

Analysis of Charged Silica Adhesion to Deep Dentin

Benjamin M. Immerman

Silica particles can be used to deliver pharmacological agents to surgically prepared dentin. The objective of this study was to determine the effect of surface charge on the ability of particles to adhere to dentin and cover the dentinal tubules. Dentin slices were prepared by sectioning human third molars. The smear layer was removed with EDTA. The discs were then split in half. One half was treated with distilled water (control), the other half with an experimental treatment. The experimental treatments were 2% aqueous dispersions of 0.5 μ m diameter silica particles with: COOH (anionic), NH₂ (cationic) or OH (uncharged) surfaces. The dentin was imaged with a scanning electron microscope (SEM). SEM images were analyzed using ImageJ so that the percent of the surface present as open tubules could be determined. A one-way analysis of variance with a pair-wise Tukey-Kramer test was performed to determine significant differences in dentinal occlusion in dentin in the different experimental groups. The mean %-surface as open tubules \pm standard deviations (N=6) was 6.05 \pm 2.5 for the control, 6.1 \pm 3.7 for COOH-silica, 1.21 \pm 0.8 for OH-silica, and 0.95 \pm 1.0 for NH₂-silica. The control and COOH-silica are not statistically different. OH-silica and NH₂-silica are not statistically different from each other, but they are both statistically lower than control and COOH-silica values. Compared to control COOH-silica did not cover the tubules. NH₂- and OH-treated silica did occlude dentin tubules. These results suggest that neutral and cationic charged silica particles cover the dentinal tubules and may be used in drug delivery systems.