Prevention of Caries by SnF_2 in a Microbial Caries Model

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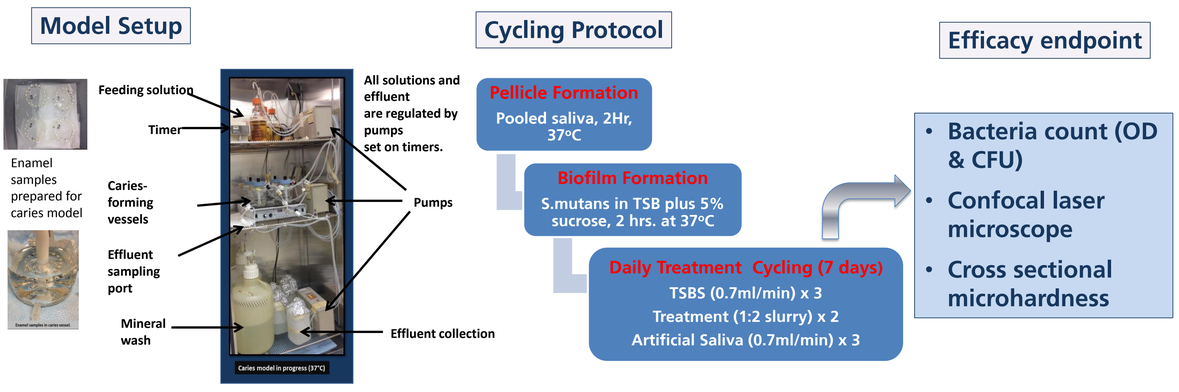
ABSTRACT

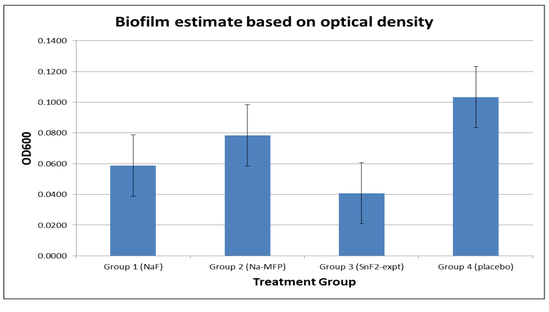
OBJECTIVE: Stannous fluoride (SnF_2) containing toothpaste has shown to have anticaries and antigingivitis effects. Its antimicrobial impact on the caries process is not well-understood. The purpose of this study was to determine the caries prevention potential of SnF_2-based dentifrice when compared to NaF- and SMFP-based dentifrices using a microbial artificial-mouth caries model. **METHODS:** Four groups of 16 human enamel specimens were inoculated with *Streptococcus mutans* and exposed for seven days to circulating Trypticase Soy Broth+5% sucrose for 30 minutes, 3x/day, and to a mineral wash solution for the rest of the day. Developing biofilms were exposed (2x/day) to one of the following dentifrice slurries containing: 1100 ppm NaF, 1100 ppm SMFP, 1100 ppm SnF_2, or 0 ppm F (placebo). Spent fluid from vessels was monitored daily for pH. At the end of the study, biofilms were sonicated and their amount was estimated. Specimens were sectioned and lesions volume was analyzed by cross-sectional microhardness (CSMH). Specimens were then stained with a fluorescent dye to determine lesion depth (LD) using confocal microscopy. **RESULTS:** SnF_2 treated specimens had significantly less biofilm than SMFP or Placebo treated specimens ($p<0.05$), and numerically lower than NaF treated specimens. Lesion depth was significantly different among all groups ($p<0.01$): placebo had the deepest lesions (65±3.5µm), followed by the NaF group (42±7.1µm), then the SMFP group (32.1±5.2 µm); and the SnF2 group showing the shallowest lesions (24.5±5.7µm). Caries lesions showed that the total amount of mineral loss (delta AUC sound – AUC lesion) was the least with the SnF_2 treated group (477±234) and the largest with the placebo group (1271±194), with no significant difference between NaF and SMFP (804±196; 758±237). **CONCLUSION:** Results from this study suggest that the antimicrobial activity observed from the SnF_2-containing dentifrice treatments could explain its greater caries prevention potential in this microbial artificial-mouth caries model.

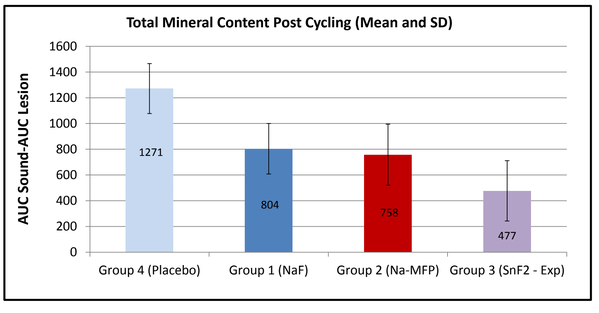
MATERIALS AND METHODS

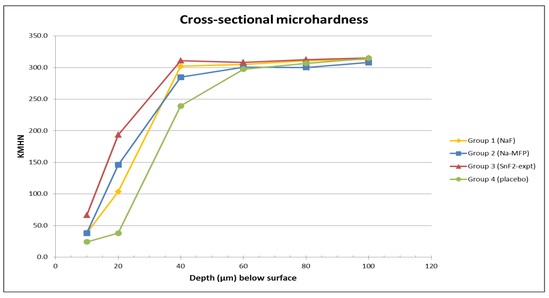
Study Design: A glass vessel housing human enamel specimens under sterile conditions is used as an artificial mouth with provision for in-flow and out-flow of liquids from the vessel. Each vessel contains 16 defect free sectioned, ground and polished specimens (3 x 3 mm) and is used for one treatment group (16 specimens / group). The lateral sides of each specimen and about 10-20% of surface were covered with an acid-resistant varnish, allowing only 80-90% of the enamel surface exposed. All groups are exposed to the same environmental conditions for seven days and differs only in the daily treatment with dentifrices. Each group received two daily 2-minute treatments with the 1:2 slurry of four different dentifrices; Placebo, 1100 NaF, 1100 SMFP and an experimental 1100 SnF2 toothpaste

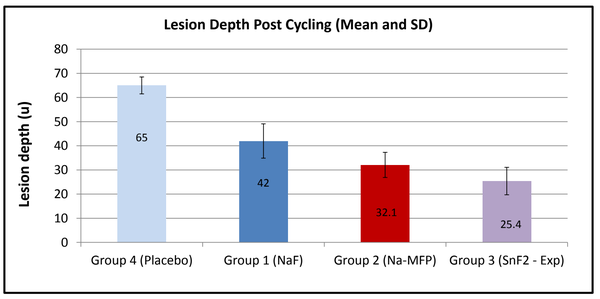


RESULTS









- SnF_2 treated specimens had significantly less biofilm vs. SMFP & Placebo ($p<0.05$), and numerically lower than NaF treated specimens.
- Lesion depth was significantly different among all groups ($p<0.01$); Placebo paste produced deepest lesion (65±3.5µm) and SnF2 shallowest (24.5±5.7µm) with NaF (42±7.1µm) and SMFP (32.1±5.2 µm) in between
- Total amount of mineral loss was the least with SnF_2 treated group (477±234) and the largest with the placebo group (1271±194), with no significant difference between NaF and SMFP (804±196; 758±237).

CONCLUSIONS

CONCLUSION: The microbial artificial-mouth caries model enables evaluation of anticaries performance of materials that work through mechanism beyond fluoride's remineralization and demin inhibition only, and the antimicrobial activity observed from the SnF_2 dentifrice could explain its greater caries prevention potential

Research presented at the IADR / AADR / CADR General Session, March 22 – 25, 2017, San Francisco, CA USA

P&G Oral Health