

Episode 134 – Silver Diamine Fluoride June 13, 2025

Background

Dental caries is the most common noncommunicable disease affecting individuals of all ages worldwide. The World Health Organization (WHO) Global Oral Health Status Report (2022) estimated more than one-third of the global population lives with untreated dental caries. Untreated dental caries in permanent teeth is the most prevalent oral disease, surpassing severe periodontitis, tooth loss, and oral cancers,[1] and affects over two billion people worldwide. Untreated dental caries in primary teeth is the single most common chronic childhood disease, affecting 514 million children[2] globally.[3] [1] [2]

Dental caries develop when oral bacteria metabolize sugars and produce acid that demineralizes the hard tissues of teeth. Dental caries progress differently in enamel and dentin. Enamel primarily consists of hydroxyapatite (95%) with trace amounts of organic matter (>1%). Hydroxyapatite is a mineral naturally occurring in teeth and bones. Enamel caries result from the dissolution of this highly mineralized tissue from bacterial acid attacks.

Dentin contains approximately 70% mineral, mostly hydroxyapatite, 20% organic matrix, mainly type I collagen, and 10% fluid. The type I collagen in dentin forms a structural scaffold that holds the hydroxyapatite together. Dentin caries involve demineralization from bacterial acid attack and degradation of the organic matrix by collagenases (enzymes that break down collagen). [3] [4] [5]

Early stages of dental caries are often asymptomatic. Advanced dental caries can lead to pain, infections, abscesses, sepsis, and tooth loss. Severe dental caries and tooth loss negatively impact systemic health, aesthetics, function, and self-esteem. Repeated episodes of pain as well as chewing and sleeping difficulties reduce quality of life and productivity. Dental caries is a major cause of productivity losses at work. [1] [3] [6]

Negative impacts of untreated dental caries are also common among children and adolescents, frequently causing acute infection, pain, and discomfort. Untreated dental caries affects children's ability to eat, leading to poor nutrition, growth, and weight gain. It also impacts ability to speak, learn, and sleep, as well as appearance and self-esteem. Tooth pain can affect school attendance, leading to poorer academic

[1] Listen to Episodes 76, 77, and 78 for additional information on oral cancer.
[2] Listen to Episodes 115, 116, and 117 for discussion on children and oral health.
[3] Refer to Episodes 86 and 87 for discussion on dental caries.

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performance. These negative impacts disproportionally affect those from more disadvantaged backgrounds. [1] [7]

Dental caries is an expensive disease to treat, consuming 5-10% of healthcare budgets in industrialized countries. In many high-income countries, extraction of carious teeth under general anaesthesia is the main reason for hospitalization of young children. Globally in 2010, it was estimated $298 billion USD was spent on direct costs associated with dental caries and $144 billion on indirect costs. [1] [3]

Fluoride is used in various forms to prevent and arrest dental caries and promote remineralization. Silver compounds have been used since the 1800s in both medicine and dentistry because of their antimicrobial properties. In dentistry, silver nitrate was used in the 1840s to reduce the incidence of dental caries in primary teeth. Later, it was used to prevent dental caries in permanent molars, disinfect cavity preparations, and desensitize dentin. [4] [5] [8]

Silver diamine fluoride

Silver diamine fluoride (SDF) is a solution containing high concentrations of fluoride and silver that work together to arrest dental caries when applied to teeth. SDF was developed in Japan in the 1960s to combine the antibacterial properties of silver ions and the preventive effects of fluoride. SDF is commonly available as a 38% solution. A drawback of SDF treatment is permanent black staining of the arrested caries lesions, which may deter its use in visible areas. [4] [9]

SDF was approved for use as a therapeutic agent in the 1960s in Japan. It has also been used in Argentina, Australia, Brazil, and China for many years to treat dental caries. In 2014, the United States Food and Drug Administration (FDA) cleared the first SDF product for use as a dentin desensitizer. In 2017, the SDF product Advantage Arrest was approved by Health Canada as a natural health product and anticaries agent for adults and children three years and older. In 2018, a second SDF product (brand name Riva Star) was approved by Health Canada. [4] [5] [10] [11]

In 2021, the WHO included 38% SDF in the WHO Model List of Essential Medicines for both adults and children. The WHO considers SDF a medicine to which everyone should always have access, and all governments should ensure SDF is available and affordable to their populations. Other WHO essential medicines to prevent dental caries include fluoride gel, mouthrinse, and varnish, and resin-based composite dental sealants. [12] [13] [14] [15]

Composition

SDF is a clear or blue-tinted alkaline solution with a pH between 9 and 13. The blue colour facilitates application. SDF is primarily available as a 38% solution composed of 25% silver, 8% ammonia, 5% fluoride (44,800 ppm), and 62% water. The ammonia helps keep the solution at a constant concentration. Like most silver compounds, SDF is unstable when exposed to light and decomposes to silver. Thus, SDF must be stored in a light-proof container and should be used as soon as possible once dispensed for

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clinical use. Applying SDF creates a highly mineralized surface on carious lesions that is rich in calcium fluoride and silver phosphate. [4] [5] [9] [16]

Dental caries process

Cariogenic bacteria metabolize carbohydrates for energy and excrete acids as byproducts. The acids lower the pH in the plaque biofilm. Hydroxyapatite is primarily composed of phosphate and calcium ions. Under normal conditions, there is a balance between the calcium and phosphate ions in saliva and the crystalline structure of hydroxyapatite. When the pH falls below a critical level (approximately 5.5 for enamel and 6.2 for dentin), it causes dissolution of the hydroxyapatite. When the natural buffer capacity of saliva raises the pH, the calcium and phosphate in saliva can recrystallize into hydroxyapatite, remineralizing the enamel. Dental caries results from repeated demineralization and remineralization cycles where demineralization conditions predominate. [17] [18]

Mechanisms of action

Silver and fluoride are the active ingredients in SDF. When silver and fluoride are in an ammonia solution, silver and fluoride ions are released. Fluoride is a remineralization agent. When fluoride is present in oral fluids (e.g., saliva), fluoride ions replace hydroxyl groups in hydroxyapatite, forming fluorapatite. Fluorapatite is more resistant to acid attacks, with a critical pH of about 4.5, compared to the critical pH of hydroxyapatite of approximately 5.5. In addition, the presence of fluoride increases the rate of remineralization. At high concentrations, fluoride also exhibits antimicrobial effects against cariogenic bacteria. Fluoride ions can also bind to bacterial enzymes, inhibiting carbohydrate metabolism and sugar uptake of acid-producing bacteria. [4] [18] [19] [20]

Silver is antibacterial. However, it is difficult for bacteria to develop resistance against it due to the various antibacterial mechanisms of silver. Silver interferes with bacterial metabolism by interacting with the sulfhydryl group of proteins and the DNA of bacteria, which hinders cellular respiratory processes, alters cell wall synthesis, unwinds DNA, and inhibits cell division. Silver inhibits biofilm formation by inactivating the bacterial enzyme glycosyltransferase. Glycosyltransferases synthesize glucan, which is essential for bacterial adhesion and biofilm thickening on tooth surfaces. Silver prevents dentin collagen degradation by inhibiting the proteolytic activities of collagenases. Silver also reduces bacterial adhesion by incorporating silver into enamel and dentin hydroxyapatite. [4]

Silver and fluoride have a synergistic caries-arresting effect. SDF inhibits bacterial growth and biofilm formation, promotes remineralization, counteracts demineralization, prevents collagen degradation, occludes dentinal tubules, and promotes tertiary (reparative) dentin. These properties make SDF an effective agent for managing dental caries and dentin hypersensitivity. Most SDF solutions are alkaline with a pH value of 9 to 13. The strong alkalinity inhibits proteolytic activities of collagenases, which can break down dentin collagen. [4]

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Clinical applications

Several manufacturers globally have developed and marketed SDF products with concentrations varying from 3.8% to 38%. The 3.8% SDF solution was developed as a disinfectant for root canal therapy. SDF is generally used as a 38% solution for treating dental caries and dentin hypersensitivity. Studies have found SDF is significantly less effective in arresting dental caries at low concentrations (10-12%) than at the 38% concentration. [4]

Clinical applications of SDF may include:

- Managing dental caries
- Desensitizing hypersensitive teeth
- Remineralizing hypomineralized molars
- Disinfecting root canals
- Managing dental erosion
- Treating gingivitis [4]

Managing dental caries

SDF can be used as a nonrestorative caries treatment as it is effective in arresting dental caries by controlling bacterial infection and remineralizing teeth. SDF can be used to manage early childhood caries and root caries. [4]

Early childhood caries

Early childhood caries (ECC) is one of the most prevalent and preventable noncommunicable chronic diseases, with a global estimate of 48%. Preserving the primary dentition is essential to a child's well-being and development. ECC management can be challenging due to client cooperation. Other factors include the confidence of the oral health practitioner, parent and guardian preferences, and the need for multiple visits. For these reasons, dental general anaesthesia (DGA) is a traditional option for providing comprehensive dental caries treatment, particularly when several carious teeth require treatment in a single visit.

However, DGA may not necessarily reduce dental fear and anxiety and can result in children receiving less regular preventive oral healthcare. Research shows children who undergo DGA are at high risk for poor oral health and dental anxiety as they get older. Undergoing DGA predicts the burden of treated dental caries ten or more years after the procedure, independent of past caries experience. Furthermore, undergoing DGA in childhood is associated with greater increased odds of dental anxiety in adolescence.[4]

Alternative interventions for managing moderate to severe dental caries in children include anti-anxiety medications (anxiolysis), conscious sedation, and minimally invasive dentistry (MID). MID includes atraumatic restorative treatments (ART), with or without a stainless-steel Hall crown and/or SDF application. [21] [22] [23] [24]

SDF is a successful tool to arrest dental caries. A systematic review by Hafiz et al. (2022) found SDF was effective in arresting dentin carious lesions in primary dentition

[4] Listen to Episode 133 to learn more about dental fear and anxiety.

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and first permanent molars in children. [25] A systematic review by Gao et al. (2016) found 38% SDF effectively arrested dentin caries among children, with an overall rate of caries arrest of 81% in primary teeth. Apart from staining the arrested lesion black, no significant complication of SDF use among children was reported. [26]

Research shows most parents and guardians accept SDF therapy for their children. They are also willing to prioritize a less invasive treatment over aesthetics, especially when their child's cooperation is a challenge for traditional treatment to avoid the need for DGA. [27] [28]

SDF is also a practical option when treatment under DGA is not feasible. Clinical studies demonstrate SDF manages dental caries without causing psychological distress to children. Advantages of SDF over DGA also include its ease of application, client acceptability, shorter treatment time, and lower costs. [21] [22] [23] [24]

Root caries

Life expectancy and aging populations are increasing worldwide.[5] Studies indicate a greater number of older adults are retaining more of their teeth beyond age 65. Older adults are at significant risk for root caries due to increased comorbidities, use of medications that cause dry mouth, dietary habits, exposed root surfaces from gingival recession, and the presence of removable and fixed dental appliances.[6] [29]

Traditional dental caries management involves surgical intervention and restoration. Advanced dental caries may need root canal treatment or extraction. Undergoing these procedures may be difficult for older adults due to cognitive decline, physical disability, and multimorbidity. Additionally, these dental treatments are expensive and public-funded plans may not cover these services. Therefore, traditional dental caries management may not be feasible for some older adults causing dental caries to be left untreated. [30]

Root caries are also challenging to restore due to the location of the carious lesion and proximity to the pulp. Several systematic reviews show SDF therapy is effective for arresting root caries. [4] [31] [32]

Yearly SDF application is a simple, inexpensive, and effective in preventing the initiation and progression of root caries in older adults. Systematic reviews found annual application of 38% SDF was the most effective treatment among the different treatments for preventing root caries. [31] [32] [33]

A systematic review by Hendre et al. (2017) evaluated SDF effectiveness in caries management in older adults. Three randomized controlled trials (RCTs) were identified that addressed SDF effectiveness on root caries. The clinical trials supported SDF use to prevent and arrest root caries in older adults. [34]

[5] Listen to Episodes 123 and 124 for discussion on aging, longevity, and oral health.
[6] Refer to Episode 55 for additional information on seniors and oral health.

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A systematic review by Chan et al. (2022) evaluated professionally applied fluoride therapy to prevent and arrest dental caries in older adults. The findings demonstrated 5% sodium fluoride varnish and 1.23% acidulated phosphate fluoride (APF) gel prevented root caries, whereas 38% SDF solution prevented and arrested root caries in older adults. [30]

Lee et al. (2024) found older adults were receptive to SDF use. However, participants were more receptive to SDF use on posterior (73%) than anterior teeth (46%). They were also more receptive when SDF was presented as a treatment to avoid infection, pain (87%), and general anaesthesia (78%). [35]

Desensitizing hypersensitive teeth
Dentin hypersensitivity arises from exposed dentin responding to heat, cold, touch, pressure, acidic or sweet foods and can result in severe, persistent pain and discomfort. Laboratory studies show SDF application occludes dentinal tubules. Clinical studies found SDF application relieved hypersensitivity pain in adults within one week. [4] [36]

Remineralizing hypomineralized molars
Hypomineralization is a developmental enamel defect that usually affects first permanent molars and incisors. However, it can also affect primary teeth. Hypomineralized teeth are clinically characterized by well-delineated opacities, ranging from chalky white to dark brown.

Due to inadequate mineralization, affected teeth are vulnerable to:
- Severe sensitivity due to rapid tooth wear and subsequent dentin exposure.[7]
- High dental caries risk from defective enamel.
- Tooth loss and subsequent occlusion problems.

SDF is a simple, painless, and noninvasive therapy for managing hypomineralized teeth. SDF application effectively desensitizes hypomineralized teeth and quickly arrests carious lesions. A clinical study by Ballikaya et al. (2022) found biannual SDF application prevented dental caries and reduced dentin hypersensitivity in hypomineralized molars. [4] [37] [38]

Disinfecting root canals
SDF is available in a 3.8% concentration for managing endodontic infection (brand name Saforide). Eliminating microorganisms in endodontic therapy is fundamental for successful treatment. Endodontic infection is often associated with *Enterococcus faecalis*. However, many irrigants and intracanal medicaments are unable to eliminate *E. faecalis* from root canals. Research indicates SDF may be effective against *E. faecalis*.

In addition, the silver salts of SDF precipitate and obliterate the dentinal tubules and prevent bacteria from reinfecting the disinfected dentinal tubules. Furthermore, studies report SDF decreases permeability, increases surface hardness, and strengthens the

[7] Refer to Episode 82 for discussion on tooth wear.

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fracture resistance of root canals. However, clinical studies are needed to support these laboratory findings. [4] [39] [40]

Managing dental erosion

Dental erosion is the chemical loss of mineralized tooth substance from acid exposure that does not involve oral bacteria. Acids can be from extrinsic sources (e.g., sports drinks, carbonated beverages) or intrinsic sources (e.g. stomach acid). SDF may be an effective anti-erosive agent due to its remineralizing properties. Also, caries lesions treated with SDF demonstrate significantly higher surface microhardness. A laboratory study found SDF was effective in reducing dental erosion in enamel and dentin. However, clinical studies need to confirm the efficacy of SDF in preventing dental erosion. [4] [41]

Treating gingivitis

A laboratory study by Rams et al. (2020) reported SDF demonstrated significant antibacterial properties against periodontal pathogens. The authors suggested SDF could be a potential new therapeutic agent to manage periodontal infections. A case study by Lim and Yang (2021) reported SDF applied to treat demineralization and dental hypersensitivity incidentally improved marginal and papillary inflammation. A 7-week randomized, controlled, double-blinded pilot study by Noureldin et al. (2024) showed 38% SDF was effective in reducing gingival inflammation and plaque accumulation in older adults. [4] [42] [43] [44]

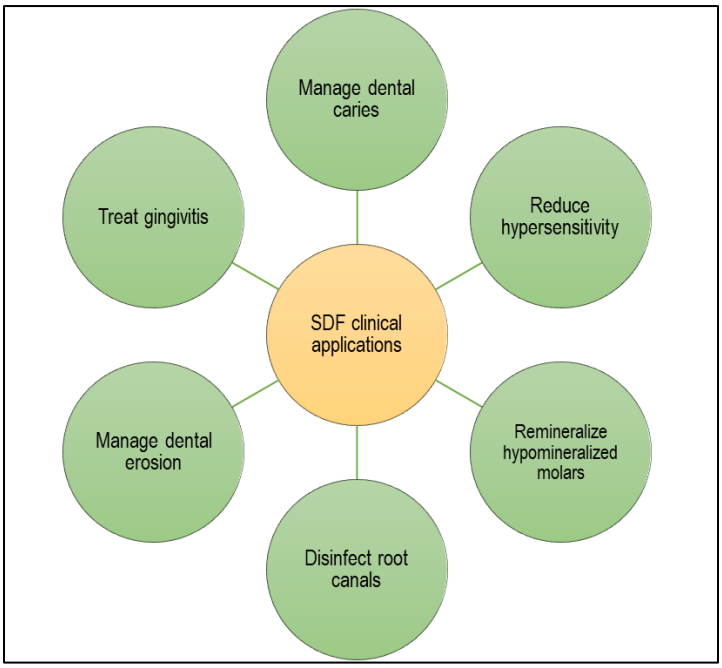
The mechanisms by which SDF improve gingival health are not fully understood. Possible explanations include:

- SDF has antibacterial properties that can inhibit oral pathogen growth, which may help prevent or reduce gingival inflammation and bleeding.
- SDF inhibits plaque biofilm adhesion and accumulation, which may help maintain a healthy gingival environment.
- SDF is proven to arrest dental caries, which may indirectly improve gingival parameters, as demonstrated in the previously discussed case study.
- SDF arrests dental caries and treats dentin hypersensitivity, both of which can cause pain and affect oral self-care.[8] Reducing sensitivity may improve oral hygiene practises and enhance gingival health. [44]

[8] Refer to Episode 89 for additional information on oral self-care.

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Clinical uses for SDF



Advantages

Advantages of SDF include:

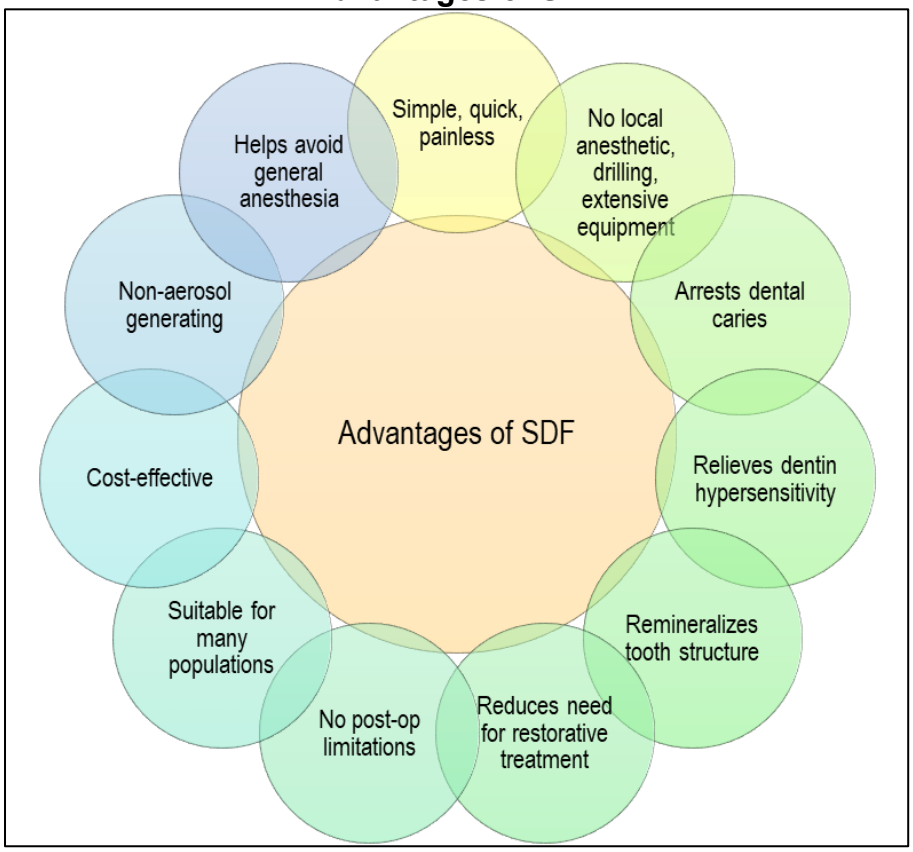
- Application is quick, simple, and painless and can be applied as soon as dental caries are clinically diagnosed.
- Applying SDF does not require local anaesthetic, drilling, extensive training, complex or specialized equipment.
- Effective at arresting dental caries and relieving dentin hypersensitivity.
- Kills cariogenic bacteria, thereby stopping the progression of decay and avoiding traditional restorative approaches in many instances.
- Remineralizes enamel and dentin, hardening the tooth structures, preventing further decay, and increasing resistance to acid dissolution.
- Potentially prevents new dental caries from developing as the fluoride component can remineralize carious tooth structures and prevent bacteria growth, and the silver component also inhibits the growth of cariogenic bacteria.[9]
- Primary teeth treated with SDF may not need definitive treatment and can remain symptom-free until exfoliation, thus holding the "space" for the permanent tooth.
- No post-procedure sensitivity or post-operative limitations for the client (e.g., able to eat and drink immediately after application).
- SDF can be applied in oral healthcare settings, medical care facilities, or community settings (e.g., schools, long-term care homes).

[9] A systematic review by Mungar et al. 2023 found SDF use had more preventative potential in permanent teeth of children and older populations when compared to other topical applications (e.g., sodium fluoride varnish). [61] A randomized clinical trial by Ruff et al. (2023) demonstrated SDF was as effective as dental sealants in caries prevention among children. The study, which included nearly 3,000 children in kindergarten through grade three, found the one-time application of SDF prevented 80% of caries lesions and arrested 50% of cavitated lesions two years later. [62]

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- Suitable option when restorative treatment is not possible due to:
    - Limited access to dental restorative care (e.g., in remote areas).
    - Difficult to treat areas (e.g., caries in partially erupted teeth) and root caries.
    - Individuals are not able to tolerate conventional treatment because of young age, cognitive ability, or medical challenges.
    - Local anaesthesia is not preferred or available.
    - Sedation is not desirable or available for young children or individuals with behavioural or medical challenges.
    - Inability to treat multiple caries lesions in a single visit. SDF stabilizes the disease before proceeding with conventional restorative treatment.
    - Cost of restorative treatment is unaffordable.
- Suitable for children, individuals with dental fear and anxiety, behavioural, or medical challenges, older adults, and urban, rural, remote, and vulnerable populations.
- Cost-effective, widely available, with negligible adverse effects, based on decades of global use.
- SDF can be integrated into restorative procedures and used prior to restoration placement as part of caries control therapy.
- Promotes minimally invasive cavity preparation, eliminating the need for extensive caries excavation.
- SDF application does not generate aerosols, which is beneficial when there is concern about possible airborne transmission of pathogens (e.g., during COVID-19 pandemic). [9] [16] [27] [45] [46] [47] [48]

Advantages of SDF



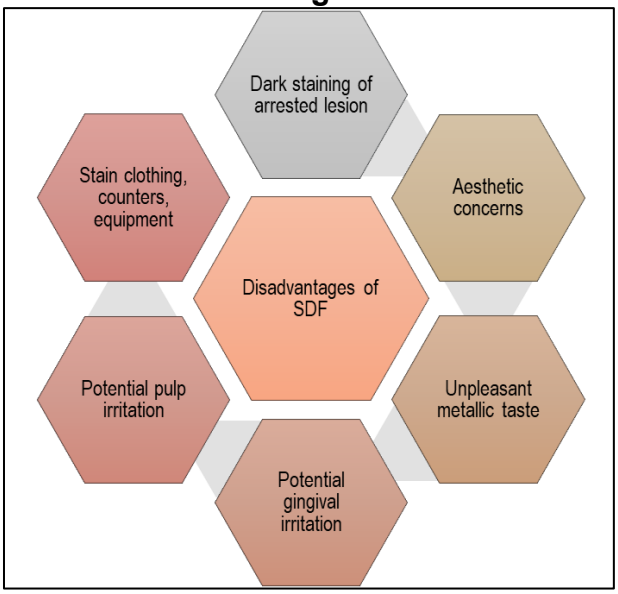
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Disadvantages

Disadvantages of SDF include:

- Possible unpleasant metallic taste and slight ammonia taste and smell. Applying fluoride varnish on top of the SDF helps to mask the taste.
- Potential to irritate gingival and mucosal tissues. The irritation is transient, does not require treatment, and can be avoided by careful isolation and application.
- Potential pulp irritation.[10] [9] [16]
- Dark staining of arrested carious lesions. SDF does not stain mature and sound tooth structure unless there is a superficial defect (e.g., hypomineralization, demineralized or immature enamel) where the porosities allow silver ions to penetrate. Thus, careful application is required. [16]
- Dark staining may cause aesthetic concerns.[11]
- Potential to stain skin, clothing, counters, floors, and instruments. Immediately wash skin exposed to SDF with water. Staining of soft tissues will fade within approximately 24 to 72 hours and clear in 1-2 weeks with no treatment required. SDF that contacts hard surfaces or clothing and not cleaned right away may leave a permanent stain. Follow manufacturer's instructions for use for cleaning hard surfaces and clothing. [4] [45] [49] [50] [51]

Disadvantages of SDF



[10] Zaeneldin et al. (2022) conducted a systematic review to investigate the effect of SDF on vital dental pulp through direct and indirect SDF applications. Directly applying SDF to the pulp resulted in pulpal necrosis. However, indirect SDF application was generally biocompatible to dental pulp tissue with no detectable inflammation to mild inflammation of the pulp, increased odontoblastic activity, and increased tertiary dentin formation. Silver particles appeared not to cross the dentin layer into the pulp tissue. While more clinical studies on SDF and dental pulp are needed, indirect SDF pulp application appears to be safe and beneficial. [63]

[11] Studies show parents and guardians are generally satisfied with SDF treatment and found the appearance acceptable. [65] [66] [67] [68] [69] Sommerfeldt et al. (2023) interviewed 15 adults aged 71 to 92 years. In general, the participants accepted SDF treatment for root caries. However, aesthetics was a concern. Participants preferred SDF therapy in less visible areas or in comparison to more invasive treatment options. [64]

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Case selection
Proper case selection will help maximize the desired results. Clients who may benefit from SDF include those with:

- High dental caries risk, presenting with active cavitated caries lesions.
- Behavioural or medical management challenges and cavitated caries lesions.
- Multiple cavitated caries lesions that may not all be treated in one visit.
- Dental caries lesions that are difficult to treat.
- Difficulty accessing or no access to oral healthcare. [48]

Tooth selection
Criteria for tooth selection include:

- No clinical signs of pulpal inflammation or reports of unsolicited or spontaneous pain.
- Cavitated caries lesions that are not encroaching on the pulp. If possible, radiographs should be taken to assess depth of caries lesions.
- Cavitated caries lesions on any surface as long as SDF can be applied with a microbrush or super floss.
- Cavitated lesions to control dental caries prior to restorative treatment.
- Carious lesions that are difficult to treat with traditional restorative options. [48] [51]

Contraindications
Contraindications may include:

- Ulcerative gingivitis, aphthous ulcers, or painful mouth sores.
- Allergies to fluoride or ammonia.
- Sensitivity to silver or other heavy-metal ions.
- Deep cavitated lesions that are possibly close to the pulp.
- Symptomatic carious lesions as SDF can further irritate the pulp.
- Carious lesions that are not accessible with a microbrush or super floss.
- Clients who are not manageable in a clinical situation. [47] [51] [52] [53]

Informed consent
Informed consent is essential. To obtain informed consent the clinician should explain:

- Benefits of SDF versus all available treatment options, including traditional restorative options (e.g., fillings, crowns), extractions, mode of sedation if required, and referrals as indicated.
- Expected staining of SDF treated carious lesions.
- Potential for staining if SDF comes in contact with skin or clothes.
- Need for follow-up and SDF reapplication at regular intervals (e.g., every six months) to sustain caries arrest. [16] [48] [51]

Application
Applying SDF typically involves the following:

- Cover any surfaces (e.g. counter tops) that may come into contact with SDF to protect from staining.
- Client should wear a plastic-lined bib and protective eyewear.
- Apply petroleum jelly to lips and surrounding skin to avoid temporary staining.

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- Dispense one drop into a disposable dappen dish (SDF corrodes glass). One drop usually treats up to five tooth surfaces. Recap bottle immediately.[12]
- Isolate the affected area with a cotton roll, gauze, or dri-angle.
- Remove gross debris from cavitation to allow better SDF contact (e.g., with microbrush or cotton pellet).
- Dry lesion with gentle flow of compressed air or with gauze, cotton pellet, roll, or swab to allow better contact with SDF.
- Bend tip of microbrush, dip into SDF, and dab on the side of the dappen dish to remove excess liquid before application.
- Carefully apply SDF to the affected tooth surface only. Avoid touching adjacent mucosal tissue or skin.
- Take caution when applying SDF on primary teeth adjacent to permanent anterior teeth that may have noncavitated (white-spot) lesions to avoid inadvertent staining.
- Allow SDF to remain for at least one minute to maximize absorption.
- Remove excess SDF with gauze, cotton roll, pellet, or swab.
- Entire dentition, including the SDF treated areas, may be covered with a thin layer of fluoride varnish. The varnish creates a barrier to keep the silver in contact for longer, helps prevent dental caries on teeth not treated with SDF, and offers a pleasant flavour rather than the metallic taste of SDF.
- Cleanup carefully to avoid contact or dripping SDF.
- Always follow manufacture's instructions for use. [48] [49] [50] [51] [52] [54]

Interproximal technique

SDF can be applied to interproximal caries lesions and other difficult-to-access high-risk surfaces by two methods. Both methods rely on capillary action.

- Method one: Dry the contact area using a gentle flow of compressed air or gauze. Saturate the contact area with SDF using a microbrush on the occlusal, facial, and lingual embrasures.
- Method two: Use woven unwaxed 'fuzzy' floss or super floss. Insert the dry 'fuzzy' part of the floss into the dried, isolated contact and apply SDF to the floss with a microbrush on the lingual and buccal and across the occlusal. Do not move the floss and wait at least one minute before removing. Protect the soft tissues (e.g., using a gloved finger) from any SDF migrating along the floss.[13] [55]

Potassium iodide

There is also a two-step SDF product (Riva Star Silver Diamine Fluoride) where potassium iodide is applied over areas treated with SDF to help minimize the risk of staining. Additional contraindications for this product include individuals with potassium or iodine allergy, undergoing thyroid gland therapy, or pregnancy.[14] [45] [53]

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[12] Note: Advantage Arrest is also available in unit-dose ampules. The application is the same as the solution format, except each ampule of gel is for individual client use and the brush is dipped directly into the ampule. The gel helps prevent accidental drips and allow more accurate application. [49]

[13] SDF application tutorial https://www.youtube.com/watch?v=zxlvbhUx3QE
Proximal SDF application without floss https://www.youtube.com/watch?v=Z6sisNlSTDw
Super floss technique tutorial using SDF https://www.youtube.com/watch?v=nPyYpZYfrHQ

[14] Listen to Episodes 108, 109, and 110 for discussion on pregnancy and oral health.

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Applying potassium iodide immediately after SDF helps reduce the risk of staining by binding with ionized silver. A creamy white precipitate of silver iodide forms as a result of the interaction with SDF. However, there is contradictory evidence on the effectiveness of potassium iodide on tooth colour. *In vitro* studies indicate significant effectiveness of potassium iodide in preventing staining. Conversely, a clinical trial on root caries in adults showed no significant effect. A clinical trial on primary dentition reported a 25% reduction in the incidence of staining after applying potassium iodide. [27] [56] [57] [58] [59]

The alkalinity of Riva Star is very high with a pH value of approximately 13, which can irritate gingiva. To reduce the risk of gingival irritation, the manufacturer produced an ammonia-free silver fluoride solution (Riva Star Aqua), removing ammonia taste and odour. [4] [45]

A randomized clinical controlled trial by Turton et al. (2020) examined dental caries arrest and lesion appearance using Riva Star SDF and stabilized aqueous silver fluoride solution on primary teeth, with and without potassium iodide. The findings demonstrated that both SDF and silver fluoride can effectively arrest carious lesions in primary teeth. The use of potassium iodide reduced the staining. However, it also reduced the likelihood of caries arrest. Over a 12-month period, a higher proportion of lesions treated with potassium iodide progressed to the pulp. The authors suggest potassium iodide should be limited to anterior teeth where the chance of arrest is higher and aesthetics are more important. Further research is needed to investigate why some lesions continue to progress despite SDF or silver fluoride application. [57]

Follow-up

- Effectiveness of SDF in arresting dental caries ranges from 47% to 90% with a single application, depending on the cavity size and tooth location.
- Anterior teeth have higher rates of caries arrest than posterior, possibly because it is easier to maintain a dry field when applying SDF, and anterior teeth are easier to keep clean.
- More than one application is recommended along with regular follow up of clients.
- Follow up two to four weeks after the initial treatment to evaluate whether the lesions are arrested.
- Reapplication of SDF may be necessary if treated lesions are not arrested. Arrested lesions appear dark and feel hard upon gentle probing.
- Additional SDF can be applied at recare appointments if needed, based on the colour and hardness of the lesion or signs of lesion progression.
- Carious lesions can be restored after SDF treatment (e.g., with glass ionomer cement to enhance aesthetics and improve tooth function).
- If lesions are not restored after SDF therapy, biannual reapplication increases the rate of dental caries arrest compared to a single application.
- Emphasize the importance of optimal home care, including twice-daily brushing with a fluoridated toothpaste, daily interdental cleaning, and reducing sugar consumption to clients undergoing SDF therapy and their caregivers to maximize efficacy and prevent the development of new dental caries. [16] [48] [60]

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Take home messages

- SDF combines the antibacterial properties of silver with the remineralizing effects of fluoride, providing a noninvasive and cost-effective option for managing dental caries.
- Application of SDF is painless, which can help reduce dental fear and anxiety, and improve client cooperation during treatment.
- SDF is a non-aerosol generating procedure that requires simple equipment, allowing clinicians to deliver treatment in various settings, including long-term care and remote areas.
- Inform clients that arrested carious lesions will exhibit permanent dark staining, and follow-up and reapplication at regular intervals are necessary to sustain the arrest of dental caries.

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Client Resources

Tooth Decay (Caries), ODHA Factsheet
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Additional Resources

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