

# BLACK TO THE FUTURE

## SILVER DIAMINE FLUORIDE

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# SILVER DIAMINE FLUORIDE: HISTORY

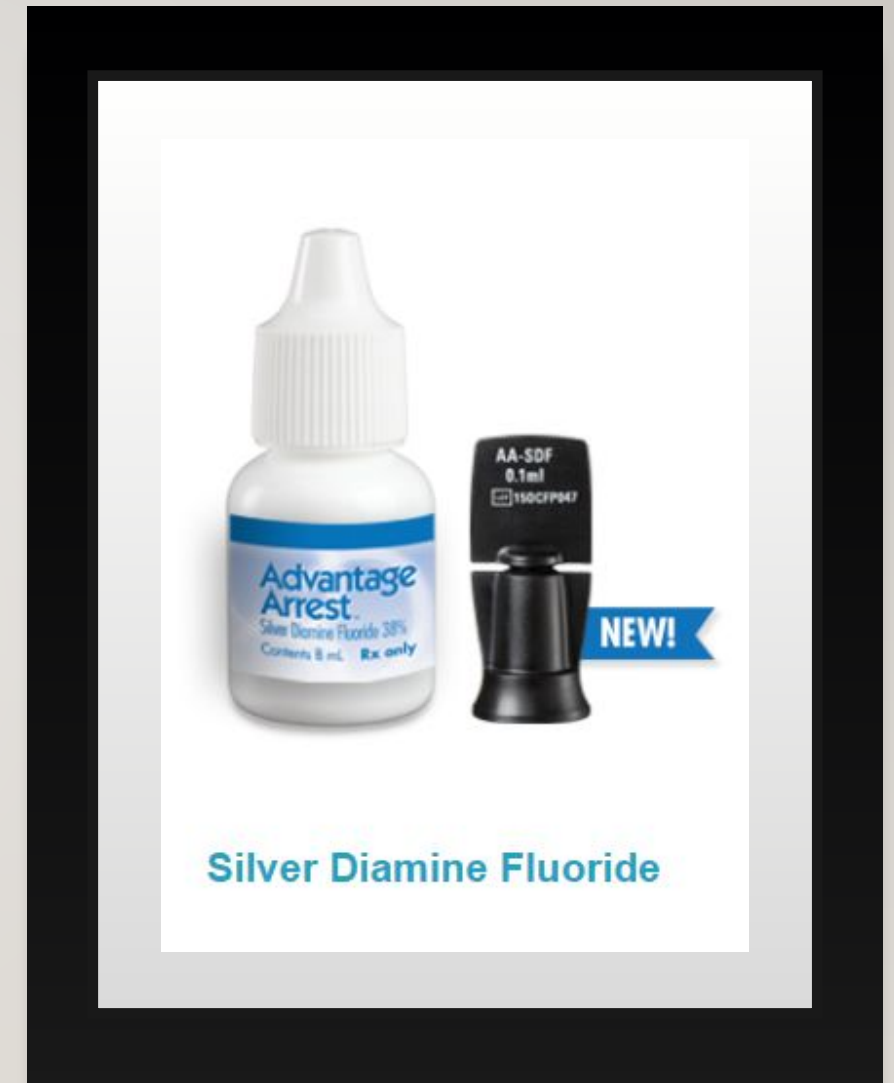
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- 1920 : GV Black wrote about a technique to arrest caries using silver nitrate
- 1981: Percy Howe used silver nitrate in ammonia as an antimicrobial on infected tooth structure
- 2012: Steven Duffin added fluoride varnish topically to 25% silver nitrate in ammonia with a 98.8% success rate in arresting caries. (571/578 lesions arrested)<sup>1</sup>
- 2014: FDA approves Silver Diamine Fluoride for reducing tooth sensitivity
- 2016: CDT Code D1354 “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.”

# SILVER DIAMINE FLUORIDE : WHAT IS IT?

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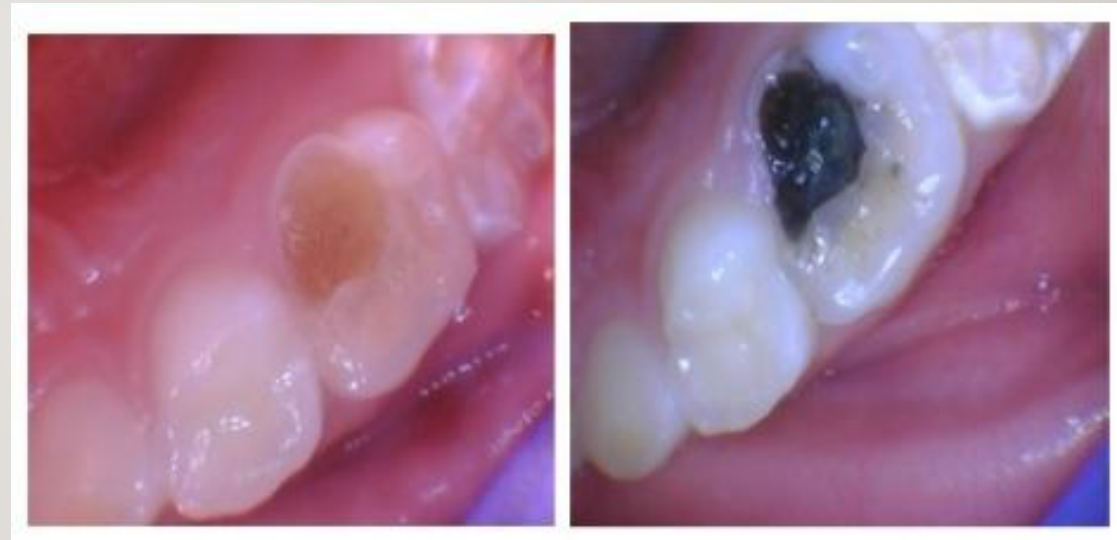
- $\text{Ag}(\text{NH}_3)_2\text{F}$ 
  - Colorless
  - Silver 24-27% :Antimicrobial
  - Ammonia 7.5-11% : Solvent - stabilizes high concentration of solution
  - Fluoride 5-6% : Remineralization
- “Advantage Arrest” by Elevated Oral Care, LLC



# SILVER DIAMINE FLUORIDE: WHAT DOES IT DO?

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- Arrests dental caries
- Prevents dental caries –
  - Directly
  - Indirectly
- Desensitizes teeth



# SILVER DIAMINE FLUORIDE: HOW DOES IT WORK?

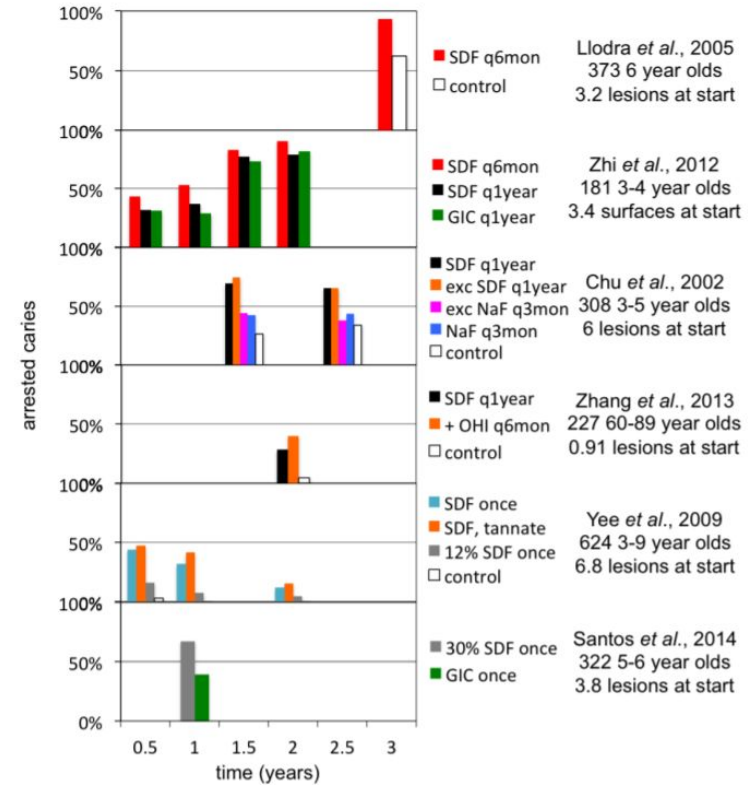
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- When SDF is applied to a decayed surface, it creates a silver-protein conjugate squamous layer. This layer is more resistant to acid dissolution and enzymatic degradation.
  - Hydroxyapatite and fluorapatite form over the exposed organic matrix □ The lesion becomes harder, more minerally dense-- calcium fluoride byproduct is a reservoir for more fluoride
  - The ionic silver deactivates macromolecules and bacteria involved in degrading the tooth. (matrix metalloproteinases; cathepsins; and bacterial collagenases.)
  - Silver is released on re-acidification and has a “**zombie effect**” killing other bacteria – prolonging the effects
- Silver and fluoride ions penetrate ~25 microns into enamel, and 50-200 microns into dentin.
- Silver diamine fluoride arrested lesions are 150 microns thick.

# CARIES ARREST

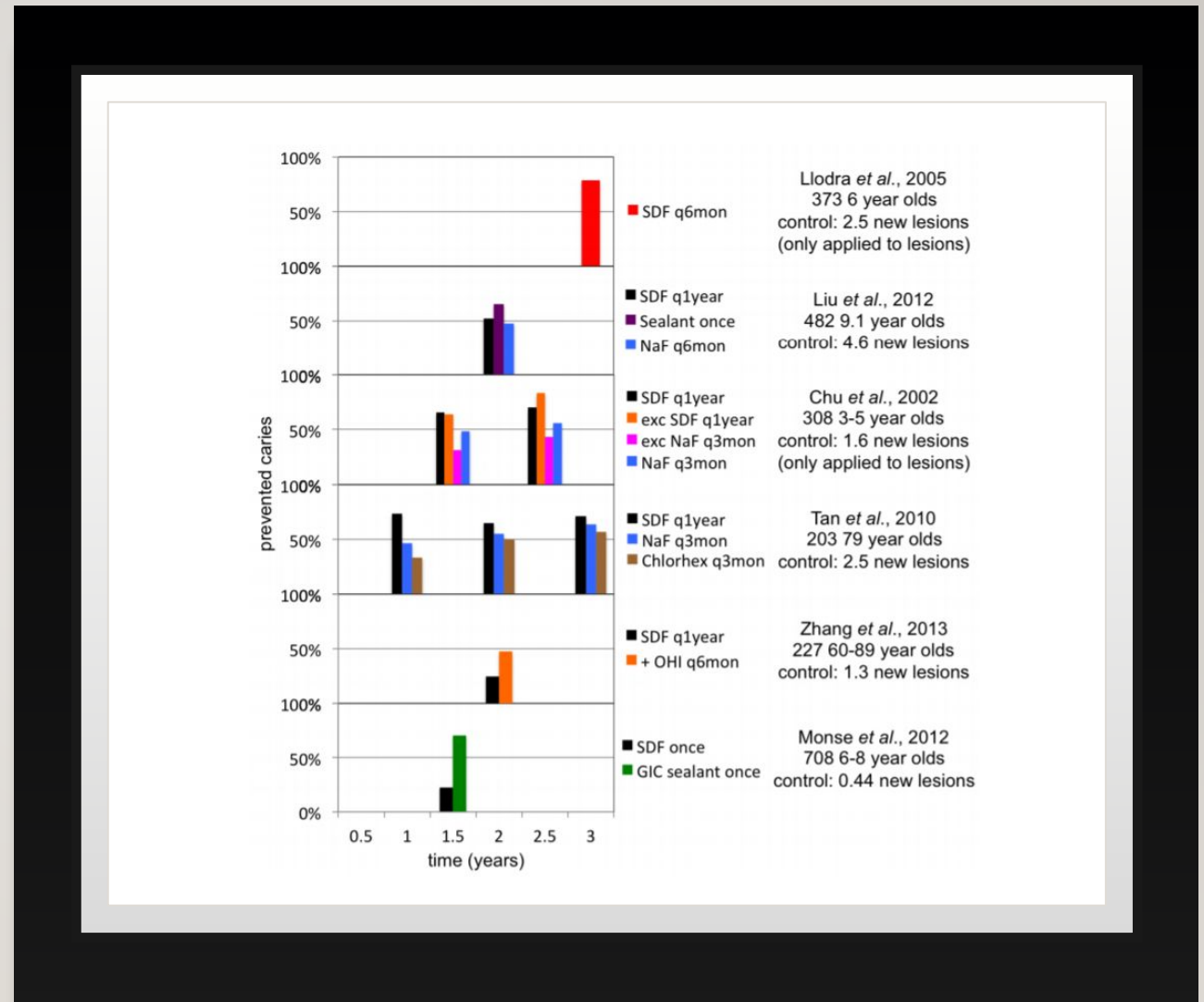
- Figure 1. Graphic summary of randomized controlled trials demonstrating caries arrest after topical treatment with 38% silver diamine fluoride (SDF). Studies are arranged vertically by frequency of silver diamine fluoride application. Caries arrest is defined as the fraction of initially active carious lesions that became inactive and firm to a dental explorer. SDF (38% unless noted otherwise); q6mon, every six months; q1year, every year; q3mon, every three months; GIC, glass ionomer cement; NaF, 5% sodium fluoride varnish; + OHI q6mon, SDF every year and oral hygiene instructions every six months.
  - SDF arrested more caries than fluoride varnish and was good as or better than glass ionomer**
  - 2x year OHI education for elderly with SDF had improved results.**



# CARIES PREVENTION

- Figure 2. Graphic summary of randomized controlled trials demonstrating caries prevention after topical treatment of carious lesions with 38% silver diamine fluoride. Prevented caries is defined as the fraction of new carious lesions in treatment groups as compared to those in the placebo or no treatment control group. Chlorhex 1% chlorhexidine varnish.

- **When applied to a carious tooth, SDF has a preventative effect for other teeth,**
- **Direct application to a healthy tooth has preventative effects**
- **Annual application – more effective than 4x year of fluoride varnish,**
- **GIC or resin sealants were more effective than SDF for prevention on 1<sup>st</sup> molars**



# SILVER DIAMINE FLUORIDE: WHEN DO I USE IT?

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1. Extreme caries risk (xerostomia – severe early childhood caries)
2. Challenging Behavior or medical management (elderly, dental phobia, immunocompromised)
3. More carious lesions than can be treated in 1 visit
4. Difficult to treat lesions – crown margin, root caries in furcation
5. Patients without access to care



# SILVER DIAMINE FLUORIDE: THINGS TO CONSIDER

- Decayed dentin will darken dark brown or black as lesion arrests.
- Saturated Solution of Potassium Iodide can be used after SDF to decrease color changes (not for pregnant or breastfeeding women)
- SDF can temporarily stain tissue (like a Henna tattoo) – goes away in 2-3 weeks.
- Will stain counter surfaces and clothes – permanently
- Apply to carious lesion 2x annually until cavity is restored, arrested or exfoliated
- Track lesions over time by photographs

## INFORMED CONSENT - SILVER DIAMINE FLUORIDE APPLICATION

Patient Name:

### Facts for consideration:

Silver diamine fluoride (SDF) is an antibiotic liquid that can be painted on tooth cavities. We use SDF on cavities to help stop tooth decay. We also use it to treat tooth sensitivity. Treatment with SDF may not eliminate the need for dental fillings or crowns to repair function or esthetics at a cost.

**IMPORTANT: I should not be treated with SDF if: 1. I am allergic to silver. 2. There are painful sores or raw areas on my gums (i.e., ulcerative gingivitis) or anywhere in my mouth (i.e., stomatitis).**

### Benefits of receiving SDF:

SDF can help stop tooth decay.  
SDF can help make teeth less sensitive.

### Risks of receiving SDF:

*The affected area will stain black permanently.* Healthy tooth structure will not stain. Stained tooth structure may be replaced with a filling or a crown.

Tooth-colored fillings and crowns may discolor if SDF is applied to them. Color changes on the surface can normally be polished off. The edge between a tooth and filling may keep the color.

If accidentally applied to the skin or gums, a brown or white stain may appear that causes no harm, cannot be washed off and will disappear in one to three weeks.

You may notice a metallic taste. This will go away.

These side effects may not include all of the possible situations reported by the manufacturer. If you notice other side effects, please contact your dental provider.

- Every reasonable effort will be made to ensure the success of the SDF treatment. There is a risk that the procedure will not stop the decay and no guarantee of success is granted or implied.

If tooth decay is not arrested, the decay will progress. In that case the tooth will require further treatment, such as repeat SDF treatment, a filling or crown, root canal treatment or extraction.

### • Alternatives of receiving SDF:

- No treatment - this which may lead to continued deterioration of tooth structure.
- Depending on location and severity of disease, options may include fluoride varnish, fillings, crowns, extractions, and /or referrals to a specialist.



• Before



• After

A perfect result from the recommended treatment cannot be guaranteed. If unexpected problems arise during the procedure, the doctor will do what is deemed necessary to correct the condition.

I consent to the oral, topical application of silver diamine fluoride (add additional comments as needed):

Patient Signature:

Date:

Witness Signature:

Date:

Dentist Signature:

Date:

# SILVER DIAMINE FLUORIDE

## HOW DO I USE IT?

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- Prophylaxis
- Saliva ejector to remove excess saliva
- Isolate area (cotton rolls /gauze/Isolite or DryShield)
- Apply Vaseline to adjacent soft tissue (if needed)
- Dry tooth
- Apply SDF with bent microbrush and allow to dry for 1-3 minutes (longer is better)
- Rinse with water
- No specification for number of applications
  - Deep cavities = consider pulp effects

[YouTube Video](https://www.youtube.com/watch?v=iPgcl9qrsA)  <https://www.youtube.com/watch?v=iPgcl9qrsA>

# SILVER DIAMINE FLUORIDE: HOW SAFE IS IT?

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- No adverse reports in >80 years of use in Japan
- Maximum Dose: 1 drop/10kg per treatment visit
- Contraindication: Silver allergy
- Relative contraindication: Ulcerative gingivitis or stomatitis
  - Protect soft tissue by petroleum jelly
- Side effects:
  - Small, white mucosal lesions • disappear in 48 hours
  - Will stain the lesion black

# SILVER DIAMINE FLUORIDE

## HOW DO I BILL FOR IT? CDT CODES

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- D1208 - Topical application of fluoride
- D9910 - Application of a desensitizing medicament, per visit
- D1999 - Unspecified preventive procedure by report
- D1354 - Interim caries arresting medicament 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."

# REFERENCES

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1. “Back to the Future: the Medical Management of Caries - Introduction” S. Duffin, CDA Journal, 40(11). November 2012.  
<http://www.cambracoalition.org/sites/default/files/Back%20to%20the%20Future-%20Medical%20Mgt%20of%20Caries%20Intro%20-%20Duffin%20-%20CDA%20Nov%202012.pdf>.
2. “UCFS Protocol for Caries Arresting Using Silver Diamine Fluoride: Rationale, Indications and Consent” J. Horst et al, J Calif Dent Assoc; 44,(1): 16-28. 2016 January.  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4778976/>.

**THANK YOU!**

