Antimicrobial Effects of Silver Diamine Fluoride (SDF) With Light Curing

Sarah Swanbeck, Gavin Banning, Jens Wilson, Victoria Sullivan, Katherine Howard, Karl Kingsley
University of Nevada, Las Vegas - School of Dental Medicine

BACKGROUND

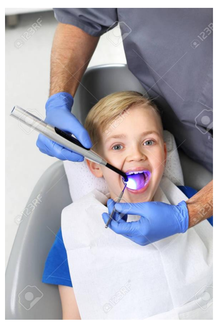
The use of silver diamine fluoride (SDF) has been proven as a useful and effective tool in clinical dentistry management of caries arrest and prevention.

The methods used for the micro brush application of SDF to arrest caries and prevent further carious lesions have been well established and standardized for the treatment of early childhood caries.

STUDY OBJECTIVE

Three recent studies have explored the effect of light curing, which may have the potential to accelerate precipitation of fluoride from SDF onto dentin and whether this has any effect on the antimicrobial properties of SDF.

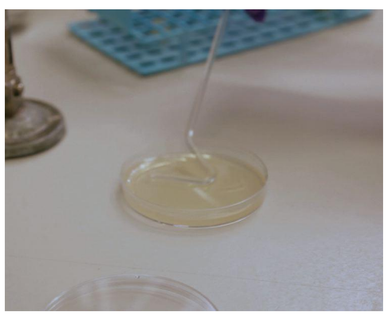
Based upon the limited evidence regarding this potential alteration, the overall objective of this project will be to explore the antimicrobial properties of SDF on oral microbes with and without light curing.



METHODS

IRB approval was not needed for this in vitro (cell-based) study.

- Single (*Streptococcus gordonii*) and polymicrobial (mixed salivary) colonies were grown according to standard protocols in LB broth.
- LB broth was made as a1-liter medium consisting of 10 grams of tryptone, 5 grams of yeast extract, and 10 grams of sodium chloride.
- Single and polymicrobial colonies were plated on LB agar nutrient-rich plates for 24 hours prior to assay.
- SDF was applied to hydroxyapatite discs with and without treatment with curing light and placed onto the bacterial plates.
- Differences in treatment were evaluated by using the Zone of Inhibition Test for Antimicrobial Activity (ZIT-AA).
- Data from the two treatments (SDF, SDF with light curing) were physical measurements of the size of the ZIT-AA and were therefore continuous data. These data were analyzed using two-tailed t-tests for statistical significance, which is appropriate for parametric data.



RESULTS

Single colony (gram-positive *S. gordonii)* and polymicrobial salivary colonies plated on LB agar nutrient-rich plates exhibited positive Kirby-Bauer Zone of Inhibition (KB-ZOI) results for both SDF and SDF plus curing light treatments.

Figure 1. A) Image showing KB – ZOI for SDF and SDF plus curing light treatments. B. Statistical analysis demonstrated no significant differences in the areas between the two treatment groups for the single bacterial colony tests (SDF: 1.27 cm^2 versus SDF plus curing light: 1.25 cm^2), p=0.887 and polymicrobial colonies (SDF: 1.26 cm^2 versus SDF plus curing light 124.5 cm^2), p=0.771.

Three separate, independent trials were conducted with no significant differences between trials.

Silver diamine fluoride (SDF) has dual mechanisms of action, with the silver acting as a general antimicrobial agent and the fluoride blocking bacterial metabolism. Fluoride blocks phosphoenolpyruvate (downstream step in glycolysis) for sacchrolytic bacteria.

Several studies have shown that some gram-negative bacteria, such as *P. gingivalis*, *Pseudomonas* and *Fusobacterium* (*F. nucleatum*), which are asacchrolytic may also be resistant to SDF. Plating of *P. gingivalis* and SDF (with and without light curing) has confirmed these observations as the negative control (image, right).

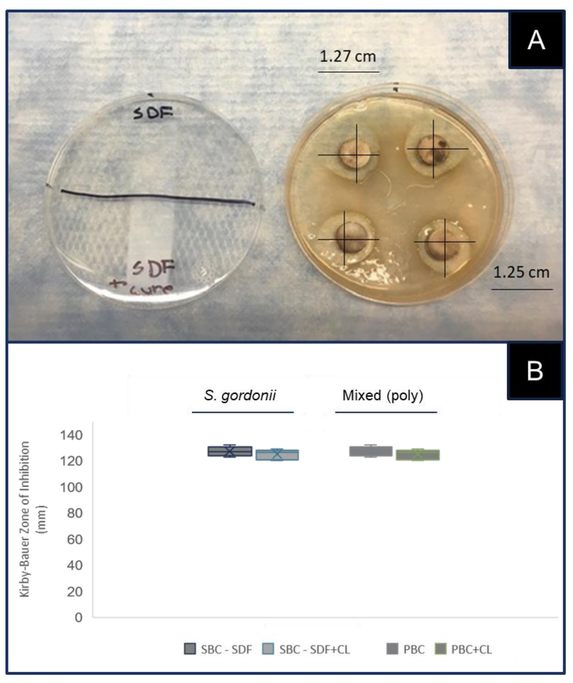


Figure 1. Zone of Inhibition Test for Antimicrobial Activity (ZIT-AA). A) Visual inspection of ZIT-AA. B) Measurements for ZIT-AA and SBC (*S. gordonii*) or polybacterial culture or PBC (mixed bacteria).

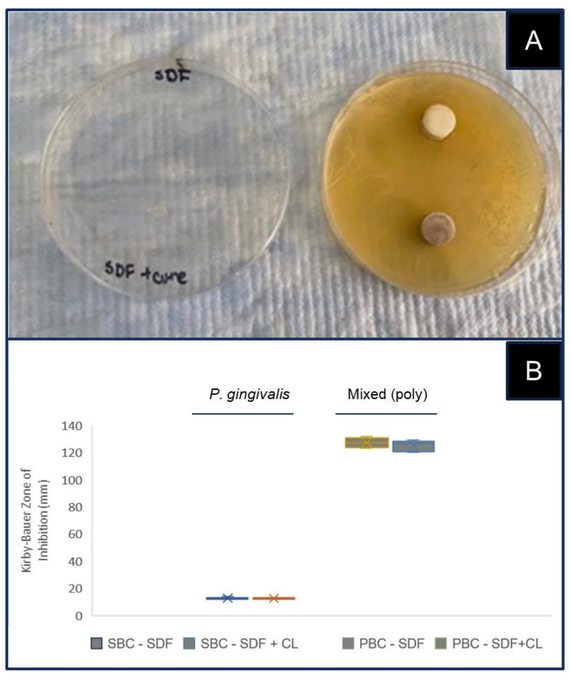


Figure 2. Zone of Inhibition Test for Antimicrobial Activity (ZIT-AA). A) Visual inspection of ZIT-AA. B) Measurements for ZIT-AA and SBC (*P. gingivalis*) or negative control.

CONCLUSIONS

Although a few recent studies have demonstrated SDF in conjunction with curing lights may increase silver ion precipitation and dentin hardness *ex vivo* and *in vitro*, the results of this study evaluated the antimicrobial properties of SDF with and without curing light and found no significant differences between these treatments.

While there may be specific properties associated with SDF induced following light curing, these differences do not appear to be associated with the antimicrobial properties affecting the *S. gordonii* gram-positive or polymicrobial films.

Future research may expand the range of bacteria evaluated to investigate whether other gram-positive organisms may be susceptible to this treatment or if these results can be broadly generalized.

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