



Silver Diamine Fluoride: A Clinical Perspective From a Pediatric Dentist

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ABSTRACT This commentary reviews how silver diamine fluoride (SDF) has been incorporated into the author's pediatric dental office and the decision-making process for its use.

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Silver diamine fluoride (SDF) is one of the hottest topics in dentistry. When an article in *The New York Times* entitled “A Cavity-Fighting Liquid Lets Kids Avoid Dentists’ Drills”¹ was published on July 11, 2016, my office began receiving phone calls and emails from all over the country asking about this “new” treatment. While this article certainly captivated many around the country and gave some people hope that they or their children would no longer be required to have their teeth “drilled,” it may have caused more confusion for the public and for the dental professionals who care for their oral health.

The purpose of this article is not to describe how SDF works or propose a protocol for its use. Many articles have been written for this purpose including two in the *Journal of the California Dental Association*: “Back to the Future: The Medical Management of Caries Introduction” by Steve Duffin, DDS,² and “UCSF Protocol for Caries

Arrest Using Silver Diamine Fluoride: Rationale, Indications and Consent” by Jeremy A. Horst, DDS, PhD, et al.³ This article explains how SDF has been incorporated into my practice and the thought process behind its use.

I have what I consider to be a fairly typical pediatric dental practice. I am a solo practitioner in a working-class area. My practice has a diverse mix of children and young adults of varying ethnicities and socioeconomic backgrounds. Many of my patients have moderate to extensive tooth decay. When I see these patients, I begin to go through a decision-making process on the treatment options taking into account factors such as their age, cooperation level, health, access to care and/or financial constraints (**FIGURE**).

For cooperative children with carious lesions, I will typically recommend that treatment be completed utilizing nitrous oxide/oxygen. Nitrous oxide has the following benefits: anxiolysis, mild analgesia, helps block the dental odors and shields the passing of the dental

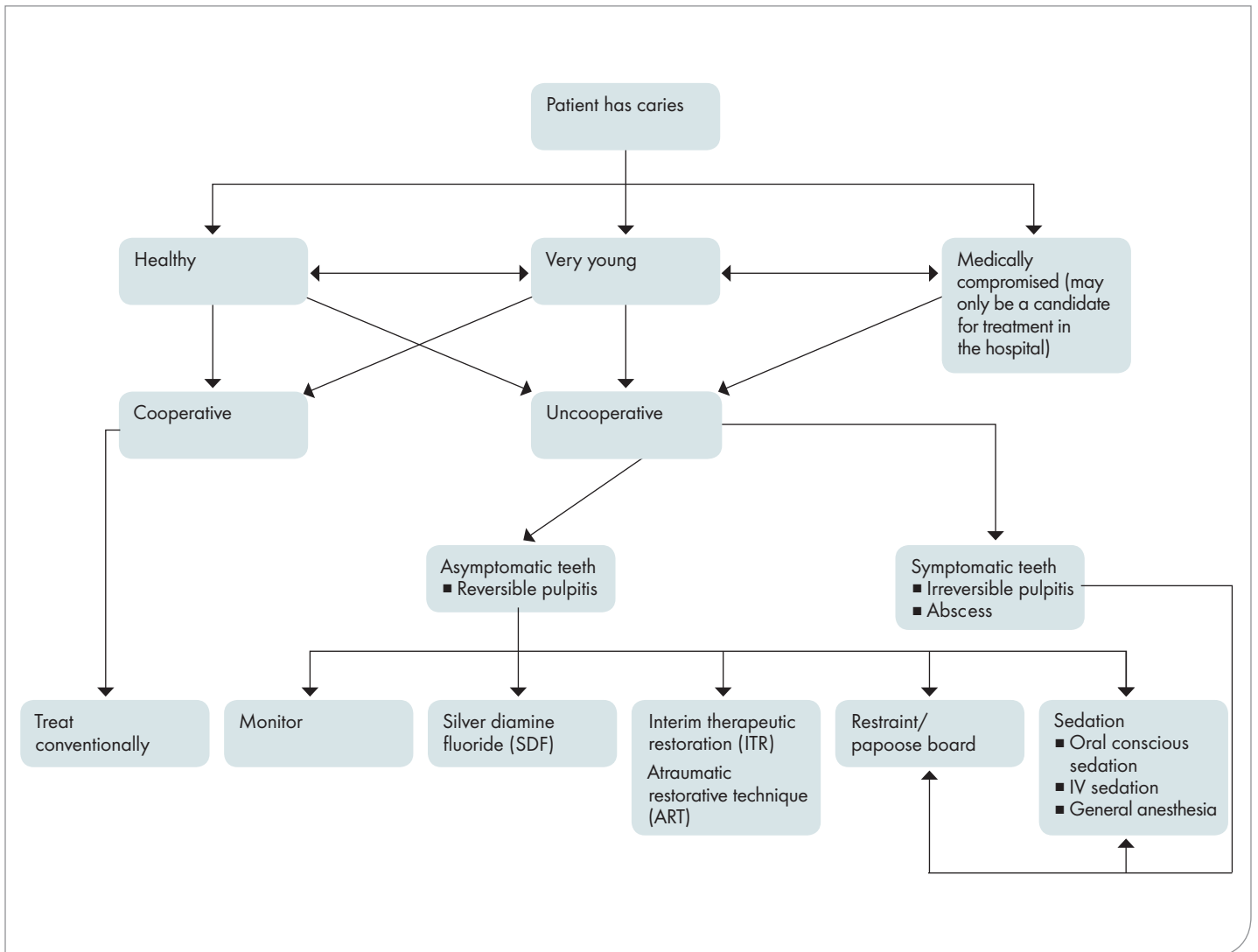


FIGURE. Silver diamine fluoride decision-making tree.

instruments so the patient's anxiety is further reduced. While not ideal, no treatment is always an option for the patient. Whether it be from apprehension, finances or other reasons unknown to us, some parents elect not to treat their children. They are informed that depending upon home care and diet, the caries may get worse potentially leading to pain and/or infection, premature loss of teeth, loss of arch length and more complicated/expensive treatment in the future. Emphasis is placed on decreased frequency and amount of sugar/carbohydrate consumption and improved

home care including increased frequency of toothbrushing and flossing. Prescription 5,000 ppm fluoride toothpaste may be recommended. Some practitioners recommend MI Paste (GC America), although in the literature, results are inconsistent.^{4,5} Xylitol products (wipes, toothpaste, etc.) are also recommended by some pediatric dentists.⁵ For cooperative children, I will typically only recommend SDF if the parents indicate that they do not want to do treatment.

The treatment choices for uncooperative/precooperative patients are much more extensive and complicated.

They are no treatment (covered previously), protective stabilization (restraint), atraumatic restorative treatment (ART), interim therapeutic restoration (ITR), SDF, oral conscious sedation, IV sedation or general anesthesia. I typically limit protective stabilization to treating uncooperative emergency patients, special needs patients or very simple procedures on patients younger than 3 years old who are less likely to remember.⁶ TABLE 1 includes the guidelines for protective stabilization from the American Academy of Pediatric Dentistry reference manual.

TABLE 1

Guideline on Protective Stabilization for Pediatric Dental Patients

Indications for Protective Stabilization

- A patient requires immediate diagnosis and/or urgent limited treatment and cannot cooperate because of emotional and cognitive developmental levels or lack of maturity or medical and physical conditions.
- Emergency care is needed and uncontrolled movements risk the safety of the patient, staff, dentist or parent without the use of protective stabilization.
- A previously cooperative patient quickly becomes uncooperative during the appointment in order to protect the patient's safety and to help expedite completion of treatment.
- A sedated patient may become uncooperative during treatment.
- A patient with special health care needs may experience uncontrolled movements that would be harmful or significantly interfere with the quality of care.

Contraindications for Protective Stabilization

- Cooperative nonsedated patients.
- Patients who cannot be immobilized safely because of associated medical, psychological or physical conditions.
- Patients with a history of physical or psychological trauma due to restraint (unless no other alternatives are available).
- Patients with nonemergent treatment needs in order to accomplish full mouth or multiple quadrant dental rehabilitation.⁷

Source: American Academy of Pediatric Dentistry's *Clinical Practice Guidelines Reference Manual*

I rarely employ ART⁸ or ITR⁹ in my practice. My feeling is that if a patient is cooperative enough to allow either technique, they are probably cooperative enough to definitively restore the tooth. With either technique, caries is removed utilizing hand instruments or a slow-speed round bur without local anesthetic, and the cavity is restored with either a glass ionomer, resin-modified glass ionomer or bioactive material (such as Activa). The patient is typically either in the dental chair or in their parent's lap in a knee-to-knee position with the doctor.

When I first began my career, I did quite a bit of oral conscious sedation and in-office IV sedation because I had extensive training in both through my hospital-based pediatric dental residency program. I feel that there has been a cultural shift over the past few years away from sedating children for dental procedures as fewer parents are scheduling these procedures. Parents are expressing concerns over sedation injuries and deaths for both in-office

anesthesia and dental surgery done in the hospital. Parents and clinicians are receiving conflicting reports about the long-term cognitive problems with young children exposed to anesthesia. An article in *Pediatrics* entitled "Cognition and Brain Structure Following Early Childhood Surgery With Anesthesia"¹⁰ suggests that young children exposed to anesthesia can have long-term cognitive problems. Another article published the same year in *Scientific American* entitled "General Anesthesia Causes No Cognitive Deficit in Infants"¹¹ refutes that claim. The cost is prohibitive for many parents. The cost for oral conscious sedation can run anywhere from \$250 to \$400 per visit, and the cost for a 90-minute procedure with a dental anesthesiologist is about \$1,000. In my office, fewer parents want to finance procedures through health care financing (such as Care Credit) and many are unable to qualify because of poor credit (TABLE 2).

In my opinion, the Affordable Care Act has resulted in many patients having worse dental coverage because it is tied in with their medical insurance. For example, as a specialty provider for Delta Care USA, I have many patients referred to me for care. Up until a few years ago, most of those patients had their dental restorative care covered at almost 100 percent and they were only responsible for the cost of nitrous oxide, oral sedation or IV sedation. Now, they are responsible for paying for a large portion of the restorative procedures plus any sedation expenses resulting in fewer parents having their child receive treatment because of the added cost.

Factors such as the above have resulted in more interest in SDF as an alternative to traditional dental treatment. I have received unsolicited emails from parents looking to SDF as a means of treating their child. Here are a few examples:

"Hello, my name is XXXX. I have read a positive article in The New York Times regarding the use of this product. I am interested in the use of this product for my son who is 1 year and 11 months old to avoid having him put under. He has cavities and I've taken him to see a dentist and he has confirmed there are cavities on several of his teeth. I hope that you can help us. If so please let me know if you have had any success stories following the use of this product. Am attaching some X-rays. Please let me know if he is a possible candidate. Thank you. Am currently living in Los Angeles and would have to make the trip over to your office. Am hoping that perhaps you can let me know beforehand. Thank you for your time and consideration."

"Hello, I am interested in the silver diamine fluoride treatment you have. I live in Redondo Beach, and I was wondering if there are other dentists to whom you could refer me that are nearer to my area. Thank you in advance for your assistance."

TABLE 2

Oral Conscious Sedation vs. IV Sedation

Oral Conscious Sedation		IV Sedation	
Pros	Cons	Pros	Cons
Benzodiazepines can provide anterograde amnesia. ¹²	Child may remember and have psychological trauma.	Patient rarely remembers the procedure.	More expensive than oral sedation.
Child may sleep for some/all of the procedure.	Local anesthetic is required increasing the chance of soft tissue trauma.	All of the treatment will be completed during sedation.	Parental fears/perceptions.
Lower cost per visit than IV sedation.	Potential for lower quality treatment if the patient struggles.	Local anesthetic is not required unless extracting teeth because the patient receives narcotics through the IV.	
Benzodiazepines (flumazenil) and Demerol (naloxone) have reversal agents.	Rarely able to obtain radiographs for a thorough diagnosis.	Radiographs can be taken leading to more accurate diagnosis and treatment planning.	
	May require multiple sedations depending upon the amount of treatment and the amount of local anesthetic necessary.	Quality of treatment is increased.	

For those practitioners who are interested in incorporating SDF into their practice, here is some information they may want to consider:

Which types of carious lesions are candidates for SDF?

Because most of the patients I treat with SDF are uncooperative, I have had the most success treating teeth that allow direct access to the carious lesion (i.e., pit and fissure and smooth surface lesions). It is much more difficult to access the interproximal areas of a tooth on an uncooperative patient. Some practitioners use unwaxed dental floss to carry the SDF in the interproximal space and report good results. In my experience, SDF works best on carious teeth that are asymptomatic although it can be used on teeth with reversible pulpitis as long as the parents are informed that it may not prevent odontogenic infection. I have not tried using SDF on patients with irreversible pulpitis as I have not read anything in the dental literature that it is effective in these cases.

What has been my outcome experience with SDF?

While I don't know the long-term results with SDF because I've only been using it for two years, I define success if the lesion is arrested (hardened) and the tooth is asymptomatic. For those children who return for recall examinations after SDF application, most have had the carious lesions either arrest or have had the caries progression slow down. For the parents who elected to have their children's teeth restored when they were cooperative enough to be treated conventionally, the SDF did not seem to affect the ability to restore the teeth. If practitioners choose to immediately restore the teeth with a resin or glass ionomer after using SDF, they should be prepared to see some darkening of the restoration.

What are the risks with SDF?

Other than some side effects such as staining of the teeth and transient staining if the SDF comes in contact with the skin, there have been no reported adverse reports in more than 80 years of use in Japan.

It is contraindicated in individuals with silver allergy and desquamative processes such as oral ulcerations, ulcerative gingivitis or stomatitis.¹³

Can SDF be used on permanent teeth?

The FDA's definition of diamine silver fluoride (dental hypersensitivity varnish) is that it is "applied to tooth enamel to block dentinal tubules for the purpose of reducing tooth sensitivity,"¹⁴ so it can certainly be used for that purpose. It can also be used in hypoplastic or carious teeth that are either too sensitive or too difficult to restore. I have used it on an adult Down syndrome patient with a large, subgingival carious lesion on a first bicuspid, and it has arrested the caries. She requires protective stabilization and is not a good candidate for oral conscious sedation or in-office IV sedation due to her poor airway.

The public is looking for low-cost, safe, nonsurgical methods to treat children's teeth. While SDF is not a remedy for all dental caries, I am glad that I have a nonsurgical option to offer to parents. My typical protocol for applying SDF is to place petroleum jelly on the lips and around the extraoral tissue of

TABLE 3

One Parent's Thoughts on SDF Treatment

Please explain why you chose to treat your child with silver diamine fluoride?

1. It was more affordable than IV sedation.
2. My husband and family members didn't feel comfortable sedating her because she's younger than when my son had it done.
3. I knew I needed to do something as soon as possible to help my daughter's teeth.

Did this treatment meet your expectations?

No, not really, but I'm hoping that it is helping her. I know it is not to cure or solve her cavity problem, but to help slow it down. Of course, it is better than not having done any kind of treatment.

Do you intend to have your child's teeth restored when she is cooperative enough to have treatment completed without sedation?

Yes, but I know that will be a long way from now.

Would you do this treatment again?

No. In all honesty I wanted to do the IV sedation for her to get treated ALL the cavity problems she has including getting X-rays done. Also because I did the sedation to my son a few years back, so I knew what to expect. I'm afraid her caries are way too advanced for the fluoride to help.

Any other comments?

I thought it was going to stain her teeth a lot more. I sometimes forget her teeth have the fluoride and think her teeth are all rotten and ready to fall out.

the mouth to help protect from staining, dry the teeth as best I can by utilizing either air from the air/water syringe or with gauze or cotton, isolate with gauze or cotton rolls, apply the SDF and let it sit for one minute. The patient is dismissed, and we recommend that the patient be reevaluated in three weeks to determine if the SDF needs to be reapplied. So far, I haven't had any parents report staining of the mucosa or skin. Should this occur, I have read that either a salt slurry or hydrogen peroxide applied to the affected area works well to remove the stain.

To get an idea about what parents think about this treatment, I interviewed a parent who had SDF placed on her 3-year-old daughter's teeth in two separate visits (TABLE 3).

Sadly, many parents in my practice still choose to do nothing because most insurance companies don't reimburse for this treatment and some remark that they don't want their child's teeth to be black. Several of my patients have not come back for recall appointments after application of the SDF. This may be because the parents think nothing else needs to be done,

that the cavities aren't going to get worse or the child isn't in pain. I firmly believe SDF has a place in dentistry as another option for patients. It will be interesting to see if it becomes an accepted treatment modality with the public or if it will fall out of favor like the vaccine for tooth decay that was going to put dentists out of business.¹⁵ ■

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