Effects of food/oral simulating fluids on microstructure and strength of dentine bonding agents.

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Abstract

This study evaluated the effect a food simulating solution, 75% v/v ethanol/water, and an artificial saliva, Moi-Stir, have on the microstructure and on the diametral tensile strength (DTS) of three dentine bonding agents (Tenure, Scotchbond Multi-Purpose and Optibond). The microstructure was examined by using a scanning electron microscope (SEM). The DTS data were analysed using ANOVA and the Tukey LSD test. The microstructural observations were compared with changes in DTS. The SEM observation revealed deterioration of all bonding agents due to conditioning in the solutions for 30 days. The different solutions appeared to cause different reactions in the bonding agents. However, these effects may be exaggerated due to the presence of an air-inhibited surface layer. Those conditioned in Moi-Stir showed swelling. The presence of filler particles in the Optibond bonding agent appears to decrease the deterioration resulting from soaking. Materials conditioned in ethanol exhibited both dissolution and thinning. Diametral samples of each bonding material were tested after being conditioned in the above-mentioned solutions for 1, 7, 14 and 30 days. Conditioning significantly decreased the DTS of all bonding agents, except Optibond in Moi-Stir. Filled Optibond maintained its DTS longer than did the two unfilled bonding agents. The decrease in DTS of all the ethanol-conditioned groups is a function of the square root of time ($P < 0.001$) and conforms to Fick's laws of diffusion. The filled Optibond showed a lower ethanol diffusivity (0.5 x 10(-5) cm2 s-1) than the other two unfilled bonding agent systems (average 1.2 x 10(-5) cm2 s-1) ($P < 0.05$). The high ethanol diffusivities were thought to be due to the presence of HEMA, a hydrophilic resin, in the bonding agent. These results also suggest that solution uptake occurred through the resin matrix. Filler particles may therefore play an important role in weathering resistance of these materials to oral environment solutions. The physical appearance and strength of dentine bonding agents are significantly altered by exposure to oral environment solutions.