

Caries Profile Testing of a New Whitening Toothpaste

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ABSTRACT

The purpose of this experiment was to demonstrate the anticaries efficacy of a new whitening/tartar control dentifrice formulation relative to the appropriate, clinically proven USP Reference Toothpaste (NaF/Silica). The profile test chosen was an *in vitro* fluoride uptake model. The fluoride uptake experiment made use of 4mm enamel disks containing 24 hour MHDP/Lactic Acid (2.0×10^{-4} mol/L disodium dihydrogen methanhydroxydiphosphonate, 2.5×10^{-2} mol/L lactic acid, pH = 4.5) lesions (White DJ; American Journal of Dentistry, Vol. 2, No. 2, April, 1989). Specimens were treated for 30 minutes with the supernatant of a 1:3 slurry of dentifrice and water, then thoroughly rinsed with ultra-pure water. Fluoride uptake was measured by the microdrill biopsy technique. Products compared were: a) USP Reference Toothpaste: 1100ppm F (NaF), Silica; b) new whitening toothpaste, 1100ppm F (NaF), 3.3% pyrophosphate, Silica; and c) placebo: 0ppm F (NaF), Silica. Fluoride uptake results [$\mu\text{g}/\text{cm}^2$ (SD)] from the *in vitro* fluoride uptake model were: a) 10.88 (0.90); b) 9.23 (1.57); c) 0.84 (<0.01), with a=b>c ($p \leq 0.05$ ANOVA). **The anticaries efficacy of the new whitening toothpaste has been demonstrated in an *in vitro* fluoride uptake model.**

INTRODUCTION

The focus of current research and marketing is in the development of multi-action dentifrices - including combinations of therapeutic and cosmetic benefits to patients. The addition of new additives and improved therapeutic and excipient ingredients must be carried out carefully - since some ingredients may influence potential anticaries actions of fluoride.

Recently, our laboratory was successful in developing a novel silica abrasive technology which shows significant clinical efficacy in the removal of tooth stains and in tooth whitening. This dentifrice, commercially marketed as Crest Extra Whitening (and now also available in Crest MultiCare Whitening) includes sodium fluoride as the anticaries source - combined with clinically proven pyrophosphate as a tartar control ingredient.

OBJECTIVE

The purpose of this research was to demonstrate the fluoridating efficiency of a new whitening/tartar control dentifrice formulation relative to the appropriate, clinically proven USP Reference Toothpaste (NaF/Silica).

MATERIALS AND METHODS

Text 4 mm enamel cores were removed from central maxillary incisors using a diamond hollow-core bit. The core was removed under water to prevent heating. The cores were mounted on Lucite rods, ground with 600 grit silicon carbide sandpaper (to remove approximately 50 microns of surface enamel), and polished to a high luster with 5 micron gamma alumina.

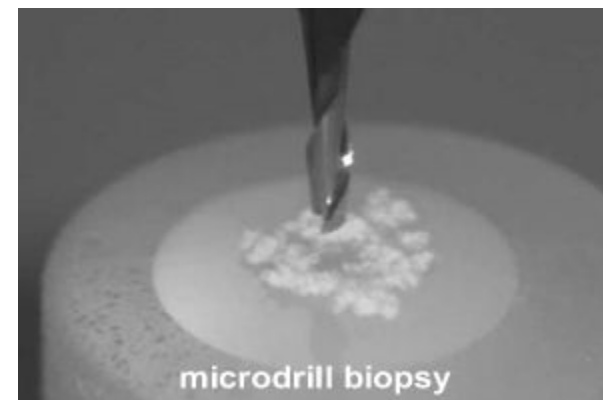
The enamel cores were then demineralized for 24 hours using 0.025M lactic acid plus 0.0002M MHDP (disodium dihydrogen methanhydroxydiphosphonate) at room temperature.

After demineralization, the cores were rinsed with deionized water, randomly assigned to treatment groups (n=5), then treated (with rotation) using 25ml of supernatant from a 1:3 (dentifrice:water) slurry centrifuged for 30 minutes at 10,000 rpm.

Upon completion of treatment with supernatant, specimens were rinsed with deionized water and analyzed for fluoride content. The microdrill biopsy technique was used to assess the product's ability to deliver fluoride to the demineralized enamel.

Specimens were mounted on the microdrill stage and sampled using a miniature carbide end-mill. The biopsy technique removes a small portion of the chip leaving behind a cylinder with the approximate dimensions 400 μm diameter and a constant 100 μm height. The powder removed was dissolved in 20 ml 0.5M HClO_4 . The volume was increased with 40 ml de-ionized water and then buffered with 40 ml Citrate-EDTA, achieving a final volume of 100 ml. Sample solutions were then analyzed by reading the millivolt potential with a calibrated fluoride ion specific electrode (Orion, Model 96-09). Fluoride concentration was determined from a calibration curve obtained on the same day as the analysis.

RESULTS



The table below shows the results of the caries profile testing.

Treatment	Fluoride Uptake (mg/cm^2)* (mean \pm standard deviation)
USP Reference, 1100 ppm NaF, Silica	10.8 \pm 80.90
Crest MultiCare Whitening	9.23 \pm 1.57
Placebo	0.84 \pm 0.00

* Means within brackets are not significantly different ($p \leq 0.05$)

CONCLUSION

This measure provides useful data to insure a product is not at a disadvantage to clinically proven formulations using the same fluoride source.

The results of this profile test confirm the anticaries effectiveness of the Crest MultiCare Whitening dentifrice formulated with 'Stain Specific Soft Silica' in a pyrophosphate base tartar control system. The positive control which produced equal efficacy was the USP NaF/Silica Reference Standard. Crest MultiCare Whitening was recently granted an ADA seal supporting both anticaries and whitening efficacy.