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Deposition of CaF-Like Material on and Fluoride Uptake into Demineralized Enamel after pH Cycling

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The in vitro fluoride uptake in demineralized enamel of an acidic fluoride varnish 43,000 ppm F^- combined with a $Ca(OH)_2$ suspension (group 1, Humanchemie, Alfeld, Germany) was compared with a standard neutral fluoride varnish (group 2, 23,500 ppm F^-, Duraphat, Colgate, Hamburg, Germany). Demineralized bovine enamel specimens (2,500 vol.%×µm) were randomly assigned to 4 groups (n = 50). Specimens of groups 1 and 2 were treated with a defined amount of the respective study product. After storing all specimens in pooled human saliva for 3 h the specimens were brushed until no more remnants of the applied product were found. Specimens of all groups were pH-cycled for 10 days. In the morning and in the evening specimens of groups 1, 2 and 3 (fluoride control) were stored in toothpaste slurry for 3 min. Group 4 served as negative control. CaF_2-like deposit on the enamel surface and structurally bound fluoride (three layers of 40 µm each) were determined using an ion-selective electrode and statistically analyzed using ANOVA and Tukey-B test. The highest amount of CaF_2-like material was found in group 1 (9.79 µg/cm²) followed by group 2 (4.64 µg/cm²), and 3 (3.39 µg/cm²), being significantly different from each other. In all three layers (outer/middle/inner) the highest fluoride concentration was found in group 1 (4,089.45 µg/cm³; 3,903.50 µg/cm³, 2,904.19 µg/cm³). Significantly less fluoride content was found in group 2 (1,771.84 µg/cm³; 1,534.49 µg/cm³; 936.27 µg/cm³) and group 3 (1,670.55 µg/cm³; 1,469.48 µg/cm³; 774.05 µg/cm³) being not significantly different from each other. The fluoride content of the specimens in group 4 was below the detection level. The combination of an acidic fluoride varnish and a $Ca(OH)_2$ suspension leads to a higher fluoride uptake after a pH challenge.

This study was supported by Humanchemie GmbH, Alfeld/Leine, Germany.

online - Ausgabe

Caries Res 2013, 47, 433-537

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