

Rampant caries management using Silver Diamine Fluoride (SDF): A case report

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ABSTRACT

The present study aims to demonstrate the efficacy of silver diamine fluoride (SDF) for the management of dental caries and to identify its potential drawbacks in a dental clinic setting. A 14-year-old female accompanied by her mother came to the clinic with a complaint of mild pain when drinking water and wanted to restore her carious teeth. Medical history was insignificant. History taking revealed poor oral hygiene with a highly cariogenic diet. Radiographic examination showed multiple caries lesions with severe decay of anterior teeth. Clinical examination revealed rampant caries of all upper and lower anterior and posterior teeth. The proposed treatment was to prevent further decay of teeth by applying silver diamine fluoride on the decayed teeth and restoring them with glass ionomer due to financial and time limitations. Glass ionomer restorations were placed during multiple visits over few weeks. The patient's discomfort and anxiety diminished substantially and she experienced no new primary or secondary caries lesions. Tooth discoloration was minimized by selective removal of superficial SDF-hardened tooth structure, followed by glass ionomer restoration. To conclude, silver diamine fluoride can be a safe and effective treatment option to address rampant caries in the young population if it is applied safely and its potential side effects addressed accordingly.

Keywords: Silver Diamine Fluoride, Caries, Public health, Oral health.

1. INTRODUCTION

The burden of untreated caries lesions is still high despite the raised awareness and better care with a constant trajectory over the last couple of decades (Peres et al., 2019; Uribe et al., 2021). Caries on primary teeth was considered second among non-communicable diseases in children aged 0–14 years old, according to the 2019 Global Burden of Disease Study (IHME, 2021). Caries activity on primary teeth has been documented to be significantly more invasive when compared to permanent teeth due to differences in histology and anatomy (Tickotsky et al., 2017). Attempting to treat children's primary teeth in dental practice can be quite a challenge depending on their cooperation. The main goal of treatment in these situations is to perform noninvasive or minimally invasive therapeutic restorative treatments. One of the proposed solutions that embody this

principle is silver diamine fluoride (SDF) (Zaffarano et al., 2022). SDF is a chemical solution based on silver nitrate and fluoride. It acts as a bacteriostatic and helps in the remineralization of enamel (Chu et al., 2012). SDF has been approved since the late 1960s in multiple countries around the world with a concentration range from 10% to 38% (Horst et al., 2016; Lo et al., 2001; Nishino et al., 1969). The main advantage of SDF is to control caries activity, which can be useful when dealing with the limitation of providing oral care on a population scale. Also, it is inexpensive and simple in its application method, resulting in easing anxiety in young children, as well as the likely impact it can have on arresting caries at the community level (Lo et al., 2001). The primary drawback of SDF is the discoloration of tooth structure. However, the discoloration after application of SDF on posterior teeth was reported to be more acceptable than discoloration of anterior teeth and was more preferred to other advanced treatment options that may require behavioral management of young children (Crystal et al., 2017). The following study aims to (1) demonstrate the efficacy of SDF in managing a child with rampant caries and (2) demonstrate a method to mitigate the possible side effects of the material as well.

2. CASE REPORT

A 14-year-old white female came with her mother to the clinic complaining of mild pain when drinking water and wanted to restore her carious teeth. The patient’s guardian was not aware of any medical conditions regarding the patient. Dental history showed previous preventive dental treatments involving fissure sealants. The family had financial limitations, could come only once a week and the patient could not withstand long appointments. Also, based on the patient’s history, there was a lack of oral hygiene since she did not brush her teeth and had a highly cariogenic diet involving eating sugary sweets and cakes regularly. Extra-oral examination findings were normal. The patient provided a set of recent full-mouth intra-oral radiographs, but could not afford to take a panoramic or other newer radiographs. Based on the radiographs provided, multiple caries lesions were evident, especially on the upper and lower anterior teeth (Figures 1, 2). Clinical examination revealed caries lesions affecting all teeth except the second molars. Fissure sealants were present on all the first molars, protecting the occlusal surfaces even though the smooth surfaces exhibited extensive caries lesions. Examination findings are photographed and written in detail (Figure 1) (Table 1).

Table 1 Clinical findings regarding the status of teeth based on caries involvement

1 st quadrant	#17	Sound	2 nd quadrant	#27	Sound
	#16	Sealant and Distal proximal caries		#26	Sealant and Mesial proximal caries
	#15	Mesial proximal caries		#25	Occlusal caries
	#14	Mesial proximal caries		#24	Occlusal and mesial proximal caries
	#13	Cervical facial caries		#23	Cervical facial caries
	#12	Significant loss of tooth structure due to caries		#22	Significant loss of tooth structure due to caries
	#11	Distal and facial caries		#21	Distal proximal caries
4 th quadrant	#47	Sound	3 rd quadrant	#37	Sound
	#46	Sealant and buccal cervical caries		#36	Sealant and buccal cervical caries
	#45	Sound		#35	Occlusal and mesial proximal caries
	#44	Buccal cervical caries and mesial caries		#34	Significant loss of tooth structure due to caries
	#43	Significant loss of tooth structure due to caries		#33	Significant loss of tooth structure due to caries
	#42	Significant loss of tooth structure due to caries		#32	Significant loss of tooth structure due to caries
	#41	Significant loss of tooth structure due to caries		#31	Significant loss of tooth structure due to caries



Figure 1 Pre-operative clinical intra-oral photos demonstrating the rampant caries especially on the lower anterior teeth

The proposed treatment plan was a combination of applying SDF on selective teeth based on the hardness and caries involvement and restoring the remaining affected carious teeth with glass ionomer restorations as part of the disease control phase of treatment, until the patient's age and finances allow for definitive treatment. SDF was applied on teeth #35 and #36 and the teeth were later restored with glass ionomer (GC Fuji II LC); a similar approach was done for teeth #44 and #46 as well (Figure 3). The rest of the caries lesions were restored with glass ionomer restorations (GC Fuji II LC) and all second molars were restored with fissure sealants (UltraSeal XT, Ultradent, South Jordan, Utah, USA). A full set of clinical photographs was taken after finishing the stated treatment (Figure 4).

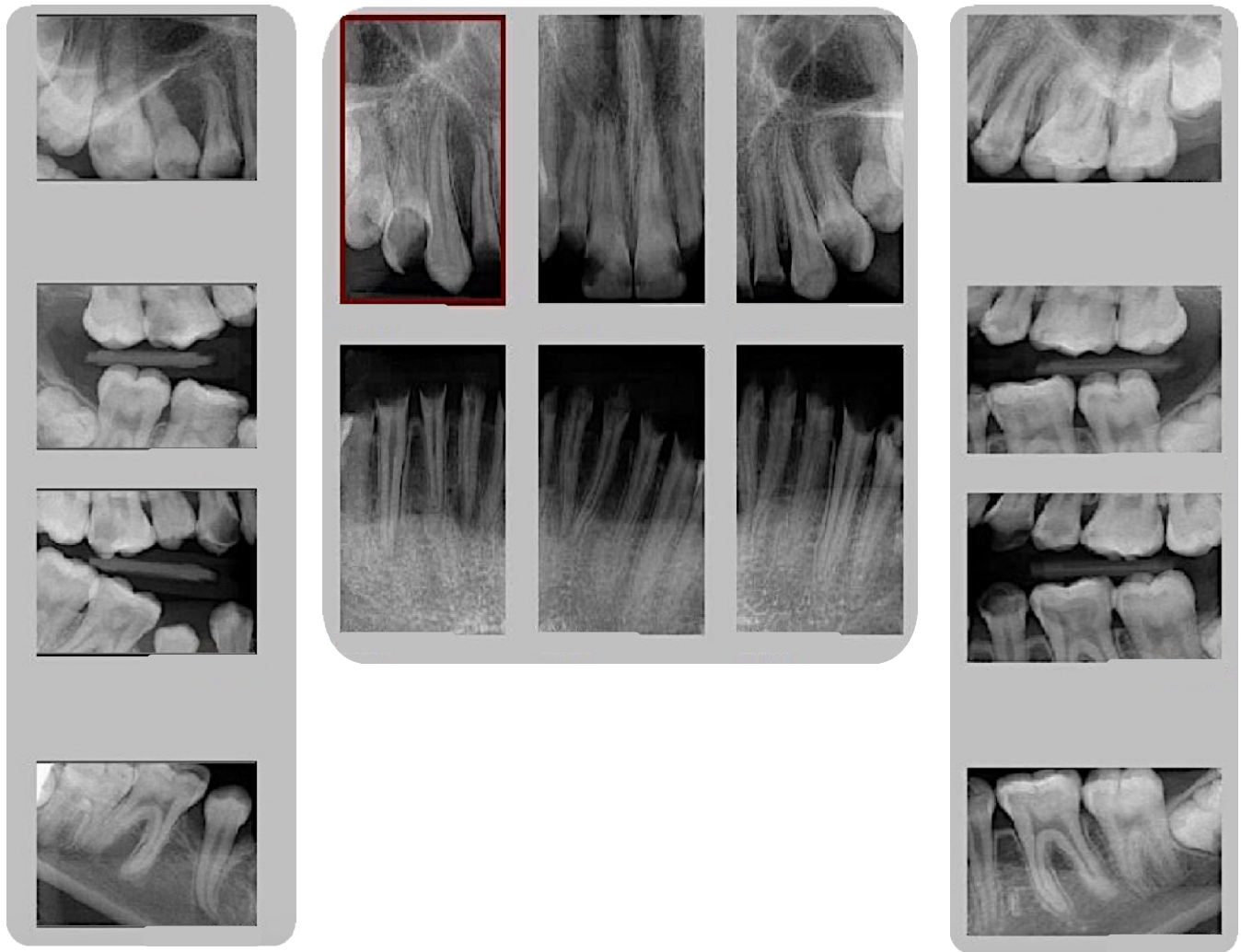


Figure 2 A set of digital full mouth intra-oral radiographs showing the general decay especially around anterior teeth



Figure 3 Hardening and darkening of active caries lesions following Silver Diamine Fluoride (SDF) application on teeth #36, #35, #44, #46



Figure 4 Clinical photos taken showing the results of all the treatment

3. DISCUSSION

The objectives of this clinical report are to showcase the effectiveness of SDF in managing rampant caries and present a method to mask the discoloration caused by its usage. Numerous pieces of evidence have shown that SDF halts caries progression and increases the process of enamel remineralization (Chu et al., 2012; Richards, 2017). One of the concerns regarding SDF is its efficacy between anterior and posterior teeth (Gao et al., 2020; Zhi et al., 2012). Different SDF application protocols have been proposed but it is still not clear which one yields the best outcome (Vollú et al., 2019). What is suggested is a recurrent application every six months, which was more effective in arresting caries progression than 5% NaF varnish application. However, further evidence is needed to support this claim (Mabangkhru et al., 2020; Vollú et al., 2019). Although there are different approaches to arresting caries, such as applying fluoride varnish or Atraumatic Restorative Treatment (ART) technique, SDF showed better results when these techniques were compared directly (Tirupathi et al., 2019). SDF application has also been shown to reduce the need for comprehensive restorative treatment in children, which might otherwise require them to undergo general anesthesia in certain situations (Nguyen et al., 2022).

The main drawback pertaining to SDF is the likely discoloration that it causes to teeth (Mei et al., 2016). Parental acceptance of SDF application can be dependent on the teeth type, if they are anterior or posterior (Crystal et al., 2017). The dark staining of posterior teeth is generally acceptable and less visible, while in anterior teeth it is not usually looked at in a favorable light (Crystal et al., 2017). Despite the unfavorable view, parents agree with SDF application if they perceive their child as uncooperative and compare it with other options such as ART or general sedation (Crystal et al., 2017). Oral quality of life after SDF application is still under investigation (Ruff et al., 2022). A recent study concluded that it is not noticeably affected by SDF application, but further studies are needed for the impact of the baseline severity of caries treated by SDF and the application of SDF on posterior versus anterior teeth on the oral health-related quality of life (OHRQoL) (Ruff et al., 2022).

This clinical report illustrates how such discoloration can be managed in order to reach a desired esthetic outcome, by explaining the drawbacks to the children and their parents, applying SDF to posterior teeth, and excavating caries lesions and restoring them with glass ionomer as the restorative treatment of choice until the caries activity and risk of the patient is controlled. It is interesting to note that the occlusal surfaces of all first molars restored with fissure sealants were not carious, supporting the efficacy of sealant application for patients with high caries risk (Nguyen et al., 2023). The patient was seen again after 1 week, 1 month and 3 months for follow-up and presented with improved oral hygiene and all restorations were intact.

4. CONCLUSION

This case presentation demonstrates that silver diamine fluoride (SDF) application can be an effective treatment for inhibiting rampant caries activity and can be used in situations where there are financial limitations. Although there is a concern over discoloration after its placement, esthetic outcomes can be achieved with the right combination of SDF and restorative dental therapy. In the stated case the material was applied and its negative impact was properly managed.

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Author Contributions

All the authors contributed equally to the case report.

Informed Consent

Written informed consent form was obtained from the individual who participated in the study.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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