

# Quantitative Tubule Occlusion in an In Vitro Remineralization/Demineralization Model

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**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 ( $1.4 \pm 0.4$ ) were visible in an SEM image compared to the control samples ( $60.8 \pm 6.8$ ,  $p < 0.001$ ). The number of open tubules on samples brushed once with MI Paste ( $33 \pm 4$ ) 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 ( $48 \pm 3$ ,  $p < 0.001$ ). Treatment with MI Paste did not significantly reduce the number of open tubules ( $31 \pm 5$ ) 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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