Silver Modified Atraumatic Restorative Technique: A Way towards "SMART" Pediatric Dentistry during the COVID-19 Pandemic

Divya Natarajan

Department of Pedodontics and Preventive Dentistry, Chettinad Dental College and Research Institute, Kancheepuram District, Tamil Nadu, India

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  * Corresponding author: Department of Pedodontics and Preventive Dentistry, Chettinad Dental College and Research Institute, Kancheepuram District, Tamil Nadu, India Email: dr.divya@outlook.in	As the coronavirus disease-2019 pandemic outbreak continues to be a global public health concern, dentists should seek means to provide oral health care with minimal risk. To meet the recommendations of the Center for Disease Control, alternative non-aerosol generating techniques have been proposed to minimize the risk of disease transmission to patients and dental healthcare personnel. Among recent materials, silver diammine fluoride (SDF) has been shown to be effective in preventing and arresting caries. This along with an atraumatic restorative treatment with glass ionomer cements (GICs) makes it a potentially attractive adjunctive therapy for caries management in pediatric patients. In this technique, SDF is applied over carious tissue and the lesion is restored with auto-polymerizing GIC. This review article aims to provide a practical background and clinical guide for the application of silver-modified atraumatic restorative technique (SMART) as a safe way to provide dental services to children during the pandemic.

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INTRODUCTION

The coronavirus disease-2019 (COVID-19) pandemic has significantly impacted dental services due to the high risk of infection transmission through the aerosol-generating procedures. Dental procedures have the potential to generate aerosols (usually < 5 μm) and droplets (usually > 5 μm) that can spread the respiratory pathogens including the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The World Health Organization (WHO), even after 6 months of declaring the COVID-19 outbreak as a global pandemic, still advises to avoid or minimize oral health care services that involve aerosol production, and emphasizes on prioritizing minimally invasive procedures with hand instruments in areas of COVID-19 community transmission [1].

In recent years, there has been a changing trend in the management of carious lesions especially in children worldwide. The current evidence suggests that removal of all infected dentin in deep carious lesions is not necessary provided that a well-sealed restoration is given [2]. A 10-year landmark clinical study showed that bonded and sealed composite restorations placed over frank cavitated lesions arrested the clinical progress of the lesions [3]. We know that affected or arrested dentin has lower bacterial activity than does the infected dentin [4]. If we could arrest the infected dentin and provide a well-sealed restoration, it could serve dual benefits. One

such procedure could be done using silver diammine fluoride (SDF) and glass ionomer cement (GIC) by atraumatic restorative treatment (ART). This new paradigm in caries intervention and management using SDF and ART together is called the silver-modified atraumatic restorative technique (SMART). This technique offers children an interim alternative to traditional restorative techniques providing the dual benefit of arresting the carious lesion and restoring the tooth without the risk of aerosols.

EVOLUTION

Silver has been used in dentistry for many years because of its antimicrobial properties; whereas, fluoride has been used to prevent and arrest caries. In 1917, silver was used by Howe in the form of silver nitrate to treat caries lesions as "Howe's solution" [5]. Later in 1972, 38% SDF was developed in Japan. It was approved by the Food and Drug Administration in 2014 as a class-II medical device to treat dentin hypersensitivity in patients over the age of 21 years, and its use for caries arrest was off-label [6]. Since then, SDF ($Ag[NH_3]_2F$) has been a popular caries management tool in pediatric dentistry. SDF has been commonly misspelled as "diamine silver fluoride" or "silver diamine fluoride" and "ammoniated silver fluoride". The term "silver diammine fluoride" is a more accurate description of its chemical structure since SDF contains two ammine (NH_3) groups and not amine (NH_2) groups [7]. In October 2016, it was recognized by the Food and Drug Administration as a breakthrough designation therapy for caries arrest. The breakthrough therapy status does not mean approval; rather, it is designated for drugs to treat a serious or life threatening disease or condition that demonstrate substantial improvement over available therapy. It has a unique ability to be a "silver-fluoride bullet" because of its potential to arrest and prevent caries [8], and has since been widely employed as part of non-restorative cavity control.

The ART was pioneered in the mid-1980s in Tanzania by Jo Frencken. It encompasses a minimal intervention approach to remove carious tissue using hand instruments and seal the tooth with adhesive restorative material; thereby, removing the sensory triggers and reducing dental anxiety [9]. One modification of the ART proposed by Massara et al. [10] included the use of a rotary handpiece on the enamel only, followed by placement of a traditional restoration and termed it the "modified atraumatic restorative treatment". This enhanced visualization of the lesion, saved time, and caused less manual fatigue. But Frencken clarified that ART consisted of the use of hand instruments only, and the use of adhesive materials and hence advocated the "adherence to the original description" [10,11]. In the SMART technique described here, the use of hand instruments or modification by using high speed handpiece depends on the patient, clinical scenario, and dental setting.

MATERIAL

SDF is a topical fluoride solution that has been used at a concentration of 38% and contains 44,800 ppm fluoride. Its fluoride concentration is the highest among all the commercially available fluoride agents in dentistry. It contains around 25% silver, 8% ammonia, and 5% fluoride [12]. SDF is available as e-SDF (India), FAgamin (Argentina), Fluoroplat (Argentina), Bioride (Brazil), Saforide (Japan), Advantage Arrest (United States), Topamine (Australia) and Riva Star (Australia) at a concentration of 38%. It is also available as Cariestop (Brazil) at a concentration of 12% and 30% and Creighton Dental CSDS – ammonia free (Australia) at 40%. It is odorless, with a pH ranging from 10-13 and is available as clear or tinted blue liquid (Advantage Arrest) based on the manufacturer for an easier application. Among these, Riva Star is the only commercially available product containing both silver diammine fluoride and potassium iodide (SDF + KI), but because of the high pH of 13, the use of a gingival barrier or rubber dam should be considered to avoid chemical burn of the soft tissue [13]. One bottle of SDF provides 250 drops, and each drop could be used for applying on up to 5 tooth surfaces.

The saturated solution of potassium iodide (SSKI) or Lugol's solution contains 1g of

potassium iodide per milliliter of solution which helps eliminate the black staining of SDF on carious tissue [14].

High-viscosity auto-cure GIC has been advocated in ART because it would chemically bond to the moist surface being hydrophilic providing seal, and acid resistance and enhancing remineralization at the tooth-restorative interphase. In the SMART restorations, auto-cure GIC is preferred over the light-cure as the light could cause darkening of the SDF [15].

RATIONALE

The basis for the SMART comes from the fact that by biologically sealing the tooth with caries, the viable bacteria present in the remaining carious dentin lose their viability by being deprived of their sucrose substrate. Thus, if the organisms were made nonviable using SDF and the staining was eliminated by the use of KI, prior to placement of a restorative material like GIC as placed in ART, it would significantly improve the prognosis of the tooth [15]. Placement of a restoration following SDF would eliminate imminent fracture of the remaining tooth structure, prevent space loss [16], provide easy access for biofilm removal [17], and eliminate the need for advanced behavior guidance [12] while satisfying the parents' demands or needs [18].

MECHANISM OF ACTION

The mechanism of carious lesion arrest by SDF has been explained by the dual action of both silver and fluoride. The silver acts by its bactericidal "zombie" effect [19,20], enzymatic inhibition of biofilm [21], inhibition of dentinal collagen degradation [22], and loss of mineral content [23]; thereby, inhibiting demineralization. The fluoride inhibits biofilm and facilitates apatite nucleation and remineralization [8].

Bactericidal and Biofilm inhibition

SDF has a strong antibacterial and antifungal effect inhibiting *Streptococcus mutans*, *Lactobacillus acidophilus*, *Streptococcus sobrinus*, *Actinomyces naeslundii* [19] and *Candida Albicans* [24] biofilm formation on demineralized dentin. In the bacterial cell, the released silver ions react with the thiol groups of amino-acids and nucleic acids and the silver amino and nucleic acid conjugates are unable to carry out metabolic and reproductive functions. The silver ions also interact with the sulfhydryl groups of proteins and DNA of microorganisms, altering the hydrogen bonding and inhibiting the respiratory process, DNA unwinding, cell-wall synthesis and cell division. It inactivates the glucosyl-transferase enzyme activity and hence the synthesis of glucans, thereby, inhibiting the sucrose-dependent adhesion of the bacteria to tooth surfaces and the viability of *Streptococcus mutans* [21]. This results in bacterial killing and inhibition of biofilm formation [8].

Another theory by Wakshlak et al. [20] proposed that the biocidal metal-like silver slowly releases cations which are toxic to bacteria. The bacteria killed by silver showed biocidal activity against the viable bacteria of the same species. This metal-induced biocidal action was called the "zombie effect". An in vivo study established a >95% reduction in total viable counts of anaerobes in carious dentin treated with SDF+KI [25]. In addition, fluoride from SDF and GIC binds to bacterial cell constituents and influences the enzymes such as enolase and proton-extruding adeno-sine triphosphatase; the latter inhibits sugar uptake and the carbohydrate metabolism of acidogenic oral bacteria, thereby, inhibiting biofilm formation [26].

Cariostatic activity

The arresting action of SDF on caries could be explained by its high concentration of fluoride, its alkaline property, and presence of silver. When SDF or SDF+KI is applied over demineralized enamel or dentin, insoluble protective precipitates of calcium fluoride, silver chloride, silver protein layer and metallic silver are formed. These precipitates of silver and fluoride were found in higher levels in demineralized dentin than in sound dentin which explains why SDF application is more effective as a means of arresting the existing dentin caries than preventing caries initiation on sound dentin surfaces. An in vitro

study by Seto et al. [27] showed silver microwires that filled the voids in the carious lesion, permeating the dentinal tubules, and distributing forces throughout the lesion and into intact dentin, resulting in reinforced hard dentin. Thus, the inhibitory effect on loss of mineral content, dentin demineralization [19], collagen degradation and biofilm formation contributed to the increased microhardness of caries dentin [28] and thereby caries arrest [21,22,29,30]. Evidence shows that SDF at a concentration of 38% is more effective than 12% for caries arrest [31]. Likewise, Dos Santos et al. [32] found 30% SDF to be more effective than GIC used as an interim restorative treatment for caries arrest. A systematic review by Chibinski et al. [33] established that SDF is 89% more effective in arresting caries than other active treatments in primary teeth.

Remineralization

During the caries process, there is loss of minerals and breakdown of collagen fibrils resulting in high porosity occupied by water. On SDF application, silver and fluoride from SDF combine with the phosphate group of proteins and calcium ions to form silver phosphate and calcium fluoride, respectively. The calcium fluoride acts as a fluoride reservoir and there is subsequent dissociation of calcium and fluoride and formation of fluorapatite [8]. It also enhances mineral deposition in the spaces filled with water forming a more resistant hybrid layer by increasing adhesive diffusion, and thereby, enhancing the microhardness of superficial dentin [34]. SDF, being alkaline, facilitates the phosphate in the saliva to attach to dentin collagen, inhibits the proteolytic enzymes, matrix metalloproteinases and cysteine cathepsins and protects them from being exposed, thereby, inhibiting collagen breakdown. This serves as a binding site for calcium ions, thereby facilitating the apatite nucleation onto the collagen [28].

Caries Prevention

When SDF is applied to healthy teeth unaffected by caries, the fluoride anions from the SDF substitute the hydroxyl ions of the hydroxyapatite crystal, forming fluoro-hydroxyapatite which is less acid-soluble, thereby, preventing the caries process [8]. In addition, limited detectable silver particles were found on the sound enamel surface treated with SDF, which explains why the sound tooth surfaces are not stained black [35]. Clinical trials have shown SDF to be efficient in preventing caries in both primary and permanent dentition [36]. Furthermore, the fluoride from GIC has also shown to be effective in preventing the progression of incipient carious lesions.

Desensitization

The silver from SDF forms microwires within the dentinal tubules and these precipitates of silver and calcium fluoride prevent fluid flow through the tubules, blocking them, and thereby diminishing pain and clinically reducing dentin hypersensitivity [13,27,37].

Synergistic action of SDF and GIC

When SDF is applied to carious tissue, it reacts with the hydroxyapatite to form calcium fluoride and silver phosphate. In addition to silver phosphate, silver oxide and silver sulfide are formed, which convert the silver ions to metallic silver nanoparticles when exposed to light. This results in black staining when SDF is applied to the surface of carious lesions. The silver particles penetrate into the dentinal tubules to form a silver enriched "zone" at the end of demineralized sites, increasing the hardness of carious dentin [35]. When potassium iodide solution is applied over this layer of SDF, the free silver ions react with the iodide to form a creamy white precipitate of silver iodide. This will remove free silver ions that would potentially stain the surface [38]. But the pitfall is that silver iodide is believed to be highly photosensitive, and may dissociate into metallic silver and iodine by exposure to light [39]. This could be the reason for the conflicting evidence regarding discoloration when KI is used.

Furthermore, in carious lesions, SDF initially reacts with the hydroxyapatite to form unstable calcium fluoride, which is washed out over time. The calcium and phosphate ions from the odontoblastic processes combined with fluoride from SDF and strontium and fluoride ions from the GIC to form a caries resistant base beneath the GIC. The infected dentin with broken collagen matrix will form

fluoride-rich arrested caries with an intact collagen matrix; this enhances the formation of stable fluoroapatite which is resistant to acid dissolution [30,40]. The GIC, used after SDF application, controls caries progression by providing proper conditions for reorganization of carious dentin. Although GIC also releases fluoride, this release is very low when compared with SDF. Thus, the GIC in SMART restorations probably controls the caries lesions by preventing biofilm retention and cavity sealing but not predominantly by fluoride release [33]. Thus, these SMART restorations kill bacteria and cut off the nutrient source for any remaining bacteria by placing a chemically sealed restoration that will arrest and remineralize the caries lesion, enhancing pulp vitality and preserving the tooth structure [15].

CLINICAL APPLICATIONS
The indications and contraindications for SMART are listed in Table 1.

CLINICAL TECHNIQUE
The clinical protocol for SMART is based on the chairside recommendations by expert panel and clinical experience of clinicians who have successfully used the SMART technique [38-42] (Box 1).

FACTORS AFFECTING SMART RESTORATIONS
Biocompatibility
When SDF is left in contact with the carious tissue for one full minute, it is capable of arresting caries to a depth of 25 μm into enamel and 200 to 300 μm into dentin. The silver formed microwires in voids caused during demineralization and concentrated at the end of demineralized sites create a self-limiting "zone" or "shield" [27,35]. In a study done on dogs by Russo et al, histological analysis of the teeth lined with 38% SDF and restored with amalgam showed that SDF acts as pulp tissue irritant with presence of lympho-histio-plasmacytic infiltrate and dark colored granules inside the cytoplasm of macrophages [41]. Contrastingly, studies by Bimstein et al, [42] and Korwar et al. [43] found evidence of silver deposits and no bacteria within the dentinal tubules, tertiary dentin deposition and absence of pulpal inflammation in deep carious primary teeth treated with SDF.

Table 1. Indications and contraindications for SMART

Indications	Contraindications
Asymptomatic carious lesions with no clinical signs of pulpal inflammation or reports of spontaneous pain.	Symptomatic carious lesions involving pulp
Non-cleansable carious lesions in posterior teeth	Patients with ulcerative gingivitis or stomatitis or undergoing thyroid gland therapy
Patients at high risk of caries with rampant caries or severe-early childhood caries OR active cavitated caries lesions in anterior or posterior teeth	Parents who do not consent to SDF treatment or color changes
Multiple cavitated caries lesions that may not all be treated in one visit	Known silver allergy
Symptomatic molar incisor hypomineralization	Potassium iodide contraindications
Prevent caries	
Root caries	
Cavity liner	
Dentinal hypersensitivity	
Behavioral, special needs, medical conditions, dental phobia, anxiety management challenges	
Patients without access to or with difficult access to dental care	
Non aerosol generating treatment	
Outreach community programs	

Box 1. Step-by-step clinical technique for SMART

Silver Modified Atraumatic Restorative Technique: Step by Step Clinical Technique

1. Language appropriate informed consent inclusive of color clinical pictures of SDF treated lesions should be obtained prior highlighting the risk, benefits and alternate treatment options for parents, particularly for caregivers with low oral health literacy. It should include that caregiver understands that the decayed part of the tooth may stain black. This is emphasized to make them aware of the staining and partial appearance of the stains at the restoration-tooth interface [44-46].

2. Wear standard personal protective equipment, and make sure the patient is wearing safety glasses and a plastic-lined bib.

3. Apply cocoa butter or petroleum jelly to perioral areas and/soft tissues that would possibly come in contact with SDF. Care should be taken that the petroleum jelly dos not contact the caries lesion as it could inhibit the uptake of SDF and affect bonding.
    Clinical tip: A scented lip balm would mask the ammonia odor of SDF

4. Remove gross debris, biofilm and pellicle with pumice, non-fluoride prophylaxis paste or moist cotton pellet from the cavity to enhance direct contact of SDF to the carious dentin [6].
    Clinical tip: Alternatively, etch with 37% phosphoric acid for 5-15 seconds, rinse and dry. Do not desiccate.

5. Isolate with isodry or isolite, saliva ejector, suction bite-block, gauze, cotton rolls, finger guard, absorbent triangles or dri-angle and dry with a cotton pellet.
    Clinical Tip: Alternatively, dry the tooth both prior and after SDF placement using a clean and dry microbrush.

6. No operative intervention (e.g., affected or infected dentin removal) is necessary to achieve caries arrest.

7. Dispense 1 drop of SDF into a disposable plastic dappen dish and use a micro-brush to apply on the lesion with scrubbing motion. Leave SDF in place for 1 minute. The arrested lesion should be matte black in color and firm on using a periodontal probe.
    Clinical Tip: Use a plastic dappen dish as SDF corrodes glass and metal and digital timer for application time. The dentist's finger could be used to block for the child's tongue when applying SDF on lower posterior teeth, which augments tooth isolation and prevents a metallic taste [46].

8. Excess should then be appropriately removed with cotton wool or a gauze.
    Clinical Tip: Avoid rinsing post SDF application to reduce the chance of staining soft tissues and metallic taste [46].

9. KI is placed on a separate dish, and a separate microbrush fully immersed in the KI should be applied to the SDF treated carious tissue. KI should be repeatedly applied one to three times until the white precipitate turns colorless. Wait for 5 to 10 seconds between applications and remove excess with cotton. Rinse with water and air-dry [47].

10. If required, the cavosurface margins could be prepared with a high-speed handpiece, slow-speed round bur, hard-tissue laser, air abrasion, or a spoon excavator.

11. Remove debris and condition with 20% polyacrylic acid for 10 seconds, then rinse for 10 seconds and blot dry with cotton leaving a moist glossy surface. This is essential to remove the smear layer and ensure good chemical bond to the tooth structure activating the surface for ionic exchange.

12. Place matrix system if required. GIC is mixed and placed into the cavity. Do not disturb the GIC for 2.5 minutes from the start of the mix. Use "finger push" technique wherein a gloved finger lubricated with unfilled resin or manufacturer's coat is used to push the GIC and at the same time removing excess material. Excessive GIC should be removed from unwanted areas using an instrument lubricated with a thin film of unfilled resin.

13. If restoring with resin modified GIC or composite, a layer of auto-cure GIC is placed up to the dentinoenamel junction, bonding agent is applied to the surface, bulk fill composite or resin modified GIC is condensed into the cavity and light cured. This is indicated only when using SDF+KI [48].

14. Finishing and polishing should be accomplished with light pressure with high-speed finishing burs and polishing cups, respectively. Manufacturer's coat or unfilled resin (without light cure to avoid blackening of tooth and restoration) should be used post restoration.

15. Invert all used cotton, microbrush, and dappen dish into a glove so SDF does not drip on any surface or skin.

Conditioning vs. etching

When the carious tissue is conditioned using polyacrylic acid, it does not facilitate SDF penetration into demineralized dentin. Contrastingly, application of 37% phosphoric acid removes the smear layer, which decreases the surface bioload and thereby facilitating deeper penetration of the SDF [49].

Bond strength

Pre-etching aids in deeper penetration of SDF or SDF+KI by inhibition of matrix metalloproteinases and cysteine cathepsins, which enhances the interlocking within the dentinal tubules, thereby, increasing the overall bond strength [49,50]. Whereas, post-etching resulted in an increase in bond strength of the adhesive restorative material like GIC or resin modified GIC. In agreement, etch-and-rinse adhesive showed higher bond strength than self-etch adhesive on SDF treated carious dentin [4]. Unfortunately, the bond strength of GIC was significantly reduced when SDF was allowed to dry and SDF+KI precipitate was left on the surface without rinsing. This is due to the deposition of silver iodide precipitate, and rinsing the SDF treated dentin eliminates this precipitate; thus favoring adhesion and thereby improving the bond strength of GIC [51,52]. It is important to understand that application of KI over SDF does not affect the bond strength of GIC or resin modified GIC to dentin [39,53].

Light curing

When SDF is applied to carious dentin, metallic silver is formed, and its production is accelerated when exposed to light and high temperature, producing a black stain. In addition, light curing of SDF-treated dentin does not affect the depth of penetration of silver particles into the dentin tubules of primary teeth [54].

Microleakage

A study reported that SDF+KI+GIC showed the highest resistance to microleakage. This could be attributed to the anti-matrix metalloproteinase action of SDF causing decreased collagen degradation and promotion of remineralization, and this resulted in improved chemical bond of GIC to the collagen fibrils [53].

BENEFITS

The most notable aspects of SMART technique are its ease of use, efficacy, low-cost, biocompatibility, and less chairside time. It is not technique-sensitive and offers a non-aerosol generating alternative to traditional caries management with a high-speed handpiece. The ART-based approach increases the children's cooperation being less painful and less time consuming [55]. With the added benefit of decreased tooth sensitivity, the brushing procedure becomes less painful and this enhances the adherence to oral hygiene procedures in children [37]. Thus, from a practical standpoint, this technique offers a simple and good value-for-money intervention that does not require specialist referral for use in resource-limited health care systems and community dental service.

SIDE EFFECTS

Despite the numerous benefits, the unesthetic black staining of the carious tissue hampers the broader acceptance of SDF. An in vitro study by Nguyen et al. [56]] found that teeth treated with SDF+KI showed minimal or no staining irrespective of being restored with auto-cure GIC, resin modified GIC, or composite. New research on bovine teeth has shown 20% glutathione to be effective for eliminating the stains predominantly on the enamel only [57]. In 2019, a scoping review by Magno et al. [58] concluded that esthetic perception of staining by SDF was influenced by lower acceptance by dentists and not by patients and parents. Further studies are required to assess the acceptability of SMART technique and this one pitfall would not undermine the numerous benefits of this technique.

Based on the follow-up of 888 preschool children in a clinical study, transient tooth and gingival pain (6.6%), gingival swelling (2.8%) and gingival bleaching (4.7%) were only reported [59]. Previous clinical studies have reported metallic taste and a small, mildly painful white lesion in the mucosa, which disappeared in 2 days without any treatment [8,36,38]. Furthermore, it causes permanent

staining of counter top surfaces, floors, instruments and clothing which may be treated with sodium hypochlorite [8]. Any staining of skin would disappear when keratinocytes are shed over a period of 14 days. The white discoloration or surface changes on the oral mucosa would resolve in 2 days [36,60,61]; whereas, a long-term mucosal stain would be evident if SDF contacts an intraoral wound. Hence, desquamative gingivitis or mucositis is a relative contraindication [47].

SAFETY AND TOXICITY

SDF has been reported to be completely safe for use in preschool children with no adverse effects or reports of acute or serious systemic illness [59,62]. The recommended limit of SDF is one drop (25 μL) containing 9.5 mg of SDF per 10 kg per treatment visit corre-sponding to 0.95 mg/kg. The average median lethal dose (LD_{50}) of SDF observed in rat studies is approximately 520 mg/kg [47] by oral administration providing a 547-fold safety margin. The average amount of SDF applied to 3 teeth was found to be 7.6 mg or 2.5 mg per tooth [47]. This corresponds to 1.5 mg of silver (0.5 mg per tooth) and 0.33 mg of fluoride (0.11 mg per tooth) [63]. Thus, a child of 10 kg with 20 decayed teeth treated with 38% SDF would receive a maximum dose of 10 mg (1 mg/kg) silver and 2.2 mg fluoride (0.22 mg/kg), which is within the safety margin. Considering, the toxic dose of fluoride which is 5 mg/kg [64], there would be a 23-fold safety margin. Similarly, the no-observable-adverse-effect level of ingested silver for rats is 181 mg/kg/day and it is 10 g for a total lifetime for humans; thus, toxicity is of low concern for silver [65,66]. A randomized controlled trial investigating the effectiveness and safety of 38% SDF in 2-to-3-year old children showed no consistent changes in relative abundance of caries-associated microorganisms, nor emergence of antibiotic or metal resistance gene expression [67].

EVIDENCE AND PRACTICE PERSPECTIVE

The SDF's clinical success has been attributed to its antimicrobial activity and inhibition of demineralization [19], and it has proven to be more effective than fluoride varnish [8]. Wright and White [12] suggested that if SDF was used for the management of early childhood caries, it would decrease the need for sedation and general anesthesia, and the cost implications for delivery of care. Alternatively, if SDF was used only as a temporary means to stabilize the disease until conventional restorative treatment could be implemented, then the oral health care costs might actually increase [12]. By implication with the right technique and choice of restorative material, SMART restorations could offer promising permanent results. In the current pandemic scenario, the use of aerosol-generating procedures in SMART restorations could be avoided. Furthermore, when KI is unavailable for use, the use of an auto-cure opaque GIC or an opaquer prior to GIC placement is advised to avoid grayish discoloration of restoration. While the clinical effectiveness of SDF and ART have been documented in scientific literature separately, there are no published trials investigating the success of SMART technique in pediatric dentistry to date.

CONCLUSION

In summary, the SMART procedure ensures the continued viability of dental practice during the COVID-19 pandemic. The synergistic benefits of antimicrobial activity and caries arrest of SDF+KI and a well-sealed restoration in a single technique could potentially be the reason for clinical success of the SMART technique. The technique offers an efficient and economical way for management of caries in young and highly anxious children and could help break the cycle of dental caries. The SMART technique could be a revolutionary approach to caries management with more clinical trials and longer follow-up to provide more information on its clinical outcomes.

CONFLICT OF INTEREST STATEMENT
None declared.

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