Determining growth inhibition of Candida albicans biofilm on denture materials after application of an organoselenium-containing dental sealant

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Abstract

Statement of problem: Denture stomatitis is a chronic inflammatory condition caused by the formation of Candida albicans biofilm on denture bases. It is associated with aggravating intraoral pain, itching, and burning sensations. It can also potentiate cardiovascular diseases and aspiration pneumonia. The problem has thus far eluded efficient, toxic-free, and cost-effective solutions.

Purpose: The purpose of this in vitro study was to investigate the effectiveness of organoselenium to inhibit the formation of C. albicans biofilm on the surface of acrylic resin denture base materials when it is either incorporated into the acrylic resin material or coated on the denture surface as a light-polymerized surface sealant.

Material and methods: Sixty heat-polymerized polymethyl methacrylate disks were fabricated and assigned to 4 groups (n=15): disks coated with a light-polymerized organoselenium-containing enamel surface sealant (DenteShield), disks impregnated with 0.5% organoselenium (0.5% selenium), disks impregnated with 1% organoselenium (1% selenium), and disks without organoselenium (control). C. albicans biofilm was grown on each disk which had been placed in a well of the microtiter plate containing 1-mL brain heart infusion broth inoculated with C. albicans. The plates were incubated aerobically at 37 °C for 48 hours. A confocal laser scanning microscope was used to determine the biofilm thickness, biomass, and live/dead cell ratio. Biofilm morphology was examined with scanning electron microscopy, whereas microbial viability was quantified by the spread plate method. The data were analyzed by using ANOVA and Tukey-Kramer multiple comparisons (α=.05).

Results: The microbial viability, biofilm thickness, biofilm biomass, and live/dead cell ratio were lower (P<.001) on disks in the test groups (DenteShield, 0.5% selenium, 1% selenium) when compared with the control group, with these variables being lowest in the 0.5% selenium and 1% selenium groups. The 0.5% selenium and 1% selenium groups did not differ significantly from each other in any of the variables (P>.05). Scanning electron microscope images showed inhibition of both biofilm growth and yeast to hyphae transition in the DenteShield, 0.5% selenium, and 1% selenium groups, with visible disruption of the biofilm morphology.

Conclusions: The present study demonstrated that organoselenium, whether incorporated into or coated on the surface of an acrylic resin denture base material, has the potential to inhibit Candida albicans biofilm growth on denture surfaces and as such can be clinically useful for the prevention of denture stomatitis.