



Objective

To determine the extent to which a proprietary dentifrice formula of sodium fluoride, stabilized chlorine dioxide, and sarcosinate accelerate fluoride ion enamel uptake, thereby enhancing remineralization of teeth.

Introduction

Dental caries, chronic among large number of humans, can be preventable and to some extent reversible with proper oral hygiene and regular visits to dentists.¹ Thorough toothbrushing with a fluoride toothpaste can be a major factor in proper hygiene. Availability of fluoride in toothpastes is routinely tested. However, uptake of fluoride and remineralization are complex chemical phenomena. Different brands of dentifrices can lead to varying incidences of caries in the animal model, despite the fact that the dentifrices may all contain fluoride.² The performance of a given dentifrice cannot be explained by the fluoride content alone and synergistic effect of the individual ingredients in a particular formulation plays a critical role.³ Therefore, all fluoridated dentifrices are not equally effective.

Methods

Toothpaste C was ClōSYS[®] Anticavity toothpaste that was made commercially available from Nov. 2017. Toothpaste B was ClōSYS[®] Anticavity toothpaste that was commercially available but discontinued in Nov. 2017. Other toothpastes were procured commercially.

ClōSYS[®] Anticavity Toothpaste C contains sodium fluoride, stabilized chlorine dioxide, and sodium lauroyl sarcosinate. Whereas, ClōSYS[®] Anticavity Toothpaste B contains sodium fluoride and stabilized chlorine dioxide. All other ingredients are same.

The methodology utilized for this experiment is described in the literature.⁴

Specimen Preparation: Enamel specimens (3 mm diameter) were removed from extracted bovine teeth, mounted on rods, ground, and polished using standard methods. Artificial lesions were formed in the enamel specimens (33 h immersion in 0.1 M lactic acid and 0.2% Carbopol C907 50% saturated with hydroxyapatite, pH 5.0). The lesion surface hardness range was 25-45 Vickers micro-hardness and average lesion depth was ~70µm.

Procedure: The treatment regimen comprised of treating specimens in 18 replicates with toothpaste slurry simulating brushing for 1 minute followed by remineralization treatment for 1 hour using pooled human saliva. The cyclic treatment regimen consisted of a 4.0 hrs/day acid challenge. The specimens were placed into human saliva for the remaining time (~20 hrs.). Fluoride analysis was conducted *via* a microdrill biopsy technique after 20 days and Surface Micro Hardness (SMH) was also determined after 10 days of treatment.

Statistical Analysis: Statistical analyses were performed with a one-way analysis of variance model using Sigma Plot Software (13.0). Individual mean differences were analyzed by the Student Newman Keuls (SNK) test.

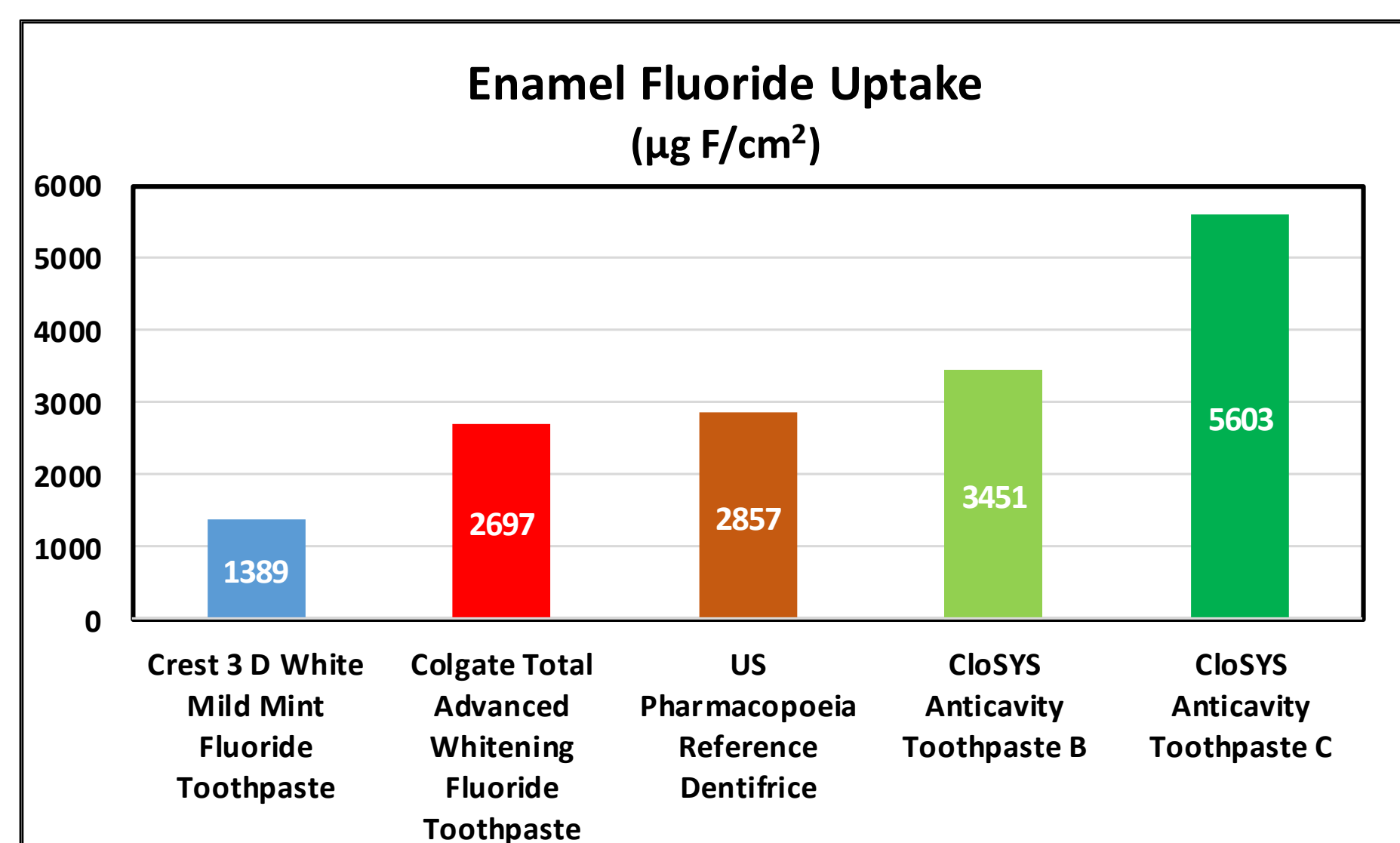


ClōSYS[®] Anticavity Toothpaste (Toothpaste C)

Results

Enamel fluoride uptake

Enamel fluoride uptake results are presented in Figure 1.



Fluoride uptake into incipient lesioned enamel by Toothpaste C was 5603 µg F/cm³, which was 62.3%, 96.1%, 107.7%, and 303.3% higher than Toothpaste B, USP Reference Dentifrice, Colgate Total Advanced Whitening, and Crest 3 D White Mild Mint toothpastes, respectively.

Remineralization

Remineralization as determined by Surface Micro Hardness (SMH) after 10 days is presented in Figure 2 and Table 1.

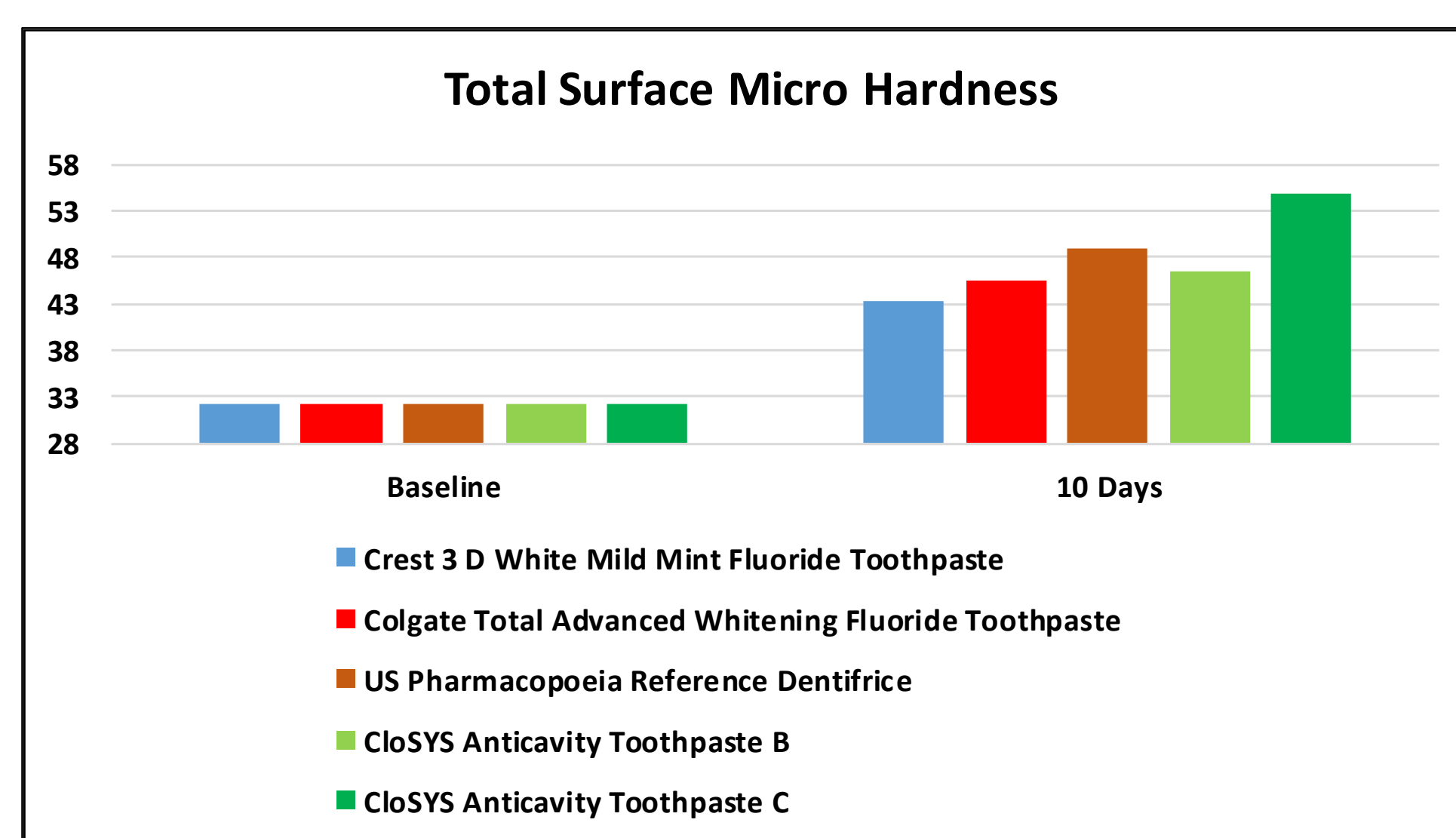


Table 1: Surface Micro Hardness (SMH) of Enamel After 10 Days

Toothpaste	Baseline	After 10 Days	Change in SMH
Crest 3 D White Mild Mint Fluoride	32.1	43.4	11.3
Colgate Total Advanced Whitening Fluoride	32.1	45.4	13.3
US Pharmacopoeia Reference Dentifrice	32.1	48.9	16.8
ClōSYS Anticavity Toothpaste B	32.2	46.5	14.3
ClōSYS Anticavity Toothpaste C	32.2	54.9	22.7

The remineralization as determined by SMH after 10 days by Toothpaste C was 34.5%, 50.6%, 69.9%, and 100.0% higher than USP Reference Dentifrice, Toothpaste B, Colgate Total Advanced Whitening, and Crest 3 D White Mild Mint toothpastes, respectively.

Conclusions

Fluoride uptake and remineralization of surface enamel is not determined by concentration of fluoride source in dentifrices alone. High fluoride uptake and enhanced remineralization by ClōSYS[®] Anticavity Toothpaste C is attributed to combined effect of sodium fluoride, stabilized chlorine dioxide, and sodium lauroyl sarcosinate. ClōSYS[®] Anticavity Toothpaste C surpassed its prior formulation (Toothpaste B), USP standard, and Crest 3D White Mild Mint and Colgate Total Advanced Whitening toothpastes in enhancing fluoride uptake and remineralization.

Financial disclosure

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References

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