

Effects of SnF₂ and Baking Soda/Peroxide/NaF Dentifrices on Plaque Glycolysis and Regrowth

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ABSTRACT

A stannous fluoride dentifrice stabilized with sodium gluconate and stannous chloride has been clinically shown to reduce gingivitis (Perlich et. al., *J Clin Dent*, VI:54-58, 1995). The antigingivitis effects observed for this dentifrice appear to be related to SnF₂'s inhibition of plaque bacterial metabolism (Liang et. al., *J Clin Dent*, VI:80-83, 1995). In contrast to the established antimicrobial properties of SnF₂, controversy exists around the potential antiplaque activity of baking soda & hydrogen peroxide. Utilizing an *in situ* plaque glycolysis and regrowth model (PGRM) the objective of the present study was to evaluate the effects on plaque glycolysis and regrowth of the following commercially available dentifrices: (1) Crest[®] Gum Care (CGC-Procter & Gamble:0.454% SnF₂); (2) Mentadent[®] Baking Soda & Peroxide (MNT-Chesebrough-Ponds:0.243% NaF); and (3) Advanced Formula Crest[®] (AFC-Procter & Gamble:0.243% NaF). A crossover design was employed in which eight subjects brushed with each of the three dentifrices. On the morning of the test, subjects presented to the site having refrained from oral hygiene the previous 12 hrs. Baseline plaque samples were collected from the upper dentition which was then brushed for 30 seconds with the assigned dentifrice. Additional plaque samples were collected from the lower left and lower right quadrants, 15 and 45 minutes post-brushing. Normalized plaque biomasses, incubated in 0.03% TSB buffers, were assayed for plaque glycolytic and regrowth activities using the standard PGRM methodology (White et. al., *J Clin Dent*, VI:59-70, 1995). Analysis of treatment effects by time (measured as area under the curve: AUC) revealed the following mean AUC results. For plaque glycolysis: (1) CGC: 32.35a; (2) AFC: 17.78b; (3) MNT: 9.58c (a>b>c:ANOVA, p < 0.05). For regrowth: (1) CGC:236.65a; (2) AFC:88.33b; (3) MNT:73.17b (a>b:ANOVA, p < 0.05). **The results of this study show that CGC was significantly more effective than AFC and MNT at reducing plaque glycolytic and regrowth activity.**

INTRODUCTION

A stabilized stannous fluoride dentifrice has been clinically shown to prevent gingivitis and gingival bleeding (Perlich et. al., *J Clin Dent*, VI:54-58, 1995).

The antigingivitis efficacy observed for this dentifrice appears to be related to SnF₂'s inhibition of plaque bacterial metabolism (Liang et. al., *J Clin Dent*, VI:80-83, 1995). In contrast to the established antimicrobial properties of SnF₂, controversy exists around the potential antiplaque activity of baking soda & hydrogen peroxide. To date, there has been little scientific evidence that the topical application of baking soda & hydrogen peroxide provides any oral health benefit.

OBJECTIVE

The aim of the present study was to compare the effects on plaque glycolysis and regrowth of three commercially available dentifrices: (1) Crest[®] Gum Care (stannous fluoride); (2) Mentadent[®] Baking Soda & Peroxide (sodium fluoride); and (3) Advanced Formula Crest[®] (sodium fluoride).

MATERIALS AND METHODS

Dentifrices Tested

- Crest[®] Gum Care (CGC) - 0.454% stannous fluoride (P & G Company)
- Advanced Formula Crest[®] (AFC) - 0.243% sodium fluoride (P & G Company)
- Mentadent[®] Baking Soda and Peroxide (MNT) - 0.243% sodium fluoride (Chesebrough-Ponds)

Study Design

A crossover design was used in which 8 subjects brushed with each of the 3 test dentifrices twice.

Test Product Application

The PGRM technique was used in this study (Special Issue *J Clin Dent*, 6:59-70, 1995). On the morning of the test, subjects presented to the site having refrained from oral hygiene the previous 12 hours.

Subjects collected baseline plaque from the maxillary dentition with a sterile polyester swab. Subjects then brushed their maxillary dentition with 1.5 grams of the test dentifrice for 30 seconds, swished the resulting slurry throughout their mouth for an additional 30 seconds and then diluted the slurry with 10 ml of water and swished for 10 more seconds.

Plaque Collection

Treated plaque samples were self-collected by subjects from the left and right quadrants of the mandibular dentition 15 and 45 minutes post-brushing respectively.

Plaque Sample Preparation

Swabs containing plaque samples were placed in 1.75 ml of 0.03% BBL Trypticase Soy Broth and vortexed for 15 seconds. The resulting suspended plaque samples were then normalized for plaque biomass by adjusting to a constant optical density (OD) of 0.2 absorbance units with 0.03% TSB solution.

For Glycolysis

One ml of the normalized plaque/TSB solution was added to 50 µl of 40% sucrose solution in a 2 ml Eppendorf vial. The plaque samples (pH = 7.10) were then incubated for 2 hours at 37°C in an Eppendorf Thermomixer at 1200 rpm agitation. Acid production was determined by measuring the pH of the plaque samples following 2 hours of incubation. The lower the pH, the greater the glycolytic activity.

For Regrowth

300 µl of the normalized plaque/TSB solution was added to a 2 ml Eppendorf vial containing 0.5 ml of 6% (w/w) BBL TSB and 100 µl of sterile water. Bacterial growth was accelerated by the addition of 50 µl of a 40% sucrose solution.

Prior to incubation, the OD of the plaque sample was measured at 600 nm. Samples were incubated for 4 hours at 37°C in an Eppendorf Thermomixer at 1200 rpm agitation. After incubation, the OD of the plaque samples was measured following homogenization with a pellet mixer. Regrowth was determined by calculating the ratio of the post incubation OD to the pre-incubation OD. The greater the OD ratio, the greater the extent of plaque regrowth.

Calculation of Area Under the Curve (AUC)

The post incubation pH's and OD ratios of the treated plaques at the various sampling points were compared graphically to the final pH's and OD ratios of the baseline plaque samples. AUC's were calculated from the area between the baseline plaque pH or OD ratio and the treated plaque pH or OD ratio. The greater the value of the AUC, the greater the inhibition of plaque glycolysis and regrowth.

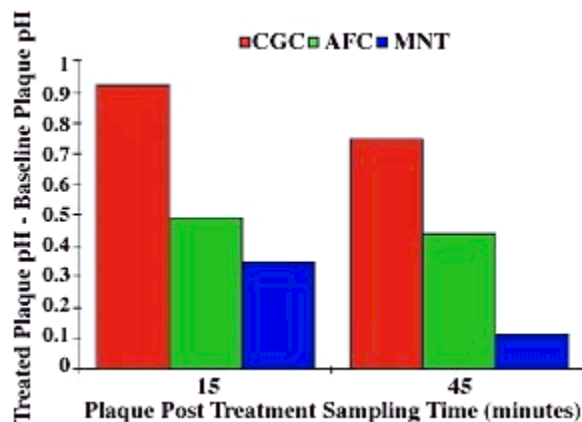
RESULTS

Table 1. Comparative Inhibition of Plaque Glycolysis

Dentifrice Tested	Mean AUC*
CGC	32.3 (9.7)a
AFC	17.8 (11.1)b
MNT	9.6 (10.7)c
	a>b>c, p < 0.01; ANOVA
* Mean of 15 treatments/test dentifrice, parenthesis enclose standard deviations	

Table 2: Comparative Inhibition of Plaque Regrowth

Dentifrice Tested	Mean AUC*
CGC	236.5 (120.4)a
AFC	88.3 (57.8)b
MNT	73.2 (45.9)b
	a>b, p < 0.05; ANOVA
* Mean of 15 treatments/test dentifrice, parenthesis enclose standard deviations	



CONCLUSION

-Crest® Gum Care was significantly more effective than Mentadent® Baking Soda & Peroxide and Advanced Formula Crest® at reducing plaque glycolysis and regrowth. These results provide additional data supporting the superior antimicrobial effects of SnF₂ relative to NaF.

-Advanced Formula Crest® was more effective than Mentadent® Baking Soda & Peroxide at reducing plaque glycolysis.

-The results of this study indicate that the addition of baking soda and peroxide does not appear to enhance a fluoride dentifrice's antimicrobial efficacy