

Silver diamine fluoride arrests untreated dental caries but has drawbacks

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Untreated dental caries are a significant pediatric public health problem. One in every seven U.S. children ages 2 to 8 years has untreated dental caries in primary teeth, according to National Health and Nutrition Examination Survey data (Dye BA, et al. NCHS data brief, no 191. Hyattsville, Md.; National Center for Health Statistics, 2015).

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While fluoride varnish application is a well-established primary intervention for preventing dental caries, it does not restore deeper cavitated lesions. Untreated dental decay extending through the tooth's enamel layer requires mechanical removal of decayed tissue with hand instruments or powered dental drills. Tooth structure lost during removal of the decayed lesion is restored with dental fillings or full coverage crowns.



Non-invasive, interim interventions for arresting untreated dental caries have been needed, especially in underserved populations lacking timely access to restorative dental services. Such an intervention — silver diamine fluoride (SDF) — recently was introduced in the U.S.

What is SDF?

SDF is an inexpensive, non-invasive medicament that is applied topically. It is 38% SDF, a silver fluoride salt made soluble in water through the addition of ammonia. SDF received Food and Drug Administration approval in 2014 as a device for treating dental hypersensitivity. Similar to its predecessor fluoride varnish, SDF has not been approved as a dental caries arrest medicament and is administered in children and adults as an off-label use.

SDF has a high LD₅₀ value indicative of low toxicity. To date, no toxic adverse events have been reported (Horst JA, et al. *J Calif Dent Assoc.* 2016;44:16-28).

Is SDF effective?

SDF has been used internationally for decades to arrest dental caries in primary and permanent teeth. As reported in a recently published meta-analysis, two-thirds of all dental caries lesions studied (those that

had progressed into the dentin) were found to be arrested after treatment with SDF (Gao SS, et al. *BMC Oral Health*. 2016;16:12).

When teeth with arrested dental decay are not subsequently restored with dental fillings or full coverage crowns, studies show it is advisable to reapply SDF every six months (Sharma G, et al. *J Clin Diagn Res*. 2015;9:ZE08-ZE11).

With a fluoride concentration of 44,800 parts per million, SDF is nearly twice the strength of commercially available 5% sodium fluoride varnishes used in primary care. Application of both agents on the same day is to be avoided as the fluoride dose would be additive, and its safety profile in children is unknown.

Which patients are candidates for SDF use?

SDF has clinical utility in children and adolescents when patient cooperation for restorative dentistry is limited due to young age, situational anxiety, or intellectual and developmental disabilities. Application of SDF does not restore form and function to teeth with dental caries as do traditional restorations. Use of SDF without a plan for restoration of the decayed teeth could provide a reservoir for exacerbation of the caries process via food impaction in cavitated lesions and subsequent metabolism of fermentable carbohydrates to acid by cariogenic bacteria.

Unrestored teeth also can lead to disturbances in a child's bite relationship and jeopardize the space needed within the dental arch for erupting permanent teeth. As a result, SDF application is not a replacement for restoration of decayed teeth with dental fillings or crowns. Rather, it is an effective interim therapy used as part of a comprehensive treatment plan supervised by a dentist within a dental home.

What side effects or negative results occur when using SDF?

This photo demonstrates the permanent black staining that develops in carious tooth structure treated with 38% silver diamine fluoride. A single application was provided to a 3-year-old. Photo courtesy Daniel Raether, D.D.S.

SDF applied to dental decay or other tissues of the mouth, lips and skin causes significant, irreversible black staining due to formation of silver oxide. Superficial black staining of the skin and oral mucosa tends to resolve within days as epithelial cells slough off. In contrast, unrestored



caries lesions treated with SDF remain black permanently — a significant aesthetic problem especially in anterior teeth. Mechanical removal of arrested dental caries and placement of a tooth restoration do not always remove or mask the black-stained tooth structure.

Countertops, floors and other surfaces can become stained black as well if they come in contact with the silver diamine. Therefore, SDF is most appropriately applied carefully to caries lesions only by trained, skilled providers in a controlled clinical environment.

What is the role of the pediatrician?

Pediatricians should identify and refer patients to a dental home when they could benefit from SDF therapy. Children with stomatitis, ulcerative gingival conditions and silver allergy are contraindicated. Patients and their families should be questioned when black teeth are noted on oral inspection to determine if SDF therapy is being used.

It is important for pediatricians to encourage restoration of SDF-treated cavitated lesions to restore form and function. Providers should stress follow-up appointments within the dental home at least every six months to

promote optimal clinical outcomes.

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