

Futurabond NR - Adhesion with simulated dentinal pressure

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Analysis of the bonding strength of adhesives is normally determined on devitalized teeth in laboratory tests. These teeth, however, exhibit a difference to vital teeth - the missing hydrostatic pressure in the dentinal tubules. The effect of this pressure on the adhesive bond was examined in a study at the University of Tanta (Egypt).^[1]

The hybrid layer of bonding materials is always in contact with the dentinal liquid in the dentinal tubules. This liquid is under hydrostatic pressure, the so-called dentinal pressure. It has already been proven in studies that this pressure leads to the penetration of water into the hybrid layer. This water is then available for the hydrolysis reactions and additionally causes a plasticization of the polymer chains, thus leading to the degradation of the physical properties of the bond.

Examination of the adhesion on dentine

In this study, the teeth used were prepared and then the hydrostatic dentinal pressure was simulated with a 20 cm high head of water. Three adhesive values were determined for each material: an adhesive value without simulated dentinal pressure, a measurement after 24 h under simulated dentinal pressure and a measurement after 6 months. The last value can especially shed light on the life expectancy of a bond.

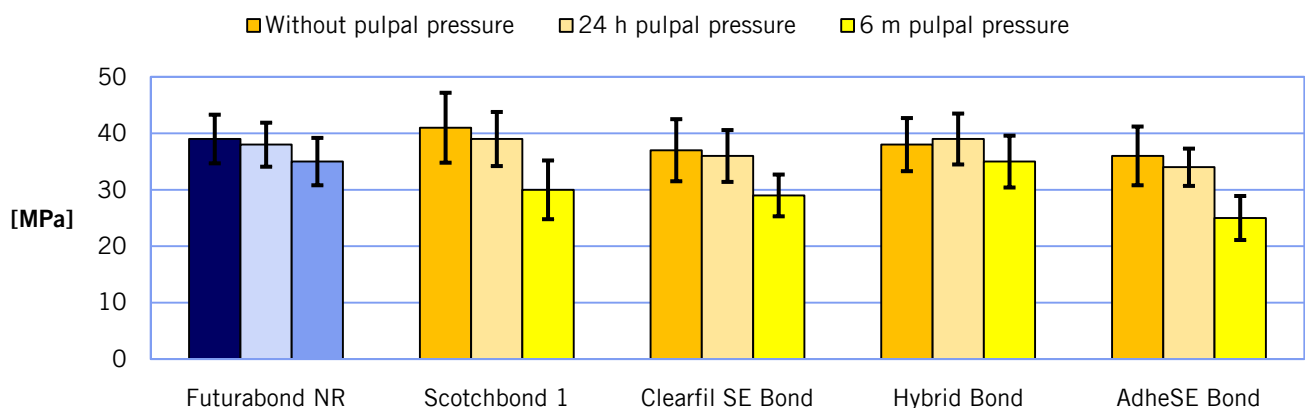


Figure 1: Adhesion values [MPa]

There were no statistically significant differences in any of the tested materials after 24 hours. This picture changed, however, with the achieved adhesive values after 6 months. While Futurabond NR still exhibited 92% of the adhesive value after 24h, the adhesive values plummeted with Scotchbond (77%), Clearfil SE Bond (81%) and AdheSE Bond (74%). Only Hybrid Bond exhibited a comparably good value like Futurabond NR.

Examination of the fracture sites

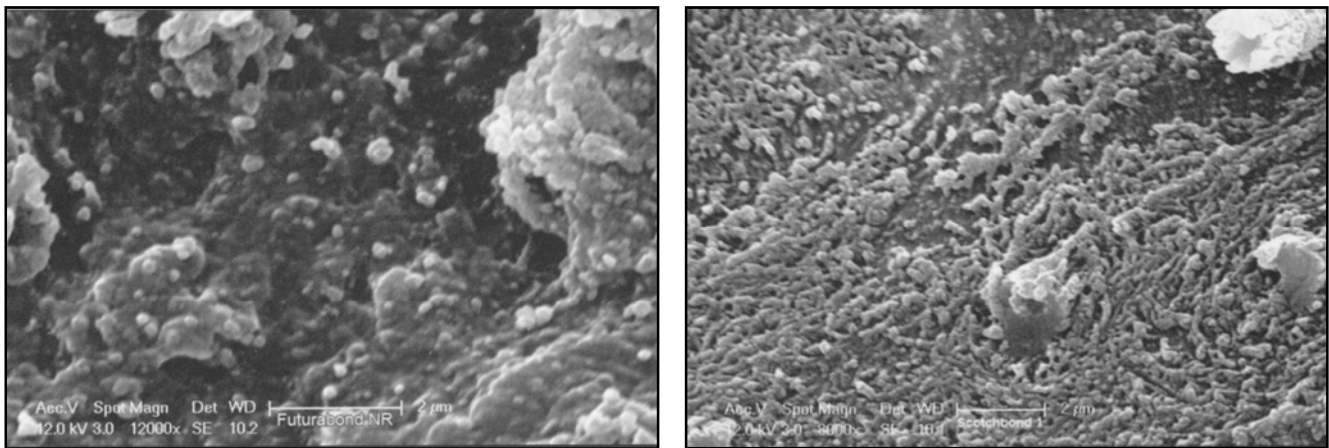


Figure 2: Scanning electronic micrographs of the fracture sites after 6 months of storage under simulated dentinal pressure. Left: Futurabond NR, right: Scotchbond 1

In Figure 1, the exemplary fracture sites from Futurabond NR and Scotchbond 1 are shown. It can be seen that the collagen fibers are well saturated with resin in the case of Futurabond NR. The surface with Scotchbond, in contrast, looks very different. The collagen fiber network is not permeated with resin and degradation of the collagen fibers is visible. This optical finding also explains the reduced adhesion values.

Conclusion: Futurabond NR, the nano-filled bond, effectively seals the dentinal tubules and prevents the dentinal liquid from penetrating the hybrid layer. The adhesive values were barely impaired after 6 months of storage under simulated dentinal pressure. An intact adhesive bond that is durable is the result.

[1] A. I. Abdalla, H. Y. Elsayed, F. Garcia-Godoy, *Am. J. Dent.* **2008**, *21*, 233-238.