

## Post-Bleach Stain Inhibition by Nano-Hydroxyapatite: a Cyclical Staining Test

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**Objective:** Office bleaching is widely used as a means of non-abrasive whitening, but is often accompanied by problems of sensitivity and relapsed discoloration believed to result from microstructural changes to the enamel during the bleaching process. We developed a nano-hydroxyapatite conditioner designed to restore tooth enamel by mineral replacement, and examined its effect on the post-bleach enamel surface and the return of post-bleach extrinsic stains, using a new cyclical staining test.

**Method:** Extracted human teeth with sound enamel were bleached with Opalescence® (Ultradent) according to the maker's instructions, then immersed in a solution of Renamel® nano-hydroxyapatite conditioner (Sangi) overnight. The specimens were observed by SEM and SPM before and after bleaching and after treatment with the conditioner. A cyclical staining test was developed to assess relapse of stains, using one group of specimens treated by bleaching only, and another treated by bleaching followed by immersion in the conditioner. Each group was placed in red wine for 4 hours' staining, followed by 1 hour in an oxygen-purged incubator for color-fixing, then 30 minutes in a 10% polyethylene glycol 400 solution for stain-removal, and this cycle repeated 3 times. Color was measured for each specimen at the start of testing and after each cycle using a spectrophotometer (Murakami Color Research) and digital camera (Canon Inc.).

**Results:** SEM and SPM showed the post-bleach enamel surface was smoother for nano-hydroxyapatite-treated specimens than for untreated specimens. Cyclical staining showed much greater stain relapse in untreated specimens than in those treated with the nano-hydroxyapatite conditioner, which retained a glossy, sparsely stained surface similar to that of sound enamel, even after three staining cycles.

**Conclusion:** We concluded that the nano-hydroxyapatite conditioner is an effective agent for use after bleaching, restoring a smooth surface to the enamel and inhibiting relapse of extrinsic tooth stains.