

On the chemical nature of the organic matrix and its influence on fiber post adherence

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INTRODUCTION: Composite posts are manufactured by embedding fibers in an organic resin matrix. Our aim was to evaluate the influence of the chemical nature of this organic phase on the experimentally measured adherence strength at the interface with a dentin bonding agent. Experimental posts were specifically designed and made according to the same criteria as standard posts to determine the sole effect of the resins by comparison tests.

METHODS: 10 Light-Posts made with 60% quartz fibers by volume and 40% Novolac-type epoxy resin made up the reference group (G0). 30 experimental posts were divided into three groups according to the nature of the matrix : G1 with bis-GMA + hexanedioldimethacrylate, G2 with epoxy bisphenol A, and G3 with polyurethane. Push out tests were performed to evaluate shear bond strength at the interface with the dentin bonding agent [1]. A special Teflon mold was used to construct the test and maintain the applied force parallel to the post axis. A Synergie 2000 MTS system was used at a crosshead speed of 1mm/min. One-step (Bisco) dentin bonding agent was placed on the post then dried and light-cured 20 sec. A microhybrid Lumiglass (RTD) composite was compacted around the post in the teflon mold and light-cured for 40 sec at 800mW/cm² with a Spectrum 800 (Dentsply). The specimens obtained were stored away from light and humidity for 7 days then tested. Shear strength, in MPa was calculated as:

$$\sigma = F/\pi dh$$

(F=force in N, d=diameter in mm and h=height of the sample in mm). After studying ANOVA validity conditions, we choose the Fisher's protected least difference (PLSD) parametric test to identify differences between pairs of groups.

RESULTS: the shear strengths and standard deviation found were (in MPa): G0 = 27.7^a (2.8);

G1 = 34.3^b (1.5); G2 = 34.4^b (1.6); G3 = 29.3^a (3.1). Means with the same letter indicate non-significant differences (p>0.05). The experimental groups made of bisGMA and epoxy bisphenol A exhibited retention values that were significantly higher than the control group (G0 vs G1 and G2 ; p < 0.0001).

DISCUSSION & CONCLUSIONS: The chemical nature of the organic matrix seems to play a significant role in shear bond strength. All the matrixes tested were cured at high temperature to reach near 100% conversion rate. This guarantees dimensional stability and good intrinsic mechanical properties for the posts. However the surfaces become more inert and less prompt to react covalently with functional groups on the adhesive. The exact nature of the link between resin and adhesive is, as yet, unknown. Resin choice should be guided not only by the bonding capacity but also by the mechanical results combined with further studies to assess the behavior of the posts upon aging. Moreover hydrolytic stability is required to maintain post integrity [2].

REFERENCES: ¹Boschian-Pest L, Cavalli G, Bertani P, Gagliani M (2002) Adhesive post-endodontic restorations with fiber posts: push-out tests and SEM observations. *Dent Mater.* Dec ; **18**(8) : 596-602. ² WD. Callister Jr (1997) *Materials science and engineering: an introduction. Composites.* 3rd ed New-York : Wiley : 513-41.

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