

# In Situ Iodide Permeability of Root Dentin Following Use of Two SnF<sub>2</sub> Products

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## ABSTRACT

Stannous fluoride's tooth desensitizing effects are likely due to this agent's ability to occlude dentinal tubules. *In vitro* iodide permeability and SEM studies have previously shown that human dentin samples brushed with a SnF<sub>2</sub> dentifrice exhibited significant tubule occlusion (J. Arends et. al., *JDR*, 74, Abstract #984). The aim of the present study was to compare the effects of SnF<sub>2</sub> product treatments on the iodide permeability of root dentin *in situ*. A 4-leg, randomized cross-over study was conducted in which 10 subjects used each of the following products: (1) Crest<sup>®</sup> Gum Care (CGC - 0.454% SnF<sub>2</sub> dentifrice); (2) Crest<sup>®</sup> Gum Care Placebo (no SnF<sub>2</sub>); (3) Regular Crest<sup>®</sup> (RC - 0.243% NaF) + GelKam<sup>®</sup> (0.4% SnF<sub>2</sub> anhydrous gel); and (4) RC + GelKam<sup>®</sup> Placebo (GKP - no SnF<sub>2</sub>). Subjects were fitted with dental prostheses holding 4 tooth root sections (2 left & 2 right). Polished and intact roots were placed on each side of the prosthesis. The smear layer was removed from all polished roots (0.5M EDTA, pH = 7, 1 minute). Fresh root surfaces were exposed for 2 weeks to each test product. Subjects brushed with the test products twice per day in the following manner: 1&2 = two minute brushing; 3&4 = One minute with RC followed by 2 minutes with GK or GKP. Results from the iodide permeability (IP) assessment are reported as average values in µg iodide cm<sup>-2</sup> (parenthesis enclose SD). For polished roots in treatments 1 - 4, IP values were: 51(41)a, 162(72)c, 55(10)a and 89(41)b respectively (a < b < c, p < 0.05, t-test). For unpolished roots in treatments 1 - 4, IP values were: 75(46)a, 229(90)c, 68(37)a and 115(48)b respectively (a < b < c, p < 0.05, t-test). **We conclude that there is no significant difference in the iodide permeability of roots treated with either CGC or the combined regimen of RC + GK. These results suggest that brushing with CGC would be expected to provide desensitizing effects similar to those provided by GK.**

## INTRODUCTION

Anhydrous gel products containing 0.4% stannous fluoride have been clinically shown to reduce the pain associated with dentin sensitivity (W.J. Thrash, et. al., *International Dent J*, 44, No. 1, Supplement 1, pgs 107-118, 1994). The observed clinical effects of the anhydrous stannous fluoride gels appear to be related to occlusion of dentinal tubules

following repeated topical application. It has been previously shown (J. Arends & J.B. Shaffer, *JDR*, 74, Abstract #984) that human dentin samples brushed *in vitro* with an aqueous based stabilized stannous fluoride dentifrice exhibited tubule occlusion similar to what was observed in dentin samples treated with a 0.4% stannous fluoride containing anhydrous gel. Results of this work suggested that the stabilized stannous fluoride dentifrice would possess dentinal desensitizing effects *in vivo*, similar to that seen for anhydrous stannous fluoride gel products.

## OBJECTIVE

The purpose of this study was to compare, *in situ*, the effects of two commercially available stabilized SnF<sub>2</sub> products on tubule occlusion, as measured by iodide permeability of root dentin.

## MATERIALS AND METHODS

### Products Tested

- Crest<sup>®</sup> Gum Care (CGC) - 0.454% stannous fluoride/aqueous dentifrice base (Procter & Gamble Company)
- Crest<sup>®</sup> Gum Care placebo (CGCP) - 0% stannous fluoride/aqueous dentifrice base
- Gel-Kam<sup>®</sup> (GK) - 0.4% stannous fluoride/anhydrous gel (Colgate Palmolive Company)
- Gel-Kam<sup>®</sup> placebo (GKP) - 0% stannous fluoride/anhydrous gel

### Study Design

- Four-leg, randomized cross-over design with 10 subjects
- Subjects fitted with a dental prosthesis holding four dentin samples
- Two dentin samples, one polished and one intact, were placed on each side of the prosthesis
- Subjects used each test product for two weeks, brushing twice per day (morning & evening) with the dentin samples inserted in the prosthesis
- Subjects brushed with the test products in the following manner: For CGC and CGCP - two minute brushing; for GK and GKP - one minute with NaF control dentifrice (Regular Crest<sup>®</sup>) followed by two minutes with GK or GKP
- Following two weeks treatment, root sections were collected for iodide permeability assays
- Fresh root surfaces were used for each treatment

### Dentin Preparation

- Roots from human teeth were cut longitudinally with a water-cooled thin blade saw

### Polished Dentin Samples

- Samples were embedded in PMMA, except for the cut surface
- Surfaces were polished on 400 and 1200 grit wet sand paper
- Samples were kept moist throughout the polishing procedure
- Dentinal smear layers were removed from all polished surfaces by treating the root with a 0.5M EDTA solution for one minute

## Intact (Unpolished) Dentin Samples

- Samples were embedded in PMMA, except for the curved surface
- Samples brushed once with a non-fluoridated dentifrice prior to study start

*In situ* brushing of polished dentin surfaces with Crest<sup>®</sup> Gum Care or Gel-Kam<sup>®</sup> resulted in significantly reduced iodide permeability relative to brushing with the placebo products.

## Iodide Permeability Assays

- Rectangular windows (3x3 mm) were made on the samples using nail varnish
- Samples were dipped in 0.5M NaI solution for five minutes and blotted dry using facial tissue
- Samples were then placed in 3 ml water for 15 minutes and slowly agitated
- After sample removal, 60 µl ISA was added to the solution and iodide content measured using an Orion iodide electrode
- Surface area of each sample was measured under a stereomicroscope and iodide permeability calculated as µg iodide per cm<sup>2</sup>

**Table 2. Iodide Permeability of Intact (Unpolished) Dentin Samples**

Treatment:	Iodide Permeability in µg/cm <sup>2</sup> *:
Crest <sup>®</sup> Gum Care	75 (46)a
Regular Crest <sup>®</sup> + Gel-Kam <sup>®</sup>	68 (37)a
Regular Crest <sup>®</sup> + Gel-Kam <sup>®</sup> Placebo	115 (48)b
Crest <sup>®</sup> Gum Care Placebo	229 (90)c
	a<b<c, p<0.05; t-test
* mean of 20 samples per treatment; parentheses enclose standard deviations	

*In situ* brushing of intact dentin surfaces with Crest<sup>®</sup> Gum Care or Gel-Kam<sup>®</sup> resulted in significantly reduced iodide permeability relative to brushing with the placebo products.

## RESULTS

**Table 1. Iodide Permeability of Polished Dentin Samples**

Treatment:	Iodide Permeability in µg/cm <sup>2</sup> *:
Crest <sup>®</sup> Care Regular	51 (41)a
Crest <sup>®</sup> + Gel-Kam <sup>®</sup>	55 (10)a
Regular Crest <sup>®</sup> + Gel-Kam <sup>®</sup> Placebo	89 (41)b
Crest <sup>®</sup> Gum Care Placebo	162 (72)c
	a<b<c, p<0.05; t-test
* mean of 20 samples per treatment; parentheses enclose standard deviations	

## CONCLUSION

-There were no significant differences in the iodide permeability of dentin treated *in situ* with either Crest<sup>®</sup> Gum Care or a combined regimen of Regular Crest<sup>®</sup> and Gel-Kam<sup>®</sup>.

-These results suggest that brushing with Crest<sup>®</sup> Gum Care would provide clinical desensitizing effects.