

Treating Severely Decayed Tooth Structure with Silver Diamine Fluoride (SDF)

(Centrix, Inc.)

Introduction

Dental caries is a common chronic disease affecting individuals of all ages, with a significant impact on the overall health and quality of life. It is caused by the demineralization of tooth structure by acids produced by bacteria in dental plaque. If left untreated, caries can progress and lead to tooth loss, pain, and infection. The traditional approach to managing caries has been to remove the decayed tooth structure and restore the tooth with various dental materials. However, incorporating alternative approaches such as remineralization therapy with **SilverSense SDF™** (Centrix, Inc.) along with modern dental materials and techniques have reshaped how clinicians approach caries management, not just in young patients but adults as well. **SilverSense SDF** (Centrix, Inc.) is a 38% silver diamine fluoride that contains, approximately, 25% silver (weight/volume), that acts as an antimicrobial, and ~5.0% fluoride to help prevent further demineralization and begin the remineralization process. It has been approved by the FDA for use as a desensitizing agent. It works by forming a layer of silver phosphate on the surface of the tooth, inhibiting bacterial growth and remineralizing the demineralized tooth structure.

Silver Diamine Fluoride (SDF) has emerged as a promising agent in the field of dentistry, particularly in aiding the remineralization of tooth structure. This case report presents four successful cases where SDF was employed to arrest decay and remineralize tooth structure, avoiding invasive treatments and preserving the vitality of the teeth.



Case 1: Deep Carious Lesion on Tooth #3

A 47-year old female patient presented with a deep carious lesion on tooth #3 with a deep carious lesion noted radiographically and clinically. Prior to administration of local anesthetic, the tooth was diagnosed as vital with normal pulpal health. Upon excavation of decay, close proximity to the pulp tissue was confirmed clinically. Selective caries removal was performed, stopping short of the pulp, followed by the application of **SilverSense SDF** (Centrix, Inc.) and was subsequently air dried. A light-curable resin-modified calcium silicate bioactive liner was placed at the deepest part of the preparation, covering the region closest to the pulp. A light-curable resin composite was placed incrementally as the final capping layer: an opaque layer of composite was initially applied followed by a universal light shade of composite to color blend with the tooth. Note that using a curing light will activate the silver ions that have been scrubbed into the dentinal tubules; therefore, the preparation needed to be refined at the cavo-surface margin and DEJ to avoid noticeable discoloration and cosmetic failures. The patient experienced no post-operative sensitivity or complications.



Figure 1. Pre-operative: Clinical decay on tooth #3.



Figure 2. Conservative selective caries removal performed prior to the application of **SilverSense SDF** (Centrix, Inc.).



Figure 3. Decay removal was stopped short of the pulp.



Figure 4-5. To avoid the discoloration, bevel the cavosurface margin after light curing or use a self-curing material. **SilverSense SDF** (Centrix, Inc.) was applied followed by an indirect pulp cap with a light curable bioactive liner **Lime-Lite™ Enhanced** (Pulpdent) and restored with an opaque universal composite resin **SimpliShade™ Universal** Opaque and Medium (Kerr).

Case 2: Root Surface Carious Lesion on Tooth #31

A root surface carious lesion was identified on the cervical of the mesio-buccal root surface of tooth #31. After removing the decay, *SilverSense SDF* (Centrix, Inc.) was applied, dried, and wiped with gauze. A dual-curing RMGI composite was then applied and allowed to self-cure to prevent potential discoloration from light curing over the *SilverSense SDF* (Centrix, Inc.)-treated surface. Once the material was cured, it was trimmed and polished. The patient reported no post-operative sensitivity or issues.



Figure 6. Tooth was initially treated at a hygiene visit with *SilverSense SDF* (Centrix, Inc.) to arrest the progression of the decay.



Figure 7. Decay was removed, and it extended approximately 2mm subgingivally. *SilverSense SDF* (Centrix, Inc.) was applied followed by a dual cure RMGI, *GC Fuji® Automix LC* (GC America) shade A2, that bonds in the presence of saliva.



Figure 8. Final restoration: RMGI was allowed to self cure to avoid discoloration.

Historical Reference Cases Using SDF

Case 3: Malformed tooth structure resulting in a severe decay on a 3-year-old female

In 2018, a 3-year-old female patient presented with underdeveloped primary second molars exhibiting poor enamel formation, resulting in moderate carious lesions on the occlusal surfaces. The patient was unable to tolerate treatment until she was older. Conservative therapy was performed. The initial recommendation from another clinician involved pulpotomies and stainless steel crowns. However, an alternative approach was proposed, involving the application of SDF and fluoride varnish every three months with continued monitoring. As the patient grew older and demonstrated improved compliance, a final application of SDF was administered, followed by the placement of a durable RMGI filling material. This technique successfully prevented recurrent decay, and the teeth continue to remain healthy and symptom-free 5½ years later.



Figure 9. 2018: Pre-operative panoramic view



Figure 10. 2020 introral images (2 years post op of SDF and fluoride varnish applications) showing arrested decay on Tooth T and K. Defects were present in the tooth structure, making it difficult to keep debris out of the area and combat subsequent recurrent decay formation.



Figure 11. 2021: 3-year follow up, bite wing of tooth T showing new interproximal decay on mesial. This is after repeated SDF and fluoride varnish applications and RMGI occlusal fillings on K and T. RMGI filling is intact, but new decay now present on mesial which was subsequently treated.



Figure 12. 2022: 4 years after repeated SDF and fluoride varnish applications and RMGI occlusal fillings K and T. Bite wing shows treated interproximal decay on mesial. Additional sites have also been treated. Occlusal surfaces of K and T that were initially treated with SDF and RMGI are intact and stable with no evidence of recurrent decay.



Figure 13. 2023: The teeth are stable and free of recurrent decay. The discoloration is of no concern since conservative therapy was performed, and pulpotomy and stainless steel crowns were avoided.



Figure 14. 2023: 5½ years after repeated SDF and fluoride varnish applications and RMGI occlusal fillings K&T

Case 4: Occlusal Decay in an 18-Year-Old Male

An 18-year-old male patient presented with severe decay on the occlusal surfaces of his second molars following orthodontic therapy. Despite the teeth exhibiting vital pulpal health, endodontic therapy was considered likely due to the proximity of the decay to the pulp tissue. Additionally, the impacted third molars further complicated the situation, as they lacked sufficient space to erupt and their positioning against the distal surfaces of the 2nd molars could potentially compromise the success of indirect restorations subsequently needed after endodontic therapy. To mitigate the progression of decay, SDF was applied until the patient could receive restorative treatment. Selective caries removal was performed, followed by the application of SDF, a light-curable resin-modified calcium silicate bioactive liner, a dual-curing RMGI base, and a final layer of light-curable resin composite. This approach preserved the vitality and health of the teeth, maintaining their asymptomatic state going on 2 years since treatment.



Figure 15 -16. 2019: Left side bitewing (photo left). Right side bitewing (photo right) No evidence of decay, but hygiene discussed as related to demineralization and gingival coverage over the patient's molars.

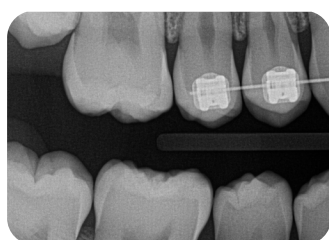


Figure 17. 2021: Patient is now 16 years old, severe decay noted on second molars. Teeth tested vital and asymptomatic.



Figure 18. 2021 Immediate post-op radiograph: Conservative selective caries removal performed with SDF. Decay removal was stopped short of the pulp. SDF was applied followed by an indirect pulp cap with a light curable bioactive calcium silicate **TheraCal LC**, (Bisco) and restored with a bioactive RMGI filling material and composite resin capping layer. Teeth remained vital and asymptomatic post operatively.



Figure 19. 2022: 11-month follow-up radiograph. Teeth remained vital and asymptomatic post operatively at subsequent follow-up appointments. Third molars were removed. The SDF discolored only the carious tooth structure, but after using a LED curing light to cure the bioactive calcium silicate indirect pulp cap, the remaining tooth surfaces became discolored.



Figure 20. 2023: 2-year follow up, tooth #31. The SDF discolored only the carious tooth structure, but after using a LED curing light to cure the bioactive calcium silicate indirect pulp cap, the remaining tooth surfaces became discolored. To avoid the discoloration shown, bevel the cavosurface margin after light curing or use a self-curing material.

Figure 21. 2023: 2-year follow up, tooth #2. The SDF discolored only the carious tooth structure, but after using a LED curing light to cure the bioactive calcium silicate indirect pulp cap, the remaining tooth surfaces became discolored. To avoid the discoloration shown, bevel the cavosurface margin after light curing or use a self-curing material.



Figure 22. 2023: Radiograph of tooth #2. Two-year followup. Teeth remained vital and asymptomatic post operatively at subsequent follow up appointments. No evidence of the progression or recurrence of decay noted.



Figure 23. 2023: Radiograph of tooth #31. Two year follow-up. Teeth remained vital and asymptomatic post operatively at subsequent follow up appointments. No evidence of the progression or recurrence of decay noted.

Discussion

The cases presented in this report demonstrate the effectiveness of SDF in aiding the remineralization of tooth structure and preventing further decay in patients of varying ages. Its application extends beyond pediatric dentistry, proving beneficial in both pediatric and adult patients. **SilverSense SDF** (Centrix, Inc.) offers a conservative approach to caries management, with the potential to avert invasive treatments such as pulpotomies, root canal therapy, and full coverage restorations.

Conclusion

The use of SDF has shown promising results in clinical practice, aiding in remineralization and preventing decay. Further studies and research are warranted to comprehensively understand the long-term effects and benefits of SDF. Nevertheless, its current applications have demonstrated significant advantages for both patients and clinicians, offering a valuable tool in the conservative management of caries and the preservation of tooth health.