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Cerium(III) Chloride Pretreatment Reduces Initial Caries Biofilm Formation in Vitro

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Objectives The incorporation of cerium instead of calcium into the crystal lattice of hydroxyapatite appears to increase the resistance of enamel to caries lesion initiation and progression. The effect on initial biofilm formation is not yet known. The aim of this study was to assess the effect of cerium(III) chloride (50%$CeCl_3$) pretreatment of hydroxyapatite (HA) discs on subsequent growth of a 3 species caries-biofilm.

Methods Twelve 9.5 mm diameter hydroxyapatite discs were divided into three groups (n=4) and treated for 1 minute with either 50% $CeCl_3$, ultrapure water (control), or 0.02% chlorhexidine digluconate (CHX) and washed twice in ultrapure water for 1 minute. Samples were incubated in artificial saliva at 21°C for two hours and then placed in an active attachment caries biofilm model comprising *Actinomyces naeslundii*, *Schaalia odontolytica*, and *Streptococcus mutans* and cultured anaerobically at 37°C for 4 hours before being fixed in 2.5% glutaraldehyde and examined using scanning electron microscopy (SEM) and energy dispersive x-ray analysis (EDX) in high-vacuum mode.

Results SEM-micrographs at a magnification up to 50,000x showed net-like or spherical precipitates on the surface of all $CeCl_3$ samples but not on the control or CHX samples. Samples treated with $CeCl_3$ also showed signs of acid attack possibly due to the low pH (2.6) of the $CeCl_3$ solution. Rods and cocci were found on all controls, but only on 2 of 4 CHX samples. 1 of the 4 $CeCl_3$ samples harbored isolated cocci. EDX-analyses confirmed the presence of cerium in all $CeCl_3$ samples with atomic percent (At%Ce) ranging from 0.1 to 0.4 for areas without visible precipitates and up to 4.1 for areas with precipitates.

Conclusions $CeCl_3$-treatment before pellicle formation results in the development of precipitates on the surface of HA and appears to have potential to inhibit initial biofilm growth on HA compared to CHX-treated or untreated controls.