



Public Health Intervention: Use of Silver Diamine Fluoride for Arresting Dental Caries

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Silver diamine fluoride (SDF) is an interim caries arresting liquid medicament clinically applied to control and to prevent the further progression of active dental caries and reduce dentin hypersensitivity. This treatment allows oral health care professionals to arrest dental caries with a noninvasive, painless, and quick method across the age spectrum. SDF treatment is highly effective in arresting dental caries¹ and the American Academy of Pediatric Dentistry recommends treated areas be actively monitored with a follow up evaluation plan. Many groups can benefit from this intervention, including the very young, individuals with disabilities or special health care needs, the elderly, and others with inconsistent access to dental treatment services.

In Illinois, SDF may be applied by licensed dentists and dental hygienists functioning within their scope of practice. In addition to this guidance, resources such as online courses and videos can be used in training providers to offer this service.²

Background

SDF (38% w/v $\text{Ag}(\text{NH}_3)_2\text{F}$, 30%w/w) is a colorless liquid mixture, with a pH of 10, composed of 24-27% silver (antimicrobial), 7.5-11% ammonia (solvent), 5-6% fluoride (remineralization), and 62.5% water. This topical treatment has been used widely outside the United States to arrest carious lesions.^{1,3} In July 2014, the Food and Drug Administration (FDA) cleared the first SDF product for market under the provisions of the federal Food, Drug and Cosmetic Act as a Class II medical device to treat tooth sensitivity.⁴ As of April 2015 that product is available. In the U.S., SDF is marketed as Advantage Arrest™ by Elevate Oral Care, LLC (West Palm Beach, FL). A second SDF product, Riva Star (SDI, Australia), is a two-step system developed for use on prepared tooth structure. There are important distinctions between the two SDF products now available in the U.S. **As Advantage Arrest and Riva Star are not equivalent products, clinicians should understand differences between them to select for optimal outcome.**

Because SDF use is relatively new in the U.S., a comprehensive review of literature, indication for use, and protocol was needed. In January 2016, the University of California at San Francisco published the seminal paper -- UCSF Protocol for Caries Arrest Using Silver Diamine Fluoride: Rationale, Indications, and Consent. This paper provides a thorough systematic review, clinical indications, clinical protocol, and consent for using SDF for caries arrest (defined as the fraction of initially active carious lesions that became inactive and firm to a dental explorer).⁵ The UCSF Protocol-quoting Dr. Clarkson and Exterkate 2015⁶ states: "Until now, no option for the treatment of dental caries in the United States besides restorative dentistry has shown substantial efficacy." No other intervention approaches the ease of application and efficacy. Multiple randomized clinical trials – with hundreds of patients each – support SDF's use for caries arrest and prevention, thus substantiating an intervention that addresses an unmet need in American dentistry.⁵

Indications for Use – Advantage Arrest

SDF can arrest active carious lesions painlessly, avoiding or delaying traditional surgical removal of caries. When SDF is applied to active carious lesions, it kills bacteria and, through a series of complex interactions, results in the treated lesion having an increased mineral density, hardness, and decrease in lesion depth. This intervention can be applied to teeth as soon as caries are detected.^{5,7}

SDF use is indicated in child and adult patients to:^{5,6,7,8,9}

- Treat dentinal hypersensitivity.
- Quickly stabilize uncontrolled dental caries (undergoing radiation therapy for head and neck cancers).
- Treat patients with high and extremely high caries risk status (e.g., Early Childhood Caries, xerostomia, methamphetamine use).
- Treat vulnerable tooth structure (e.g., exposed root).
- Treat difficult to treat carious lesions (e.g., in a furcation or at the margin of a fixed bridge).
- Treat patients who cannot tolerate routine dental care due to physical or physiological reasons (e.g., dental phobia, autism, or dementia).

- Treat children waiting for restorative care with general anesthesia or sedation.
- Treat patients who need care with general anesthesia but are not good candidates due to medical complexity or frailty.
- Treat patients with limited or no access to dental care (e.g., financial limitations).
- Treat patients with limited life expectancy (SDF use in hospital, nursing home, or hospice settings).

Clinical Application and Safety

Clinical protocols, including the use of written consent, should be utilized when providing SDF caries arresting therapy. Written and oral consent should be in an appropriate language, literacy level, and should include pictures. Treatment of teeth in the esthetic zone is of special concern due to the resulting discoloration. Informed consent is needed so that the patient/parent/caregiver understands the teeth and possibly clothing will be stained black and that timely follow-up is indicated.

CAUTION

SDF should not be used if a patient has an allergy to silver; where soft tissue irritation, ulceration, desquamative gingivitis, or mucositis is present; or for carious lesions that have symptoms of pulpitis.^{5,6,8} Lack of evidence precludes recommendation of SDF use in pregnancy. Caution should be taken when SDF is used near areas of initial stages of caries or demineralization (early caries) that may be reversible with fluoride application as the demineralized area may darken if SDF is applied to it.

Although this product now is available with blue tint for easier visualization, it flows like water. It stains most surfaces it contacts, including skin, clothing, countertops, flooring, and instruments. If SDF contacts skin, absorb as much as possible with gauze. Do not wipe it, as wiping can spread the material and result in a larger stain. Blot the area of any excess material and wash the area thoroughly with soap and water. Stains on skin and tissues normally fade over two-three weeks. Wash operatory surfaces, instruments, and carriers thoroughly.

Protect your patients

Have your patients wear protective eyewear and cover exposed clothing. Isolate surrounding oral structures. To avoid staining or irritation of soft tissues, isolate the tongue using 2x2 gauze or cotton rolls. Protect gingival margins with petroleum jelly, a rubber dam, or an injectable dam. If contact occurs, rinse the area thoroughly. **Do not let pediatric patients taste silver diamine fluoride.**

Existing Restorations

Tooth-colored restorations and crowns may discolor if SDF is applied to the area. Some of the staining may be polished off, but some may be permanent.

Restorative Procedures

Several studies report SDF does not have an adverse effect on bond strength to dentin^{10,11} or to enamel¹². However, it is recommended that clinicians not use this material as part of same day restorative procedures. SDF is safe and effective, but some direct restorations can dramatically change color when completed the same day. Curing lights may cause SDF to change rapidly from clear to black. Restorative procedures should be completed at subsequent appointments.

Therapeutic Risk

While highly effective, the risk exists that the procedure will not stop the caries.

Clinical Protocol

For detailed protocol and sample consent for treatment, review the 2016 University of California at San Francisco Protocol for Caries Arrest Using Silver Diamine Fluoride.⁵ In summary, the application protocol is as follows:

1. Provide dental caries prevention education, including proper oral hygiene and nutritional counseling.
2. Obtain consent for use of SDF for caries arresting therapy.
3. Provide protective eyewear for patients to wear and cover exposed clothing.
4. Isolate treatment area with gauze and/or cotton roll, remove bulk of saliva with saliva ejector.
5. Dry lesion with compressed air or with cotton and maintain dry field during application.
6. Dispense one drop of SDF into deep end of plastic dappen dish.
7. Bend a micro-sponge, immerse in SDF, remove excess, and apply directly to treatment surface.
8. Treat lesion by keeping it moist with SDF for 1-3 minutes.
9. Remove any excess material to minimize systemic absorption.

10. Rinse lesion with water.
11. Repeat for each additional lesion for up to four lesions per visit.
12. Approximal caries lesions and other difficult to access surfaces may be treated using capillary action methods (desiccate and re-saturate with SDF using micro brush or woven unwaxed floss).
13. When completed, wrap disposable materials in gloves used and dispose to minimize staining.
14. Document specific teeth treated with date of service to track application history.
15. Inform patient the treated lesion will increase in darkness over the next week, and they may experience a metallic taste immediately after SDF application.
16. Inform patient/parent/caregiver that treated areas must be actively monitored and a follow-up evaluation may be necessary to determine if additional interventions are indicated.

Frequency of Application^{5,13}

For maximum benefit, SDF re-application is generally recommended at six-month intervals for at least two years and may be extended if the caries risk remains high or extremely high. If patient's caries risk remains elevated, an additional application at three months after initiation of SDF therapy should be considered. If significant tooth structure is missing, tooth may need restoration to reestablish form and function.

Coding for Reimbursement¹³

CDT code D1354 for "interim caries arresting medicament application – per tooth" was approved by the Code on Dental Procedures and Nomenclature Code Maintenance Committee for 2018. The code definition is "Conservative treatment of an active, non-symptomatic carious lesion by topical application of a caries arresting or inhibiting medicament and without mechanical removal of sound tooth structure."

Status of SDF as covered service

Medicaid coverage was adopted by Arkansas, Arizona, California, Colorado, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Hampshire, New York, North Carolina, New Jersey, Ohio, Oklahoma, Oregon, Tennessee, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

Commercial Insurers: Insurers such as Delta Dental Plans, MetLife, Aetna, United Concordia, and others are covering this benefit in some of their plans.

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