Silver Diamine Fluoride
a non-operative treatment
for dental caries

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disclosures

I have no financial interest in SDF.

Actually, I have a financial disinterest in SDF.
Silver Nitrate

- Used in medicine for ages
- First dental use in 1840s
- Used by founding DDS’s
- 61% arrest (1891)
- Arrests initial lesions (1973)
- Prevention in overdenture abutments (1978)
- Disappeared with local anesthetic
- Rediscovered by Duffin*
- 30,000 patients in Oregon
- Placeholder for SDF

Stebbins, 1891
Hyde, 1973
Toolson & Smith, 1978
Duffin, 2012
Silver diamine fluoride
\[ \text{Ag}^+ \ (\text{NH}_3^+)_2 \ F^- \]

= treatment.

• AgF used in Japan for ~millennium.
• NH\(_3\) added 80 years ago.
• Prevents decay in other teeth.
• Compatible with ART.
• Arrest = stained lesion.
• Potassium iodide decreases staining.
• Products available in Japan, Brazil, Argentina...
• ... and US. Cleared by FDA !!!
SDF clearance same as F varnish
SDF is now available in the U.S.

- Today
- ~$100 per 5mL bottle
- 200 drops: 50¢/drop
- CDT code for caries arrest approved for 2016
- Advantage Arrest, by Elevate Oral Care

FDA clearance = hypersensitivity.

Off label use = caries treatment.
silver ion = wrecking ball

Antimicrobial:
- denatures all proteins.
- breaks cell walls & membranes.
- inhibits DNA replication.

Strengthens dentin:
- protective layer formed by reaction with dentin proteins is acid resistant (Hill & Arnold, 1937).
- penetrates ~50μm.
SDF resists demineralization

silver diamine fluoride  control
SDF application

0. (cotton isolation)
1. dry tooth gently
2. apply with micro-sponge
3. remove excess to prevent taste & excess ingestion

Considerations:
- vasoline
- cooperation

Contraindications:
- Silver allergy
- Ulcerative gingivitis
- Stomatitis
typical SDF stains

A: time 0
B: 1 day
C: 1 week

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Color stain? Potassium iodide

– reduces Ag to \textit{white} oxidation state.
– \textit{in vitro} studies show no impact on antimicrobial.
– it does decrease stain.
– avoid in pregnant/lactating women.
the clinical evidence for caries arrest by SDF
SDF caries arrest in children with repeat application

Zhi et al., 2012
Llodra et al., 2005
Chu et al., 2002
SDF caries arrest in children with single application

Yee et al., 2009
dos Santos et al., 2012
SDF caries arrest in older adults with repeat application

n=227
- SDF q1year
- OHI q6mon, SDF q1year
- control

n=323
- SDF q1year
- SDF, KI q1year
- control

Zhang et al., 2013
Lo et al., tba
Radiation-treated oral cancer Survivor with SDF arrested dental caries, 3 year follow-up

courtesy of Peter Milgrom
the clinical evidence for caries prevention by SDF
SDF caries prevention in children with repeat application

Liu et al., 2012
Llodra et al., 2005
Chu et al., 2002
SDF caries prevention in older adults with repeat application

Tan et al., 2010
Zhang et al., 2013
Lo et al., tba
Safety of silver diamine fluoride

- 10 kg child = 4 teeth per visit.
- Does not harm gingiva, vaseline sometimes recommended.
- Irritating to pulp in deep lesions (though pulp cap).
- Protect eyes, pH 10.
- No evidence of fluorosis if used properly. (Health Dept of Western Australia)
- 80 years of use in Japan, 12 clinical trials: If there were going to be problems they would have shown up.
- Will stain face, clothes, counters. Always wear gloves. Wash any exposed areas with water. Stain will go away in days.
UCSF SDF indications

1. Difficult to treat carious lesions.
2. Carious lesions in patients with extreme caries risk (Xerostomia).
3. Patients with carious lesions that may not all be treated in one visit.
4. Treatment challenged by behavioral or medical management.
where we are now

• Technique taught in >50% of pedo programs.
• 30,000 application of SN, will switch to SDF.
• Cleared by FDA, same as fluoride varnish.
• Effort to gain approval as drug for caries.
• Compatible with glass ionomer bonding.
• May decrease adhesion of composites: prep.
• ??? Why do some lesions not arrest ???
what I want from you

Ask questions.

Give advice.

Drive demand.

Change expectations.
wrap up

• This is a public health issue.
• This is an ethical issue.
• Dental workforce doesn’t meet disease burden.
• SDF is the only material with potential.

• Advantage Arrest, by Elevate Oral Care
THANK YOU

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