

Silver Diamine Fluoride—An Exciting New Tool for Patient Care and Public Health

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Presenter Disclosure

Dr. Milgrom

The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

Dr. Milgrom is a director of Advantage Silver Dental Arrest, LLC

Presenter Disclosure

My presentation will include discussion of “off-label”
use of the following:

Silver diamine fluoride

SDF - what is it?



Colorless liquid

25% **silver**: antimicrobial

8% ammonia: solvent

5% **fluoride**: remineralization



Where is Silver Used in Medicine?

- Ointments for Treating Burns
- Wound Dressings
- Urinary Catheters
- Implantable Devices
- Water Purification Devices
- Surgical Gowns and Drapes
- Future Composites and Partial Dentures



SDF - what does it do?

- Arrests dental caries
- Prevents dental caries
 - *directly & indirectly*
- Decreases dentin hypersensitivity



How do you use it?



Accessible cavity.



1. Isolate with cotton.
2. Air dry.
3. Apply with microbrush.

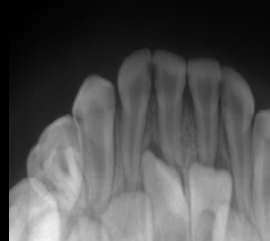
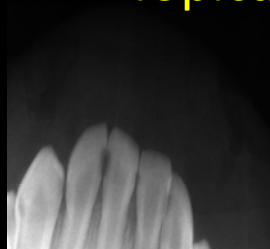


Arrested cavities after 1 year

Topical arrest

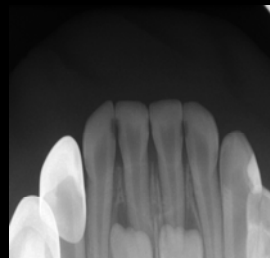
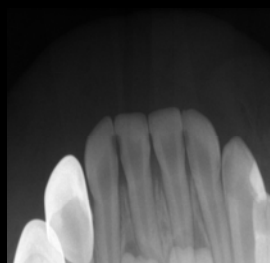
3y10m

@ 2years: 0 new cavities



3 treatments

+2 treatments



5y10m

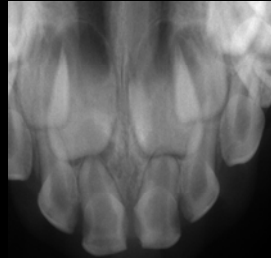
Courtesy, Dr. Jeremy Horst

Topical arrest

3y10m



@ 2years: 0 new cavities



3 treatments

+2 treatments

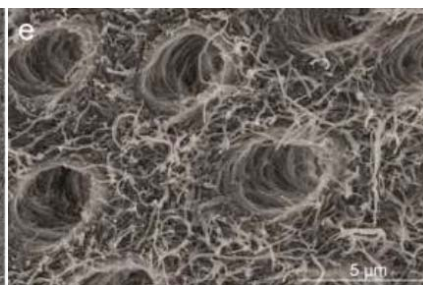


5y10m

Bovine dentin slab demineralized and treated with 38% SDF*



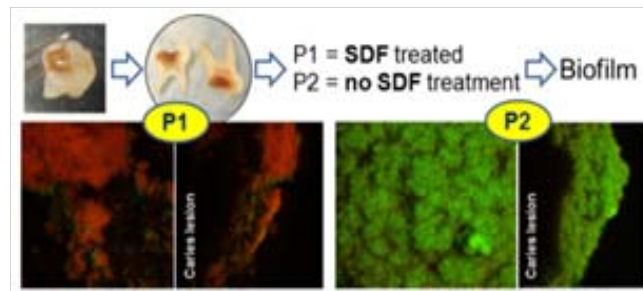
Treated



Control

*Courtesy Edward Lo, U Hong Kong

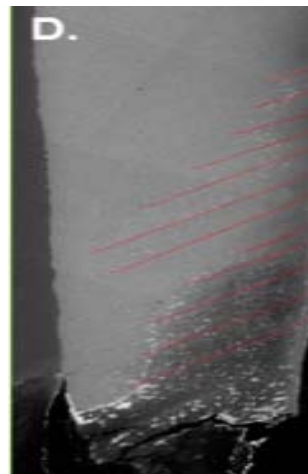
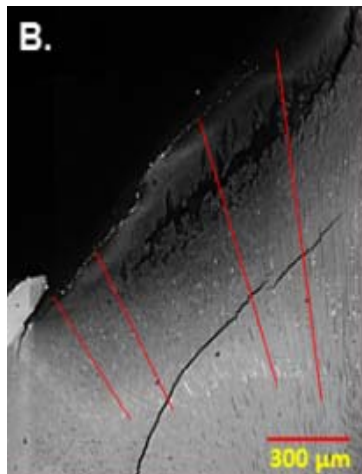
Inhibition of *S. mutans* U159 biofilm in carious lesion of extracted deciduous teeth pretreated with 38% SDF under Confocal Laser Scanning Microscopy*



Shows a decrease in bacterial cell viability and biofilm film thickness after 14 days incubation

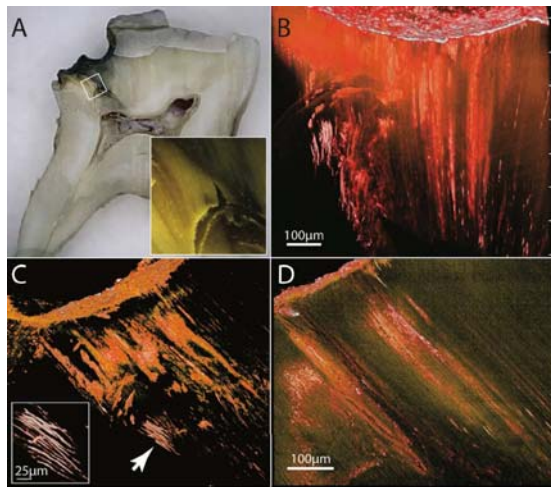
*Courtesy Dr. Lihong Li, NYU

Silver penetration into dentin (B)
Silver penetration in softened enamel (D)



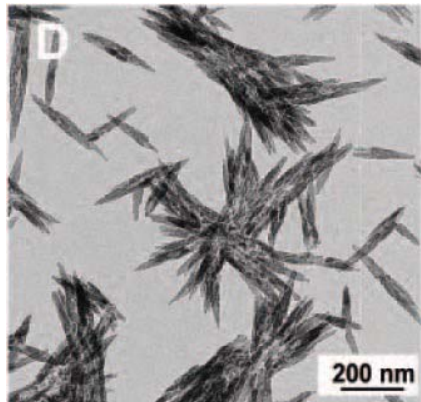
Courtesy Dr. Yihong Li, NYU

Silver penetration into dentin



Courtesy, Dr. Jeremy Horst

Formation of Fluorohydroxyapatite



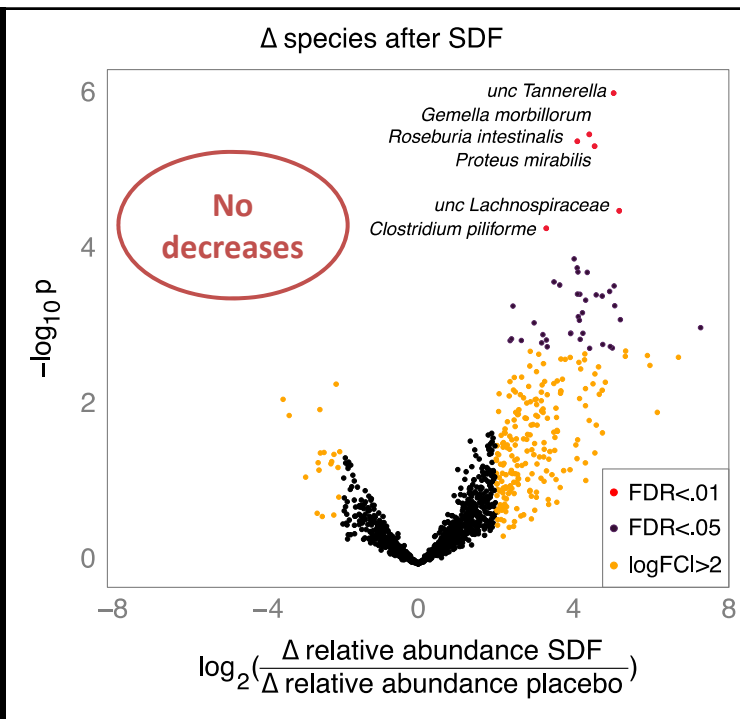
Mei et al. JDR 2017

How much *can* you use?

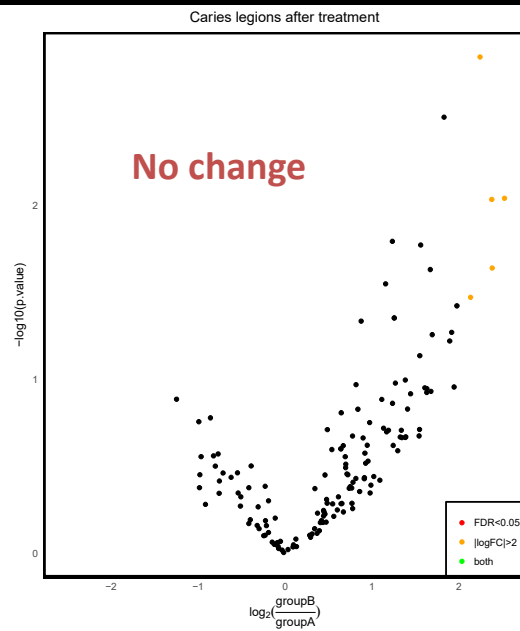
- FDA rat & mouse LD50 studies:
 - Oral LD50 = 520 mg/kg
 - Subcutaneous LD50 = 380 mg/kg
- 20uL drop in 10kg child (100% absorption)
~15 month old = 0.76 mg/kg
 - **500-fold LD50 safety margin.**
- NOAEL level for 14 days of daily exposure = 1.3 mg/kg
 - 13 mg/kg resulted in mild gastric inflammation.



UCSF limit: 1 drop per 10kg of weight per visit.



Metal & Antimicrobial resistance genes



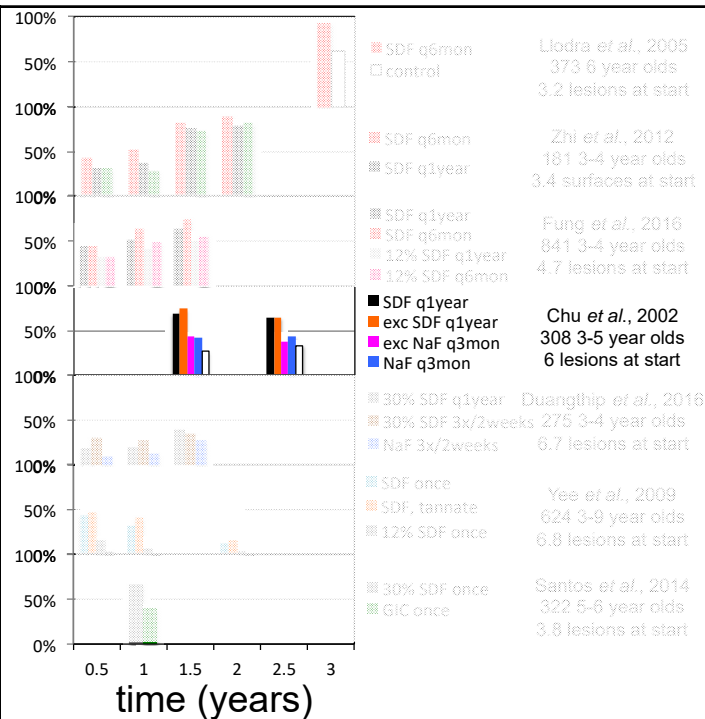
Arrested carious lesion treated with 38% SDF



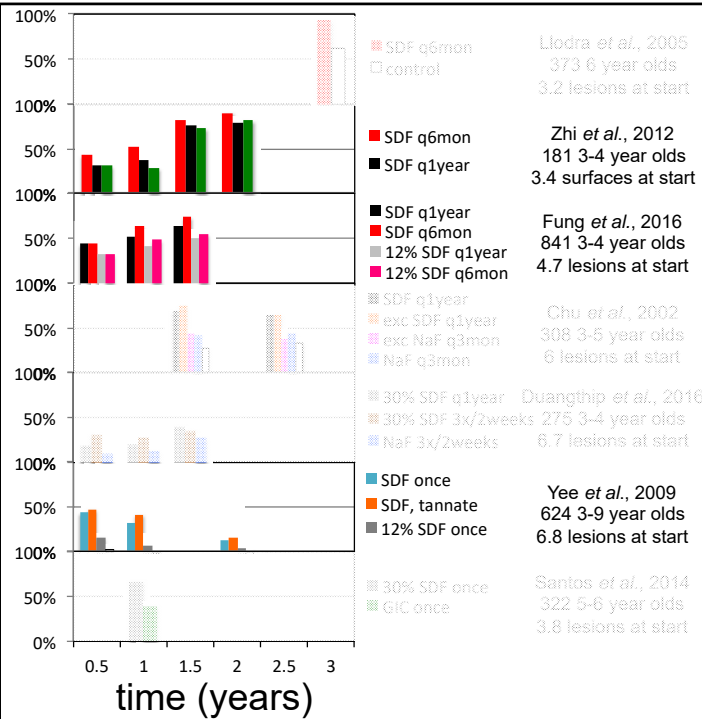
Arrested carious lesion treated with 38% SDF



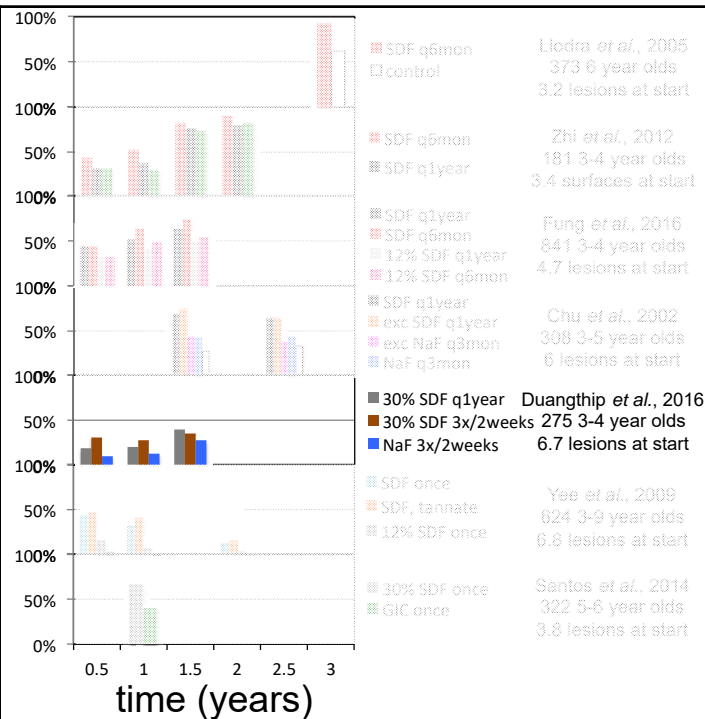
Caries Arrest in kids



Caries Arrest in kids



Caries Arrest in kids



Stopping Cavities Trial (Oregon) caries arrest after 2 weeks in deciduous teeth with exposed dentin (Nyvad criteria)

Condition	N	Mean (SD)	95% CI ¹	Median (IQR)	Min - Max
SDF	29	0.72 (0.38)	0.55 to 0.84	1.00 (0.50, 1.00)	0.0 – 1.0
Placebo	35	0.05 (0.18)	0.00 to 0.16	0.00 (0.00, 0.00)	0.0 – 1.0
Difference (Group 2 – Group 1)		0.67	0.49 to 0.80		

¹95% CI: Bias-corrected bootstrap, 95% confidence interval for mean fraction of arrested caries and difference in mean fraction of arrested caries

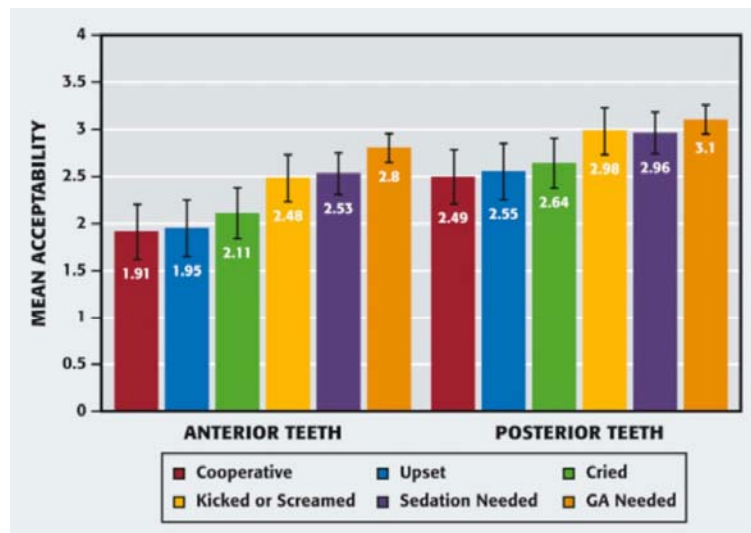
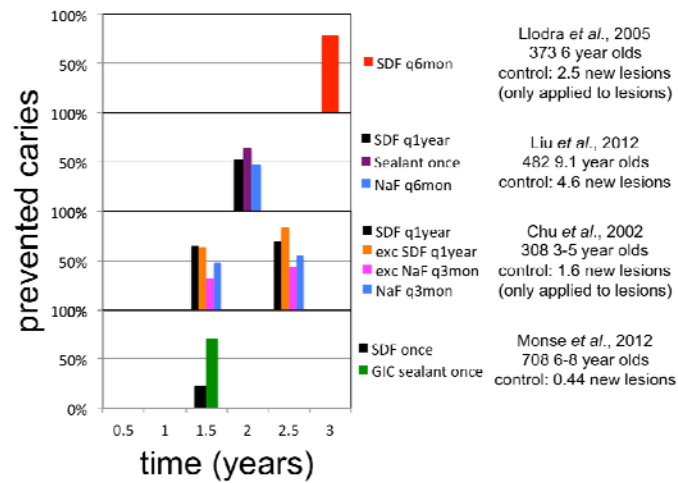


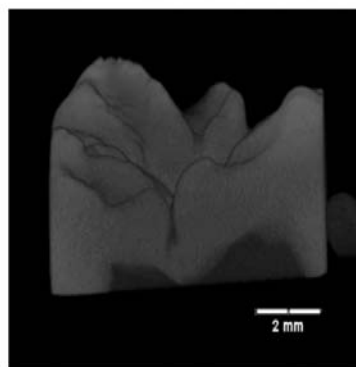
Figure 2.

Acceptance according to behavior for treatment. In the rating scale, a score of 1 indicated "unacceptable" and 4 indicated "acceptable." Error bars indicated 95% confidence intervals. GA: General anesthesia.

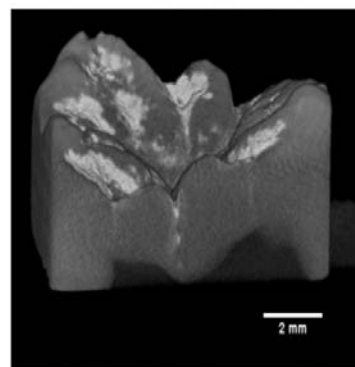
Prevention in unaffected teeth when only lesions are treated or when used instead of a sealant



3-D CT-scan Shows Silver Sealing The Fissures



Before SDF application (cross section)



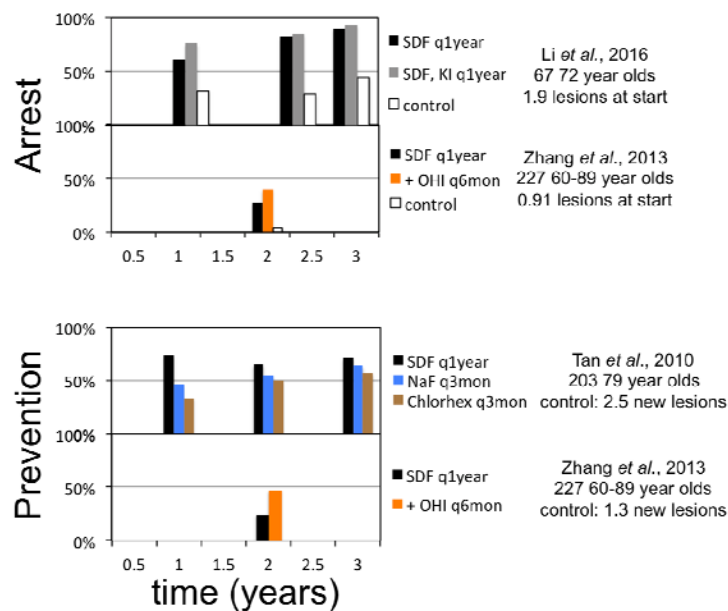
After SDF application (cross section)

Courtesy Dr. Edward Lo, U Hong Kong

Pre and Post Treatment with SDF



Arrest of Root Caries



38% SDF in an Adult Lesion

Compatible with glass ionomer and composite



Time 0



Time 24 hours



Time 7 days

Courtesy, Dr. Jorge Castillo, Peru

Radiation Treated Oral Cancer Survivor with SDF arrested dental caries, 3 year follow-up, University of Washington

