



Development of a dentin substituting material in vitro biomechanical trials: preliminary results

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PURPOSE: The purpose of this study was to develop a new material which shows the mechanical and adhesive properties of the human dentin and can be milled with CAD/CAM technology. This material may be used as substrate for laboratory testing of CAD/CAM fabricated prostheses.

METHODS AND MATERIALS: An epoxy matrix was tested for its mechanical properties and filled with reinforcement fibers to reach dentin Young's modulus (E=18 GPa), flexural strength (σ_f =300 MPa), and ultimate compressive strength (CS=275-300 MPa). The filler content was 54% in weight, and proportioned as follow: one third of long woven carbon fibers (160 μ m), two thirds of long woven glass fibers (160 μ m), Fig. 1 and 2. Hydroxyapatite (HAp) sub-micron particles (15% in weight) were mixed to the epoxy matrix in half of the specimens. Two groups (n=10 each) were tested: 1) w-HAp: hybrid glass-carbon reinforced composite without HAp and 2) w-HAp: hybrid glass-carbon reinforced composite with HAp. Three-point-bending flexural test was conducted for each specimen (45x4.5x4.5 mm bars), and the Young's modulus (E), compressive strength (CS) were calculated for group 1) according to the ISO D6641 6641M 14 standard test method (compressive force was applied perpendicularly to the direction of the fibers); Shear bond strength (SBS) with self-adhesive luting cement (RelyX Unicem, 3M, ESPE) was evaluated on rectangular specimens (15x10 mm, 2 mm thickness) after short-term (24 h) dry and wet storage. (Fig. 3). t-Student test was used for statistical comparisons ($\alpha < 0.05$).

Fig. 1 Glass and carbon fibers



Fig. 2 Procedure for fabrication of the hybrid glass/carbon composite material



Fig. 3 Three-point-bending test of the composite material

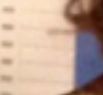


Fig. 4 Shear bond strength test



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