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Characterization and evaluation of the compression and diametrical traction resistance of restorative dental cement modified with fibers

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Abstract - This study modified a commercial restorative glass ionomer cement (CIVC) with cellulose fibers (CIVCMF). Samples of CIVC and CIVC with different concentrations of fibers (CIVCMF1 and CIVCMF2) were prepared and submitted to tests of compression and diametrical traction resistance. The results were submitted to ANOVA and Tukey test (p<0,05). Some samples were characterized through SEM/EDS. The composites showed no statistically significant differences in relation to CIVC in the diametrical traction resistance (p>0,34), although showed statistically significant differences with relationship to the compression resistance (p=0,00). The CIVCMF1 presented adequate characteristics of manipulation, high viscosity and the best compression resistance.

The glass ionomer cement is a featured material and is very studied in the Dentistry, because came to aggregate physical and biological favorable properties, that were not obtained with other materials as biocompatibility and adhesion to the dental structure, besides fluor liberation [1]. However, this restorative cement presents undesirable characteristics, as low mechanical resistance, syneresis and imbibition, reduced translucency, friability and sensitivity of the technique. For many years, attempts to incorporate fiber as a reinforcement of the material to improve their physical and chemical characteristics [2], especially its resistance [3]. The cellulose fibers have characteristics that make its use advantageous, as low cost, low density, specific resistance, high elasticity modulus, and is not abrasive and not toxic. The aim of this study was modified a restorative commercial glass ionomer cement with eucalyptus fibers, in order to improve its resistance.

Samples (n=10) of the restorative commercial glass ionomer cement (CIVC) and samples of the CIVC with two different concentrations of fibers were prepared (CIVCMF1 and CIVCMF2) and inserted in a Teflon matrix measuring 4mm in diameter and 8mm high. The samples were submitted to a universal testing machine (Emic DL2000) with a load cell of 200kgf. This force was applied to each sample that occurs before the fracture, with a 1mm/min crosshead speed, with its long axis in the vertical position for the test of the compression resistance and with 0,5mm/min crosshead speed, with its long axis in the horizontal position for the test of the diametral traction resistance. The results were submitted to the variance analysis and the Tukey test (p<0,05). Representative samples of the materials were characterized through Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDS).

The CIVCMF1 composite presented wettability and surface brightness more appropriate after the handling and sufficient viscosity that facilitated the insertion of the material within the matrix. The composites showed no statistically significant differences in relation to CIVC in the diametrical traction resistance (F=1,12, p>0,34), although showed statistically significant differences with relationship to the compression resistance (F=22,86, p=0,00), which the CIVCMF1 and CIVCMF2 composites showed high resistance than CIVC. The SEM/EDS analysis of the CIVCMF1 composite showed peaks of high intensity corresponding to Carbon and Oxigen of the fibers and gelatinous matrix of the CIVC, as well as trace elements of the CIVC constitution: silica (SiO_2), alumina (Al_2O^3) and calcium (CaF_2) and sodium (Na_3AlF_6) fluorides.

The CIVCMF1 presented adequate handling characteristics, high viscosity and the best compression resistance showing a considerable improvement of their properties probably due to the addition of the fibers.

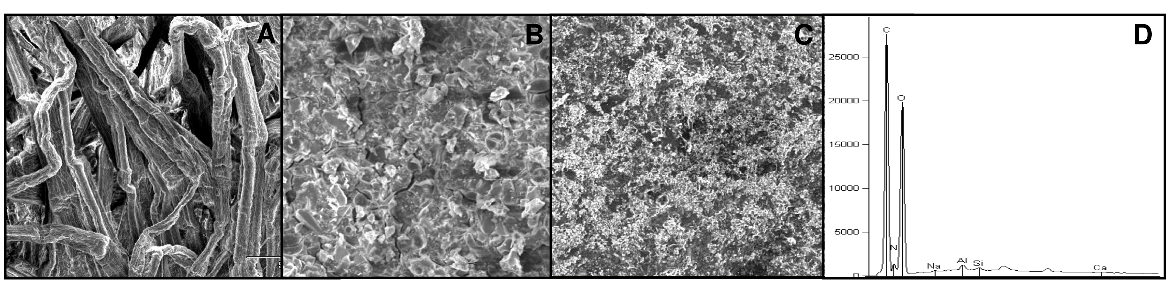

Figure 1: SEM photomicrographs of the eucalyptus fibers, 750X, 10KeV (A), CIVC composite, 1500X, 10KeV (B), CIVCMF1 composite, 1000X, 10KeV (C); EDS spectrum of CIVCMF1 with peaks of high intensity of the main constituents of the fibers, C and O, and the elements of the CIVC composite C, O, F and trace elements Na, Al, Si and Ca (D).

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