Silver Diamine Fluoride (SDF) current evidence for the management of dental caries

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Disclosures:

- I have no relationship or financial interest with any of the companies or products mentioned in this presentation.
- This presentation mentions the off-label use of an FDA approved device.
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The problem: Dental Caries in children

- Affects a subset of the population very early and aggressively
- Fast progression
- Has a significant impact on quality of life

Children with caries in primary dentition are 3 times more likely of having caries in permanent dentition.

- Alm A et al 2007 Caries Res,
- Peretz B et al 2005, Ped Dent

Do not treat the underlying condition
**Traditional treatment: Restorations**

- Technique sensitive
- Expensive
- Require significant cooperation from the patient

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**The problem: Treating Dental Caries in children**

Advanced forms of behavior management:

- Nitrous oxide,
- moderate sedation
- general anesthesia

Increase cost, risk and add barriers to care
Silver Diamine Fluoride  SDF

FDA approved as device for dentin desensitization on subjects over 21 years

Silver Diamine Fluoride  SDF

clear liquid/blue
38% SDF
8 ml bottle
aprox. 160 drops
1 drop treats 4-6 lesions
$129 per bottle
SDF: In the news

A Cavity-Fighting Liquid Lets Kids Avoid Dentists’ Drills

By CATHERINE SAINT LOUIS  JULY 11, 2016

Silver Diamine Fluoride

Silver: antibacterial

Fluoride: remineralizing agent

Use:
Dentin desensitization
Caries arrest
Caries prevention
SDF Systematic Reviews

Silver Diamine Fluoride: A Caries “Silver-Fluoride Bullet”

INTRODUCTION
With a wealth of fluoride-based caries-preventive agents (Table 1), what might one be interested in yet another fluoride delivery system? The answer lies in silver diamine fluoride’s (SDF) hypothesized ability to halt...

Caries arrest 96%
Caries prevention 70%
vs. F varnish
arrest 21%
predention 58%

SDF Meta-Analysis (4 studies)

At 12 months:
SDF caries arrest was 89% higher than other materials or placebo
Reviewed 19 studies: 16 on primary teeth, 3 on permanent teeth. Meta analysis from 8 studies (primary teeth): 81% caries arrest CI (68-89%)
**SDF Treatment Considerations**

SDF Clinical Trials

**Randomized Clinical Trial of 12% and 38% Silver Diamine Fluoride Treatment**

M.H.T. Fung¹, D. Duangthip¹, M.C.M. Wong¹, E.C.M. Lo¹, and C.H. Chu¹

**Abstract**

This 30-mo randomized clinical trial compared the effectiveness of 2 concentrations (12% or 38%) of silver diamine fluoride (SDF) and 2 periodicity of application (once or twice a year) in arresting carious lesions in primary teeth. Children aged 3 to 6 years who had at least 1 active carious lesion were enrolled and randomly allocated into 6 groups for intervention. Group 1 had 12% SDF applied annually (every 12 mo), group 2 had 12% SDF applied semianually (every 6 mo), group 3 had 38% SDF applied annually, and group 4 had 38% SDF applied semianually. Clinical examinations were performed semianually in kindergarten by a single examiner to investigate whether the SDF-treated cavities became arrested. A total of 884 children with 4,320 decayed tooth surfaces received SDF application at baseline, and 799 (90.2%) children with 2,755 surfaces (87.0%) were evaluated at the 30-mo examination. The arrest rates were 35.2%, 38.6%, 64.9%, and 75.7% for groups 1, 2, 3, and 4, respectively (p < 0.001). Caries treated with 38% SDF had a higher chance of becoming arrested than those treated with 12% SDF (odds ratio [OR], 1.98; 95% confidence interval [CI], 1.31–2.94; P < 0.001). The interaction between frequency of SDF application and viable plaque index (VPI) score was significant (p = 0.017). Among those children who received annual SDF application, children with a higher VPI score had a lower chance to have their caries become arrested (OR, 0.59; 95% CI, 0.44–0.72). In conclusion, SDF at a concentration of 38% is more effective than that of 12% in arresting active carious lesions in primary teeth. For children with poor oral hygiene, arrest rate of SDF treatment can be increased by increasing the frequency of application from annually to semianually (ClinicalTrials.gov NCT02395474).

**Keywords:** dental caries, dentin, clinical studies/trials, primary teeth, silver compounds

**Arrest rates after 30 months:**
- 67% once a year
- 76% twice a year

**2x/year by location:**
- Max ants 86%
- Max post 57%
- Mand ants 92%
- Mand post 62%

**RCTs conducted on children 3-8 years old**
- 99-100% of soft lesions had visible plaque vs. 72% of arrested lesions
- Lesions in posterior teeth, large lesions and lesions in a child with a larger VPI score had a lower chance of becoming arrested
- Lesions with visible plaque had lower chance of arresting

Fung et al 2016

Conclude that disturbance of dental plaque is an effective measure contributing to the control of caries progression and affecting the success rate of SDF

SDF Treatment Considerations

Minimally invasive treatment
Does not require caries removal
Easy to apply
Inexpensive
Poses minimal risks
Twice a year for caries arrest
Can be combined with F varnish at 3 month intervals
Could be monitored and re-applied after 2-4 weeks for reapplication in large posterior lesions
SDF Treatment Considerations. Toxicity

Less Fluoride content than one application of FV

No lasting acute toxicity issues reported
- Transient gingival irritation
- Metallic taste

We don’t know:
• Long term chronic effects of repeated exposure to Silver (heavy metal)
• Its effects on the whole oral microbiome or the GI microbiome

SDF Treatment Considerations

Indications:
Interim treatment for patients who can’t receive traditional restorative treatment for whatever reason: pre-cooperative, special needs, delayed treatment, etc...

Contraindications:
Silver allergy
Tooth that is symptomatic or pulpally involved
Presence of stomatitis or ulcerative gingival conditions
SDF: Billing Code

CDT Code 1354: Interim caries arresting medication application

“conservative treatment of an active, non-symptomatic carious lesion by topical application of a caries arresting or inhibiting medicament and without mechanical removal of sound tooth structure:

SDF: Technique

- dispense 1 drop for 4-6 teeth on glass dappen dish
- place Vaseline on lips
- isolate with cotton rolls
- apply SDF with microbrush to caries lesion and rub for 1 min
- air dry
- light curing accelerates precipitation onto dentin.
Survey: SDF in Pediatric Dentistry Programs

Silver Diamine Fluoride in Pediatric Dentistry Training Programs: Survey of Graduate Program Directors

Travis Nelson, DDS, MS, MPH • John M. Scott, PhD • Yvani O. Crystal, DMD • Joel H. Berg, DDS, MS • Peter Milgram, DDS

Abstract: Purpose: The purpose of this study was to investigate practice, teaching, and perceived barriers to using and other caries control agents in U.S. pediatric dentistry residency programs. Methods: A 14-question survey was sent via email to residency program directors in 2015. Survey participants completed the survey by completing a paper and pencil survey instrument, or by interview. Results: Surveys were completed by 87 percent of the respondents. More than a quarter (29.7 percent) reported use of silver diamine fluoride increase use. The use of silver diamine fluoride was not associated with region or program type. Program directors who reported use of silver diamine fluoride should be used only with high-risk patients (89.2 percent) to primary and permanent teeth. The most frequently reported barrier to use of silver diamine fluoride was parental acceptance to staining (91.8%).

SDF: staining side effects

The most frequently reported barrier to use of SDF was parental acceptance to staining (91.8%).
SDF: staining side effects

SDF: Staining effects
SDF: Staining effects

PERCENT ACCEPTABILITY BASED ON STAINING ONLY

<table>
<thead>
<tr>
<th>PERCENT</th>
<th>unacceptable</th>
<th>somewhat unacceptable</th>
<th>somewhat acceptable</th>
<th>acceptable</th>
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<tr>
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<td>23.73</td>
<td>19.49</td>
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<tr>
<td>posterior</td>
<td>21.67</td>
<td>10.83</td>
<td>45.83</td>
<td>21.67</td>
</tr>
</tbody>
</table>

Crystal et al, JADA 2017
40% found treatment unacceptable under any circumstance for anterior teeth, and 30% for posterior teeth

Conclusions:

• Staining on posterior teeth is more acceptable to parents than on anterior teeth.

• Although most parents may perceive the staining of SDF in anterior teeth as esthetically unacceptable, many of them will accept the treatment to avoid general anesthesia.
Conclusions:

• This suggests that many parents are open to compromise esthetics in favor of a less invasive approach when their child's cooperation is a barrier for traditional treatment.

• To identify the third of parents who find the treatment unacceptable under any circumstance, informed consent should include pictures of the staining, especially when treating anterior teeth.

SDF Consent

Consent for SDF

Cavities on baby teeth can grow very fast and cause pain and infection. We always recommend to fix the cavities as soon as we find them to prevent further damage to the teeth and prevent an emergency caused by pain and/or infection. There are cases when fixing the cavities immediately is not possible. This can happen when the child is uncooperative, sick, too young or to have either laughing gas or sedation to help his cope with the treatment. It is not recommended to let the cavities grow, because they can very fast get to the point that they can no longer be fixed, and the only treatment possible is to pull the teeth. If this is the case for your child, placing silver diamine fluoride on the cavities will stop them from growing for a period of about 6 months. This treatment is very fast to do (about 2 minutes), does not hurt, and therefore requires minimal cooperation from your child. It has a history of being very safe, and it will have no adverse effects on the permanent teeth.

Important things you should know about this treatment are:
- SDF has a slightly metallic taste that we try to minimize by putting cotton rolls next to the teeth.
- The treatment can sometimes cause a mild irritation to the gums, that will heal by itself in a couple of days.
- Most importantly, THE CAVITIES WILL BE STAINED BLACK. This is permanent. If the cavities are on the back teeth, it is hardly noticeable. If the cavities are on the front teeth, it can be very noticeable as you can see in the pictures. As your child gets older and behavior and/or health improves, fillings or caps can be placed on the teeth to cover the discoloration.
- If the child resists too much and the liquid touches his lips or skin, he could have a dark stain for a few days. We try to minimize this by using cotton rolls next to the teeth and by asking you to help keeping the child still while we do the treatment.
- If fillings can not be done, SDF will need to be re-applied in six months for the effects to continue.
- For the treatment to work its best, you will need to keep your children’s teeth clean, brushing with fluoride toothpaste twice a day or more to keep food out of the cavity.

By signing below you acknowledge that you understand the information presented, have had all your questions answered satisfactorily, and give consent to perform this procedure.

Signature
The panel made a conditional recommendation regarding the use of SDF 38% for the arrest of cavitated caries lesions in primary teeth as part of a comprehensive caries management program.