

Quantitative Analysis of Tubule Occlusion Using NovaMin (Sodium Calcium Phosphosilicate)

D.T. Jennings¹, K.M. McKenzie¹, D.C. Greenspan¹, A.E. Clark²
1 NovaMin Technology, Inc, Alachua, Florida, USA, 2 University of Florida, Gainesville, Florida USA



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Objective: The objective of this study was to determine the efficacy of a NovaMin® particulate in occluding dentinal tubules in vitro using quantitative techniques.

Methods: Bovine root dentin was prepared by grinding and polishing, followed by a 37% phosphoric acid etch for 15 minutes to remove any smear layer. The dentin blocks were treated with either NovaMin® particulate mixed with water or Quell™ Desensitizer, following the manufacturer's instructions. Untreated dentin blocks served as negative controls. Following treatment, the specimens were dried and prepared for analysis by Scanning Electron Microscopy (SEM) and Energy Dispersive Spectroscopy (EDS). Twenty-five samples of each treatment group were analyzed, and 24 samples of the negative control were analyzed. From the SEM images at 2000x magnification, the number of fully open and partially open tubules were manually counted and summed, and ANOVA and Bonferroni post hoc statistical analyses were used to evaluate and compare the treatment methods.

Results: The mean number of open tubules in the control group was 37.79. The mean number of open tubules for the NovaMin® treated group was 6.96, while the Quell™ group averaged 26.00. The statistical analysis showed that both treatment groups had statistically fewer open tubules than the control group ($p < .001$) and that the NovaMin® group occluded significantly more tubules than the Quell™ group ($p < .001$). In addition, EDS analysis demonstrated a significant calcium phosphate layer with the presence of silica from the NovaMin® bioactive glass particles on the surfaces of the dentin blocks.

Conclusions: This study demonstrated that it is possible to develop an in vitro method for quantifying the occlusion of dentinal tubules. The study further demonstrated significant occlusion of tubules using NovaMin® bioactive glass particulate, suggesting that this material may provide relief from tooth hypersensitivity.

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