SDF Silver Diamine Fluoride for Caries Control

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Why SDF for Caries Control?

- Dental caries and limited access to dental care are major public health problems for low-income families
- Dental caries is the most prevalent untreated chronic and INFECTIOUS disease of children
- In 2009, more than 16 million Medicaid enrolled children (56%) received no dental care
 - Only ~10% of Florida's dentists participate in Medicaid
 - Only ~10% of children under the age of 6 receive any dental services
- Untreated decay can cause pain, infection, malnutrition, poor general health, missed school days etc.
- Nonsurgical management of caries disease!





Indications for SDF Treatment

- Arrest/slow down progression of carious lesions to eliminate/reduce pain and infections
- Extreme caries risk
- Young uncooperative children
- Patients without access to dental care
 - Children from disadvantaged families
 - Community-based programs
 - Institutionalized individuals
- Dentin hypersensitivity

















Mechanism of Action of SDF

- 38% SDF contains ~44,800 ppm fluoride and ~253,870 ppm Ag
- Both fluoride and silver ions contribute to mechanism of action
 - Silver acts as an anti-microbial agent killing bacteria and preventing the formation of new biofilm, while the fluoride acts to prevent further demineralization
- SDF AgF(NH₃)₂+ hydroxyapatite Ca₁₀(PO₄)₆(OH)₂ = Calcium fluoride CaF2 + silver phosphate Ag₃PO₄ + NH+₄ + OH⁻
 Formation of fluorapatite Ca₅(PO₄)₃F !
- SDF inhibits dentin demineralization, preserves collagen and inhibits collagen breakdown, increases dentine hardness

Yamaga et al. 1972 Mei et al. 2013

Mechanism of Action of SDF

- SDF has antimicrobial properties
- Silver ions can bind with bacterial cell walls and disrupt membrane and enzyme functions causing death of bacteria
- In Vitro studies:
 - Silver ions reduces acidogenicity of dental plaque
 - Silver ions inhibits bacterial DNA replication
 - Silver ions kill bacteria and inhibit S mutans growth

Coward et al., 1973; Bragg & Rainnie 1974; Russell & Hugo 1994, Oppermann et al., 1980, Wysor & Zollinhofer 1972



control





- SDF treated dentin exhibits a smooth surface with few dentine collagen fibers exposed
- Control surface is porous and rough

Evidence for SDF

Study	N (age)	Duration/Intervention 38% SDF	Main results	
Chu et al. 2002 China	375 children at baseline - 308 completed (3-5 yrs) Max ant teeth Mean dmfs 4.66 Low F	 Duration 30 mo I. Remove caries then annual SDF 2. Annual SDF 3. Remove caries then NaF every 3 mo 4. NaF every 3 mo 5. Water (cnt) 	Mean # of arrested carious surfaces 1. 2.5 2. 2.8 3. 1.5 4. 1.5 5. 1.3 p<0.001	PF% for arrest/prevention 96/84 122/70 14/44 21/56
Llodra et al. 2005 Cuba	452 children at baseline 373 completed (~6 yrs) Primary canines, molars Permanent I st molars/ Low F	Duration 36 mo I. Biannual SDF 2. Cnt	Mean # of arrested carious surfaces 1. 2.8 2. 1.8 p< 0.05	PF% for arrest/prevention 56/79 (prim) 100/64 (1 st molars)
Zhi et al. 2012 China	212 children at baseline 181 completed (3-4 yrs) Dmfs 5.1±4.0/ Low F	Duration 24 mo I. Annual SDF 2. Biannual SDF	% of caries arrested 1. 79% 2. 91% p=0.007	
Yee et al. 2009 Nepal	976 children at baseline 624 completed (3-9 yrs) Low F	 Duration 24 mo I. SDF once 2. SDF once +tannic acid 3. 12% SDF once 4. Cnt 	Mean # of arrested carious surfaces at 6mo/12/24mo 1. 4.2/3.4/2.1 2. 4.5/4.1/2.2 3. 2.3/1.7/1.5 4. 1.6/1.3/1.0P<0.001/p<0.001/p<0.01	
Zhang et al. 2013 Hong Kong	277 <mark>elderly</mark> 227 (60-89 yrs)	Duration 24 mo I. Annual SDF +OHI+OHE 2. Annual SDF+ OHI 3. OHI	Mean # of arrested carious surfaces 0.33 0.28 0.04 p=0.006	

Evidence for SDF

Study	N (age)	Duration/Intervention 38% SDF	Main results	
Liu et al. 2012 Southern China	501 children at baseline 485 completed (9 yrs) fissures	 24 mo duration I. Sealant 2. Biannual NaF 3. Annual SDF 4. Cnt 	 % of decayed fissure sites 1. 1.6% 2. 2.4% 3. 2.2% 4. 4.6% 	PF for SDF = 39%
Tan et al. 2010 HongKong	306 elders at baseline 203 completed (79 yrs) Exposed roots	Duration 3 yrs I. Annual SDF 2. NaF every 3 mo 3. CHX every 3 mo	Mean # of new lesions 1. 0.7 2. 0.9 3. 1.1	PF 1. 71% 2. 64% 3. 57%
Monse et al., 2012 Philippines	704 children (6-8 yrs) Daily F toothpaste program I st molars	Duration 18 mo 1. SDF once 2. GIC sealant once 3. Cnt	Caries incrementF toothpasteNon-FI.0.09I.0.122.0.012.0.063.0.083.0.17	

SDF

- In 2014, FDA cleared SDF in US for the treatment of dentinal hypersensitivity
- Off-label use for caries treatment
- In 2015, I product available in US market: Advantage Arrest, by Elevate Oral Care





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SDF CDT Codes

DI208 - Topical application of fluoride

"SDF is categorized as a fluoride and can be used to treat site-specific locations. It's application and effect is very different than most fluorides, but the off-Label indication is acceptable for this code use."

D 9910 - Application of a desensitizing medicament, per visit

"SDF is indicated for dentinal hypersensitivity treatment and can be used to treat site-specific locations."

D1999 - Unspecified preventive procedure by report

In 2016 there will be a new CDT code for the use of caries arresting medicaments; the off-label use of Advantage Arrest.

DI354 - 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."

Elevate Oral Care

Procedure for SDF Use

- Plastic-lined cover for counter, plastic-lined bib for the patient.
- Standard Personal Protective Equipment (PPE) for the provider and the patient.
- I drop of SDF into a glass or plastic dish.



SDF application

- Remove excess saliva
- Isolate with gauze or cotton rolls.
 - rubber dam optional.
- Apply petroleum jelly to gingiva near affected areas.
- Dry the affected areas gently.
- Immerse the micro-sponge in a drop of SDF (a drop treats ~5 sites).
- Apply to the lesion with micro-sponge.
- Allow to absorb for 1 min.
- Rinse with water.
- Consider pt cooperation, consent, protection (gloves, safety eyewear etc).
- I-2 reapplications at intervals of I week (UCSF)
- Recall after 3-6 wks, 3-6 month intervals (Elevate)
- 1-2 x/year (most studies)





Safety of SDF

- 80 years of use in Japan, ~12 clinical trials: No significant adverse effects or acute toxicity cases (no studies on toxicity on children)
- No severe pulpal damages have been reported may irritate pulp in deep lesions
- Mild gingival irritation can occur (vaseline can be used over gingival margins to prevent irritation)
- No evidence of fluorosis if used properly (Health Dept. of Western Australia; Neesham, 1997)
- hypothetical risk due to high conc. of F- 44,800 ppm

Contraindications:

- Silver allergy
- Ulcerative gingivitis
- Stomatitis



Considerations for SDF Use

- ✓ No excavation, decay removal or anesthesia needed
- ✓ Do not use on exposed pulp
- ✓ Does not stain sound tooth tissue
- Darkening of the lesions occur over 24 hrs and many increase over a week
- SDF can stain the skin which will clear in 2-3 weeks without treatment
 - ✓ wear gloves and advice children not to spit or rub the saliva over their face/skin
- SDF can permanently stain surfaces, clothes
- ✓ Protect eyes
- ✓ First recall within 3-6 weeks
- Set recall appointments based on the risk level with high risk patients at 3 month interval
- Re-apply if lesion is not arrested



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Considerations for SDF Use

- Do not use other F products at the same appt
- May decrease adhesion to composites
- No post op instructions, pt can eat and drink
- Saturated Solution of Potassium Iodide (SSKI, various sources) can be used after SDF to decrease color changes.
 - Potassium lodide not for pregnant of breastfeeding women
- ✓ Consent!



Fluoride Varnish Treatment



- NaF varnish containing 2.26% F (22,400ppm) applied topically to the teeth
- Safe, easy and efficient application
- 2-4 x/year applications

THANK YOU!

Contact Information:

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