

The use of silver diamine fluoride

The use of silver diamine fluoride can be a successful technique, when case selection is appropriate, to halt the progression of caries in patients where other options may not be feasible.

Introduction

Caries continues to be a public health problem worldwide, and the prevention and conventional treatment of carious lesions may present challenges. Caries into dentine in primary teeth is common, with 30% of five-year-olds having dental caries in Ireland.¹ In young children, there can be barriers to using some of the evidence-based recommended techniques to restore carious teeth. Reasons for this include access, co-operation and age. Similarly, root caries, commonly found in older adults, can be challenging to manage conventionally, particularly where the caries rate is high and there are access barriers or medical comorbidities.

Silver diamine fluoride (SDF) is an alternative option to treat such cases where conventional methods are not appropriate or achievable for the patient. It has demonstrated efficacy in arresting both cavitated dentinal caries in primary teeth and root caries in the permanent dentition across a number of systematic reviews.² Success rates of 65–91% have been demonstrated in arresting caries in the primary dentition. For root caries arrest in the permanent dentition, SDF was found to be more effective than placebo.² In 2021, the World Health Organisation (WHO) added SDF to its list of essential medications. Other recent additions to the list for the prevention and treatment of dental caries include glass ionomers and fluoride toothpaste.

SDF is commonly available as a 38% colourless solution containing 253,900ppm silver and 44,800ppm fluoride ions. It works through the synergistic action of silver and fluoride, and is applied topically to the carious area of the tooth.³ The silver is antibacterial and the fluoride promotes remineralisation. The technique should not be used where there is pulpal involvement, soft tissue ulceration or stomatitis. Indications and contraindications for case selection can be seen in **Table 1**.

SDF does have an important side effect in that it permanently changes the colour of the carious lesion to black (**Figure 1**). As such, consent regarding this known side effect is a critical step in discussions with the patient or family about this technique. The consent process should include coloured pictures to ensure that the patient and their family have full understanding of the aesthetic implications of the procedure. Additionally, dentists should follow protocols when applying SDF and ensure contemporaneous documentation of consent and treatment.

Table 1: Case selection.

Indications	Contraindications
Cavitated lesions into dentine	Allergy to silver, other metals or components
Patient (and parent) understand the aesthetic implications	Stomatitis, ulceration
Other evidence-based techniques not possible or appropriate	Pulpitis, non-vital teeth



FIGURE 1: The appearance of carious lesions on the labial tooth surface following SDF application. (Reproduced courtesy of Timms, Deery, Stevens, and Rodd.)⁵

SDF has been used successfully to arrest caries lesions for many years, although it is licensed as a desensitising agent in most countries. Riva Star is the SDF product available in the EU, and is licensed as a desensitising agent through a CE mark. As such, Riva Star's use in children and adults is off label for the treatment of caries. Use of off-label treatments is permitted where there is no suitable licensed alternative and where there is available evidence in the patient's best interest.³ In this situation, the prescriber bears more responsibility; the Health Products Regulatory Authority (HPRA) does not have additional guidance on off-label prescribing. Prescribers may wish to contact their indemnity provider if they

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FIGURE 2: Soft tissue protection with cotton roll and petroleum jelly.

are unclear on their position before using SDF off label.

Clinical use of SDF within the HSE dental service as a caries arresting medication is governed by the informed consent protocol, application and documentation protocols, and incident reporting processes.

Clinical technique

1. Soft tissue protection

This stage is critical as the pH of Riva Star can cause a chemical burn/soft tissue burn. The Riva Star kit may include a soft tissue barrier that can be used; alternatives are petroleum jelly and cotton rolls (Figure 2) or rubber dam. A temporary soft tissue stain can also result from inadvertent contact with the soft tissues, and can last for two to four weeks. Additional petroleum jelly should therefore be used on areas not immediately adjacent to the tooth in order to try to prevent this staining.

2. Cleaning and drying of the tooth

Clean the tooth of debris/plaque in order to apply the SDF directly to the lesion. The tooth should be dry before application.

3. Application of SDF

SDF is applied topically with a microbrush to the carious area. One drop of SDF is used to treat up to five teeth (Figures 3 and 4). If an additional drop/capsule is required then this should be applied at a separate visit (one week later according to the manufacturer's instructions). The SDF should be left in place for at least one minute where possible.

4. Dry and remove excess

Blot dry the lesion and remove any excess, using gauze, cotton wool or a microbrush.

5. Potassium iodide

The SDF kit includes potassium iodide. The manufacturer states that this can be used to try to reduce the staining from SDF. The evidence is not conclusive as to whether this affects the efficacy of SDF for caries arrest.³ If this is to be used, it is applied immediately following the SDF, and left in situ until the creamy precipitate that occurs becomes clear.

Conclusion

SDF is a simple and effective technique, where other options are not possible or appropriate for the patient.



FIGURE 3: SDF capsule and microbrush. (Reproduced courtesy of Timms, Deery, Stevens, and Rodd.)⁵



FIGURE 4: Application of SDF to a cavitated disto-occlusal lesion. Dark discoloration is seen for the disto-occlusal lesion in the first primary molar, and the mesial lesion of the second primary molar. (Image courtesy of Dr Isabel Olegario da Costa.)

References

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4. Jiang M, Mei ML, Wong MCM, Chu CH, Lo ECM. Effect of silver diamine fluoride solution application on the bond strength of dentine to adhesives and to glass ionomer cements: a systematic review. *BMC Oral Health*. 2020;20(1):40.
5. Timms L, Deery C, Stevens C, Rodd H. Covid-19 – time to use silver diamine fluoride for caries arrest in dental practice? *Dental Update*. 2020;47(8):662-668.

Recommended reading

Crystal YO, et al. American Academy of Paediatric Dentistry Guideline. Use of Silver Diamine Fluoride for Dental Caries Management in Children and Adolescents, Including Those with Special Health Care Needs. https://www.aapd.org/media/policies_guidelines/g_sdf.pdf.

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