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Abstract
Although silver products have been used to treat caries in other countries for decades, a lack of formal education about them has contributed to misconceptions about their efficacy after silver diamine fluoride (SDF) received FDA clearance in the United States. As an early adopter of silver diamine fluoride, I would like to shed some light on these common misconceptions.

Educational objectives
After completing this course, the participant should be able to:
1. Identify and dispel common misconceptions about silver diamine fluoride.
2. Identify challenges and shortcomings of traditional restorative dentistry.
3. Describe indications for the use of SDF.
5. Identify the ideal material for SMART.

Introduction
In July 2016, I was featured in a New York Times article about SDF, “A Cavity-Fighting Liquid Lets Kids Avoid Dentists’ Drills.” The article created a surge of public interest and dialogue about SDF among dental professionals, both positive and negative.

As a member of various online dental forums, I followed several SDF-related threads in the article’s wake. I found it interesting that the negative comments tended to stem from misconceptions and a general lack of knowledge. It’s no surprise that most modern dentists have never used SDF or perhaps even heard of it until the Times article came out. For most of us, it wasn’t part of our dental education. I went to a well-respected dental school, for example, and when I first heard of SDF in a 2014 online dental article I thought, “What is this tree-hugging quackery?” It turns out the joke was on me, and this method of treating decay can be traced back to the 1800s.

The father of modern dentistry, G.V. Black, is said to have used silver nitrate exclusively to treat decay in children in the
early 1900s. It has been used for decades in other countries including Japan, China and Australia. In fact, 12 randomized clinical trials tout its efficacy.\(^2\)\(^3\)\(^-\)\(^{13}\)

In the U.S., the use of silver products to treat caries seemed to have vanished in the 1950s when we introduced “painless” dentistry with better anesthesia and added fluoride to toothpastes and water. Apparently, we thought we would eradicate decay and if an issue did arise, it wouldn’t be painful to have it fixed. Well, it’s 2017 and sugar is king, and the cavities are rampant—especially in the Southwest, where I practice. According to the latest Centers for Disease Control and Prevention data, 91 percent of the American population has caries.\(^14\) It has become increasingly apparent that we cannot simply drill our way out of this problem.

Unfortunately, our prevention programs (exams, prophylaxis and fluoride varnishes) aren’t cutting the caries incidence rates in high-risk individuals. There must be a better way. Unlike surgical dentistry, or drill and fill, SDF treats the decay-causing bacteria and biofilms. Shortly after Elevate Oral Care’s Advantage Arrest SDF 38% came on the market in 2015, I ordered a bottle and now use it daily for patients in a wide array of scenarios. I hope more dentists will open their minds and expand their knowledge base by reading up on SDF and introducing it to their practices. Let us start by addressing what I consider to be the five most common SDF misconceptions.

1. It’s going to run you out of business

   I thought an angry mob was going to come for me with pitchforks and torches after my patient’s parents told Times reporter Catherine Saint Louis that they paid me $25 to place SDF on their 4-year-old child’s incipient carious lesion. I thought pediatric dentists would be in a state of panic that they’d be on the verge of bankruptcy because someone had helped out a child in a humane and affordable manner.

   Now, I find this misconception laughable. The procedure takes mere minutes—often done the same day as the exam—with little more than a microbrush. For a measly 50–80 cents per drop, Advantage Arrest SDF can treat up to five lesions.

   SDF can be applied to incipient lesions you would normally watch and check in six months. We offer patients same-day SDF application on noncavitated incipient lesions. Very few insurance companies currently reimburse D1354 (caries arresting medicament), but most parents are more than willing to pay out of pocket for SDF. Your routine exam and cleaning then becomes more productive, and you’ve given the patient a better chance of being caries-free at the next checkup. It’s a win-win.

   As a pediatric dentist, it’s frustrating to have time blocked out for a sedation patient only to have the person no-show, cancel last-minute because of an illness or violate NPO. Talk about a waste of time and money! Simple and quick yet effective treatments like SDF and SMART allow you to treat more patients in less time by eliminating the need for local anesthetic and sedation. Because SDF is a fluoride, often a hygienist or expanded-function dental assistant can apply subsequent treatments to arrested lesions, freeing up the dentist’s time to examine and treat other patients.

   Remember that SDF does not restore form or function, nor is it cosmetic—there will still be fillings, crowns, extractions, cosmetic dentistry, implants, and the like. SDF isn’t putting anyone out of business; it’s just another tool in the tool kit for fighting decay. Any notion otherwise is simply unfounded.

   I now use SDF daily in my practice. We’ve enjoyed an increase in new patients, improved retention of existing patients and increased internal marketing via word-of-mouth referrals. I’ve dramatically reduced our minimal oral conscious-sedation cases, eliminated the use of in-office IV sedation and rarely have the need to refer a case out for general anesthesia—all while maintaining a thriving, seven-figure producing practice. (This financial misconception will be explained further when discussing Myth No. 4.)
Your patients will reject it because of its poor aesthetics

I attended a 2015 pediatric lecture in which the speaker, a very well-respected pediatric dentist, took a completely dismissive stance on SDF and said that parents would reject it because of the cosmetic factor—they wouldn’t want black teeth.

I beg to differ. When given the option, plenty of parents choose SDF for their children—I see such patients daily. The parents’ reasons vary considerably—no insurance coverage or lack of funds; fear of sedation; behavioral or special-needs medical issues; eruption timing; and so on.

SDF advocate Dr. Jason Hirsch of Royal Palm Beach, Florida, shares a similar sentiment: “Perception leads to barriers, but barriers are often overcome with discussion, education and resourcefulness,” says my fellow Townie. Some parents will still choose a more cosmetic treatment option, of course, but giving them all the options and empowering them to make the decision is what will set you apart as a practitioner.

The No. 1 reason I see patients for a second opinion is that they hadn’t been given treatment options—they had been told it was GA or the highway. Often the parent’s concerns about sedation or general anesthesia had been entirely dismissed, but parents who don’t want or can’t afford treatment for their children end up hopping from office to office ... or just disappearing altogether. In my mind, SDF treatment is better than no treatment at all.

When it comes to black stains, fillings or crowns, we shouldn’t be the ones to decide what parents want. We should give them all the options, review the pros and cons, and let them decide for themselves. You might be surprised how many opt for the less-invasive, less-cosmetic, but highly effective choice.

It’s only for children

Patients of all ages can benefit from SDF. The University of California San Francisco School of Dentistry identified five indications for SDF use:

1. Extreme caries risk, such as those with salivary dysfunction secondary to cancer treatment, Sjögren’s syndrome, polypharmacy, aging or methamphetamine abuse, when prevention visits and traditional restorations fail to stop the disease progression.

2. Treatment challenged by behavioral or medical management, such as the frail elderly or immunocompromised, those with severe cognitive or physical disabilities, and patients with dental phobias who may not be good candidates for anesthesia because of medical complexity.

3. Patients with carious lesions that may not all be treated in one visit, such as in the slow-moving pace of a dental-school setting or county clinics that could be booked out for several months, or those unable to complete treatment in a timely manner because of insurance or financial issues.

4. Difficult-to-treat dental carious lesions, such as partially erupted molars, recurrent caries at a crown margin or root caries in a furcation.

5. Patients without access to dental care.

SDF has huge potential in our overburdened public health system—it has an unprecedented ability to help treat decay in the most vulnerable patients, such as the elderly and Medicaid population.

Thanks to forward-thinking dentists, the state of Oregon helped put SDF back on the map; in January 2016, it became the first state to reimburse Medicaid providers for treating cavities with SDF. Last October, the FDA granted Advantage Arrest Silver Diamine Fluoride 38% the “Breakthrough Therapy” designation for caries arrest, making it the only oral medicine to receive this prestigious recognition.

Adults can also benefit from SDF treatment to target the disease process first, and restorative and cosmetic dentistry second. Because fillings and crowns are not cariostatic, much of the dentistry performed on adults is “redo dentistry” for margins that are decayed or simply discolored. Why not use SDF to arrest marginal decay, then seal the margins? This has been advocated by evidence-based meta-analysis, but too many restorations are being removed, and the death spiral of redo dentistry is alive and well. We must break this pattern of not treating the disease first.

Why not give your patients the option of treating incipient lesions at a crown or filling margin in a conservative manner? Your patients will love you for it, and they’ll tell all their friends.

Also, SDF was cleared by the FDA to treat dentin sensitivity—just like fluoride varnish, which holds the same classification and is also used off-label to prevent decay. Using SDF can decrease the odds of recurrent decay and/or postoperative sensitivity with your restorations.

Learn more about SDF for additional CE credit

Dr. Jeanette MacLean’s next online CE course for Dentaltown will discuss the history and science behind SDF and SMART and will share clinical protocols you can immediately incorporate into your practice. The course, titled “Silver is the New Black: Improving Your Practice with Silver Diamine Fluoride,” will be loaded and promoted on dentaltown.com before year’s end.
4. Patients will not complete treatment

I’ve heard many colleagues say they fear their patients will never get SDF treatment done.

First, SDF is a treatment: a noninvasive, medicinal approach to managing the bacteria that’s contributing to decay in the first place—something fillings and crowns don’t do. SDF alone does not restore form or function to cavitated teeth, but combining it with a glass ionomer cement such as SMART makes an excellent restoration.

Another viable option is SDF as an indirect pulp therapy, along with a stainless steel or Hall crown. When new patients come in wanting SDF and have giant holes that will trap food, I educate them that I could apply SDF, but ultimately the tooth may also need a restoration to prevent food impaction or space loss.

Also, not every tooth is a candidate for SDF. Teeth with abscesses and lesions involving the pulp aren’t eligible for this treatment.

Shortly after the Times article was published, a mother brought her 2-year-old to me all the way from Oklahoma in favor of quadrant dentistry versus general anesthesia. In the end, it cost her more money and time, but she didn’t care; for her, all at once was too much, and she had major safety concerns after two highly publicized deaths of children who had received dental treatment under anesthesia the previous year. Where is the harm in listening to our patients and their concern—or, within reason, accommodating their needs?

Second opinions for IV and general anesthesia are now commonplace for me, and it’s not unusual to have a patient come from across town, or even out of state, to receive noninvasive care. As I mentioned earlier, the main reason patients come to me for a second opinion is that they weren’t given any other options elsewhere.

The notion that an aggressive surgical approach is the superior and only choice is sadly misguided. In fact, gold-standard OR/GA pediatric dentistry has relapse rates of between 20 and 80 percent. The treatment planning discussion is an important opportunity to educate patients that fillings and crowns are not cures for caries—and neither is SDF. They must understand that if the behaviors such as poor diet and hygiene persist, these treatments will ultimately fail, and the caries can (and will) return.

5. You can’t bond to it

I’ve received numerous emails, and viewed concerned and confused posts on online forums, where dentists wonder if they can cement crowns or bond adhesive restorations to SDF-treated tooth structure. The answer is yes.

Dr. Ryan Quock of the University of Texas School of Dentistry at Houston conducted an in vitro study to examine whether SDF applied to noncarious permanent dentin would adversely affect bond strength of resin composite. The study showed that there were no significant differences in microtensile bond strength of composite to control versus dentin samples treated with 38% SDF. The same was true whether etch-and-rinse or self-etch adhesive was used. A study by Dr. Ivy Wu on primary teeth yielded similar data.

In light of these results, it seems that bonding is compatible with dentin pretreated with SDF. Quock does recommend the mechanical preparation of enamel and the DEJ to remove demineralization. This preparation maximizes the bond to sound tooth structure and improves the marginal seal.

It’s important to be aware that light-curing any restorative material on the same day that you apply SDF poses an aesthetic issue; the curing light will precipitate the silver out of the solution and turn the entire restoration gray. Even a self-curing, high-viscosity glass ionomer cement (HV GIC)—the preferred material for SMART—will eventually turn gray if it’s applied the same day that SDF is applied. Such discoloration can be avoided by placing restorative materials during a separate visit, after the SDF application. (Some high-quality HV GICs such as Fuji Equia Forte are often opaque enough to mask SDF-arrested caries.)

If you need to place a resin composite or resin-modified glass ionomer (RMGI) on the same day as your SDF application, simply cure the SDF after it’s applied and before the resin placement. The excess stain can be polished off sound enamel using a slow-speed tufted prophyl brush and plain pumice before etching and placing your light-cured restorative material. Universal opaquers such as Shofu Beautifil can also effectively mask the black scar under resins or RMGIs such as Fuji II LC. Trying these techniques on extracted teeth can help you gain experience before using the product on a patient for the first time. Of course, this is a nonissue if aesthetics are not a concern.
Conclusion

When current modes of prevention and restorative treatment fail to control caries, it raises certain questions. What could we do differently? What could we do better? Twetman and Dhar concluded in 2015 that “There is lack of substantial evidence to suggest that restorative treatment leads to acceptable long-term clinical outcomes,” and “There is certainly a need to go beyond the drill-and-fill dentistry and integrate other concepts of disease management to ensure long-term success.”

Is our profession ready for a paradigm shift to a medical management of caries model—one that incorporates early intervention with topical antimicrobials such as SDF as a first line of defense? One that uses minimally invasive restorations with biocompatible materials such as glass ionomer and our patients to never stop learning, never ignore. As dentists, we owe it to ourselves supporting the efficacy of SDF is too strong whenever possible?

The abundance of evidence-based data supporting the efficacy of SDF is too strong to ignore. As dentists, we owe it to ourselves and our patients to never stop learning, never stop reading, and never get too comfortable or stuck in our current mode of thinking.

I encourage my colleagues to read the evidence for themselves. SDF is not a panacea, but it is a powerful oral medicine that satisfies the triple aim of health care—increases access, improves health and reduces cost—and is a welcome addition to our tool kit.

References
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1. Which earlier version of topical silver was used in the late 1800s and early 1900s in the United States to treat caries?
   A. Silver chloride.
   B. Silver fluoride.
   C. Silver nitrate.
   D. Sodium fluoride.

2. According to data from the Centers for Disease Control and Prevention, what percentage of the American population has caries?
   A. 91 percent.
   B. 80 percent.
   C. 76 percent.
   D. 50 percent.

3. One drop of silver diamine fluoride 38% can treat up to how many teeth?
   A. One.
   B. Two.
   C. Three.
   D. Five.

4. SDF restores the form and function of teeth.
   A. True.
   B. False.

5. Which of the following are considered indications for the use of SDF?
   A. Extreme caries risk.
   B. Difficult to treat lesions.
   C. Patients with more lesions than can be treated in one visit.
   D. All of the above.

6. According to the literature, restorative dentistry performed under general anesthesia on primary teeth can have relapse rates as high as:
   A. 50 percent.
   B. 60 percent.
   C. 80 percent.
   D. 75 percent.

7. The FDA cleared silver diamine fluoride 38% for treatment of:
   A. Caries.
   B. Dentin hypersensitivity.
   C. Decalcification.
   D. Gingivitis.

8. You cannot bond to SDF-treated dentin.
   A. True.
   B. False.

9. What is a SMART filling?
   A. SDF Material Above Restorative Technique.
   B. Silver-Modified Atraumatic Resin Treatment.
   C. Silver-Modified Atraumatic Restorative Treatment.
   D. SDF-Masked Restoration Technique.

10. Which was the first state to reimburse Medicaid providers for SDF treatments?
    A. Maine.
    B. Oregon.
    C. Minnesota.
    D. Alaska.

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Top 5 Misconceptions About Silver Diamine Fluoride

by Jeanette MacLean, DDS

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