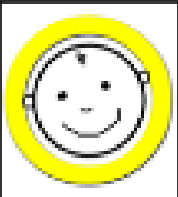
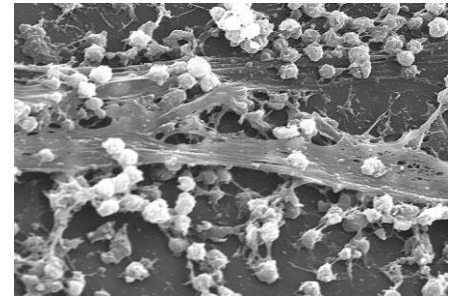
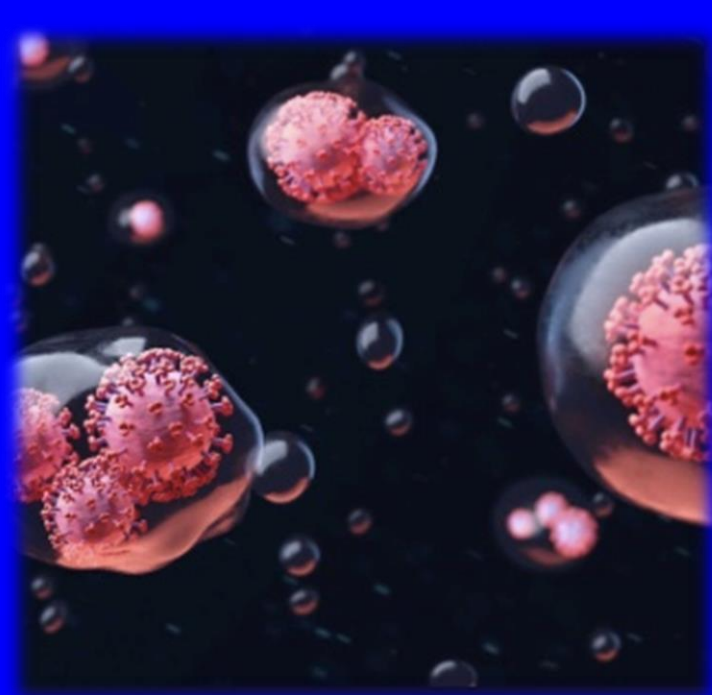


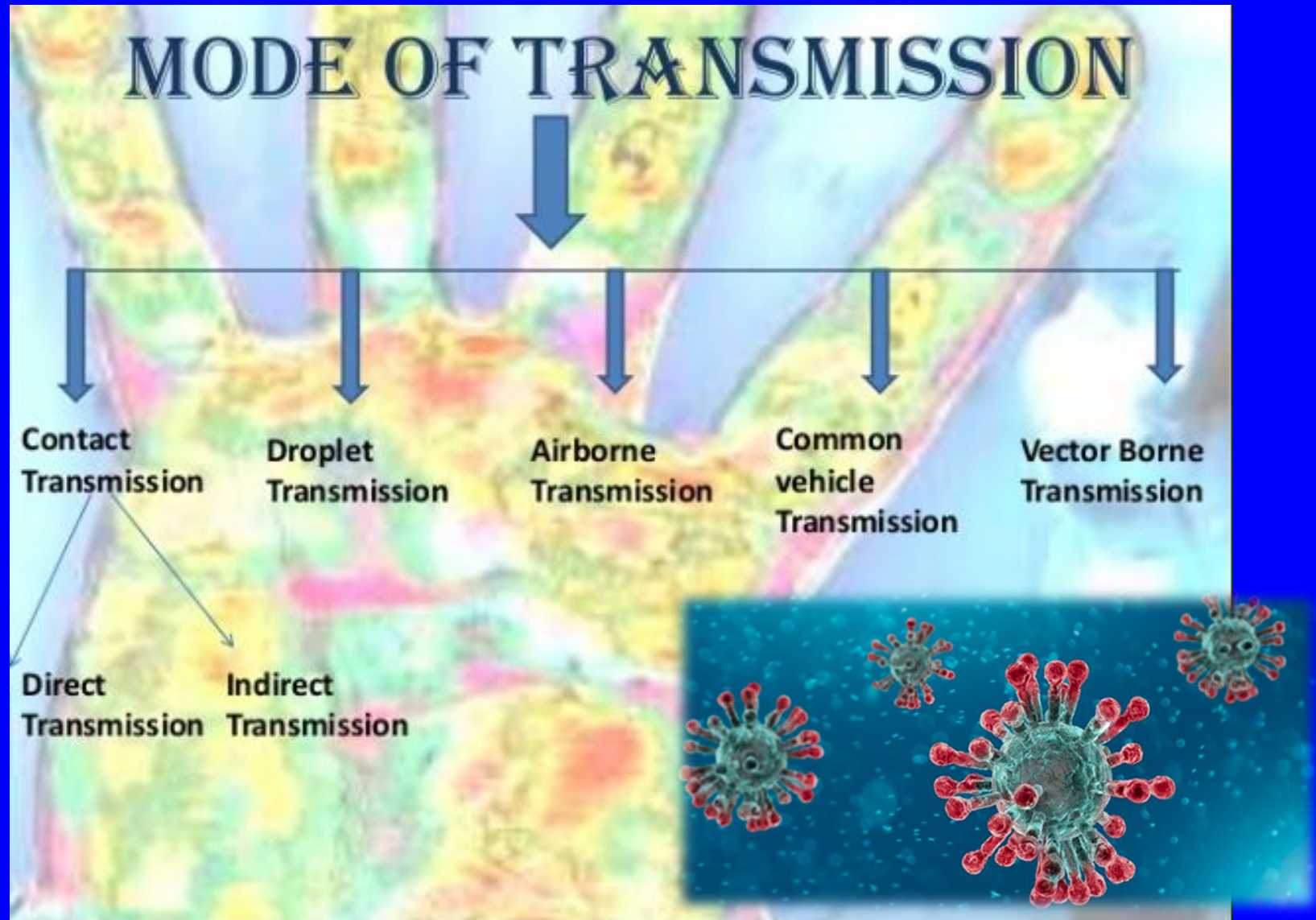
Non-Aerosol Caries Management: Pandemic Approaches



Tim Wright DDS, MS



SARS-CoV-2 Transmission







Non-Aerosol Caries Management

- Optimize Primary Prevention
- Silver diamine fluoride
- Atraumatic Restorative Approaches
 - ART
 - SMART
 - Hall Crown Technique

Non-Surgical Caries Management Approaches

Treatment Recommendations During the COVID-19 Pandemic

Tim Wright, D.D.S., M.S. | UNC Adams School of Dentistry

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Beau Meyer, D.D.S., M.P.H. | UNC Adams School of Dentistry

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Jeannie Ginnis, D.D.S. | UNC Adams School of Dentistry

Bill Vann, D.M.D., Ph.D. | UNC Adams School of Dentistry

Mike Roberts, D.D.S., M.Sc.D. | UNC Adams School of Dentistry



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NC ORAL HEALTH
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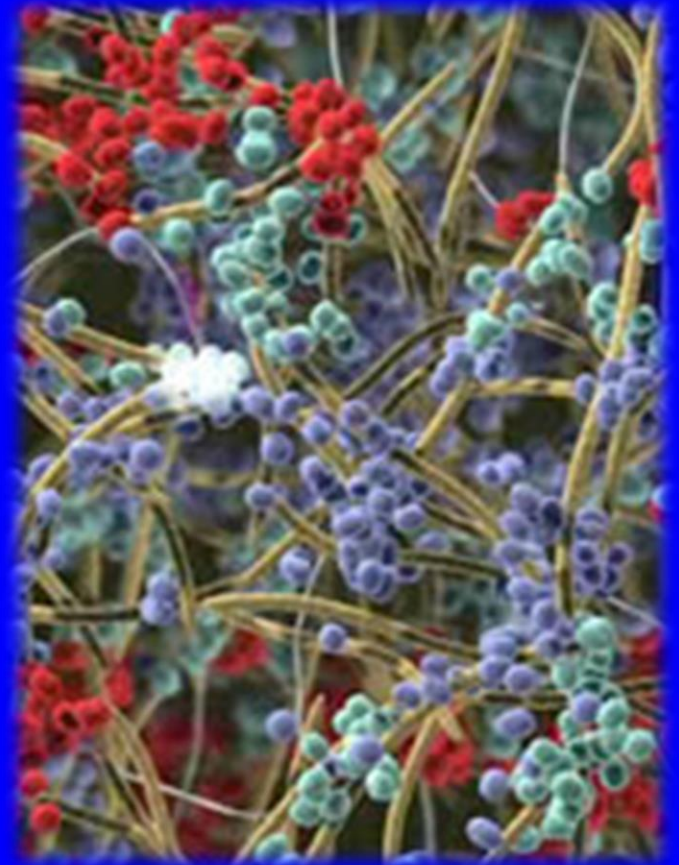
Caries Management Challenges

- Very young children
- Elderly
- Medically compromised
- Uncooperative patients
 - Age
 - Cognitive status



Antimicrobial Approaches to Manage Caries

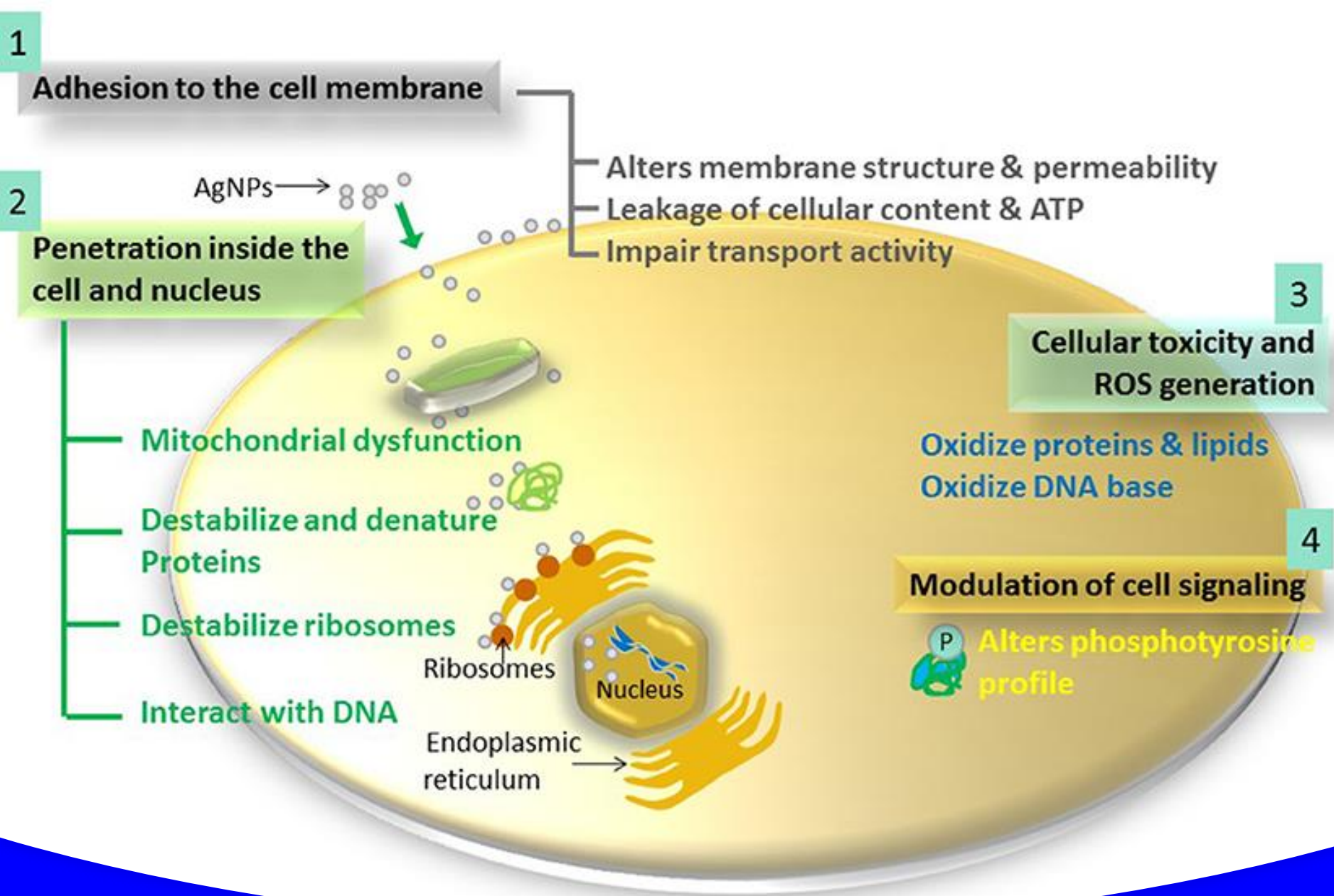
- Chlorhexidine
- Povidone Iodine
- Silver Diamine Fluoride
- Silver Nitrate



Commercially Available Ag Salts for Caries Management

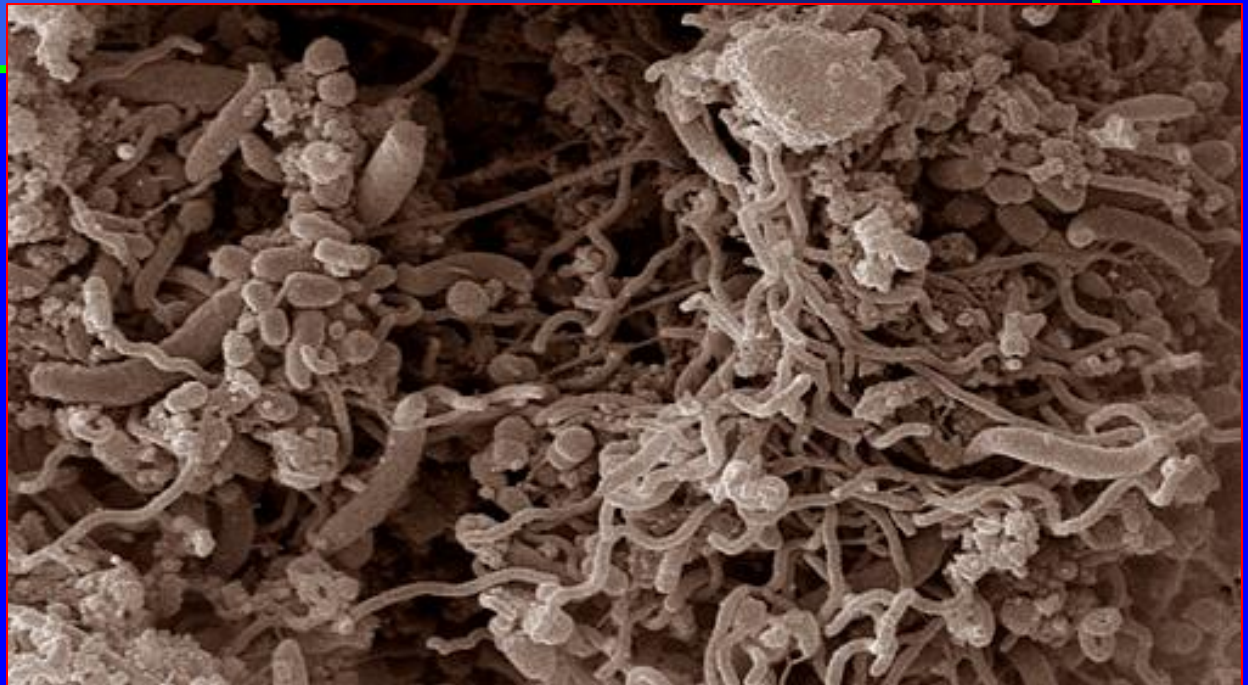
- Three Ag salt products are currently available in the USA for caries management.
 - Silver Nitrate solution (25%)
 - Silver Diamine Fluoride Solution (38%)





SDF Effect on Microbiome

- *In vitro* studies – biofilm and specific microbes



Hamama et al. Aust Dent J. 2015

Mei et al. Ann Clin Microbiol Antimicrob. 2013

SDF Kills Cariogenic Organisms

- SDF, AgF, AgNO₃, NH₄F, NH₄Cl, NaCl, NaF
- Strep Mutans, Lactobacillus acidophilus, Actinomyces naeslundii
- SDF, AgF, AgNO₃, NH₄F antibacterial effect (NH₄F only at high concentrations)
- Conclusion – Ag ion primary antibacterial action

J Contemp Dent Pract. 2018 May 1;19(5):591-598.

Antibacterial Effect of Silver Diamine Fluoride on Cariogenic Organisms.

Lou Y¹, Darvell BW², Botelho MG³.



Silver Diamine Fluoride

- 38% Silver Diamine Fluoride
- $(\text{Ag}(\text{NH}_3)_2\text{F})$ –
 - Blue solution
 - pH ~8 to 10
 - Metallic taste



SDF Solution and FDA

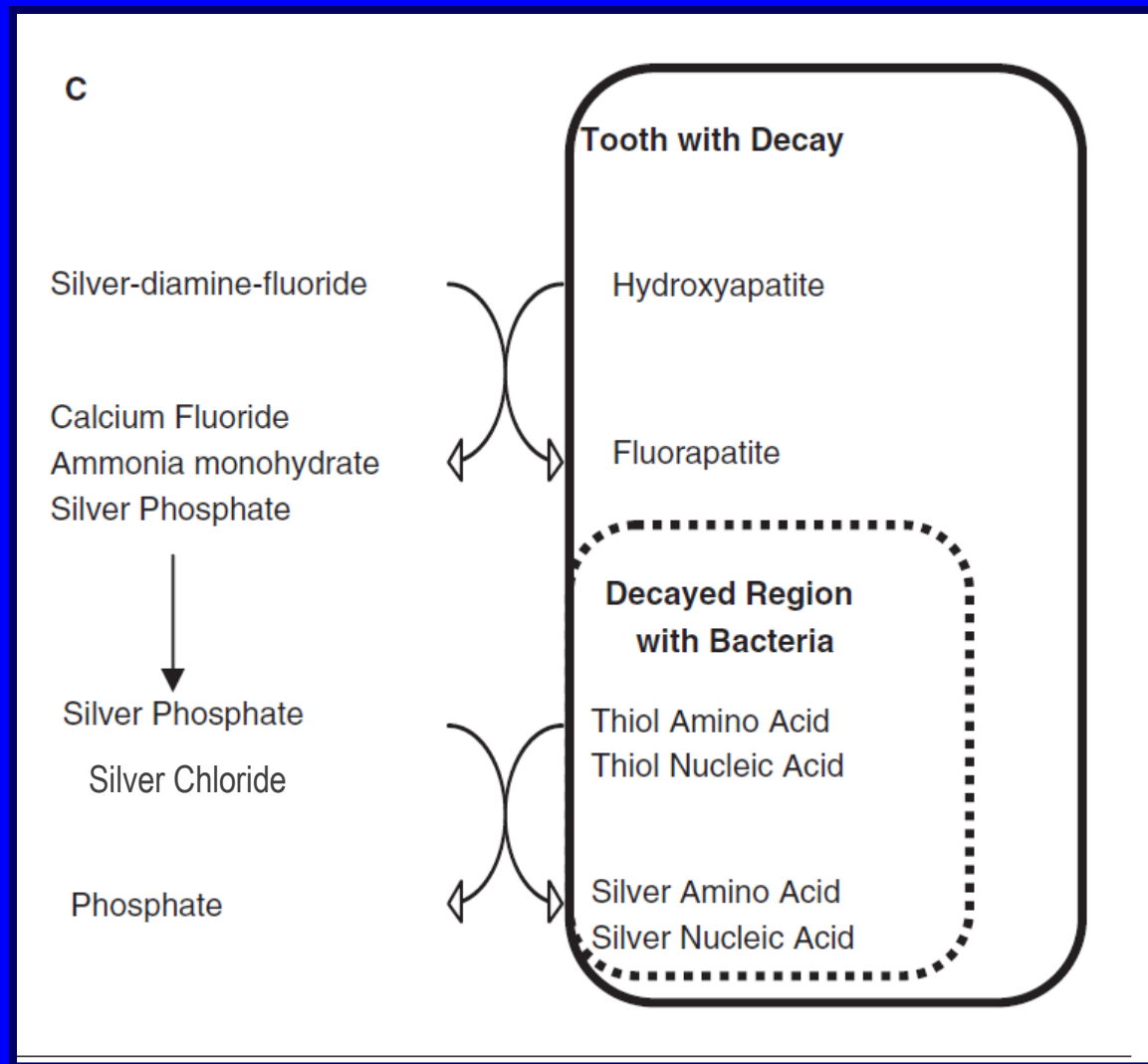
- Became commercially in United States - March 2015
- FDA clearance - Class II medical device tooth hypersensitivity
- Not recommended for use in people under the age of 21



Safety Data Sheet
Advantage Arrest
Silver Diamine Fluoride 38%
($\text{Ag}(\text{NH}_3)_2\text{F}$)

Ingredient	Percentage
Silver (Ag)	24 - 27
Ammonia (NH3)	7.5 - 11
Fluoride (F)	5-6
Deionized Water	≤ 62.5

Action of SDF Components

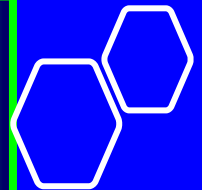


Rosenblatt et al., 2009

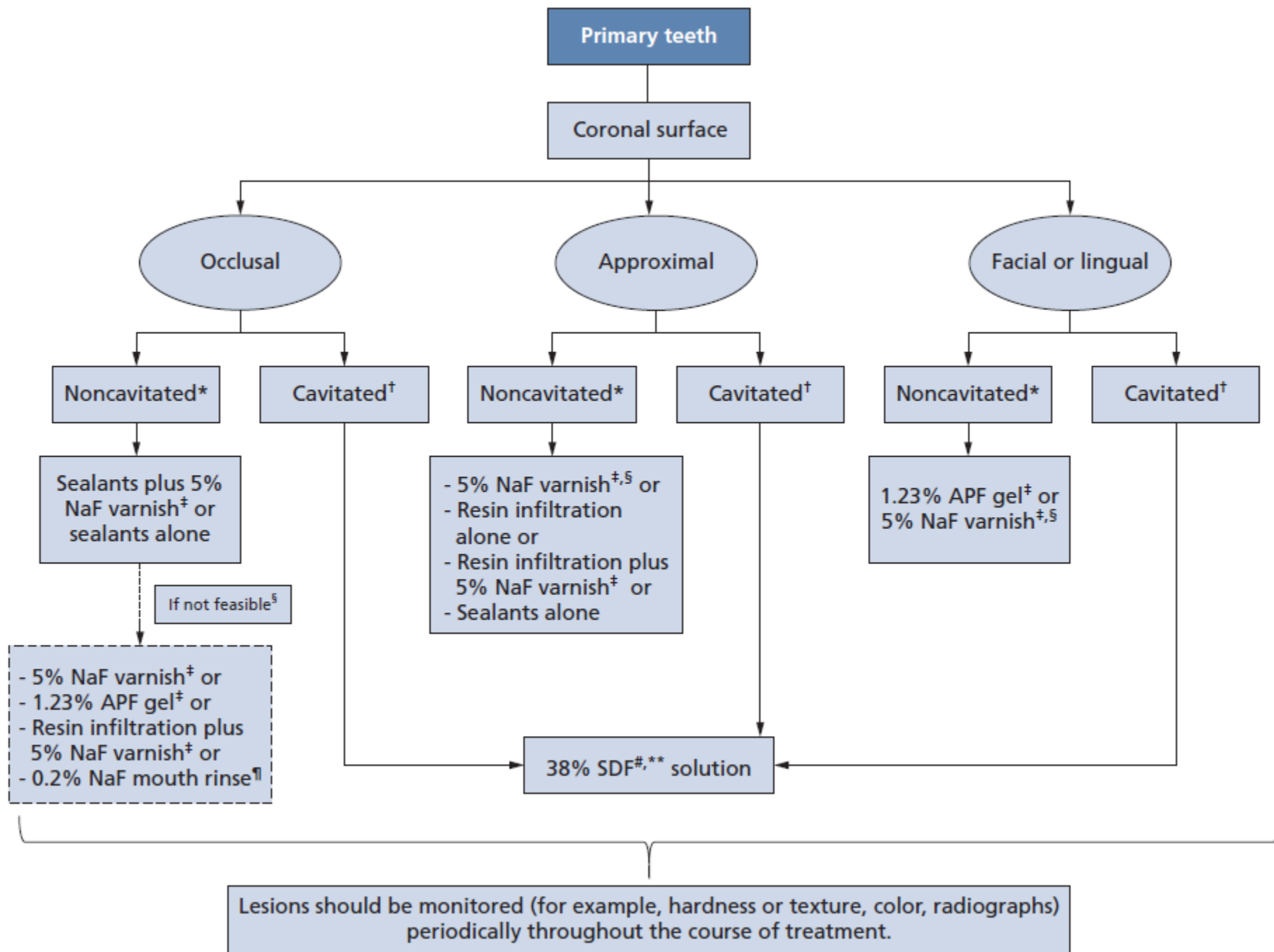


SDF Caries Management

- Outcomes:
 - Caries arrest – stops and arrests active lesions
 - Primary caries prevention



Dr. Scott Eidson





RECOMMENDATIONS: *CLINICAL PRACTICE GUIDELINE*

Use of Silver Diamine Fluoride for Dental Caries Management in Children and Adolescents, Including Those with Special Health Care Needs

Yasmi O. Crystal, DMD, MSc, FAAPD¹ • Abdullah A. Marghalani, BDS, MSD, DrPH² • Steven D. Ureles, DMD, MS³ • John Timothy Wright, DMD, MS⁴ • Rosalyn Sulyanto, DMD, MS⁵ • Kimon Divaris, DDS, PhD⁶ • Margherita Fontana, DDS, PhD⁷ • Laurel Graham, MLS⁸

Recommendations

The SDF panel supports the use of 38 percent SDF for the arrest of cavitated caries lesions in primary teeth as part of a comprehensive caries management program. (*Conditional recommendation, low-quality evidence*)



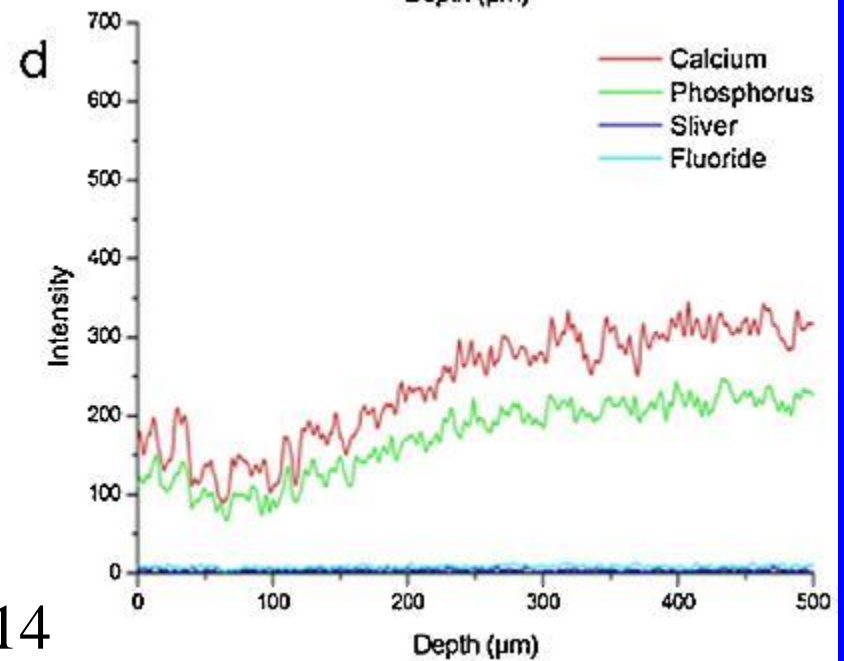
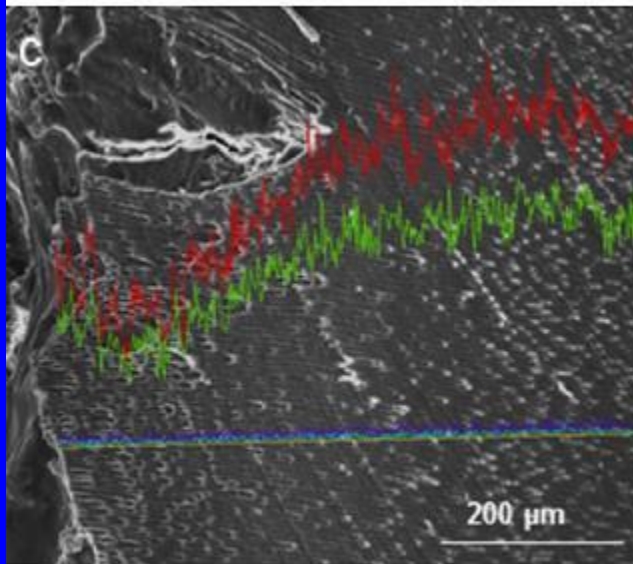
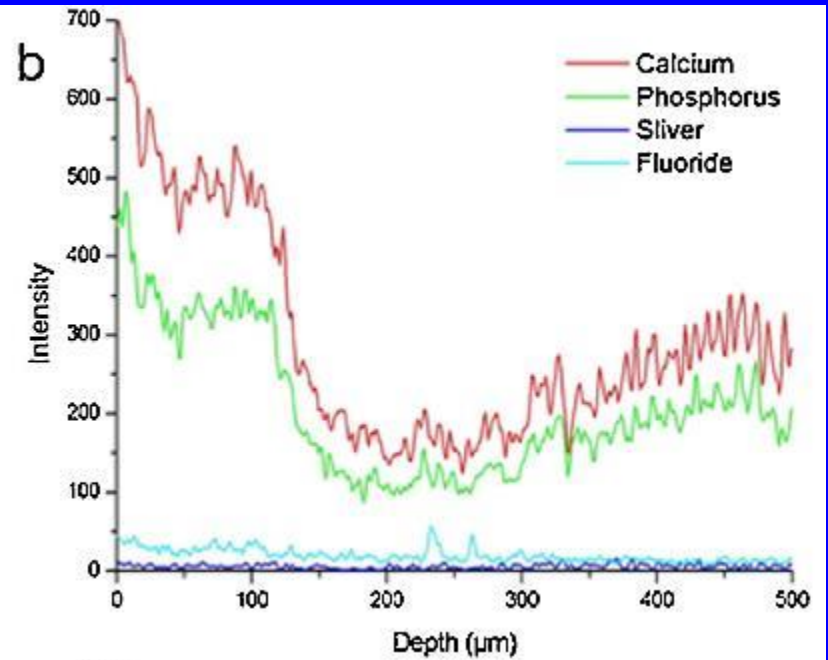
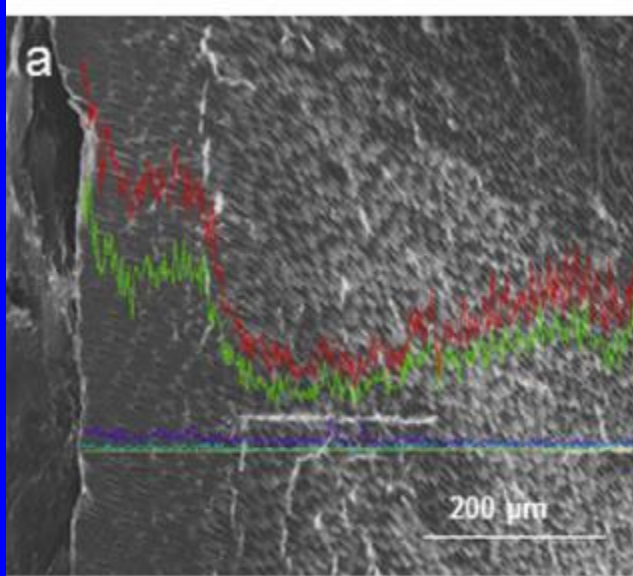
Before



After Tx with Ag



SDF



Mei et al. J Dent. 2014

Lesion



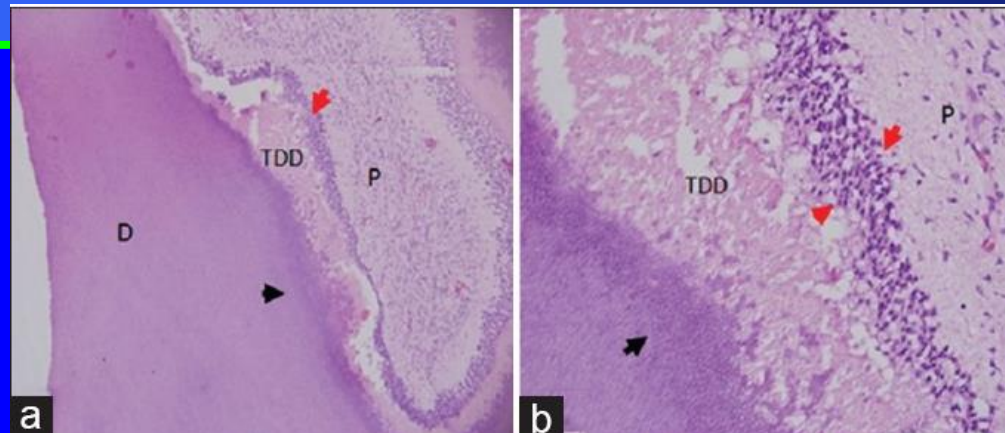
SDF Pulp Study: Wistar Rat

Acta Odontol Latinoam 2017

- Pulp not histologically altered after 38% SDF placement in cavity preparation

SDF and Pulpal Health

- Indirect pulp cap 0.25-.5 mm (Class V prep)
- No inflammation/necrosis
- Good tertiary dentin
- Recommended as IPT material for deep caries management



SDF Safety/Toxicity



Safety Data Sheet

Advantage Arrest Silver Diamine Fluoride 38%



Section 11 - Toxicological Information

Hazardous Ingredients:

SODIUM FLUORIDE
ORL MUS LD50 57 mg/kg
ORL RAT LD50 52 mg/kg
SCU RAT LD50 175 mg/kg

US EPA Lowest Observed Adverse Effect Level (LOAEL)
Oral Dose: 0.014 mg/kg/day – outcome is chronic - Agyria

Short Term SDF serum Pharmacokinetics

- Mean DSF solution applied - 3 teeth was 7.57 mg (6.04 μL)
- 4 hour observation
- Mean max serum concentrations: F = 1.86 $\mu\text{mol/L}$: Ag = 206 nmol/L
- F  and Ag  EPA oral reference dose - cumulative daily exposure over a lifetime

Silver Compound Safety



- If consumed excessively will cause argyria
- Will stain skin black





SDF Caries Management

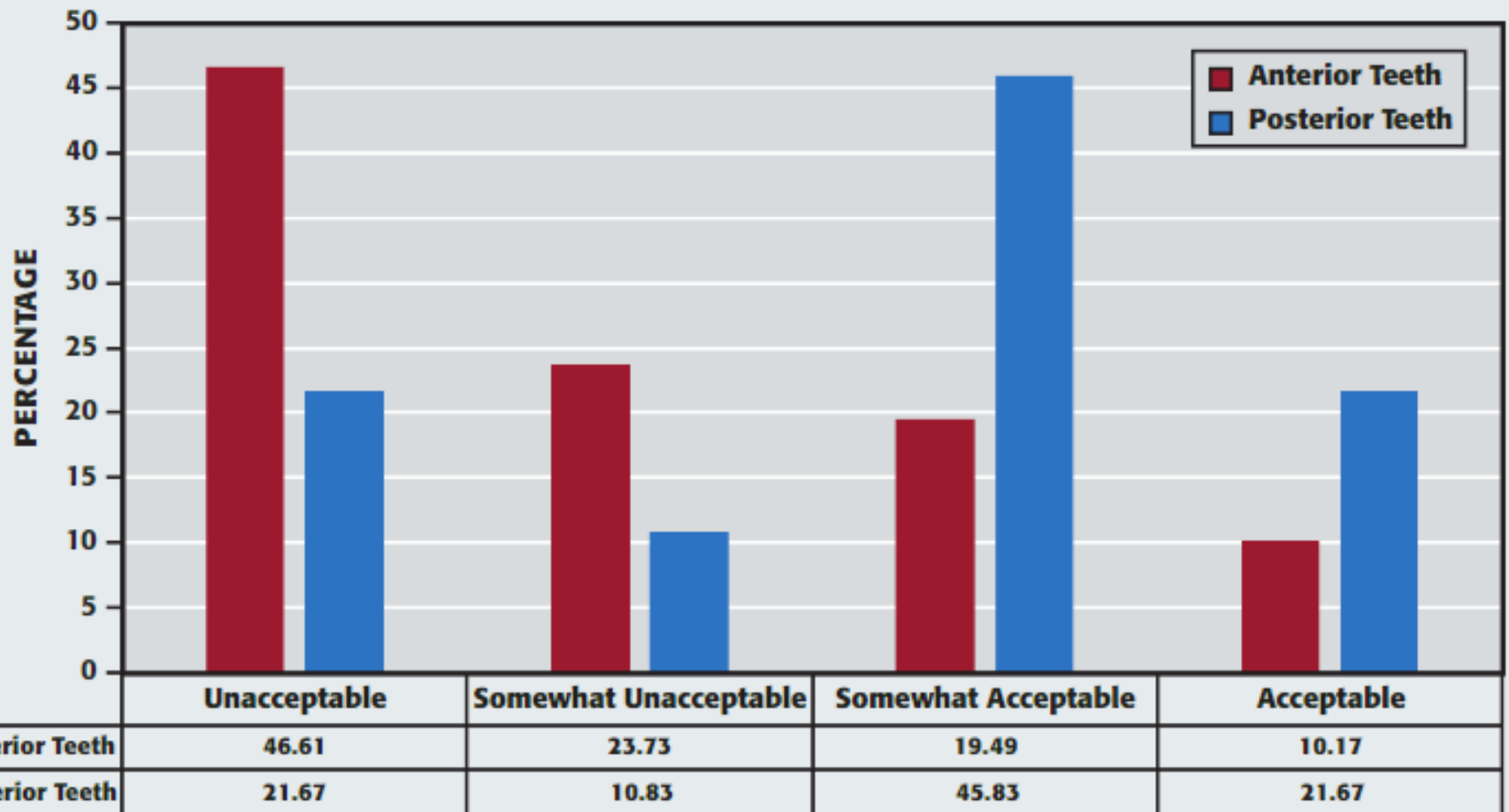
- Case selection
- Application technique
- Post SDF treatment protocol
- Restoring SDF treated teeth

Silver Diamine Fluoride

Possible Advantages

- Pain control (noninvasive)
- Infection Control (inherent in the material)
- Ease of use
- Affordability (pennies per application)
- Minimal application time
- Non-aerosol producing





ACCEPTABILITY OF ESTHETICS





INFORMED CONSENT FOR SILVER DIAMINE FLUORIDE TREATMENT

Chart Number: 0002-7861

Patient Name: JOHN WRIGHT

Notice: THE ATTENDING DENTIST IS RESPONSIBLE FOR OBTAINING SIGNATURE AND FOR CROSSING OUT ANYTHING THAT DOES NOT APPLY.

Your dental healthcare provider believes that you or your minor child would benefit from the application of Silver diamine fluoride (SDF) in one or more cavities that you may have. SDF is an antibiotic liquid used on cavities to help stop tooth decay and tooth sensitivity. SDF application every six to 12 months is necessary.

Procedure

Your dental healthcare provider will paint each cavity with a small amount of SDF followed by a layer of sodium fluoride varnish on top of the cavity. The patient will be required to not rinse, eat or drink for 30 minutes after the application. SDF treatment does not eliminate the need for dental fillings or crowns to repair function or esthetics and such additional procedures will incur a separate fee.

Contraindications

The following patients should not receive SDF treatment:

- Patients allergic to silver.
- Patients with painful sores or raw areas on gums (i.e., ulcerative gingivitis) or anywhere in the mouth (i.e., stomatitis).
- Pregnant patients. (There are no known side effects of SDF treatment on unborn babies, but if you are pregnant or may be pregnant, discuss any concerns with the treating dental healthcare provider.)

Potential Side Effects

Patients may experience the side effects and risks related to SDF treatment, including, but not limited to:

- The affected area will stain black permanently. Healthy tooth structure will not stain. Stained tooth structure can be polished with fluoride varnish.



Figure 2. Root caries at baseline (left panel), 24 hrs after treatment (middle panel), and 7 days after treatment with diamine silver fluoride (right panel).

Castillo et al, JDR, 2010



Dr. Scott Eidson

Alternative Treatments for Tooth Decay

Alternatives to SDF treatment, include, but are not limited to the following:

- No treatment, which may lead to continued deterioration of tooth structures and cosmetic appearance. Symptoms may increase in severity.

Dr. LaRee Johnson & Dr. Clark Morris



Carolina Pediatric Dentistry

Johnson & Morris PLLC

E. LaRee Johnson, DDS, MS -- Pediatric Dentist
Diplomate of the American Board of Pediatric Dentistry
Clark L. Morris, DDS -- Pediatric Dentist
Diplomate of the American Board of Pediatric Dentistry

2800 Wakefield Pines Drive, Suite 110
Raleigh, NC 27614-6898
(919) 570-0180 fax (919) 570-0280
www.carolinapedo.com



Silver Diamine Fluoride Treatment Consent (SDF)

Patient Name: _____ Date of Birth: _____

Parent/Legal Guardian (print): _____

Silver diamine fluoride facts:

- Silver diamine fluoride (SDF) is an antibiotic liquid that is applied to an active area of decay (cavity) to kill the bacteria causing the cavity. It also prevents the formation of a plaque layer on the treated surface and strengthens the tooth.
- Procedure: 1. Dry the affected area. 2. Place a small amount of SDF on affected area. 3. Allow area to dry. 4. Rinse. 5. Apply fluoride varnish to all teeth including over SDF treated teeth (optional).
- Your child likely still will require treatment of the tooth/teeth (fillings, crowns and possibly nerve treatment) to restore the tooth to form and function. SDF is only the final treatment for some select teeth with cavities.

Benefits of receiving SDF:

- SDF can help stop tooth decay and help relieve tooth sensitivity.

Risks related to SDF include, but are not limited to:

- The areas of the tooth with active dental decay (cavity) will turn dark black. The healthy areas of the tooth will not be effected and will remain your child's natural tooth color. The black color indicates that the treatment is working as intended. Pits, defects and grooves in the enamel may turn black due to the presence of small enamel cavities.
- SDF will cause a metallic taste. This will go away quickly.
- Any tooth-colored fillings may experience discoloration if SDF is applied to them. This color change can usually be polished off.
- If SDF contacts the skin or gum during placement the area may stain a brown or white color. This stain should fade in 1-3 weeks. SDF will stain clothes if your child bumps the brush during application causing a splatter.
- If tooth decay is not stopped by SDF, further treatment may be necessary for a tooth which may include an additional treatment with SDF, filling, crown, nerve treatment or extraction.
- These side effects may not include all of the possible situations. If any other symptoms arise, please contact our office.

Alternative treatment options:

- No treatment allowing continued decay of tooth structure. Symptoms may increase in severity.
- Depending on the severity of the decay, other treatment options may include filling, crown, nerve treatment or extraction.

As a parent or legal guardian of the above patient, I grant Drs. Johnson and Morris permission to provide my child's dental treatment as presented. I also understand that this treatment may not be covered by my insurance (if applicable) and any estimates of insurance coverage discussed by any staff member at Carolina Pediatric Dentistry was provided to me as a courtesy. It is my responsibility to contact my child's dental insurance company, including any insurance provided to my child by the state, to discuss and understand my child's policy.

I agree to inform Drs. Johnson and Morris and the staff of Carolina Pediatric Dentistry of any changes in the patient's medical history. All risks, benefits and options for treatment have been explained. This authorization is valid until revoked by me in writing.

☐ My child does not have a silver allergy.

I CERTIFY THAT I HAVE READ AND FULLY UNDERSTAND THIS DOCUMENT AND ALL MY QUESTIONS WERE ANSWERED:

Parent/Legal Guardian Signature _____ Relationship to Patient _____ Date _____

Witness Signature _____ Witness Name _____ Date _____

Specialists in Dentistry for Infants, Children, Teens and Children with Special Needs
OFFICE HOURS Monday - Friday 6:45am - 5:00pm

Before Silver Diamine Fluoride Treatment



After Silver Diamine Fluoride Treatment





Case Selection is Critical

- Caries control approach: enamel – dentin caries not involving the pulp or associated with spontaneous pain.

Goals of Treatment



- Arrest caries process
- Prevent surgical treatment - sedation/GA
- Prevent pulpal involvement
- Subsequent restoration - consider need to replace form, function, esthetics



Clinical Application of Silver Diamine Fluoride

- Informed consent: patient/parent
- Protect counter surfaces - paper tray cover
- One drop of SDF
- Avoid SDF tattoos

Patient Preparation

- Eye protection
- Lip protection
- Napkin
- Clean lesion debris





Silver Diamine Fluoride Protocol

- Isolate area
- Moisten lesion
- Don't get SDF on soft tissues

Silver Diamine Fluoride Protocol

- Moisten carious lesion with SDF for 2-3 minutes
- Recommendation FDA – don't treat more than 5 lesions
- Place 5% NaF varnish over
- all teeth

Clinical Application Video
<https://www.youtube.com/watch?v=zxlvbhUx3QE>







Post SDF Treatment Protocol

- Return to office for recare visit 2-6 weeks
- Evaluate lesions for arrest at regular visits
- Reapply SDF to lesions not arrested

SDF Cost of Application



Advantage Arrest Silver Diamine Fluoride 38% - Bottle

Each bottle contains 8 mL of Tinted SDF

Quantity	Price
1	\$162.50
2	\$149.50
3 – 11	\$141.50
12 +	\$129.00





Advantage Arrest Silver Diamine Fluoride 38% - Unit-Dose Ampule


Box of 30 Ampules - Tinted, plus 30 each small and large applicators

Quantity	Price
1	\$122.50
2	\$116.50
3 +	\$109.50

Description
RIVA STAR SILVER DIAMINE FLUORIDE KIT SDI 8800504

Vendor
SDI

Promo
Reg Price
\$91.38 / KT



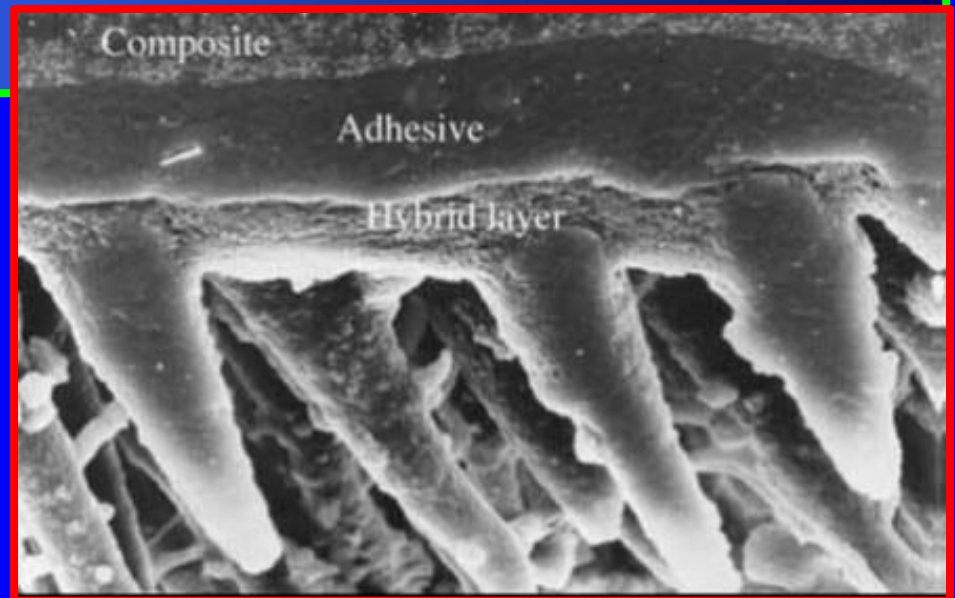
SDF Billing NC Medicaid

- ADA CDT Code 1354
- Interim caries arresting medicament application – per tooth
- NC Medicaid- reimburses \$10 for 1st tooth - \$5 additional teeth – Max \$25
- NC covers children under 5 years of age

Authors (Year)	Results
Studies on Primary Teeth	
Chu et al. (2002) (Lo e	SDF arrests lesions better than FV and nothing (1x/year: PF ~ 70-84%; better than FV ~44- 38% SDF better then lower concentrations
Llodra et al. (2005)	2x/year better than nothing in prevention and arrest No advantage to excavating caries % and 64% in
Yee et al. (2009)	38% more effective than 12% SDF
Zhi e	Repeated application increases benefit increasing the frequency of application to every 6 months can increase the caries arrest rate of SDF application.
doSantos et al. (2012)	SDF was more effective than interim restoration with GI for arresting caries in primary teeth.
Duangthip et al. (2015)	Annual or three consecutive weekly applications of SDF solution is more effective in arresting dentine caries in primary teeth than three consecutive weekly applications of NaF varnish.
Studies on Permanent Teeth Only (Occlusal surfaces)	
Braga et al. (2009)	All the tested techniques were equally efficient in controlling initial occlusal caries in erupting 1 st molars
Liu et al. (2012)	SDF equally effective to FV and sealant on sound/non-cavitated 1 st molars
Monse et al. (2012)	1X 38% SDF not an effective method to prevent dentinal (D3) caries lesions if brushing with F toothpaste. 1) ART sealants significantly reduced the onset of caries over a period of 18 months.

Effect of SDF on Bonding

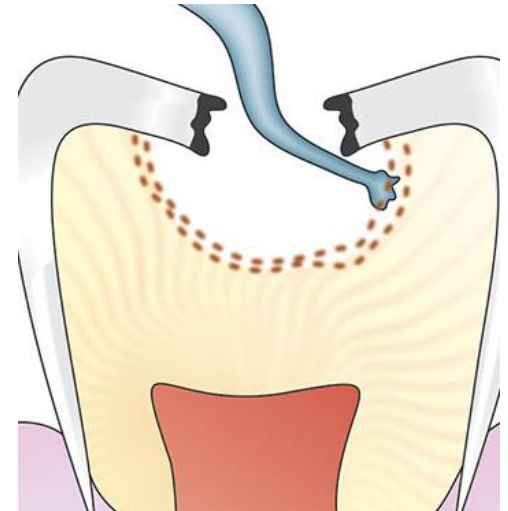
- Multiple studies on bond strength of SDF and SDF/KI
- Etch rinse - OK



Wu et al. Pediatr Dent. 2016



Non-surgical Restorative Approaches



ART – Atraumatic Restorative Treatment

- Traditionally involves hand instrument caries removal
- Restore cavity and adjacent fissures, usually with glass ionomer.



High Viscosity GIC vs Amalgam

- 20 trials reviewed
- Systematic Review - failure rate of GIC/ART similar to amalgam after periods longer than 6 years



SADJ 67:329-331, 2012



SMART Technique



The Hall Technique is a method for managing carious primary molars where decay is sealed under preformed metal crowns (PMCs) without local anaesthesia, tooth preparation or any caries removal.



Hall Crown Case Selection

- Non-inflamed pulp
 - No unsolicited pain and preferably no solicited pain (delineate food impaction from pulpal pain.
- Parental desire - esthetic crown





A random conventic metal cro

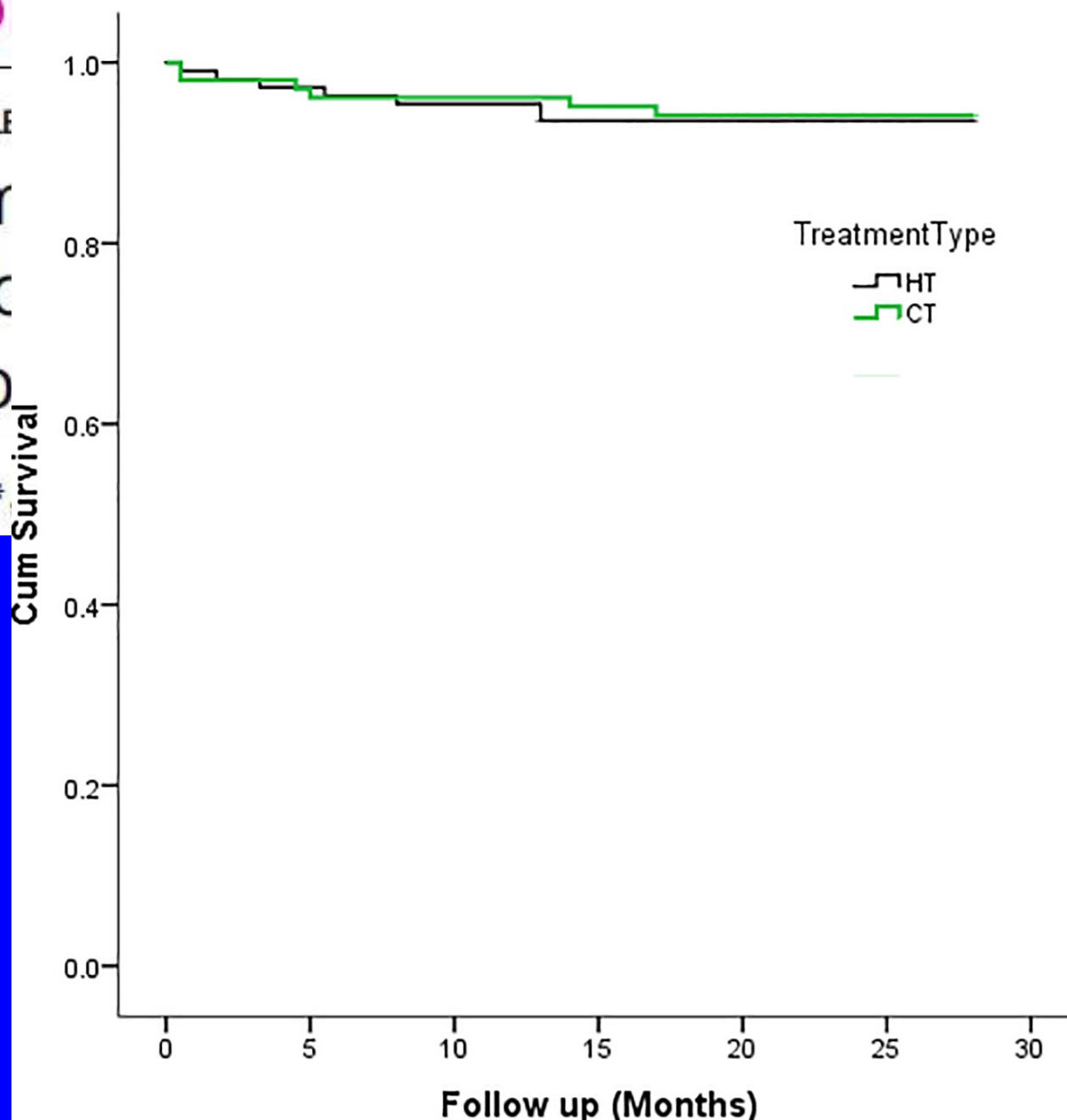
Fadil Elamin^{1,2*}

Survival Functions

ne 3, 2019

VS
red

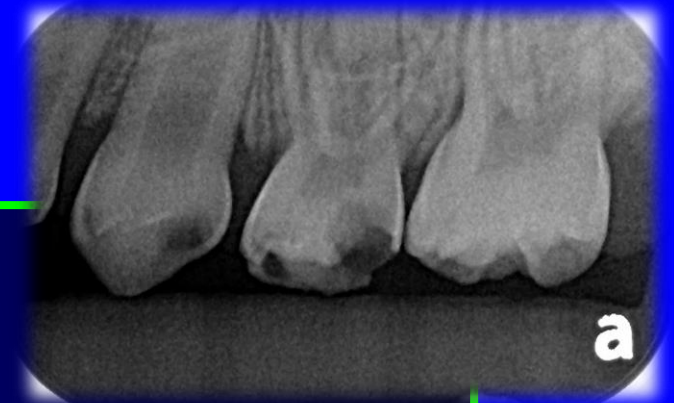
Wong¹



SUMMARY



- Case selection and consent!
- Consider goals of treatment
- Application of SDF is easy
- Mechanical caries removal
- Variety of non-aerosol approaches





Improving People's Lives
Through Improved Health

Questions

