was rinsed and blot dried leaving the dentin visibly moist. The prototype adhesive was applied and after 30 second gently air dried thoroughly and light cured for 20 seconds. After a second application,drying and light curing

Spectrum TPH composite resin was incrementally placed and each increment visible light cured for 40 seconds. The restored teeth were stored in deionized water at 37 °C for 5 days. After storage, the teeth were sectioned using a diamond wafering blade through the restoration from facial to lingual. The tooth and restoration surfaces were polished using the Enhance polishing discs and polishing pastes. The specimens were demineralized by placing them in concentrated HCL for 15 seconds followed by a treatment in 5% NaOCl for 20 minutes. The specimens were dehydrated in two ethanol baths of 50 % and 100% ethanol and dried for 12 hours in a 37 °C oven.

The tooth specimens were mounted on an aluminum stub and conductivley coated with gold prior to visualization in a JEOL Model 1120 Scanning Electron Microscope.

Results

6 tooth halves were prepared and visualized. While some delaminmation of the dentin and enamel occurred due to the vacuum effects, in general the interfaces between the composite and tooth structure was gap-free and a uniform an consistent acid resistant zone was observed between the adhesive layer and the dentin substrate.

The film thickness of the adhesive was generally 10-11 microns with and area of acid resistant dentin indicative of a "hybrid zone" immediately below with a thickness of about 3 microns. Resin tag penetration into the dentinal tubules was evident and in some cases could be seen extending as far as 50 microns or more into the dentin area demineralized by the acid induced decalcification. The hybrid layer was seen to be generally uniform around the periphery of the restoration but was most clearly seen on the pulpal floor of the cavity preparation.