<Journal of Dental Research, Vol.85, Special Issue B(Brisbane Abstracts), 2006>

Remineralization by Nanohydroxyapatite-Containing Dentifrice: a pH Cycling Study Using Slurry

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Objective: To compare the effects of dentifrices containing nanohydroxyapatite (nHA) with fluoride dentifrices on the remineralization of artificial enamel caries-like lesions using slurry preparations (a method designed to allow for the postulated action of hydroxyapatite at nanocrystalline and ionic levels) in a pH cycling model.
Methods: Extracted third molars with artificial lesions, 100-120µm deep, were sectioned to 100-150µm thick. Specimens were studied using polarized light microscopy and microradiography to evaluate the lesion depth and the mineral content before and after 10 days of pH cycling. Each cycle involved three hours of demineralization twice daily, with two hours' immersion in a remineralizing solution approximating human saliva between demineralization, and another 16 hours similar immersion overnight. One-minute treatments with a slurry of the selected dentifrice preparation were performed thrice daily, before the first demineralization and before and after the second demineralization. Fifty-five sections were randomly divided into five groups, Group 1: 900ppm MFP dentifrice (+ve control 1); Group 2: 900ppm NaF dentifrice (+ve control 2); Group 3: 10% nHA type A; Group 4: 10% nHA type B and Group 5: -ve control.
Results: Lesion depth decreased by 4% in Group 1 and 5% in Groups 2, 3 and 4. Those in Group 5 increased by 27%. Groups 1, 2, 3 and 4 were significantly different from Group 5 ($p<0.001$, ANOVA and SNK test). No significant difference was found among Groups 1, 2, 3 and 4 ($p>0.05$, ANOVA and SNK test).
Conclusions: The dentifrices that contained 10% nHA showed no significant difference in healing efficacy from the dentifrices that contained fluoride. The pH cycling method using slurry preparations of dentifrices, can be successfully used to compare the remineralization effects of nHA and fluoride-containing dentifrices. This study was supported by Sangi Co., Ltd. Japan.

Group	Dentifrice	LD(µm)±SD Before	LD(µm)±SD After	% change ±SD
1	Positive control 1 (MFP)	107±3	102±1	-4%±3 **
2	Positive control 2 (NaF)	109±4	103±2	-5%±4 **
3	10% nano-hydroxyapatite A	109±1	103±1	-5%±2 ***
4	10% nano-hydroxyapatite B	109±8	103±1	-5%±7 *
5	No active ingredients (-ve control)	106±5	135±9	27%±9

** $p<0.05$, ** $p<0.01$, ***$p<0.001$, paired-*t*-test

Anova & SNK tests confirmed no significant difference among all groups ($p>0.05$) other than the negative control.

Depth of Demineralized Lesions (LD)