Learning Objectives:

1. Introduce silver diamine fluoride (SDF) and its basic application procedure.
2. Describe the preparation and education efforts which led to successful incorporation of SDF into daily practice.
3. Share forms and resources useful in clinical practice.
4. Discuss the potential for dental hygienists to utilize and educate patients about this emerging method of caries arrest and prevention.
Research shows that it takes approximately 17 years for evidence to become broadly adopted into clinical practice. In the case of silver diamine fluoride (SDF) therapy, a simple and painless treatment alternative to drilling dental caries in children, we should move faster.

Professional And Moral Obligation To Consider SDF
Given the emerging evidence, we should consider the professional and moral obligation of medical and dental clinicians to provide children and their parents with all available and indicated treatment options.

We’ll share two stories…
• An 18 month old facing hospitalization for general anesthesia
• A frail elder in Long-Term Care with multiple failing teeth

Apple Tree Dental
Access • Compassion • Excellence

Seven Centers for Dental Health
145 Community Sites
• Low income children and their families
• Adults with disabilities
• Seniors and elders in long-term care
• Urban and rural communities
Total Age Distribution, 2018

34,455 individual patients treated
96,297 dental visits and screenings provided

Community Collaborative Practice

Collaborating to deliver oral health services where people live, go to school, or receive other health and social services

Our “Centers for Dental Health” are the “hub” for mobile delivery of care in the surrounding community

Apple Tree’s “Multi-Site Delivery Vehicle”
Implementing SDF at Apple Tree
Relevance of SDF for Vulnerable Patients

- **Children**
  - better tolerated by very young / pre-cooperative patients
  - preventing the need for general anesthesia
- **Adults**
  - limited benefits / treatment options in public programs
- **Older adults**
  - high risk / low access

Timeline of SDF Implementation

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>Fall 2015 Apple Tree staff intro to SDF</td>
</tr>
<tr>
<td>2016</td>
<td>11/15 Medicaid recommends SDF coverage</td>
</tr>
<tr>
<td>2017</td>
<td>2016 Apple Tree pilots, then implements SDF in Centers</td>
</tr>
<tr>
<td>2018</td>
<td>2017 Apple Tree pilots, then implements SDF in LTC</td>
</tr>
</tbody>
</table>

SDF Medicaid coverage

- D1354 Interim Caries Arresting Medicament Application
- Once per six month;
- tooth number required
- cannot be billed on the same date as D1206 and D9910

Preparation for SDF Implementation

For Apple Tree staff

- Lunch and learn sessions with an Elevate Oral Health representative
- Apple Tree protocol development based on UCSF
- Staff SDF education sessions
- Customized EHR for SDF tracking / Open Dental
- Talking points for Care Coordinators

Staff Instructions

- 

Care Coordinator Talking Points

- 

Preparation for SDF Implementation

For patients

- Education sheet for Patients and Responsible Parties
- Letters to Directors of Nursing
- Informed Consent with photos
Information for Directors of Nursing and long-term care staff

Implementation Strategy - Centers
- 110 clinical and administrative staff, including
  - 90 dentists, dental therapists, hygienists, and assistants
  - 20 care coordinators
- Initial pilot with select dentists and dental therapists at Centers for Dental Health. Feedback incorporated.
- Expansion to all clinic-based clinicians, beginning with dentists and dental therapists and allowing clinical teams to determine when/whether to delegate to hygienists and/or assistants.

Implementation Strategy - LTC Facilities
- Pilot in LTC setting, with select dentists and facilities, feedback incorporated prior to expansion to all on-site clinicians
- Eight dentists, two dental therapists, and six dental therapy students provided SDF treatments for LTC residents during the pilot.
- More than 75 staff members of 35 long-term care facilities received information about SDF as new treatment option for their residents and reinforcing the importance of oral health.

Results of our Pilots

Sites, Patients, SDF Treatments 2016 - 2017

<table>
<thead>
<tr>
<th>SITES &amp; CENTERS</th>
<th>PATIENTS</th>
<th>DECLINED TX</th>
<th>SDF RX</th>
</tr>
</thead>
<tbody>
<tr>
<td>NURSING FACILITIES (35)</td>
<td>216</td>
<td>20</td>
<td>462</td>
</tr>
<tr>
<td>COOM STARDS</td>
<td>20</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>PETROS FALCS</td>
<td>50</td>
<td>8</td>
<td>195</td>
</tr>
<tr>
<td>KIMMEL</td>
<td>48</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>MACCLE</td>
<td>181</td>
<td>1</td>
<td>189</td>
</tr>
<tr>
<td>ANDERS VIEW</td>
<td>20</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>ROCHESTER</td>
<td>29</td>
<td>1</td>
<td>78</td>
</tr>
<tr>
<td>TOTAL</td>
<td>563</td>
<td>31</td>
<td>1,097</td>
</tr>
</tbody>
</table>
SDF by Tooth # in Long-term Care 2016-17 Pilot

Long-Term Care Age Distribution in Pilot

Center Patient Age Distribution in Pilot

Early Adopters’ Use, 2017

Q3: How likely are you to recommend SDF to other dental professionals?

• Highly Likely 43%
• Likely 50%
• Unlikely 1% (respondent had not yet used SDF)
• Would Not Recommend 0%

Sites, Patients, SDF Treatments through 2018

Lessons Learned at Apple Tree

Planning
• Challenging to incorporate a paradigm shift into day-to-day practice
• Multiple educational opportunities helpful

Clinical
• Patients/Parents are highly receptive - ie informed consent is important but staining, less of a barrier than anticipated
• Evaluation of caries arrest raised questions - clinical judgement of a new product takes time
• Time & experience is necessary for clinicians to incorporate into their practice
SDF Basics

- Cleared by FDA in 2014
- >80 yrs of use in other countries
- 38% Silver Diamine Fluoride
  - 62% water; 24-28% silver; 5-6% fluoride; 8% ammonia weight/volume
- 44,800ppm Fluoride
  - Reference for Fluoride content
    - 5% sodium fluoride varnish = 22,700ppm
    - Rx 1.1% Sodium Fluoride toothpaste = 5,000ppm
    - OTC 0.2% sodium fluoride toothpaste = 1,000ppm
    - OTC 0.5% sodium fluoride mouthrinse (ACT) = 225ppm

How does SDF work?

- Silver-salts stimulate dentin sclerosis & calcification
- Silver nitrate acts to kill bacteria
- Fluoride aids in remineralization and prevention


How SDF works

- Kills cariogenic bacteria
  - Silver ions act directly against bacteria in oral environment and within dentinal tubules
  - Silver and fluoride is deposited in demineralized dentin
  - Creates a reservoir within the cavity
- When bacteria interact with other bacteria killed by silver ions, the silver is re-activated
  - “Zombie effect”
- Reduces Sensitivity
  - Forms layer that partially plugs dentinal tubules

Advantages

- Pain-free, no need for local anesthetic
- Quick procedure
  - Short set-up and patient chair-time
- Relatively easy procedure
- Aids in prevention
- Inexpensive

Side Effects

- Staining
  - Arrested decay turns black
- Other carious teeth, possibly demineralized white-spot lesions
- Can mix with saliva - isolation is critical
- Tissue - gingiva, lips, cheeks, tongue, etc.
- Clothing
  - Counter, instruments
- Metallic taste
- Is it toxic?
  - No reports of toxicity and extremely rare adverse consequences

Fluoride content in SDF and Fluoride Varnish commercial unit doses:

<table>
<thead>
<tr>
<th>Fluoride product</th>
<th>Unit dose</th>
<th>Concentration</th>
<th>F ion mg/mL</th>
<th>Price $/oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDF 38%</td>
<td>1 drop</td>
<td>44,800 ppm</td>
<td>44.8</td>
<td>1.12</td>
</tr>
<tr>
<td>5% NaF Solutions</td>
<td>0.25 ml</td>
<td>22,600 ppm</td>
<td>22.6</td>
<td>5.65</td>
</tr>
<tr>
<td>2.5% NaF Solutions</td>
<td>0.5 ml</td>
<td>22,600 ppm</td>
<td>22.6</td>
<td>11.3</td>
</tr>
<tr>
<td>2.5% NaF Solutions</td>
<td>1 ml</td>
<td>11,300 ppm</td>
<td>11.3</td>
<td>5.65</td>
</tr>
</tbody>
</table>

In short, one drop of SDF has the same amount of F as one liter of properly fluoridated water.
Example of SDF staining of tissue

"Whiskers" from super floss
4 days later, whisker-free!

Efficacy/Evidence

- ADA - "Moderate" certainty of the evidence, and give "strong" recommendation that biannual SDF application is preferred to arrest advanced cavitated lesions on primary teeth
- ADA - "low" certainty of the evidence, and give "conditional" recommendation that biannual SDF application is preferred to arrest advanced cavitated lesions on permanent teeth
- AAPD - quality of evidence is "low" - limited number of RCTs and various studies have different protocols - give "conditional" recommendation for use in primary teeth as part of caries management protocol

Considering low cost, and high disease burden, the panel is confident the benefits in target populations outweigh undesirable effects

Near the same efficacy of dental fillings after 2+ years, and prevents future caries

~70% of cavitated carious lesions in primary teeth would be expected to be arrested two years after SDF application (with 1-2/year applications)

Anterior teeth have better arrest rates than posterior

Annual application of SDF is more effective in arresting carious lesions than application of five percent sodium fluoride varnish four times/year

Patients with high plaque index have lower rates of caries arrest
- Still need to focus on OH and diet!

How often to apply?

- No consensus for number or frequency of application
- Reapplication 1-2 times/year until the tooth is restored or exfoliates
- One study found that after a single application of 38% SDF, 50% of the arrested surfaces at six months had reverted to active lesions at 24 months, so should reapply!
- Single application insufficient for sustained effects
- Biannual application had increased caries arrest; studies with three times/year applications had higher arrest rates
- ATD Recommendation/Protocol: Reapply 2-8 weeks after initial application
Who can apply it?

- LDAs, DHs, DTs, ADTs - same as Fluoride Varnish
  - DH, DT, ADT: General supervision (dentist has prior knowledge and has given consent for procedure, does not need to be present)
  - CDHP: Currently, MN requires a treatment plan by a DDS or ADT for D1354 billing
  - LDA: Indirect supervision (dentist is in-office, authorizes the procedure, and remains in the office throughout procedure)
  - Would not recommend applying this as an individual without assistance unless the tooth is easy to isolate and the patient is cooperative

Indications

**Patients:**
- High caries risk with incipient and cavitated lesions (dentinal hypersensitivity, ECC, xerostomia, root caries etc.)
- Behavioral challenges
  - Pre-cooperative children, intellectual or developmental disabilities, older adults
- Medical challenges
  - Multiple cavities that cannot be treated in one visit or difficult to access lesions
  - Patients with difficulty accessing dental care
  - i.e. OUR PATIENTS!

**Teeth:**
- Incipient carious lesion
- Carious tooth nearing natural exfoliation
- Cavitated lesions
- Difficult to treat cavitated lesions
- Root Caries
- Exposed root surfaces with hypersensitivity

Contraindications

- Patient
  - Silver Allergy (very rare) - absolute
  - Open mouth sores, ulcers, desquamative gingivitis
- Tooth
  - Very deep cavities adjacent to pulp
  - Signs of irreversible pulpitis (spontaneous pain)

HOW to Apply SDF - Preparation

- Prepare tray and space
  - Plastic-lined cover for counter
  - Plastic-lined cover for counter
- Prepare Patient
  - Standard PPE for provider and patient
  - Large plastic bib for patient
  - Vaseline on pt’s lips, possibly on teeth you don’t want treated

HOW to Apply SDF - accessible caries

- Remove bulk saliva (saliva ejector)
- Isolate tongue, cheek from cavity teeth - cotton rolls, dry angles, etc.
- Dry affected tooth surfaces with air (is like a dry sponge - absorbs the SDF)
- Immerse microbrush in SDF, remove excess on inside of dappen dish
- Apply to tooth surface - gently scrub the tooth surface
- Allow to absorb into tooth for 1+ minutes (use a clock/timer)
- Gently dry with air to help absorb
- Remove excess with cotton pellet, cotton roll
- Dispose of materials and change gloves

*Should NOT excavate/prep cavities prior to application!
HOW to Apply SDF - accessible caries

Note the great isolation!

HOW to Apply SDF - Interproximal decay

- Remove bulk saliva (saliva ejector)
- Isolate tongue, cheek from carious teeth - cotton rolls, dry angles, etc.
- Place superfloss between contact - be careful the floss ends don’t touch patient (can have assistant hold the loose ends, or cut the ends of the floss)
- Dry affected tooth surfaces with air (is like a dry sponge - absorbs the SDF)
- Apply SDF to superfloss and tooth at the contact area
- Allow to absorb into tooth for 1+ minutes (use a clock/timer)
- Gently dry with air to help absorb
- Remove floss (be careful!), dispose of materials and change gloves

*Limitations - can “wick” along floss and get onto practitioner gloves, or the patient

SMART Technique

● “SMART” - Silver Modified Atraumatic Restorative Technique
  ○ SDF applications - typically 2+ (until caries arrested)
  ○ Preparation at margins (minimal, no LA needed)
  ○ Restore with glass ionomer
  ● If placed as definitive restoration, bill as glass ionomer restoration
  ● If placed as an interim restoration, or just to fill the void, bill D2940 (TF)
  ● If you place SDF on same day as a restoration, use a self-cure glass ionomer restoration

Other Considerations

● If SDF stains counters, immediate clean-up with ammonia-based cleaner (like Windex), or use of alcohol/ethanol, or polish surface with prophy cup/pumice

Informed Consent

● Families must understand:
  ○ Helps slow and arrest decay, and prevent cavities, but doesn’t “fix” the cavity
  ○ Will stain teeth permanently
  ○ Could unintentionally cause staining of tissue, clothes, etc.
  ○ Requires monitoring and reapplication over time
  ○ Caries could continue to advance
  ○ Tooth could still require restoration in the future
How to Bill/Code - general info

- D1354 - Interim Caries Arresting Medicament Application - per tooth
  - CANNOT bill on same day fluoride varnish (D1206) is billed
  - For CHILDREN: FLV covered by Medicaid/State insurance 2x/yr
  - For ADULTS: FLV covered by Medicaid/State insurance 1x/yr
- CANNOT bill on same day as other desensitizing medicament (D9910)
- Some insurances won't cover if both SDF and a restoration are placed and billed on the same day

CDT Codes for Advantage Arrest

- D1354 - Interim application of a caries arresting medicament (2018 change to per tooth)
- D1208 – fluoride application - excluding varnish
- D9910 – Application of a desensitizing medicament
- Use the appropriate code based on your primary purpose of use and document in the patient chart

SMART Technique - 3.5 year old, medically complex

On 1/15/19 SDF Re-applied, Prepped Margins, Restored w/ Fuji II

Case Examples

Dr. Somchenko’s case for restoring tooth #22

Caries present facial of #22

Smart technique treatment
Case Examples
Dr. Teresa’s case for exposed mesial of #19, adjacent to erupting #20

Case Examples
Recurrent Decay: #29 distal caries under the crown

Case Examples
Delaying an extraction: #16DB

- Male in mid-thirties with caries #16DB
- Tooth is non-functional
- Difficult to access with handpiece giving restoration poor prognosis
- Extraction recommended but patient not ready to have the procedure

Case Examples
Pre-cooperative 2.5 year old

Before and After SDF

SDF Stand Alone Treatment

SMART Technique

Ongoing Research

- University of Michigan
  - The NIDCR Grant provides $9.6 million over four years to fund a Phase III randomized clinical trial to test the effectiveness of silver diamine fluoride (SDF) in arresting caries in children. The study will provide the necessary data for obtaining a cavity arrest drug claim in the U.S. It will closely follow 1,060 children, ages 2-5, in preschool programs such as Head Start during a school year.

- New York University
  - Granted $13.3 million funding award by the Patient-Centered Outcomes Research Institute (PCORI) to study cavity prevention, quality of life, and school performance. NYU Dentistry’s Richard Niederman, DDS, and Ryan Richard Ruff, MPH, PhD, will lead the four-year study comparing the effectiveness of two cavity prevention techniques—a "simple" treatment of topical silver and fluoride, and a "complex" treatment of traditional sealants and fluoride. The study will be conducted in elementary schools in the Bronx, an area with a scarcity of dental care providers and clinics.
Insurance & Medicaid Coverage

- An increasing number of states offer coverage through Medicaid
- Delta Dental included in National Plans 2019 – Delta plans can now include D1354

Resources - additional information

- Concise summary of SDF, the Association of State and Territorial Dental Directors: https://www.astdd.org/www/docs/sdf-fact-sheet-09-07-2017.pdf
- UCSF Protocol for SDF (a systematic review, clinical indications, clinical protocol, and consent procedure to guide application for caries arrest treatment) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4778976/
- ADA’s “Nonrestorative Treatments for Carious Lesions”: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4778976/

Apple Tree SDF Resources

Download forms using this link to News and Resources on www.appletreedental.org:

Closing with two stories from across the lifespan...

Avoiding general anesthesia...
- Elderly pt in with dementia in long term care facility
- Daughters want “comfort care”, nothing invasive or stressful
- Areas of root decay, a few lost restorations with recurrent caries including #7DFL
- Cleaning, exam and SDF all completed at November appointment avoiding winter travel

Providing “Comfort Care”...
- Elderly pt in with dementia in long term care facility
- Daughters want “comfort care”, nothing invasive or stressful
- Areas of root decay, a few lost restorations with recurrent caries including #7DFL
- Cleaning, exam and SDF all completed at November appointment avoiding winter travel

Questions and Discussion
Thank you!
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