

Monitoring Extracted Teeth Treated with Silver Diamine Fluoride using PTR-LUM Abstract # 2431



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Introduction

Silver diamine fluoride (SDF) is a colorless liquid that at pH 10 is 24.4% to 28.8% (weight/volume) silver and 5.0% to 5.9% fluoride. SDF Forms silver-protein conjugates in decayed surfaces. Hydroxyapatite and fluoroapatite form on the exposed organic matrix, along with the presence of silver chloride and metallic silver. Silver ions act directly against bacteria in lesions by breaking membranes, denaturing proteins, and inhibiting DNA replication.

Research Questions: Is SDF incorporated into ICDAS 1 and 2 lesions? If so what happens to these lesions over time?

Objectives

This study evaluated the ability of PTR-LUM (The Canary System, CS), and visual examination (ICDAS II) to monitor changes in extracted teeth treated with Silver Diamine Fluoride (SDF) for 100 days in vitro.

Materials & Methods

Fifteen extracted human molars and premolars, consisting of five teeth with a marked ICDAS 0 surface, 5 teeth with ICDAS 1-2 lesions on one surface and 5 teeth with natural-cavitated lesions were stored in distilled water until one day before the study commenced. One day prior to commencing, the teeth were placed in artificial saliva. Next day, SDF (Elevate Oral Care) was applied on the lesions and marked ICDAS 0 surfaces, allowed to dry and the tooth placed back into the artificial saliva. The treated surfaces and all untreated smooth tooth surfaces were scanned using CS and photographed before starting the study and on day 1, 6, 40, 60 and 100. On the first day following the application of SDF the teeth were placed back into fresh artificial saliva. The average Canary Number (CN) for each smooth surface was used in the covariance and correlation analysis.

Results

The Canary Number Scale



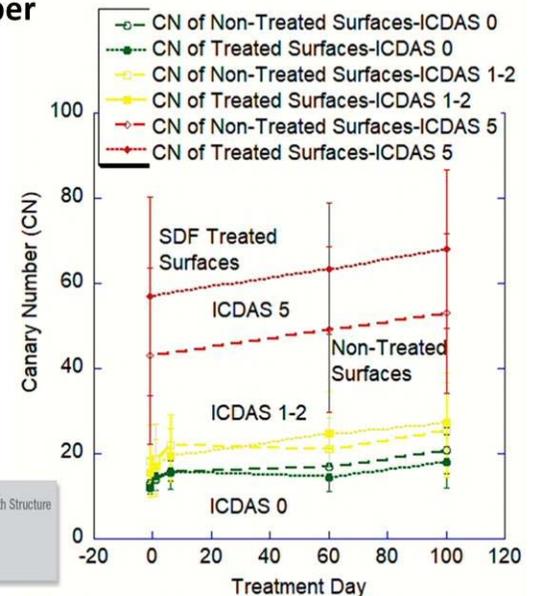
The Canary Number Scale is a relative scale of 0 - 100 that reflects the state of tooth mineralization and crystallization. This is a graduated scale where lower numbers indicate sound enamel and higher numbers indicate more advanced tooth decay / caries.

ICDAS 0 Non-Treated Surfaces that Picked up SDF



Tracking Canary Number in 3 SDF Treatment Groups over Time

Note: The error bars are large since these are average measurements from across the entire tooth - both treated and non-treated surfaces of 5 samples.



The Canary Number (CN) increased on all tooth surfaces in all groups over time after SDF application. Covariance and correlation coefficient increased with increase in ICDAS ranking. It is presumed that CN increased primarily as silver ions diffused into the tooth structure, which caused an increase in PTR signal. Some of the ICDAS 0 tooth surfaces did pick up SDF and changed colour over time (as shown above). Some of the teeth in the ICDAS 1-2 group, which should have non-uniform crystal structure did not change colour or show an increase in Canary Number. This may be due to visual exam not indicating a change in enamel structural integrity.

Discussion

- In clinical practice, SDF is being applied to open lesions (ICDAS 5 – 6) to help stabilize the lesion and prevent further degradation due to caries.
- It appears that clinically, SDF may be picked up by adjacent tooth surfaces or neighbouring teeth if there is not proper isolation.
- SDF may also be picked up by saliva after initial application and absorbed into neighbouring teeth or adjacent tooth surfaces over time.
- In this study, one application of SDF and then storage of the teeth in artificial saliva did cause the Canary Number to increase over time on treated and non-treated tooth surfaces.
- On open lesions (ICDAS 5 -6) the Canary Number rose on both treated lesion and non-treated surrounding tooth surfaces and there was a significant colour change
- On ICDAS 1 – 2 teeth the Canary Number did increase, especially in the area of a white spot lesion. On some teeth there were changes in colour as well.
- On ICDAS 0 group there were situations there were changes in colour and the Canary Number rose over time. This might indicate SDF was incorporated into the tooth surface.

Conclusion

It appears that SDF or its components become incorporated into lesions over time. The Canary System can detect these changes even if colour changes aren't detected. Additional research should assess:

- If SDF is being picked up by adjacent teeth or tooth surfaces?
- Does SDF impact the structural integrity of ICDAS 1 or 2 lesions and will it inhibit remineralization?