6

SDF's "Black Magic" Arrests Caries in Prosthodontic and Sjögren's Patients

LAING, LESLIE P. [1,2]

[1]Discipline of Prosthodontics, Faculty of Dentistry,
University of Toronto, Toronto, ON, CANADA; [2]Sjögren's Society of Canada

ABSTRACT

Background: Recent evidence has indicated that silver diamine fluoride (SDF) is 89% more effective in controlling/arresting caries progression than other treatments[1,2]. Patients with multiple long-standing crowned teeth or Sjögren's Disease (SjD) frequently present with numerous oral manifestations: dry mouth, rampant dental decay, and frequent deterioration of dental restorations. Despite repeated applications of high fluoride-containing products, the decay often persists.

Objective/Hypothesis: To investigate the effects of SDF application in patients with long-standing crowned teeth or with SjD.

Methods: Participants who had 20 or more years with crowned teeth (Group 1) or who had been diagnosed with SjD (Group 2) were recruited and given written/verbal information about the advantages/disadvantages of SDF application. After obtaining consent, charting of participants' teeth was made and the presence of decay and/or patient-reported sensitivity was noted. SDF was applied to posterior teeth in contralateral quadrants. Two to six weeks later, SDF was applied to posterior teeth in the remaining two quadrants. Re-examination and re-application occurred at three- to six-month intervals for up to four years. Teeth were analyzed intra-orally for their hardness and lack of sensitivity. Where appropriate, cavitated lesions arrested by SDF were restored atraumatically with composite resin (CR) or glass ionomer (GI). Patient satisfaction questionnaires were completed.

Results: SDF stained only those areas of enamel and/or dentin where softness had been detected or at borders of previously placed CR restorations. The decay rate significantly decreased over the testing period for up to four years following initial SDF application. Patients reported decreased sensitivity and increased self-esteem, self-confidence, and satisfaction with restored teeth.

Conclusion: The clinical use of SDF in patients with long-standing crowns or with SjD was shown to reduce/arrest caries progression which had previously proven to be elusive.

INTRODUCTION

- Patients who decades ago had placement of tooth-supported crowns or fixed partial dentures (FPD) frequently find that decay arises at the gingival margins of these restorations. As these patients age, they are often reluctant to have such reconstructive work replaced. Such complications are frequently associated with an increased use of medications with dry mouth as a side effect.
- Another source of dry mouth is Sjögren's Disease (SjD), a systemic autoimmune disease characterized by the lymphocytic infiltration and dysfunction of the exocrine glands, notably the lacrimal and salivary glands.
- The oral consequences of dry mouth/ hyposalivation are:
  - Altered salivary compositions
  - Loss of the protective effects of saliva including:
    - buffering capacity
    - antimicrobial capabilities
    - oral clearance of bacteria and food debris[3].
  - A dysbiosis created in the oral microflora
  - An increase in aciduric/acidogenic genera
  - A more caries-susceptible environment[4]
- Resulting oral manifestations include:
  - rampant tooth decay **(Figure 1)**
  - frequent deterioration of dental restorations
  - increased tooth loss
  - oral candidiasis

Figure 1. Dentitions of two patients with SjD. The bottom 3 photos are of the same patient over a 5-year period.

- The decay characteristics in SjD patients do not conform to those in salivators suggesting that species, other than *Strep. mutans* may be held suspect.
- We previously reported[5] through real-time PCR that *Actinomyces naeslundii*, *Scardovia wiggsiae*, *Lactobacillus fermentum*, and *Lactobacillus acidophilus* were all significantly elevated in oral plaque obtained from SjD patients and that an organism, *Scardovia wiggsiae*, associated with **Severe Early Childhood Caries (SECC)** is also an indicator species in SjD **(Figure 4 A)**.

- In recent years, **silver diamine fluoride** (SDF) has been approved in North America as minimally invasive treatment for dentine hypersensitivity and carious lesions[6].
- The silver ions exert broad-spectrum antimicrobial effects through mechanisms such as disrupting bacterial cell membranes and/or walls, inhibiting enzyme activity and inactivating bacterial nucleic acids **(Figure 2)**.
- The fluoride enhances remineralization and prevents further demineralization of tooth structure.
- Numerous studies are emerging indicating that SDF is highly effective in arresting and preventing carious lesions, particularly in pediatric patients suffering from **SECC**[7-9].
- To date there are no clinical trials that have explored whether it may confer similar oral health benefits for dry mouth patients, and particularly SjD patients, who share a similar decay pattern and decay-causing bacteria as those with SECC.

Figure 2. Mechanism of Action of Advantage Arrest (38% silver diamine fluoride (SDF)):

- 25% silver: antimicrobial
- 8% ammonia: solvent
- 5% fluoride: remineralization

(ScienceDirect.com)

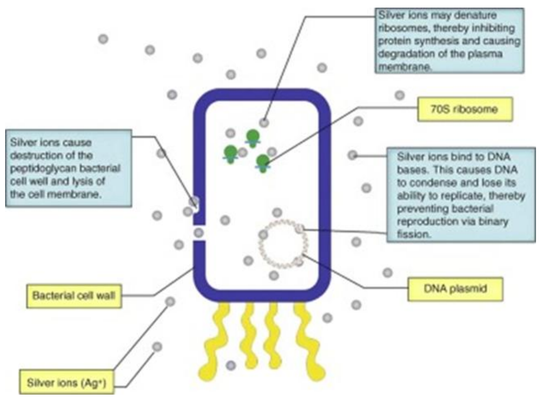

Figure 3. SDF application procedure

Figure 4. Decay Pattern in Severe Early Childhood Caries Primary anterior teeth: (A) Before SDF; (B) After SDF application[10]

OBJECTIVE

To investigate the effects of SDF application in patients with long-standing crowned teeth or with SjD.

METHODS

- Participants who had at least 20 years with either tooth-supported crowns or fixed partial dentures (FPDs) (Group 1) or who had previously been diagnosed with SjD (Group 2) were recruited.
- Diagnosis of SjD was made at the Sjögren's Clinic, Toronto Western Hospital, University Health Network.
- Each participant was given written and verbal information following the protocol as outlined by UCSF, and standardized consent forms were signed[6]
- Dental charting was completed, and presence of decay and/or patient-reported sensitivity was noted.
- Carious lesions were identified by softness as determined by explorer probing and noted along with patient-reported indications of sensitivity.
- After cotton roll isolation and drying of the area 38% SDF (**(Figure 3)** Advantage Arrest, Oral Science) was applied with a wet micro-tip brush to exposed enamel, dentin, and/or cementum of posterior teeth for 60 seconds in contralateral and cross-arch quadrants *i.e.*, quadrants 1 and 3 or 2 and 4.
- Participants were instructed to follow their usual oral hygiene routine at home.
- Because of concerns about darkening of the teeth, the SDF was initially applied only to posterior teeth to gauge the patient's response.
- Two to six weeks later, SDF was similarly applied to posterior teeth in the remaining two quadrants and, with the patient's approval, to the lingual side anterior teeth where aesthetically appropriate.
- Teeth were analyzed intra-orally for their hardness and lack of sensitivity.
- Re-examination and re-application of SDF occurred at subsequent three- to six-month intervals with SDF re-application to all previously treated teeth for up to four years following initial SDF application
- With patient's approval and request, cavitated lesions arrested by SDF were restored atraumatically with composite resin (CR) or glass ionomer cement (GIC).
- Participants completed satisfaction questionnaires.

RESULTS

- Participants included > 25 Group 1 patients with 20⁺-year-old crowns/FPDs (**Figure 5**), > 85 Group 2 SjD patients (**Figure 6**), + healthy controls
- Any previously reported sensitivity issues disappeared for the duration between application periods.
- All areas with previously soft carious lesions were now hard in as quickly as a week
- SDF stained only those areas of enamel and/or dentin where softness had been detected or at borders of previously placed CR restorations.
- The rate of decay significantly decreased over the testing period for up to four years following initial SDF application.
- Patients reported decreased sensitivity and increased self-esteem, self-confidence, and satisfaction with restored teeth.

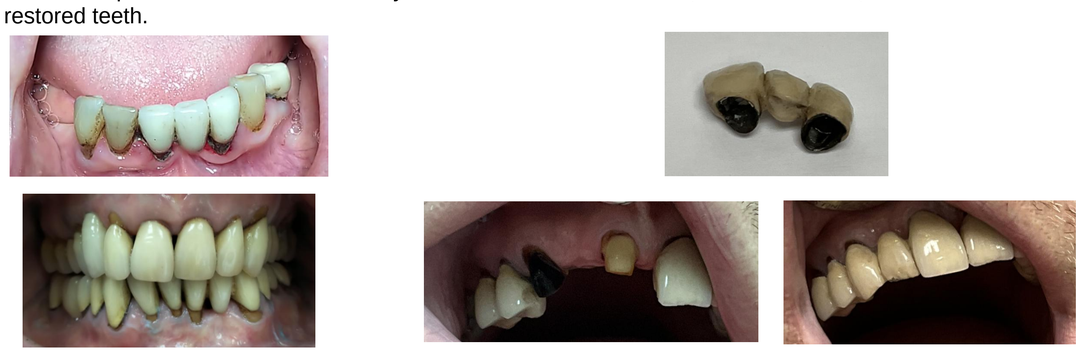

Figure 5: SDF-treated teeth of patients with long-standing fixed prostheses (Group 1). On the right is shown FPD 11-x-13, which had fallen out. The abutment teeth had previously been treated with SDF. No decay was detected on the 13, allowing appropriate and acceptable recementation of the FPD.

Figure 6: SDF-treated teeth of SjD patients (Group 2). Note the staining of the borders of previously placed CR restorations on the left. On the right, note the staining of the gingival margins on the buccal of the mandibular teeth but the lack of SDF-staining on the lingual surfaces which is likely due to the proximity of sub-lingual salivary secretions.

Figure 7: SDF-treated teeth of SjD patients (Group 2) before restorative treatment (top) and after (bottom).

CONCLUSIONS

- The use of SDF in patients with decades-old full-coverage restorations or SjD was shown to have arrested decay as early as the three-month follow-up examination appointment.
- With continued reapplication of SDF at 3-6 months, the caries process was stabilized for 3+ years.
- Where appropriate, aesthetic restorations were placed atraumatically with minimal invasion, *i.e.*, without the use of anaesthetics or drilling, and remained without detectable decay for up to four years.

CLINICAL SIGNIFICANCE

- The clinical use of SDF at 3-6-month intervals in patients with long-term fixed prostheses or with SjD was shown to reduce/arrest caries progression which had previously proven to be elusive.
- Once treated, a minimally invasive bonding technique with either CR or GI can provide a durable, inexpensive, yet aesthetic option for the SjD patient.

REFERENCES

1. Chibinski AC, *et al*. Caries Res 2017;51:527-554.
2. Oliveira BH, *et al*. J Am Dent Assoc. 2018 Aug;149(8):671-679.e1.
3. Gonçalves C, *et al*. Phytochemistry. 2005 Jan;66(1):89-98.
4. Proctor DM, *et al.* Nat Commun. 2018 Feb 14;9(1):681.
5. Laing Gibbard LP, *et al*. BATTS; 2016 Oct.
6. Horst JA, *et al.* J Calif Dent Assoc. 2016 Jan;44(1):16–28.
7. Mei ML, *et al.* J Dent Res. 2018 Jul;97(7):751–8.
8. Chu CH, *et al.* Int J Paediatr Dent. 2012 Jan;22(1):2–10.
9. Mei M-L, *et al*. Med Oral Patol Oral Cirugia Bucal. 2013 Nov1;18(6):e824-831.
10. Nuvvula S and Mallineni SK, J South Asian Assoc Pediatr Dent 2019;2(2):73–80.

ACKNOWLEDGEMENTS

- Funding provided by the Sjögren's Society of Canada.
- Gratitude to the participants