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Quantitative Tubule Occlusion in an In Vitro Remineralization/Demineralization Model

A. Burwell, D. Greenspan
NovaMin Technology, Inc, Alachua, Florida, USA

OBJECTIVE: The currently accepted hydrodynamic theory relates dental hypersensitivity to the exposure of dentin tubules. The purpose of this work was to evaluate the ability of two calcium phosphate-containing materials to occlude tubules in an *in vitro* remineralization/demineralization (remin/demin) model.

METHODS: Bovine tooth roots were ground, polished, and acid-etched to expose the dentin layer and create an *in vitro* hypersensitivity model. One group of dentin samples were brushed once for two minutes with either NovaMin®-containing SootheRx™ dentifrice, RECALDENT™-containing MI Paste, or deionized (DI) water (control group).

A second group of samples were subjected to a 10-day remin/demin cycle that consisted of a twice-daily 30-minute soak in demineralizing solution (pH=4.52) at 37°C followed by a two-minute brushing with either SootheRx™, MI Paste, or DI water. Samples were soaked in artificial saliva (pH=7.00) at 37°C between the two daily demineralization/brushing periods.

Quantitative tubule occlusion data were obtained from scanning electron microscopy (SEM) images of the treated samples taken at a magnification of 2000X.

RESULTS: After a one-time brushing with the SootheRx™ dentifrice, significantly less open tubules (1.4 ± 0.4) were visible in an SEM image compared to the control samples (60.8 ± 6.8 , $p < 0.001$). The number of open tubules on samples brushed once with MI Paste (33 ± 4) did not differ significantly from the control samples.

After the 10-day remin/demin cycle there were no visible open tubules visible on the samples treated with SootheRx™; a significant reduction when compared to the control samples (48 ± 3 , $p < 0.001$). Treatment with MI Paste did not significantly reduce the number of open tubules (31 ± 5) compared to the control samples.

CONCLUSION: Treatment with a NovaMin®-containing dentifrice results in the formation of a precipitated layer on the dentin surface that is more effective at occluding tubules and is more resistant to repeated acid challenges than the amorphous calcium phosphate deposited by a RECALDENT™-containing dentifrice.

KEY WORDS: Hypersensitivity, Tubule Occlusion, Remineralization, Demineralization

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