Cutting the Cutting Edge
Silver Diamine Fluoride

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UCSF
I have no financial interests in any product discussed here.
Outline

1. US short term RCT
2. Case
3. Following by Xrays
4. SDF + GIC/ART = SMART
1st US study of SDF... 2 week outcome

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>arrested (SD)</th>
<th>95% CI</th>
<th>adverse events</th>
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</thead>
<tbody>
<tr>
<td>SDF</td>
<td>29</td>
<td>.72 (.38)</td>
<td>.55 to .85</td>
<td>flu, nausea, redness, spot</td>
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<tr>
<td>placebo</td>
<td>35</td>
<td>.05 (.18)</td>
<td>.00 to .16</td>
<td>diarrhea x 2, tummy ache, toothache + diarrhea</td>
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</tbody>
</table>

microbiology...

Peter Milgrom
Sharity Ludwig
Lloyd Mancl
Marilyn Rothen
Caries Arrest in kids

- **Llodra et al., 2005**
  - 373 6 year olds
  - 3.2 lesions at start
- **Zhi et al., 2012**
  - 181 3-4 year olds
  - 3.4 surfaces at start
- **Chu et al., 2002**
  - 308 3-5 year olds
  - 6 lesions at start
- **Yee et al., 2009**
  - 624 3-9 year olds
  - 6.8 lesions at start
- **Duangthip et al., 2016**
  - 275 3-4 year olds
  - 6.7 lesions at start
- **Fung et al., 2016**
  - 841 3-4 year olds
  - 4.7 lesions at start
- **Santos et al., 2014**
  - 322 5-6 year olds
  - 3.8 lesions at start
3 year outcome – severely fragile 4-7 year old

1.5 years

3+ years
pre/post SDF Xray analysis

333 patients treated
4.7 (± 2.0, 1-12) yo @ start

Xrays before & after.
• 17 patients.
• 3.6 (± 2.0) lesions
• 2.6 (± 1.3) applications
• 8.8 (± 4.5, 6-20) month Xrays f/u

30% of lesions progressed
.28 (± .57) new lesions, vs 2.1 (±1.3) in matched controls
2 treatments

@ 1 year: 0 new cavities
2 treatments

@ 1y4m: 0 new cavities
2 treatments

@ 1y2m: 2 new cavities
Topical arrest

3y10m

@ 2years: 0 new cavities

3 treatments

+2 treatments

+1 treatment

5y10m
Topical arrest

@ 2 years: 0 new cavities

3y10m

3 treatments

+2 treatments

+1 treatment

5y10m
Topical arrest

3y10m

@ 2years: 0 new cavities

3 treatments

+2 treatments

5y10m
Topical arrest

@ 2 years: 0 new cavities

3 treatments

+2 treatments
Synthesis: what to do clinically

- Offer options
- Monitor with more Xrays
- Disking
- Consider sealing with GIC
SDF + GIC: silver modified ART SMART

- Glass Ionomer Cements (GICs) add the benefit of sustained fluoride release and a seal!
- Protocol: SDF, then standard ART protocol.

(they darken over time)

Drs. John Frachella & Cate Quas
SMART armamentarium
GIC stain by SDF

- SDF + GIC
  - Fuji 2LC
  - Fuji 9
  - no-prep GIC

- 1 month
- 1 month
- 2 weeks

Shofu Beau_fil
Confirmation of silver in the dentinal tubules by SEM-EDX
The paradox of covering

Lesion (GIC)
- seal stops progression
- seal may seal in SDF
- GIC prevents lesions nearby
- GIC needs less frequent reapplication
- Small lesions may not retain GIC

Mouth (SDF)
- SDF prevents lesions throughout mouth
- SDF needs more applications
- SDF is cheaper
- SDF is less technique sensitive
- Deep lesions may progress
THANK YOU
Instead, the proportion of teeth or tooth surfaces with active caries that had become arrested after SDF treatment was used in the meta-analysis. Most clinical studies on SDF solution used a concentration of 38% to manage dental caries among children while a few studies used SDF at concentrations of 30%, 12%, and 10% (Mei, Chu, Lo, et al. 2013). All studies using SDF with high concentration (38%) reported a statistically significant caries-arresting effect on children. Although the fluoride concentration was high (44,800 ppm in 38% SDF), no significant complication was reported in these studies.

Two studies used SDF with a low concentration (11,800 ppm in 10% SDF), and their results were conflicting (Maciel 1988; Braga et al. 2009). Another clinical trial found that one-off application of 12% SDF (14,100 ppm) was not effective in arresting caries among children (Yee et al. 2009). The effectiveness of using SDF at a low concentration in caries arrest is yet to be confirmed.

Studies of SDF used not only different concentrations but also different application frequencies. The application frequency could be one-off or repeated applications every 3, 6, or 12 mo. One study reported that increasing the application frequency increased the caries arrest rate of SDF application (Zhi et al. 2012). This review found that the guidelines on the prevalence of caries arrest are yet to be confirmed.

![Forrest plot of studies using 38% SDF to arrest caries in primary teeth. CI, confidence interval; ES, estimate; FE, fixed effects; LR, likelihood ratio; RE, random effects.](Gao et al., 2016)
Clinical Trials of SDF in Arresting Caries among Children

The odds ratio of treatment effectiveness between treatment and control groups was not adopted in the meta-analysis. The absolute values, or delta changes, of the number of teeth or tooth surfaces with arrested caries were not used for analysis because the number of teeth or tooth surfaces with active caries at baseline varied among the studies.

Table 2. Risk of Bias Assessment on the Clinical Studies.

<table>
<thead>
<tr>
<th>Authors, Year of Publication</th>
<th>Random Sequence Generation (Selection Bias)</th>
<th>Allocation Concealment (Selection Bias)</th>
<th>Blinding of Outcome Assessment (Detection Bias)</th>
<th>Incomplete Outcome Data (Attrition Bias)</th>
<th>Selective Reporting (Reporting Bias)</th>
<th>Other Bias</th>
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<tr>
<td>Duangthip et al., 2016</td>
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<td>dos Santos et al., 2012</td>
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<td>Braga et al., 2009</td>
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, low risk; , high risk; , unclear risk.
Caries Prevention in kids

- **Llodra et al., 2005**
  - 373 6 year olds
  - Control: 2.5 new lesions (only applied to lesions)

- **Liu et al., 2012**
  - 482 9.1 year olds
  - Control: 4.6 new lesions

- **Chu et al., 2002**
  - 308 3-5 year olds
  - Control: 1.6 new lesions (only applied to lesions)

- **Monse et al., 2012**
  - 708 6-8 year olds
  - Control: 0.44 new lesions
GIC sealants > Resin sealants???

2 years
Beiruti 2006 n=315
Chen 2012 n=867
Liu 2014 n=357
Hilgert 2015 n=203

3 years
Beiruti 2006 n=292
Oba 2009 n=137
Hilgert 2015 n=171

4 years
Beiruti 2006 n=266
Zhang 2014 n=741

5 years
Beiruti 2006 n=156
Barja 2009 n=49

Does a sealant here prevent caries here?

2,557 7yo, 2.5 years in Italy

New caries on distal of 2nd primaries

<table>
<thead>
<tr>
<th>Material</th>
<th>Caries Rate</th>
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<tr>
<td>GIC</td>
<td>0.61</td>
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<tr>
<td>Fluoride Resin</td>
<td>0.72</td>
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<tr>
<td>Resin</td>
<td>0.94</td>
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</tbody>
</table>

* indicates significant difference

Cagetti et al., *J Dent Res* 2014