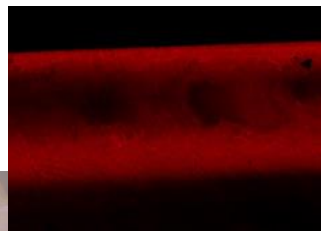


What we are teaching at UMSoD

Best practices for detection,
diagnosis, risk assessment,
prevention and non-restorative
management of dental caries



Margherita
Fontana



Livia
Tenuta



Carlos
Gonzalez

Program Specific Objectives

Cariology in the Curriculum

Detection and diagnosis of caries lesions

Risk assessment of patients a potential risk for dental caries

Evidence-based approaches and protocols for managing caries lesions and prevention of future ones, with special focus on fluorides

Cariology Clinical expectations and Competencies for dental students

Today's Plan

Caries Competency. Main philosophy

Dental Caries Prevention and Management

Fluorides

Break

Sealants

Others (OH, Diet, Ca-based Products, Antimicrobials, Sugar Alcohols, etc.)

Break

Detection, Diagnosis, Risk Assessment

Break

Cariology in the Curriculum

Cariology Clinical expectations and Competencies for dental students

Cariology Competency

...to prepare our graduates for **active independent learning, critical-thinking, problem-solving, and use of evidence-based information** for dental caries detection, diagnosis, risk assessment, prevention and management (both at the individual and population level)

Development of a Core Curriculum Framework in Cariology for U.S. Dental Schools

Margherita Fontana, Sandra Guzmán-Armstrong, Andrew B. Schenkel, Kenneth L. Allen, John Featherstone, Susie Goolsby, Preetha Kanjirath, Justine Kolker, Stefania Martignon, Nigel Pitts, Andreas Schulte, Rebecca L. Slayton, Douglas Young and Mark Wolff

Journal of Dental Education June 2016, 80 (6) 705-720;

Recommended “Caries Management” Competency

Upon graduation a dentist must be competent in evidence-based detection, diagnosis, risk assessment, prevention, nonsurgical and surgical management of dental caries, both at the individual and community level, and be able to re-assess the outcomes of interventions over time.



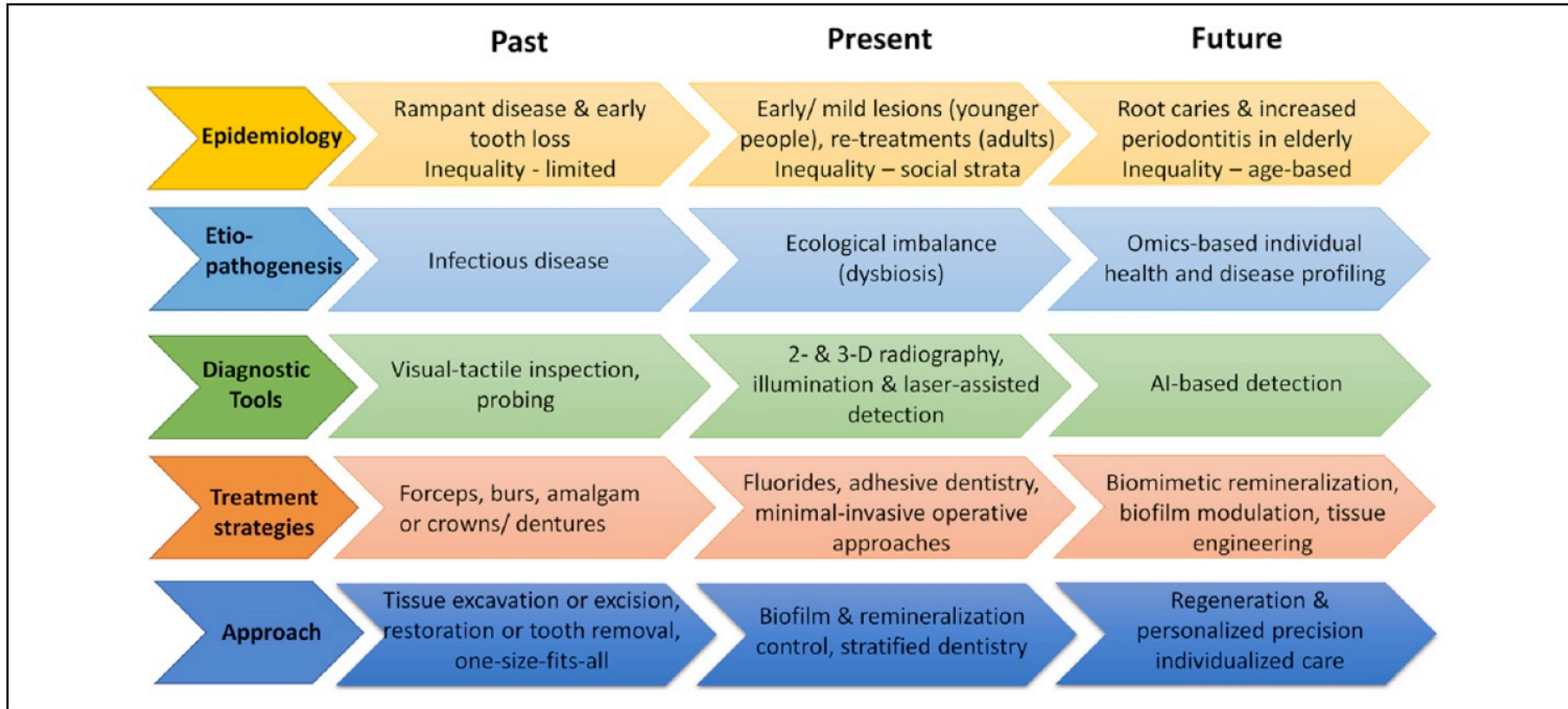
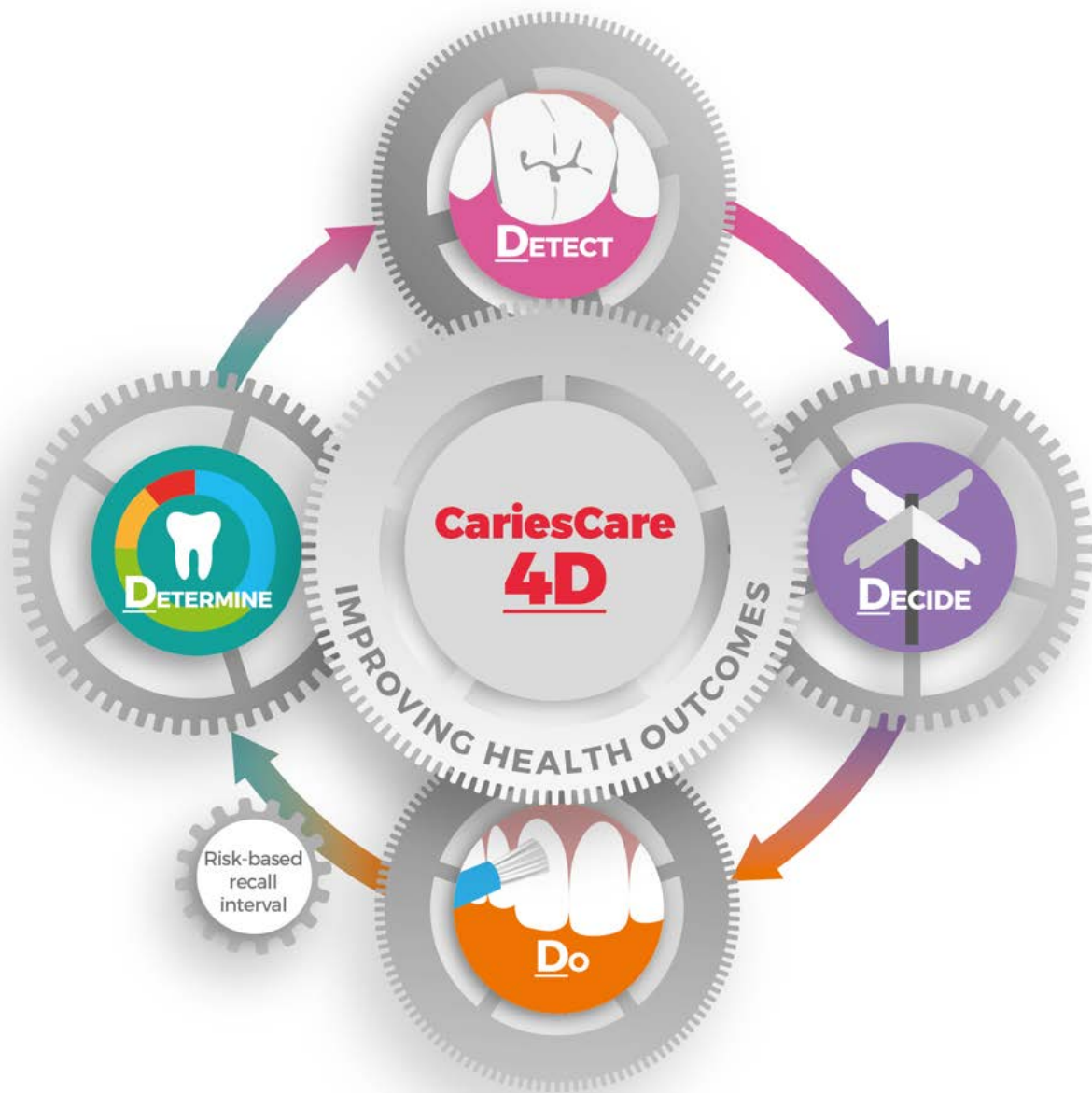


Figure. Past, present, and future aspects of prevention and minimal intervention in cariology.

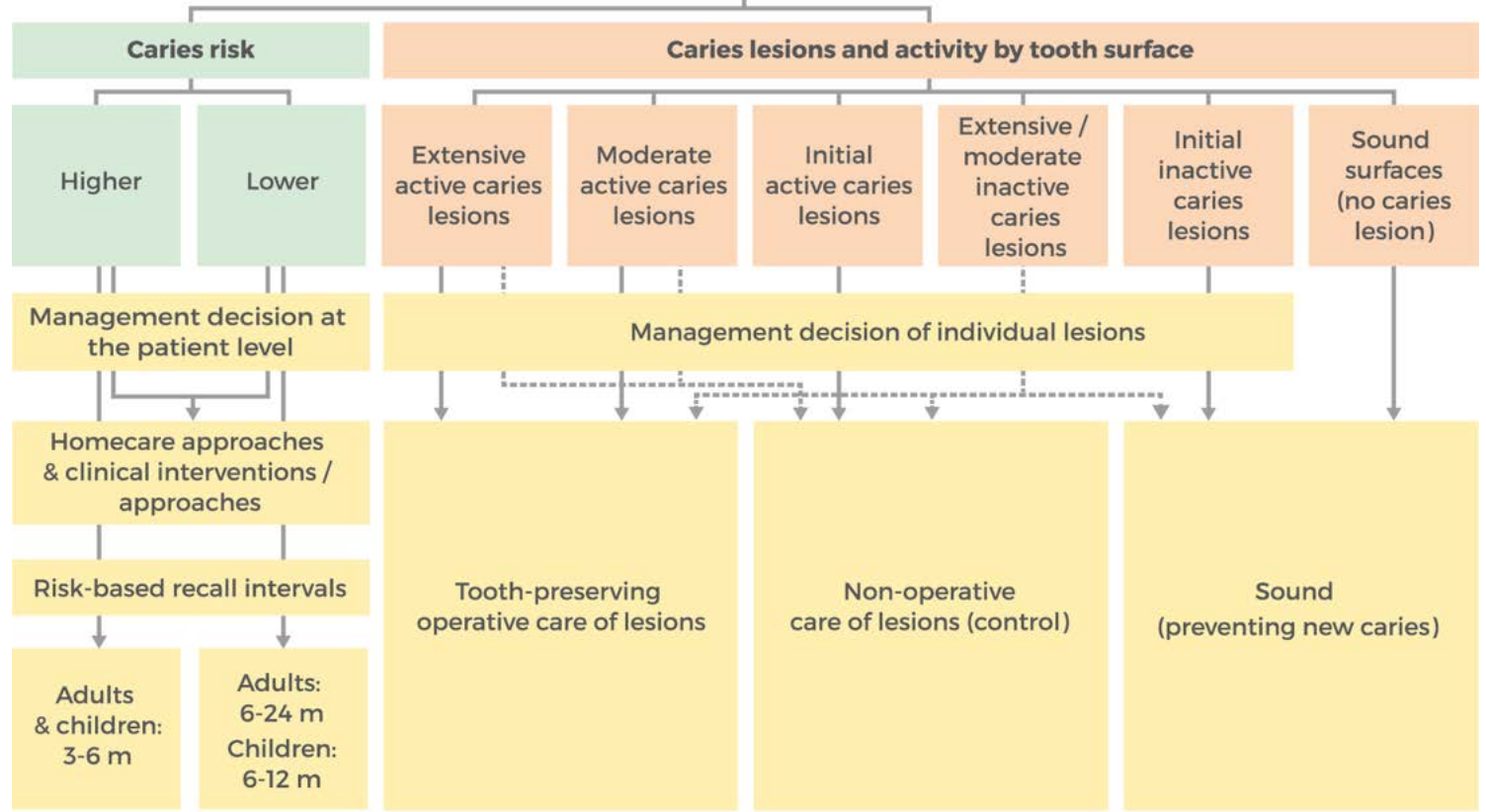


ICCMS™ 4D
Caries Management





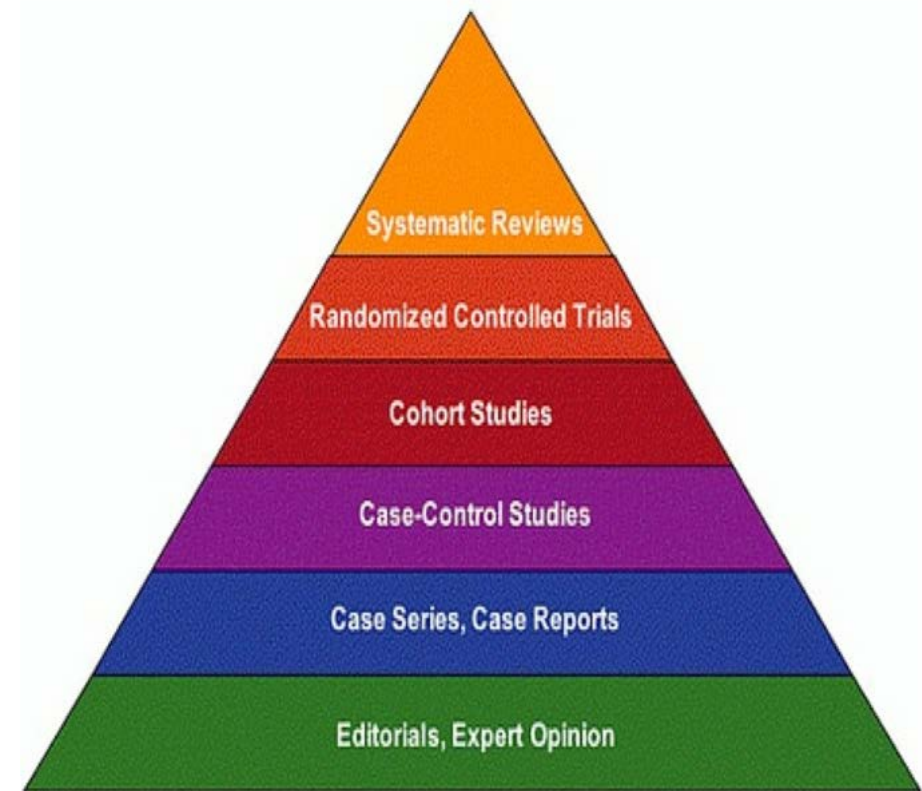
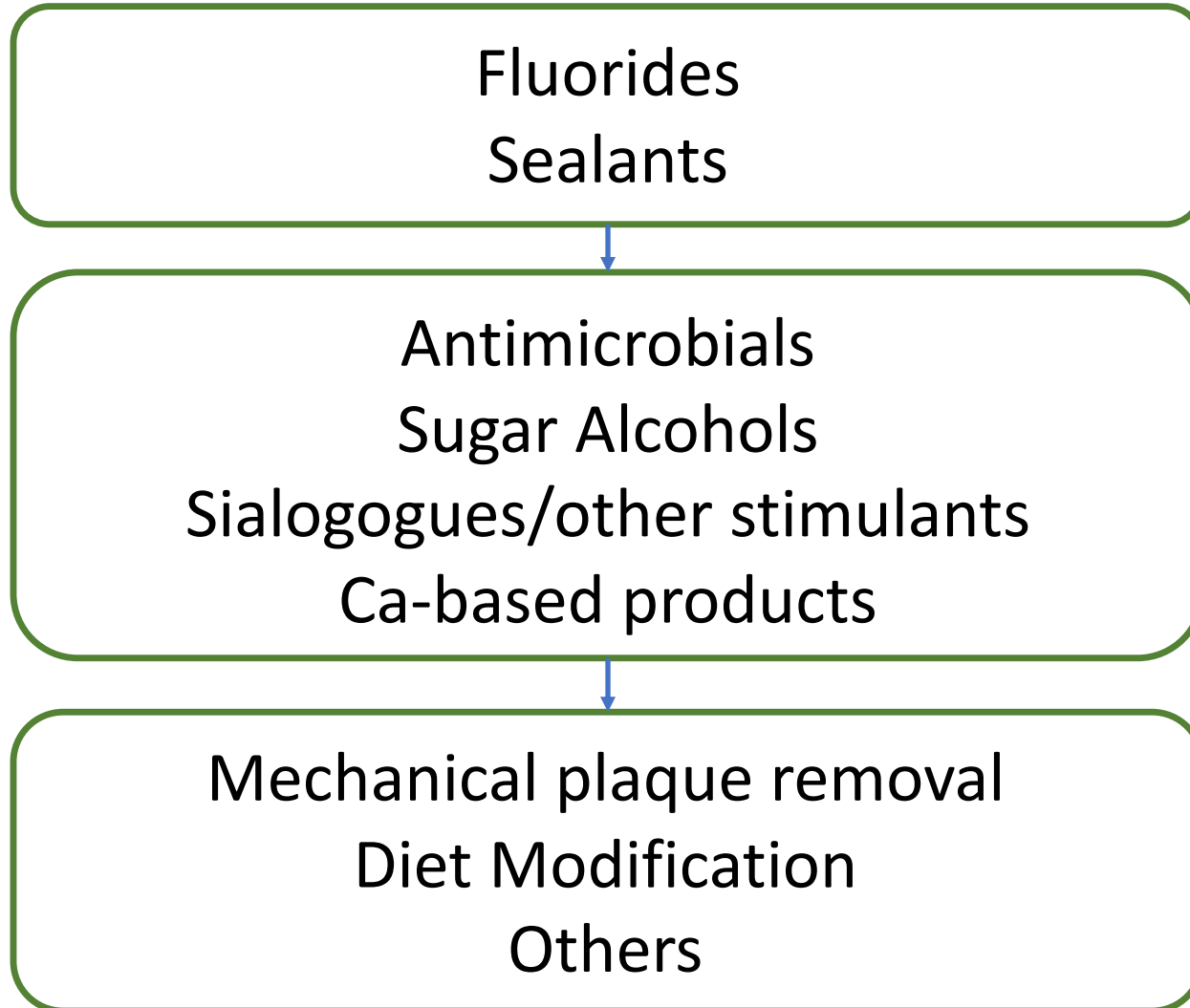
**MANAGEMENT OPTIONS:
Personalised caries prevention, control
& tooth preserving operative care plan**



→ leads to - in most cases

-----> leads to - in some cases

Non-Operative Management Options



**How to best use
fluoride in our clinics?**

Summary

- How **fluoride** works to inform your clinical decisions
- The evidence and the guidelines
- A bit about **root caries**
- Some clinically relevant tips
- Q & A

How does **fluoride** work in caries control?

Pre-eruptive effect

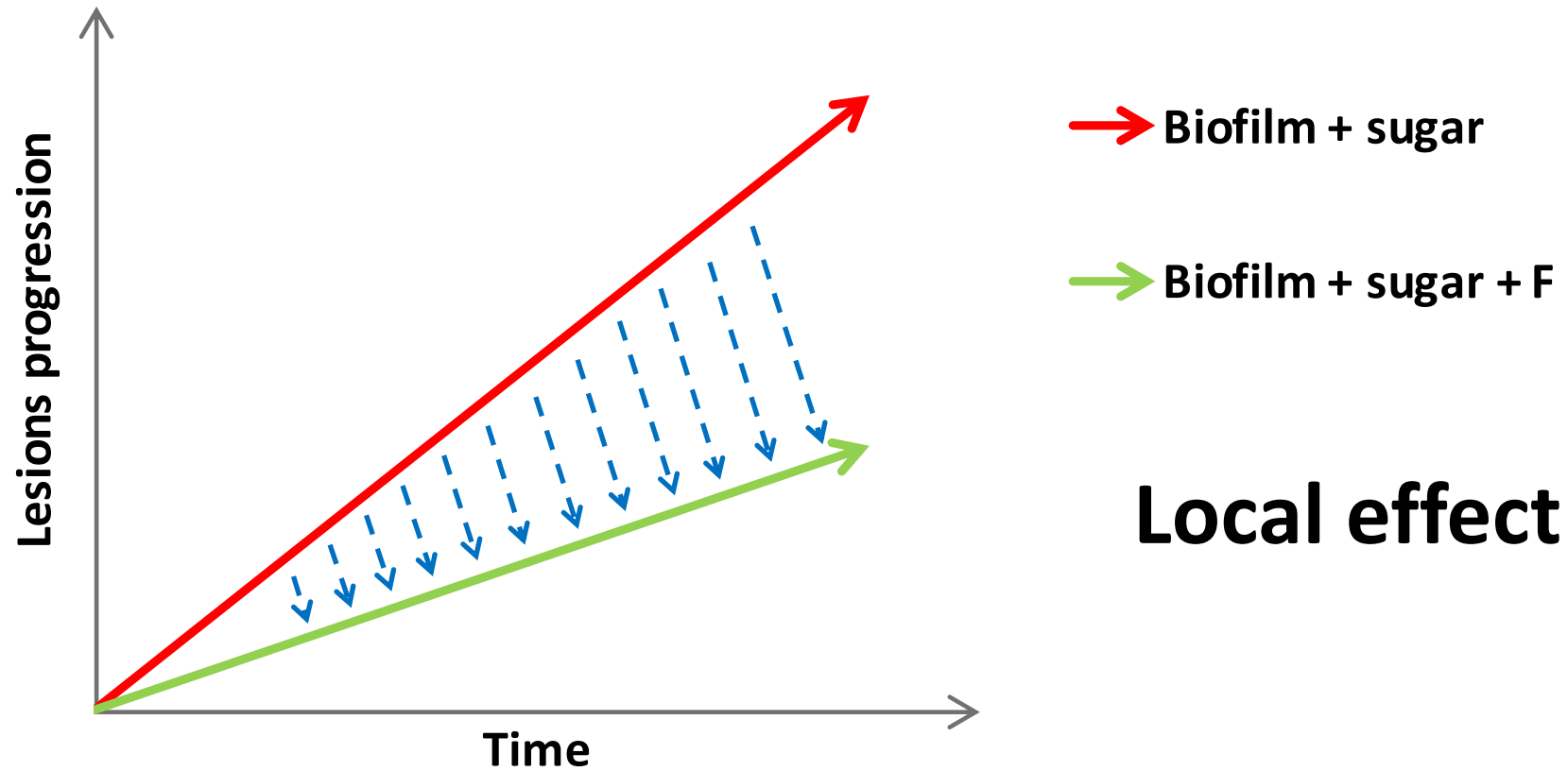
Post-eruptive effect

Reducing tooth **demineralization**

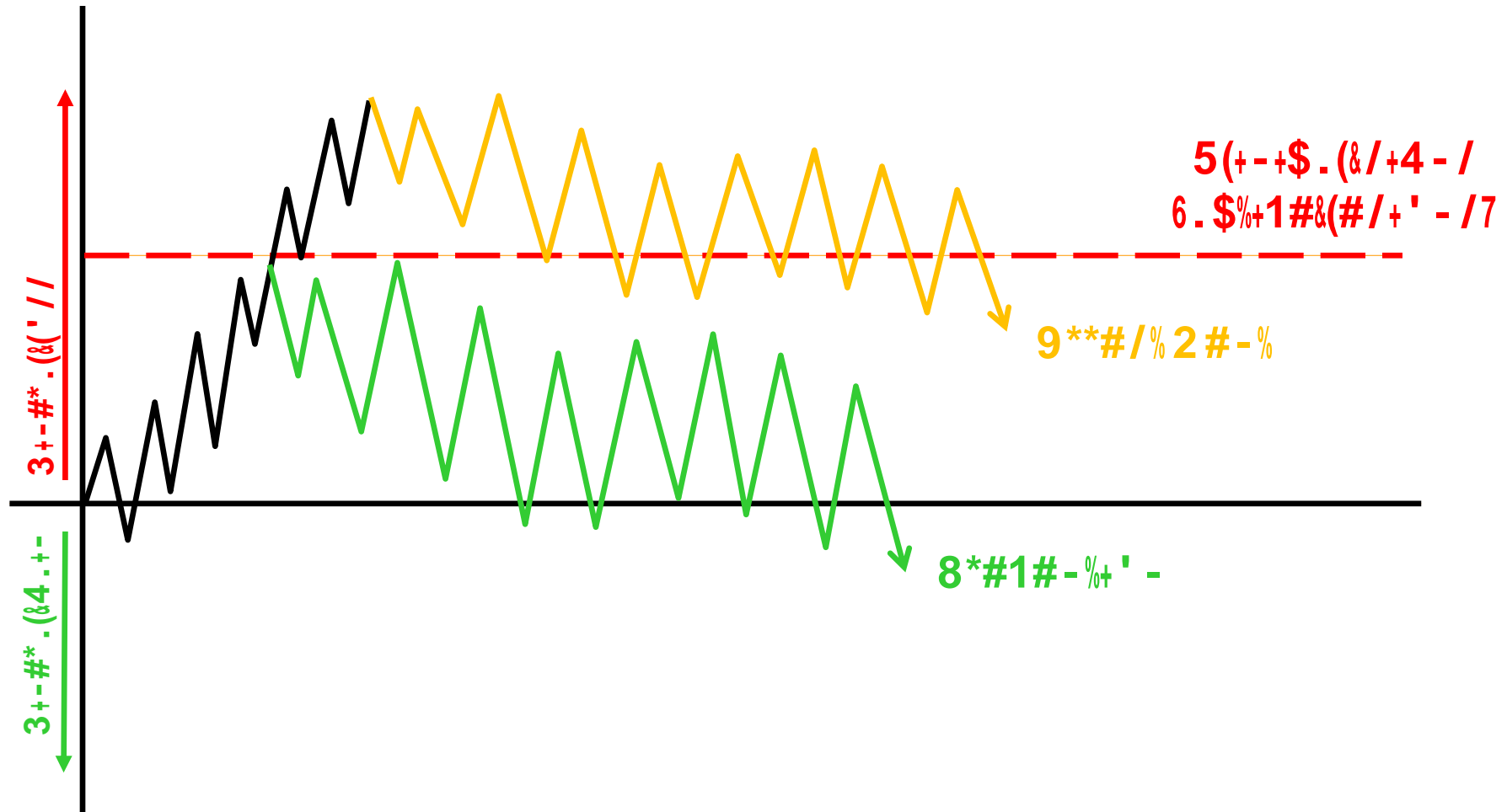
Enhancing tooth **remineralization**

Antimicrobial?

Effect of fluoride on caries lesions progression



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 ' * & . * * # / % 2 # - %



Methods of fluoride use

- **Community level**

Fluoridated water
Fluoridated salt
Fluoridated milk



- **Individual level**

Fluoride toothpastes
Fluoride rinses
Fluoride tablets



- **Professional use**

Fluoride varnishes
Fluoride gels/foams
Fluoride solutions
Fluoride-releasing
dental materials

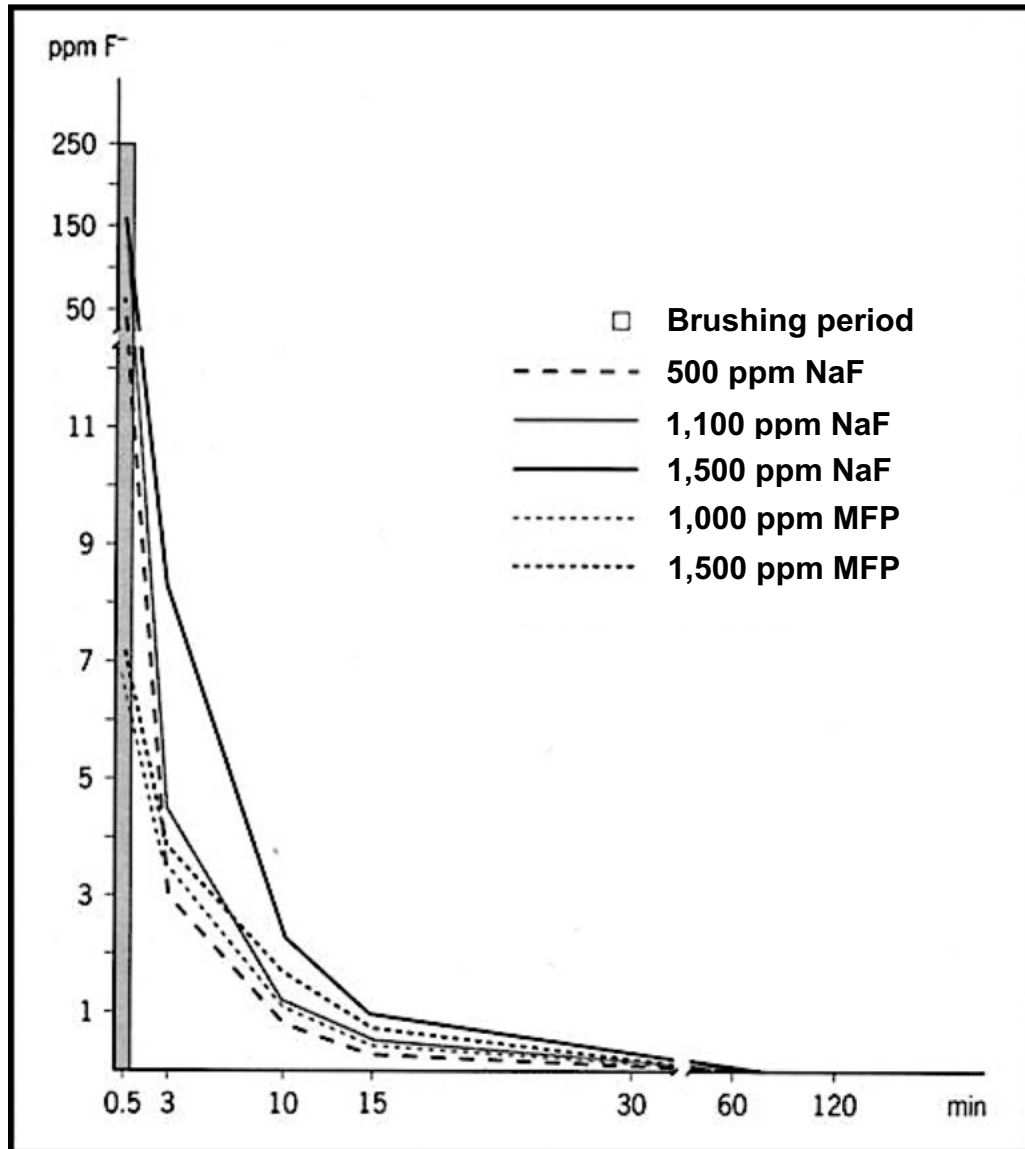
The aim is to keep
F available in the
oral fluids

MOUTHRINSES		
0.01% F	100 ppm F or 0.02% NaF	<div style="border: 2px solid blue; border-radius: 50%; padding: 5px; display: inline-block;">SELF-APPLIED PRODUCTS</div>
0.02% F	226 ppm F or 0.05% NaF	
0.09% F	905 ppm F or 0.2 % NaF	
DENTIFRICES		
0.10% F	1,000 ppm F or 0.76% SMFP	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="width: 15px; height: 15px; background-color: #90EE90; margin-right: 5px;"></div> Over-the-counter </div> <div style="display: flex; align-items: center;"> <div style="width: 15px; height: 15px; background-color: #FFD700; margin-right: 5px;"></div> Needs prescription </div> </div>
0.11% F	1,100 ppm F or 0.243% NaF	
0.11% F	1,100 ppm F or 0.454% SnF ₂	
0.5% F	5,000 ppm F or 1.1% NaF	

Fernández & González-Cabezas, 2015



Toothpastes and mouth rinses maintain increased fluoride concentrations in the oral fluids for 1-2 h after use



Bruun, Givskov, Thylstrup. Caries Res 1984

Rinsing with water after brushing reduces the anticaries effect of fluoride dentifrices

O'Mullane et al., 1997

- DMFS increment after 3 years
- Cup: 4.5 No Cup: 3.9

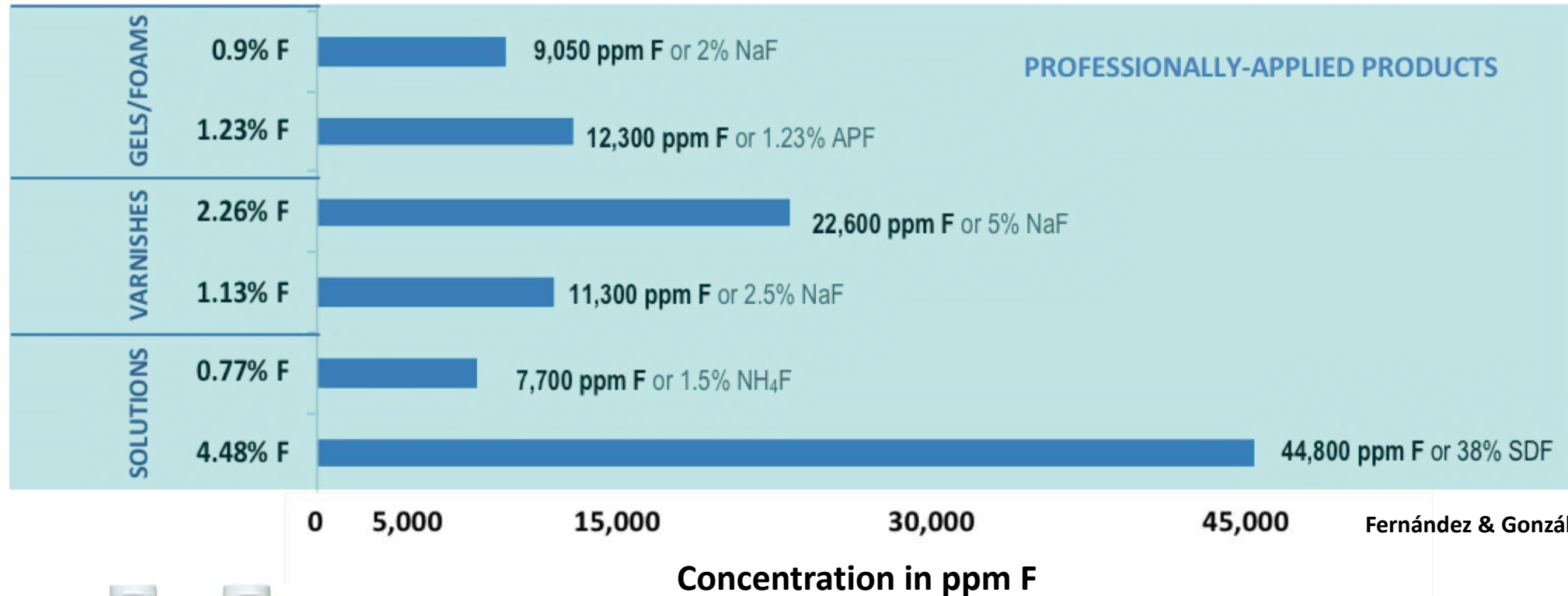
Chestnutt et al., 1988

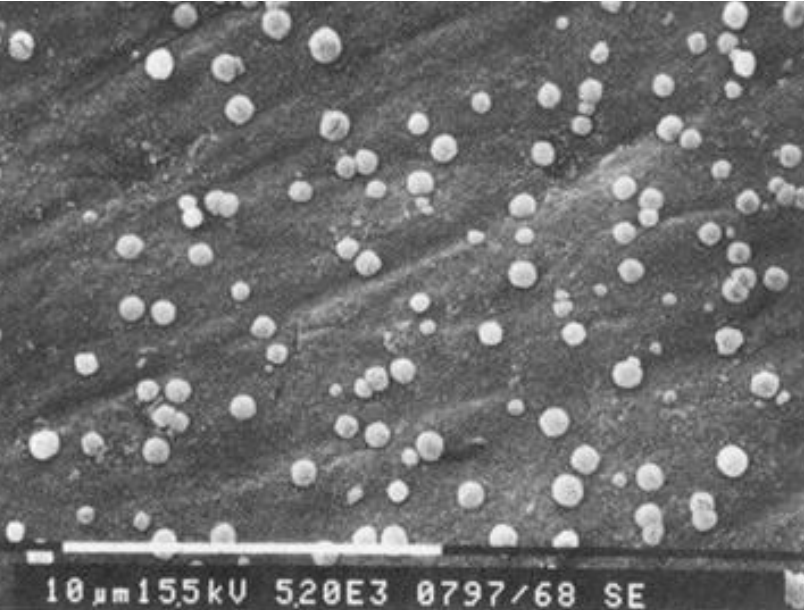
- DMFS increment after 3 years
- Beaker: 6.8 Non beaker: 5.8

Ashley et al., 1999

- DMFT linearly increasing from groups not rinsing at all to those rinsing with more water

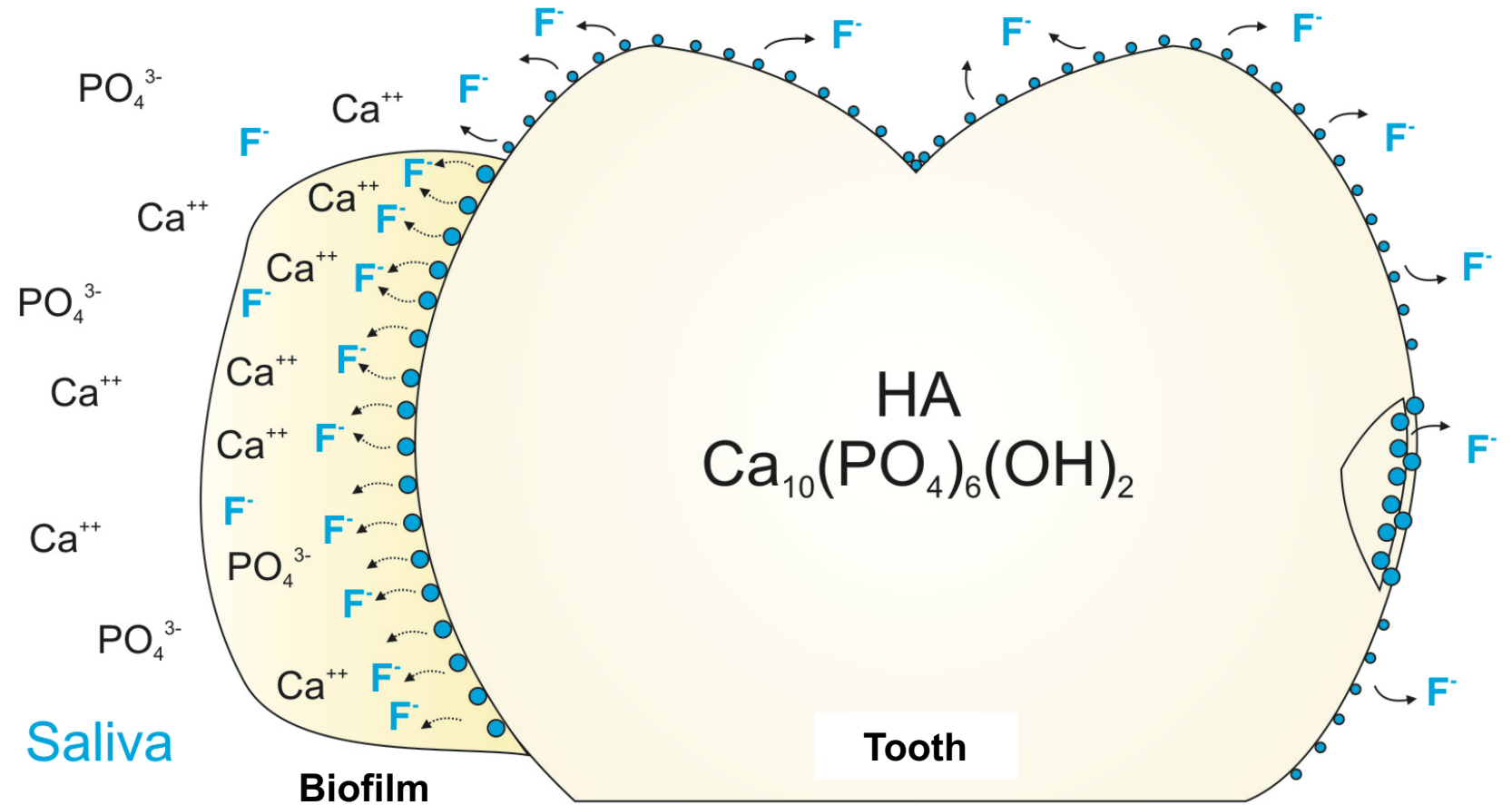
Professionally applied fluoride





CRUZ, 1999

Fluoride from gels and varnishes react with the tooth structure forming fluoride reservoirs (CaF₂-like)



The evidence and the guidelines

[Intervention Review]

Fluoride mouthrinses for preventing dental caries in children and adolescents

Valeria CC Marinho¹, Lee Yee Chong², Helen V Worthington³, Tanya V

¹Clinical and Diagnostic Oral Sciences, Barts and The London School of Dentistry, London, UK. ²UK Cochrane Centre, Oxford, UK. ³Cochrane Oral Health, London, UK. ⁴Division of Dentistry, School of Medical Sciences, Faculty of Bio

Contact address: Valeria CC Marinho, Clinical and Diagnostic Oral Sciences, Queen Mary University of London, Turner Street, Whitechapel, London, UK.

Editorial group: Cochrane Oral Health Group.
Publication status and date: Edited (no change to conclusions), published 2016.

Citation: Marinho VCC, Chong LY, Worthington HV, Walsh T. Fluoride mouthrinses for preventing dental caries in children and adolescents. *Cochrane Database of Systematic Reviews* 2016, Issue 7.

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ABSTRACT

Background

Fluoride mouthrinses have been used extensively as a caries-preventive measure. This is an update of the Cochrane review of fluoride mouthrinses first published in 2003.

Objectives

The primary objective is to determine the effectiveness and safety of fluoride mouthrinses in children and adolescents.

The secondary objective is to examine whether the effect of fluoride

- initial level of caries severity;
- background exposure to fluoride in water (or salt), toothpastes or
- fluoride concentration (ppm F) or frequency of use (times per year)

Search methods

We searched the following electronic databases: Cochrane Oral Health Central Register of Controlled Trials (CENTRAL) (the Cochrane Library (1980 to 22 April 2016), CINAHL EBSCO (the Cumulative Index to Nursing and Biomedical Literature (1986 to 22 April 2016), Proquest Dissertation: Proceedings (1990 to 22 April 2016). We undertook a search for ongoing clinical trials (clinicaltrials.gov) and the World Health Organization International Clinical Trials Registry Platform when searching electronic databases. We also contacted authors and manufacturers.

[Intervention Review]

Fluoride varnishes for preventing dental caries in children and adolescents

Valeria CC Marinho¹, Helen V Worthington², Tanya Walsh³, Jan E Clarke

¹Clinical and Diagnostic Oral Sciences, Barts and The London School of Dentistry, London, UK. ²Cochrane Oral Health Group, School of Dentistry, The University of Manchester, Manchester, UK. ³Dental Health Services Research, Manchester, UK. ⁴Dental Health Services Research, Manchester, UK.

Contact address: Helen V Worthington, Cochrane Oral Health Group, 5 Building, Oxford Road, Manchester, M13 9PL, UK. helen.worthington@man.ac.uk

Editorial group: Cochrane Oral Health Group.
Publication status and date: Edited (no change to conclusions), published 2013.

Citation: Marinho VCC, Worthington HV, Walsh T, Clarkon JE. Fluoride varnishes for preventing dental caries in children and adolescents. *Cochrane Database of Systematic Reviews* 2013, Issue 7. Art. No.: CD007868.

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ABSTRACT

Background

Typically-applied fluoride varnishes have been used extensively as a caries-preventive measure. This review updates the first Cochrane review of fluoride varnishes first published in 2002.

Objectives

To determine the effectiveness and safety of fluoride varnishes in preventing dental caries in children and adolescents.

Search methods

We searched the Cochrane Oral Health Group's Trials Register (to 13 May 2013), MEDLINE via OVID (1946 to 13 May 2013), LILACS and BBO via the BIREME Virtual Health Library (1986 to 13 May 2013), and Web of Science Conference Proceedings (1990 to 13 May 2013). There were no restrictions on language or date of publication.

Selection criteria

Randomised or quasi-randomised controlled trials with blind outcome assessment comparing a fluoride varnish with placebo or no treatment in children up to 16 years during at least one dental visit.

Data collection and analysis

At least two review authors assessed all search results, extracted data and contacted authors for additional information. The primary measure of effect was the difference in decayed, missing and filled tooth surfaces (DMFS) between the treatment and control groups expressed as a percentage. Potential sources of heterogeneity were examined in randomised controlled trials.

[Intervention Review]

Fluoride gels for preventing dental caries in children and adolescents

Valeria CC Marinho¹, Helen V Worthington², Tanya Walsh³, Lee Yee Chong

¹Clinical and Diagnostic Oral Sciences, Barts and The London School of Dentistry, London, UK. ²Cochrane Oral Health Group, School of Dentistry, The University of Manchester, Manchester, UK. ³UK Cochrane Centre, Oxford, UK. ⁴UK Cochrane Centre, Oxford, UK.

Contact address: Valeria CC Marinho, Clinical and Diagnostic Oral Sciences, Queen Mary University of London, Turner Street, Whitechapel, London, UK.

Editorial group: Cochrane Oral Health Group.
Publication status and date: New search for studies and content updated 2015.

Citation: Marinho VCC, Worthington HV, Walsh T, Chong LY. Fluoride gels for preventing dental caries in children and adolescents. *Cochrane Database of Systematic Reviews* 2015, Issue 6. Art. No.: CD007868.

Copyright © 2015 The Cochrane Collaboration. Published by John Wiley & Sons.

ABSTRACT

Background

Typically applied fluoride gels have been widely used as a caries-preventive measure for over three decades. This updates the Cochrane review of fluoride gels first published in 2002.

Objectives

The primary objective is to determine the effectiveness and safety of fluoride gels in preventing dental caries in children and adolescents.

The secondary objectives are to examine whether the effect of fluoride gel background exposure to fluoride in water (or salt), toothpastes, or rinses (self applied under supervision or operator-applied), and whether the frequency of application; frequency of use (times per year) or fluoride concentration.

Search methods

We searched the Cochrane Oral Health Group Trials Register (to 5 May 2015) (CENTRAL) (Cochrane Library 2014, Issue 11), MEDLINE via OVID (1946 to 5 November 2014), LILACS and BBO via the BIREME Virtual Health Library (1986 to 5 November 2014) and Web of Science Conference Proceedings (1990 to 5 November 2014) and Web of Science Conference Proceedings (1990 to 5 November 2014) and Web of Science Conference Proceedings (1990 to 5 November 2014) and Web of Science Conference Proceedings (1990 to 5 November 2014).

Selection criteria

Randomised or quasi-randomised controlled trials where blind outcome assessment comparing a fluoride gel with placebo or no treatment in children up to 16 years. The main outcome was caries increment in both permanent and primary teeth (DMFS) and d(e/m)fs.

[Intervention Review]

Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents

Tanya Walsh¹, Helen V Worthington², Anne-Marie Glenny¹, Valeria CC Marinho³, Ana Jeroncic⁴

¹Division of Dentistry, School of Medical Sciences, Faculty of Biology, Medicine and Health, The University of Manchester, Manchester, UK. ²Cochrane Oral Health, Division of Dentistry, School of Medical Sciences, Faculty of Biology, Medicine and Health, The University of Manchester, Manchester, UK. ³Clinical and Diagnostic Oral Sciences, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, UK. ⁴Department of Research in Biomedicine and Health, University of Split School of Medicine, Split, Croatia

Contact address: Tanya Walsh, Division of Dentistry, School of Medical Sciences, Faculty of Biology, Medicine and Health, The University of Manchester, Coupland Building 3, Oxford Road, Manchester, M13 9PL, UK. tanya.walsh@manchester.ac.uk

Editorial group: Cochrane Oral Health Group.
Publication status and date: Edited (no change to conclusions), published in Issue 11, 2019.

Citation: Walsh T, Worthington HV, Glenny AM, Marinho VCC, Jeroncic A. Fluoride toothpastes of different concentrations for preventing dental caries. *Cochrane Database of Systematic Reviews* 2019, Issue 3. Art. No.: CD007868. DOI: [10.1002/14651858.CD007868.pub3](https://doi.org/10.1002/14651858.CD007868.pub3).

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ABSTRACT

Background

Caries (dental decay) is a disease of the hard tissues of the teeth caused by an imbalance, over time, in the interactions between cariogenic bacteria in dental plaque and fermentable carbohydrates (mainly sugars). Regular toothbrushing with fluoride toothpaste is the principal non-professional intervention to prevent caries, but the caries-preventive effect varies according to different concentrations of fluoride in toothpaste, with higher concentrations associated with increased caries control. Toothpastes with higher fluoride concentration increase the risk of fluorosis (enamel defects) in developing teeth. This is an update of the Cochrane Review first published in 2010.

Objectives

To determine and compare the effects of toothpastes of different fluoride concentrations (parts per million (ppm)) in preventing dental caries in children, adolescents, and adults.

Search methods

Cochrane Oral Health's Information Specialist searched the following databases: Cochrane Oral Health's Trials Register (to 15 August 2018); the Cochrane Central Register of Controlled Trials (CENTRAL; 2018, Issue 7) in the Cochrane Library (searched 15 August 2018); MEDLINE Ovid (1946 to 15 August 2018); and Embase Ovid (1980 to 15 August 2018). The US National Institutes of Health Ongoing Trials Register (ClinicalTrials.gov) and the World Health Organization International Clinical Trials Registry Platform were searched for ongoing trials (15 August 2018). No restrictions were placed on the language or date of publication when searching the electronic databases.

Selection criteria

Randomised controlled trials that compared toothbrushing with fluoride toothpaste with toothbrushing with a non-fluoride toothpaste or toothpaste of a different fluoride concentration, with a follow-up period of at least 1 year. The primary outcome was caries increment measured by the change from baseline in the decayed, (missing), and filled surfaces or teeth index in all permanent or primary teeth (D(M)FS/T or d(m)fs/t).

Data collection and analysis

Two members of the review team, independently and in duplicate, undertook the selection of studies, data extraction, and risk of bias assessment. We graded the certainty of the evidence through discussion and consensus. The primary effect measure was the mean

Caries Management for the Modern Age: Improving Practice one Guideline At a Time

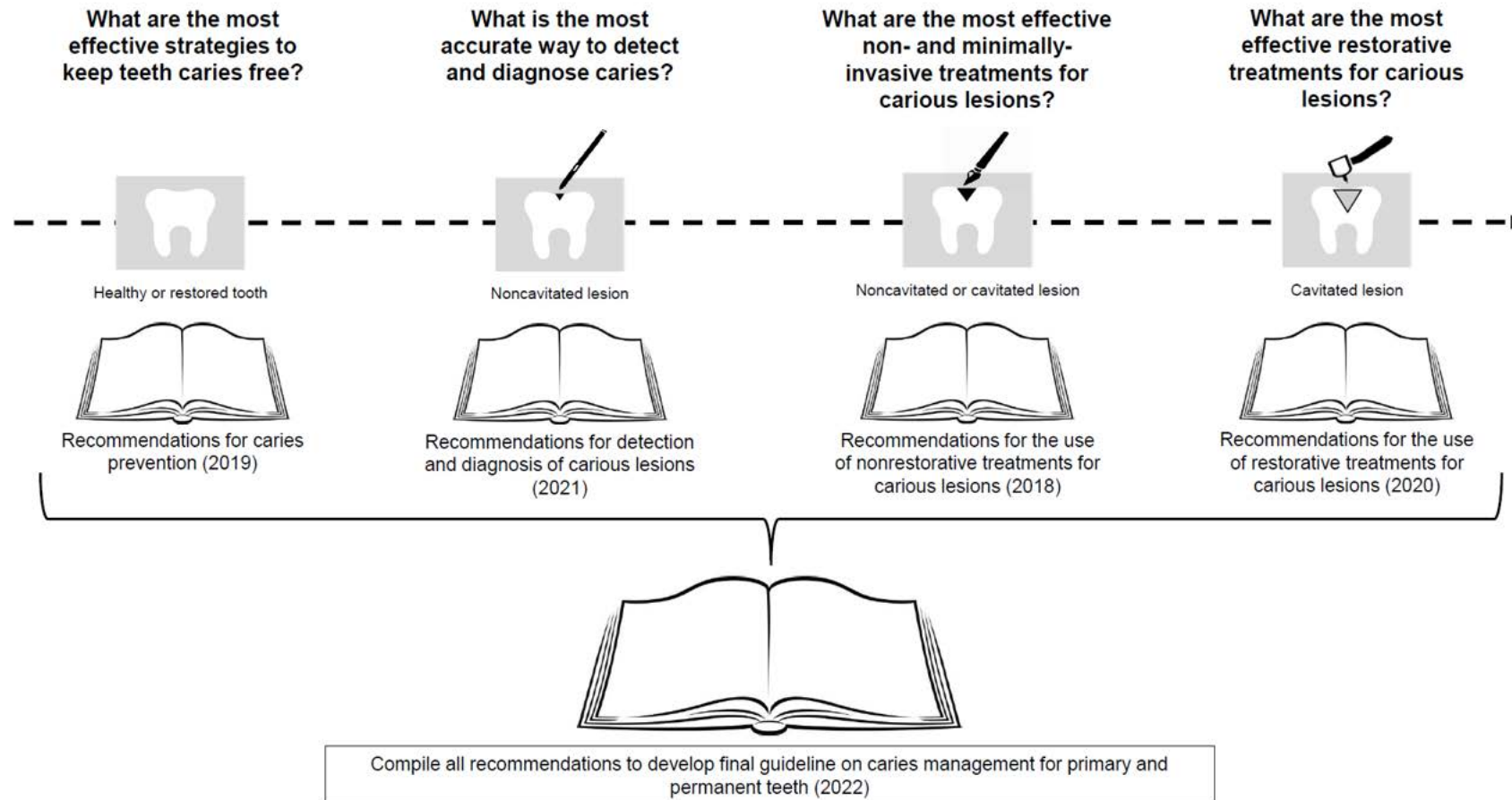


Figure1 . Timing and scope of each chapter for the ADA clinical practice guideline series on caries management

Topical fluoride for caries prevention

Executive summary of the updated clinical recommendations and supporting systematic review

Robert J. Weyant, DMD, DrPH; Sharon L. Tracy, PhD; Theresa (Tracy) Anselmo, MPH, BSDH, RDH; Eugenio D. Beltrán-Aguilar, DMD, MPH, MS, DrPH; Kevin J. Donly, DDS, MS; William A. Frese, MD; Philippe P. Hujoel, MSD, PhD; Timothy Iafolla, DMD, MPH; William Kohn, DDS; Jayanth Kumar, DDS, MPH; Steven M. Levy, DDS, MPH; Norman Tinanoff, DDS, MS; J. Timothy Wright, DDS, MS; Domenick Zero, DDS, MS; Krishna Aravamudhan, BDS, MS; Julie Frantsve-Hawley RDH, PhD; Daniel M. Meyer, DDS; for the American Dental Association Council on Scientific Affairs Expert Panel on Topical Fluoride Caries Preventive Agents

JADA 144(11) <http://jada.ada.org> November 2013

TABLE 4

Clinical recommendations for use of professionally applied or prescription-strength, home-use topical fluorides for caries prevention in patients at elevated risk of developing caries.

Strength of recommendations: Each recommendation is based on the best available evidence. The level of evidence available to support each recommendation may differ.

 Strong Evidence strongly supports providing this intervention	 In favor Evidence favors providing this intervention	 Weak Evidence suggests implementing this intervention only after alternatives have been considered	 Expert Opinion For Evidence is lacking; the level of certainty is low. Expert opinion guides this recommendation	 Expert Opinion Against Evidence is lacking; the level of certainty is low. Expert opinion suggests not implementing this intervention	 Against Evidence suggests not implementing this intervention or discontinuing ineffective procedures
---	--	--	--	---	--

Age Group or Dentition Affected	Professionally Applied Topical Fluoride Agent	Prescription-Strength, Home-Use Topical Fluoride Agent
Younger Than 6 Years	2.26 percent fluoride varnish at least every three to six months ● In Favor	
6-18 Years	2.26 percent fluoride varnish at least every three to six months ● In Favor OR 1.23 percent fluoride (APF*) gel for four minutes at least every three to six months ● In Favor	0.09 percent fluoride mouthrinse at least weekly ● In Favor OR 0.5 percent fluoride gel or paste twice daily ● Expert Opinion For
Older Than 18 Years	2.26 percent fluoride varnish at least every three to six months ● Expert Opinion For OR 1.23 percent fluoride (APF) gel for four minutes at least every three to six months ● Expert Opinion For	0.09 percent fluoride mouthrinse at least weekly ● Expert Opinion For OR 0.5 percent fluoride gel or paste twice daily ● Expert Opinion For
Adult Root Caries	2.26 percent fluoride varnish at least every three to six months ● Expert Opinion For OR 1.23 percent fluoride (APF) gel for four minutes at least every three to six months ● Expert Opinion For	0.09 percent fluoride mouthrinse daily ● Expert Opinion For OR 0.5 percent fluoride gel or paste twice daily ● Expert Opinion For

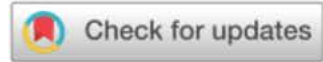
Practice Guidelines

Cover Story

Evidence-based clinical practice guideline on nonrestorative treatments for carious lesions

A report from the American Dental Association

Rebecca L. Slayton, DDS, PhD; Olivia Urquhart, MPH; Marcelo W.B. Araujo, DDS, MS, PhD; Margherita Fontana, DDS, PhD; Sandra Guzmán-Armstrong, DDS, MS; Marcelle M. Nascimento, DDS, MS, PhD; Brian B. Nový, DDS; Norman Tinanoff, DDS, MS; Robert J. Weyant, DMD, DrPH; Mark S. Wolff, DDS, PhD; Douglas A. Young, DDS, EdD, MS, MBA; Domenick T. Zero, DDS, MS; Malavika P. Tampi, MPH; Lauren Pilcher, MSPH; Laura Banfield, MLIS, MHSc; Alonso Carrasco-Labra, DDS, MSc



Supplemental material
is available online.

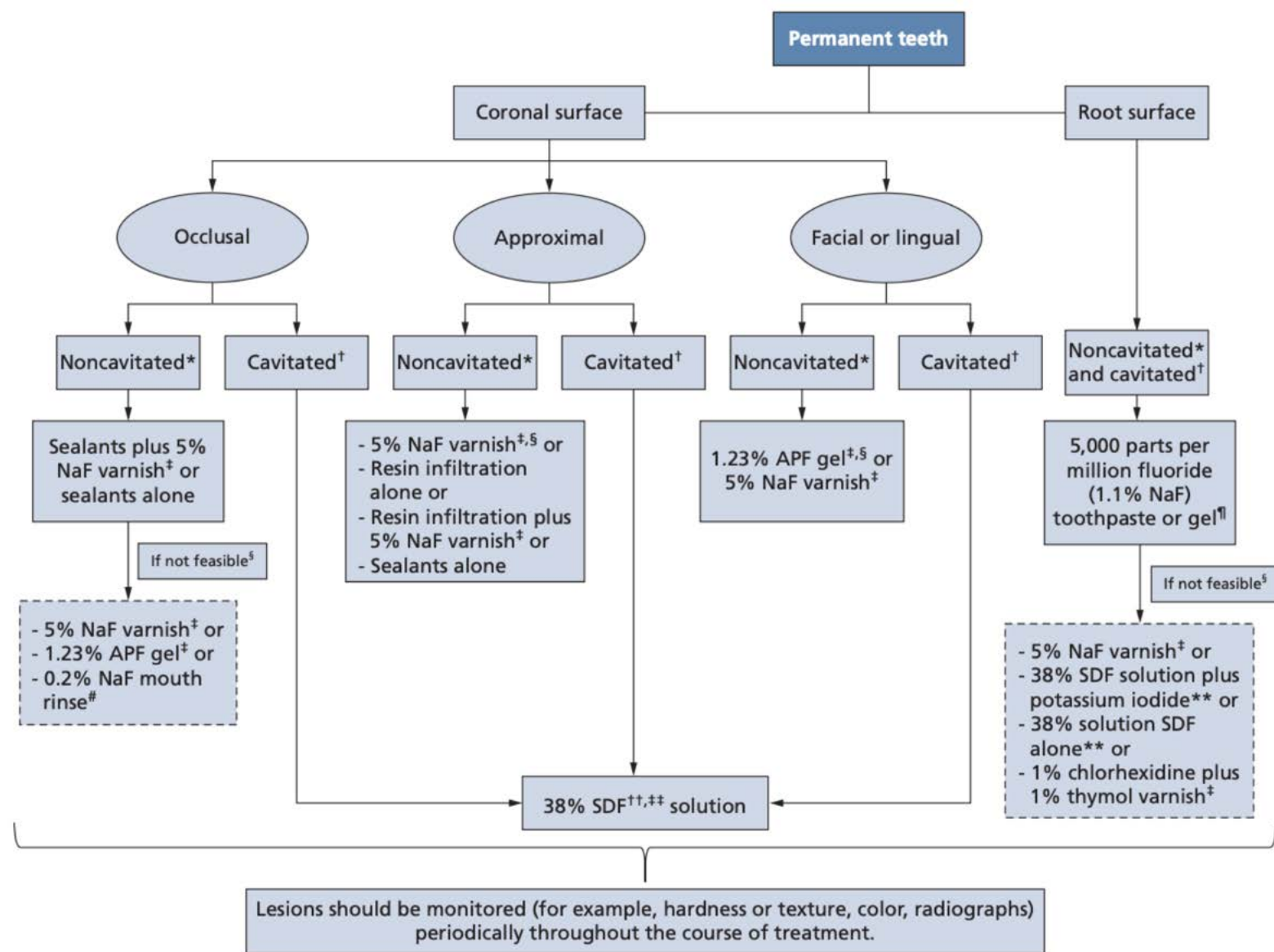
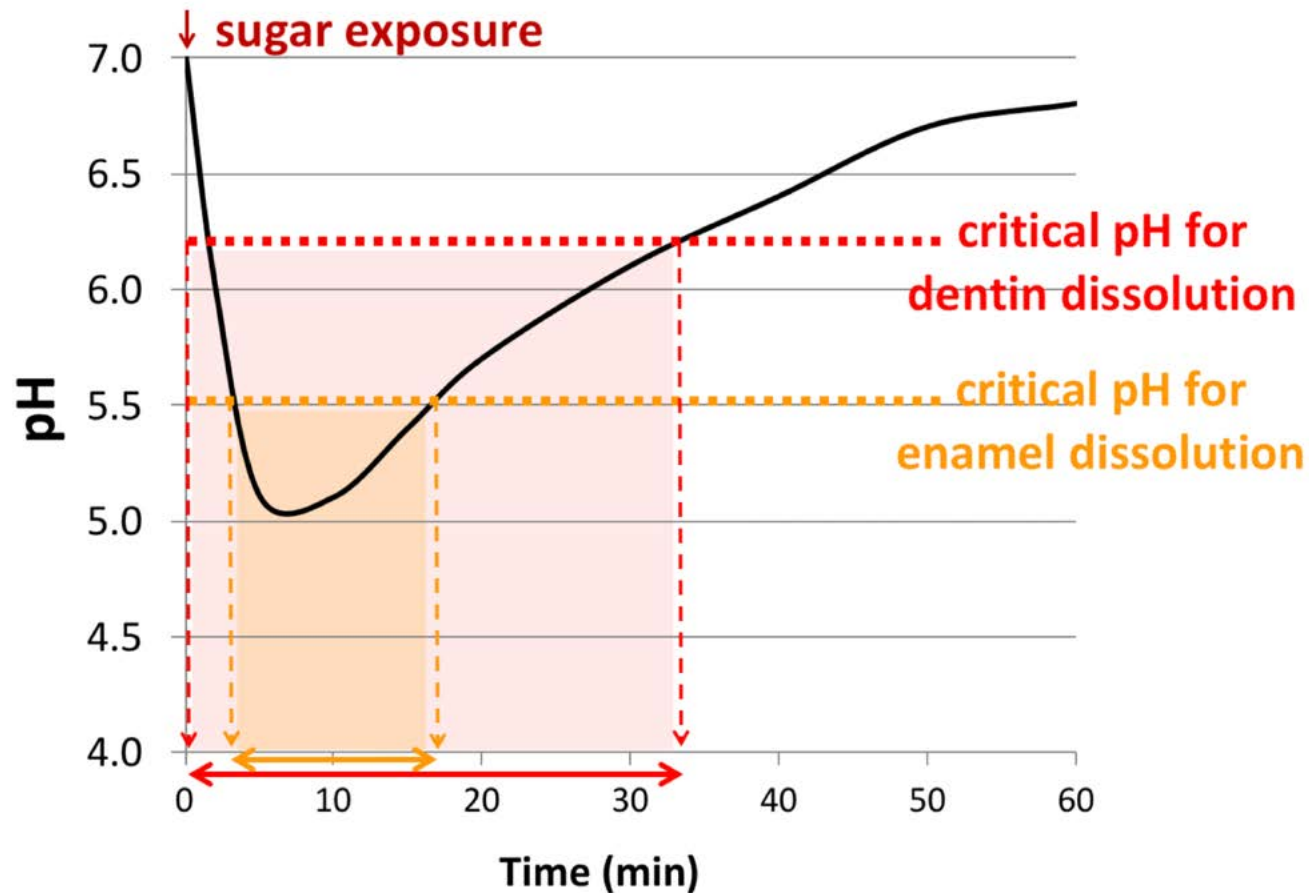


Figure 2. Clinical pathway for the nonrestorative treatment of noncavitated and cavitated carious lesions on permanent teeth. APF: Acidulated phosphate fluoride. NaF: Sodium fluoride. SDF: Silver diamine fluoride. * Defined as ICDAS 1-2. † Defined as ICDAS 5-6. ‡ Application every 3 to 6 months. § The order of treatments included in this recommendation represents a ranking of priority defined by the panel when accounting for treatment effectiveness, feasibility, patients' values and preferences, and resource utilization. Considerations such as a particular patient's values and preferences, special needs, or insurance status should inform clinical decision making. # At-home use once per week. †† Biannual application. ¶ At-home use at least once per day. ** Annual application. †† In keeping with the concept of informed consent, all nonsurgical and restorative treatment options and their potential side effects (such as blackened tooth surfaces treated with SDF) should be offered and explained to all patients.

Root caries



The higher solubility of root dentin



- At any given sugar challenge, dentin will dissolve for longer periods of time
- Diet carbohydrates that are not cariogenic for enamel because they cause a very small drop in pH (e.g. starch, lactose), may be cariogenic for dentin

More fluoride is needed to control root caries

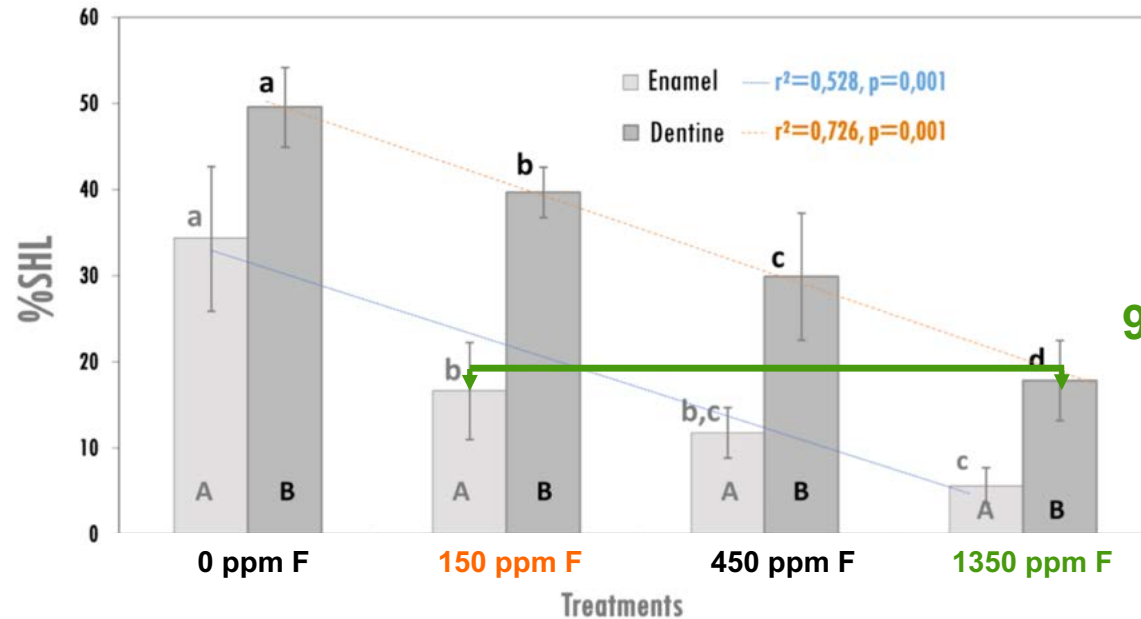


Fig 2. Percentage of surface hardness loss (%SHL) on enamel and dentine, according to the treatments (mean \pm SD; n = 12), and values of regression analyses between treatments by substrate. Distinct capital letters indicate differences ($p < 0.05$) between enamel and dentine and distinct lower case letters indicate differences ($p < 0.05$) among fluoride treatments by substrate.

doi:10.1371/journal.pone.0146478.g002

9 times higher concentration needed for the same effect on dentin vs enamel

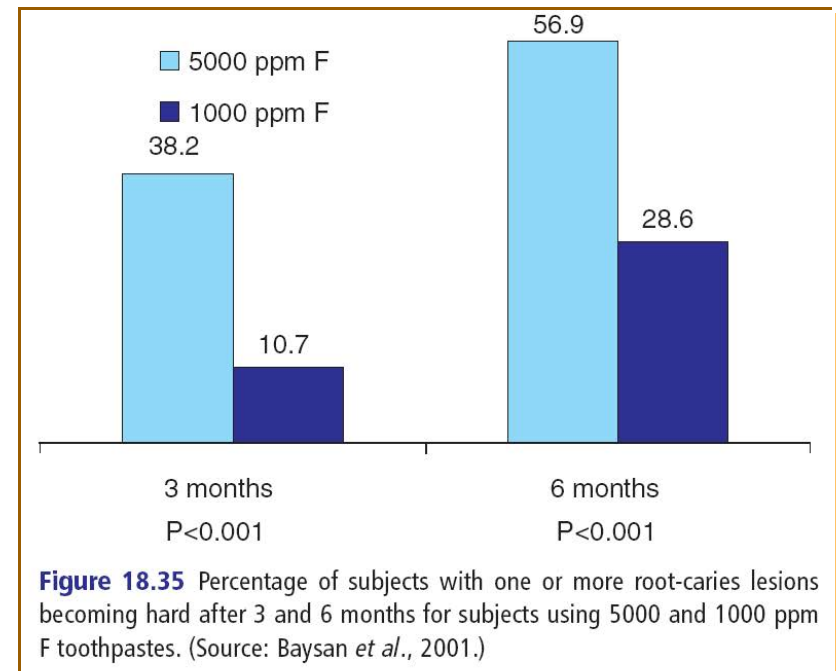
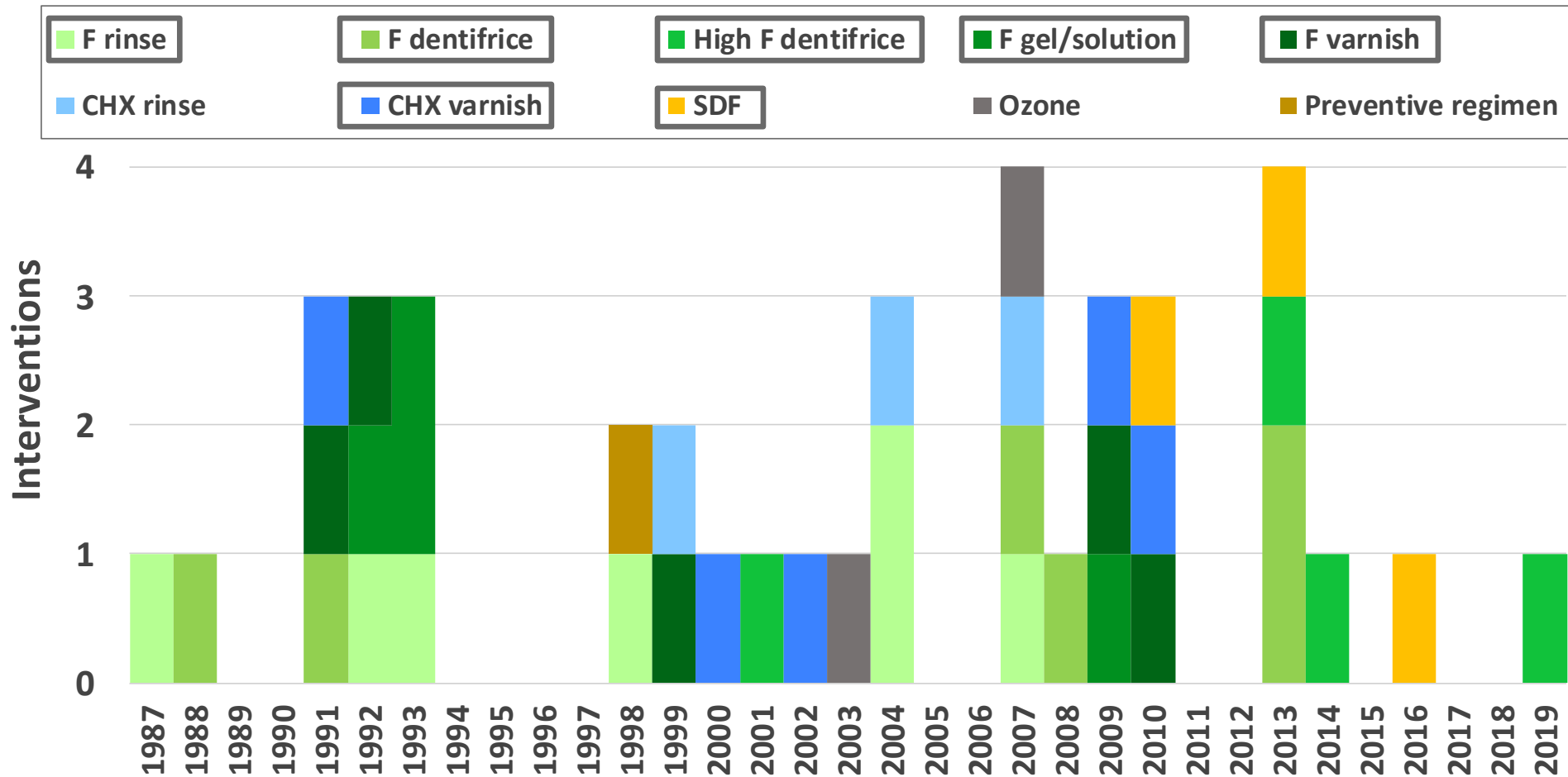


Figure 18.35 Percentage of subjects with one or more root-carries lesions becoming hard after 3 and 6 months for subjects using 5000 and 1000 ppm F toothpastes. (Source: Baysan *et al.*, 2001.)

Interventions to control root caries tested in clinical trials over the years

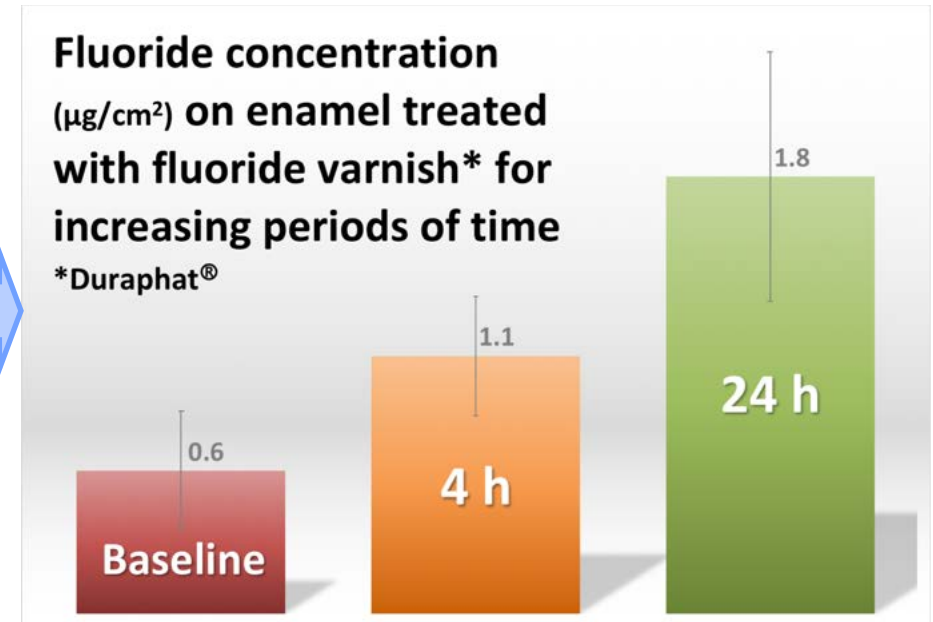


Clinically-relevant tips

- **Achieving best performance with the fluoride varnish**
- **Does the patient need to stay 30 min without drinking water after fluoride application?**

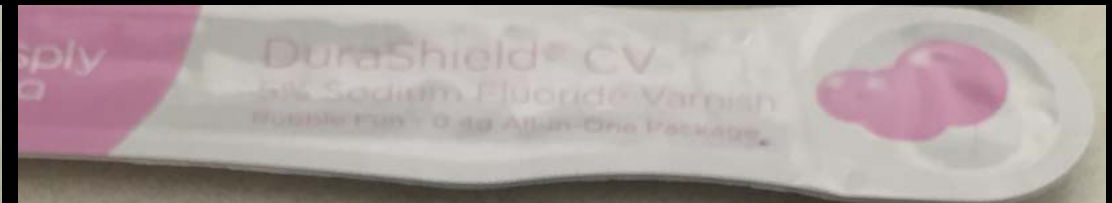
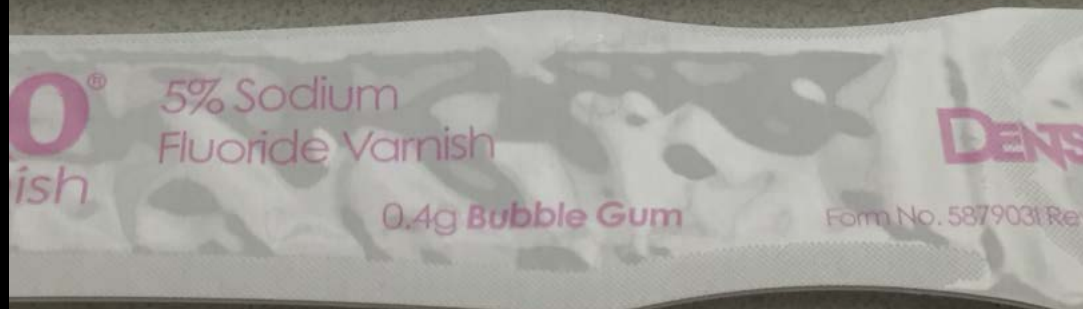
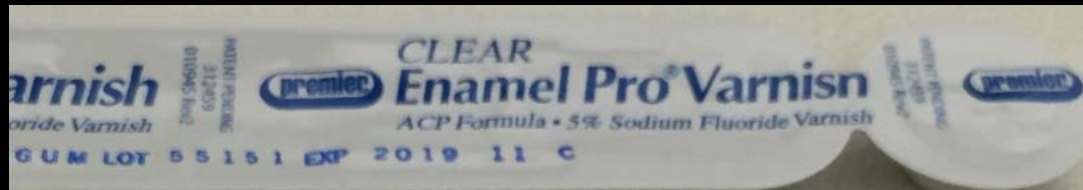
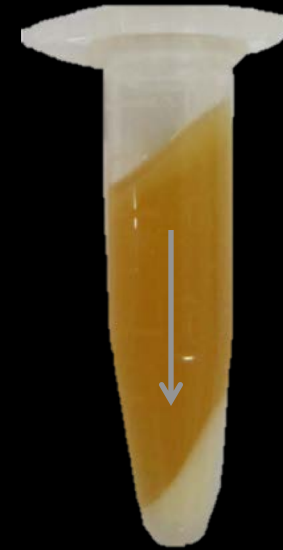
Fluoride gels at high concentration (neutral NaF (9,000 ppm F), APF (12,300 ppm F)) react very fast with the tooth – 1 min!

But the fluoride varnish requires hours of retention to react with enamel



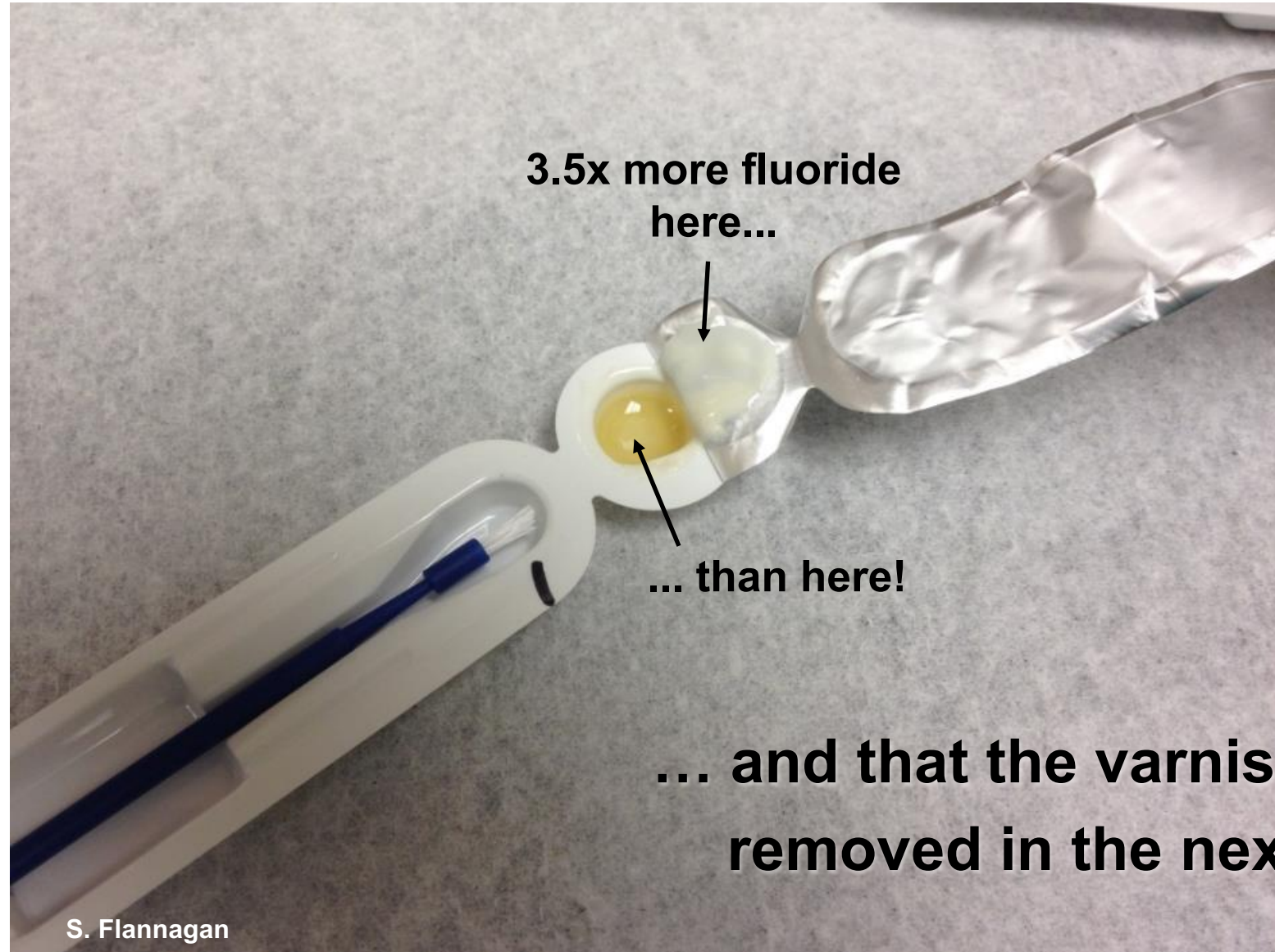
5% NaF varnishes (22,600 ppm F)

NaF solubility: max 4% in water



Make sure you mix before you apply...

(we want the total fluoride in the package to be applied for reaction with the tooth)



The “30 min” myth after F gel application

Caries Research

Caries Res 2005;39:258–260
DOI: [10.1159/000084808](https://doi.org/10.1159/000084808)

Received: March 19, 2004
Accepted after revision: August 21, 2004

Effect of Rinsing with Water Immediately after APF Gel Application on Enamel Demineralization *in situ*

A.C.B. Delbem^a L.P.R. Carvalho^b R.K.U. Morihisa^b J.A. Cury^c

^aFaculty of Dentistry of Araçatuba, UNESP, Araçatuba, SP, ^bFaculty of Dentistry of Marília, UNIMAR, Marília, SP, and ^cFaculty of Dentistry of Piracicaba, UNICAMP, Piracicaba, SP, Brazil

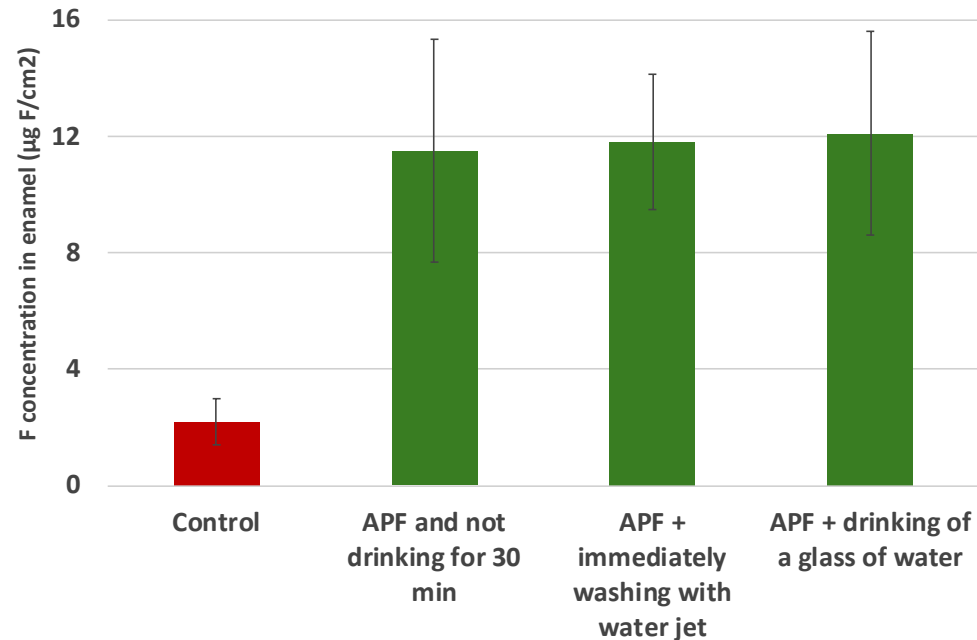
Cariogenic *in situ* test

Biofilm accumulation

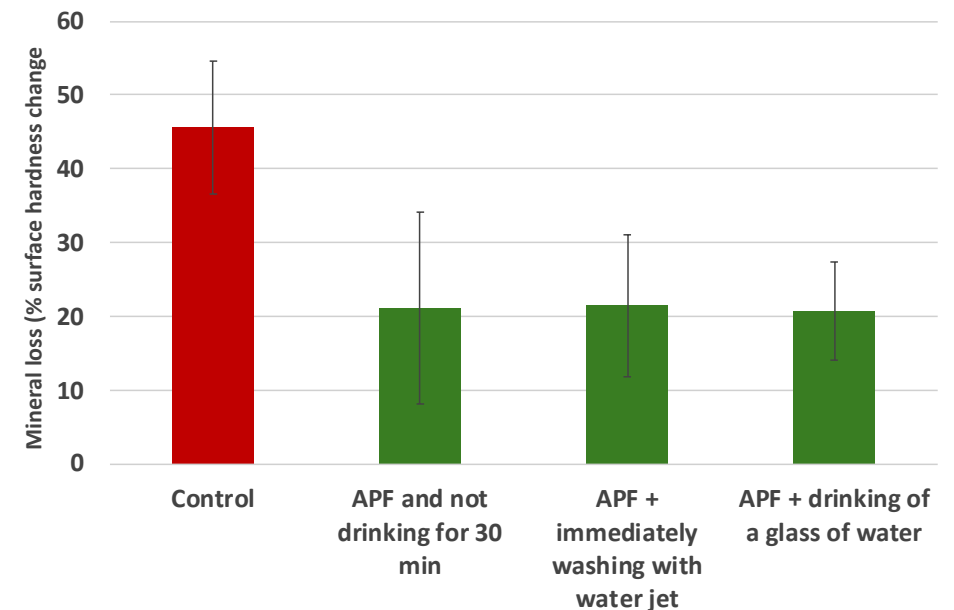
Sugar exposure 6x/day

15 days

Fluoride concentration on enamel



Mineral loss



Take away messages

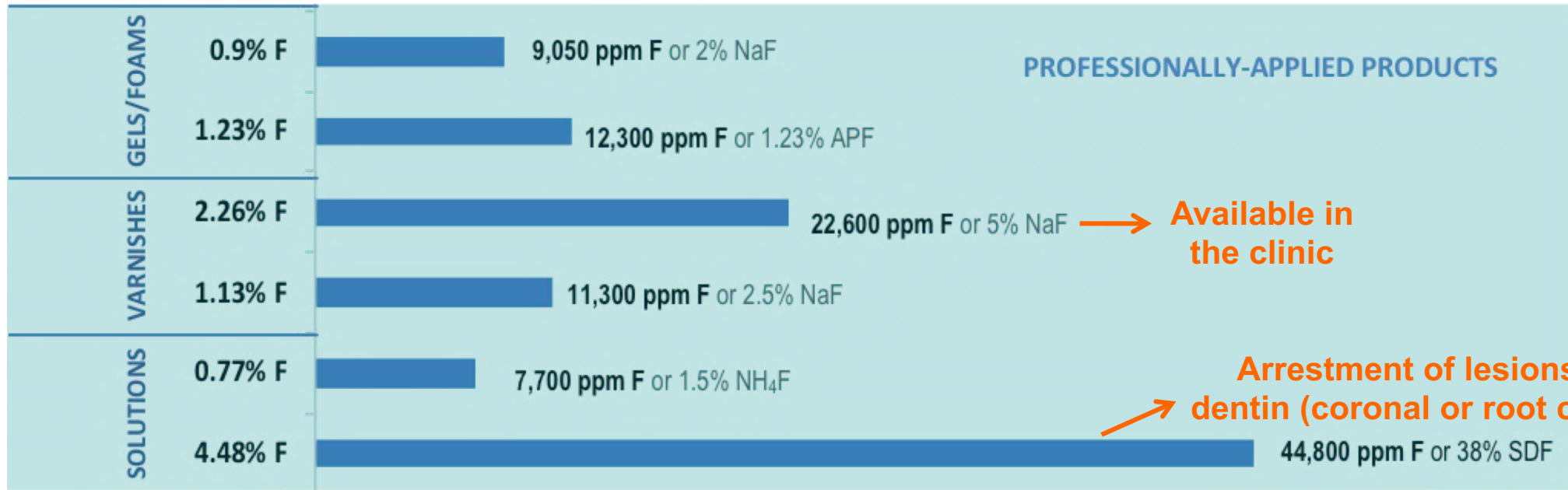
		SELF-APPLIED PRODUCTS	
MOUTHRINSES	0.01% F	100 ppm F or 0.02% NaF	
	0.02% F	226 ppm F or 0.05% NaF	More fluoride for high-risk patients
	0.09% F	905 ppm F or 0.2 % NaF	
DENTIFRICES	0.10% F	1,000 ppm F or 0.76% SMFP	Brushing twice/day for every patient
	0.11% F	1,100 ppm F or 0.243% NaF	
	0.11% F	1,100 ppm F or 0.454% SnF ₂	
	0.5% F	5,000 ppm F or 1.1% NaF	More fluoride for high-risk patients

- Over-the-counter
- Needs prescription

Fernández & González-Cabezas, 2015



Professionally applied fluoride → More fluoride for high-risk patients



Available in the clinic

Arrestment of lesions in dentin (coronal or root caries)

0 5,000 15,000 30,000 45,000

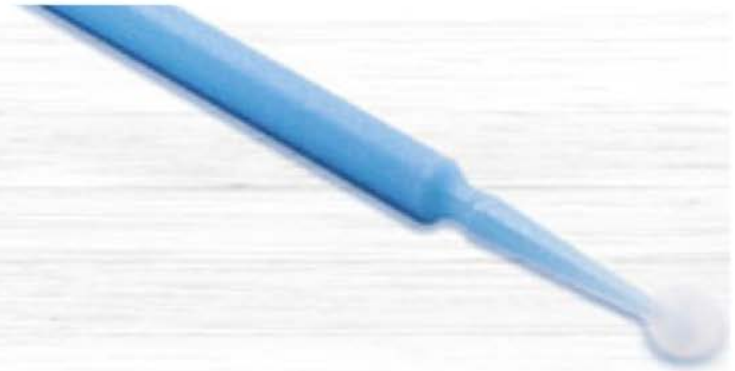
Fernández & González-Cabezas, 2015

Concentration in ppm F

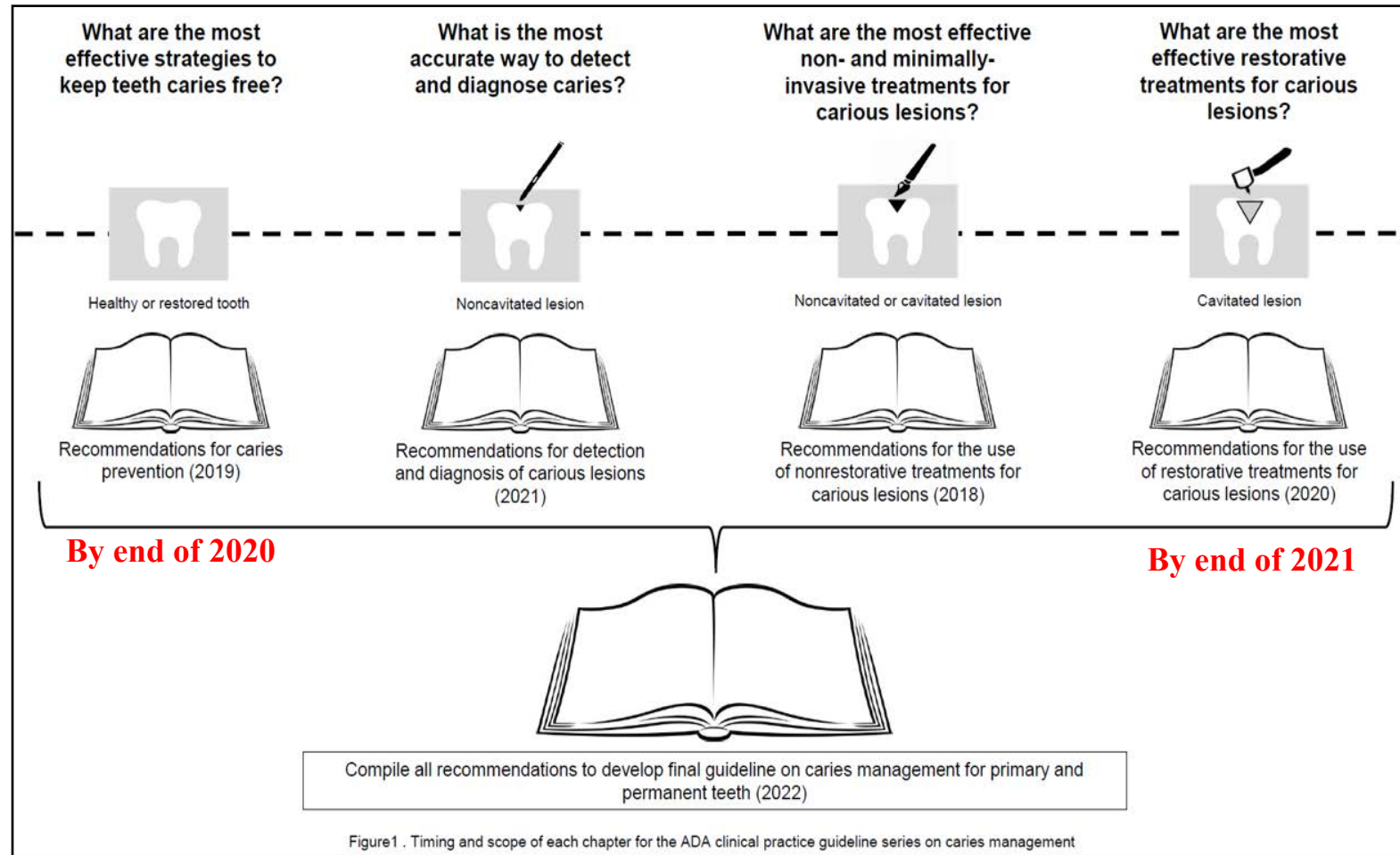


**SILVER
DIAMINE
FLUORIDE**

FOR CARIES CONTROL



Caries Management For The Modern Age: Improving Practice One Guideline At A Time



Nonrestorative Treatments for Caries: Systematic Review and Network Meta-analysis

Journal of Dental Research

1-13

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for Dental Research 2018




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DOI: 10.1177/0022034518800014

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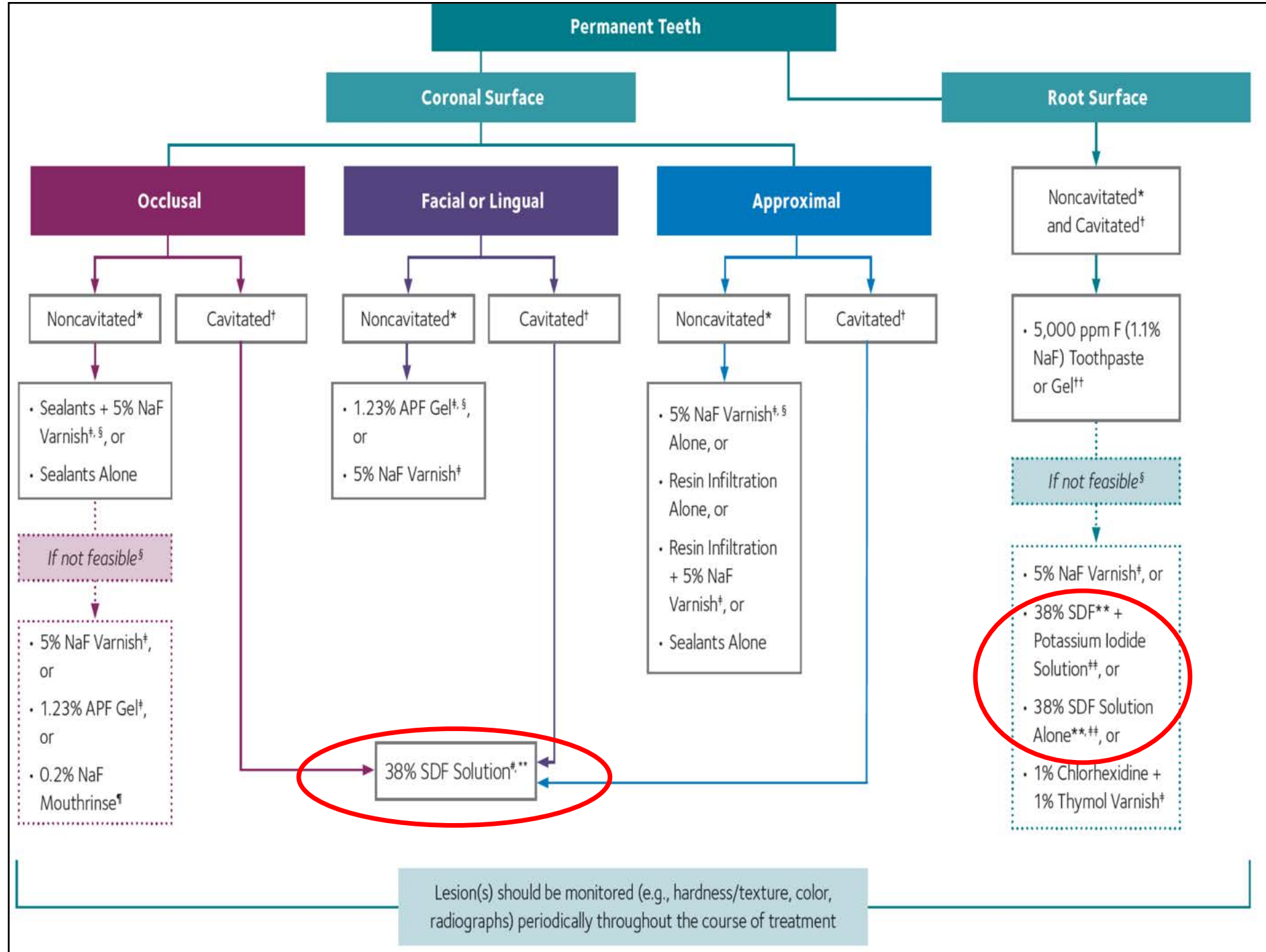
O. Urquhart¹ , M.P. Tampi¹, L. Pilcher¹, R.L. Slayton², M.W.B. Araujo³,
M. Fontana⁴, S. Guzmán-Armstrong⁵, M.M. Nascimento⁶, B.B. Nový⁷, N. Tinanoff⁸,
R.J. Weyant⁹, M.S. Wolff¹⁰, D.A. Young¹¹, D.T. Zero¹², R. Brignardello-Petersen¹³,
L. Banfield¹⁴, A. Parikh¹⁵, G. Joshi¹⁶, and A. Carrasco-Labra^{1,17}



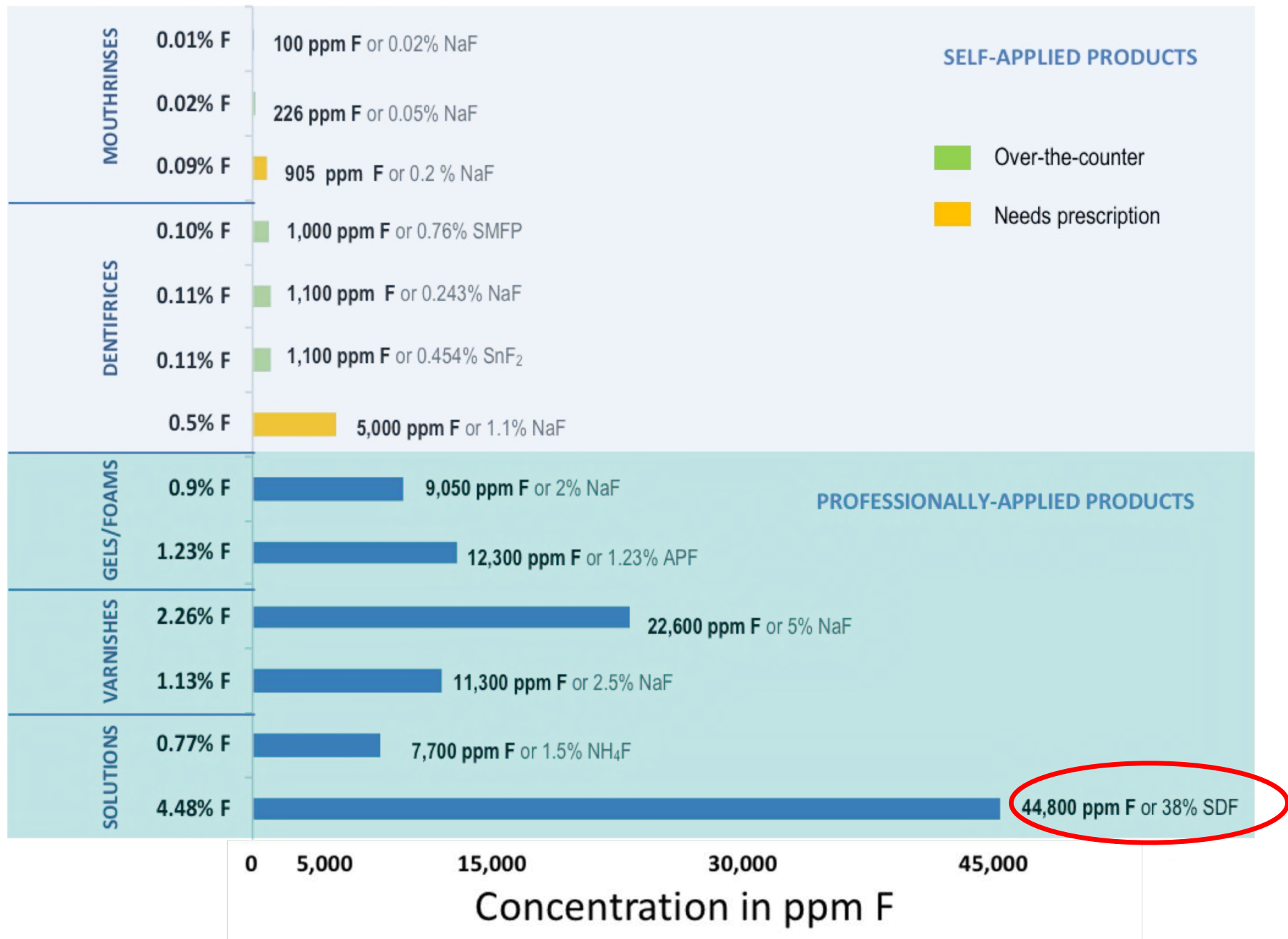
Evidence-based clinical practice guideline on nonrestorative treatments for carious lesions

A report from the American Dental Association

Rebecca L. Slayton, DDS, PhD; Olivia Urquhart, MPH; Marcelo W.B. Araujo, DDS, MS, PhD;
Margherita Fontana, DDS, PhD; Sandra Guzmán-Armstrong, DDS, MS;
Marcelle M. Nascimento, DDS, MS, PhD; Brian B. Nový, DDS; Norman Tinanoff, DDS, MS;
Robert J. Weyant, DMD, DrPH; Mark S. Wolff, DDS, PhD;
Douglas A. Young, DDS, EdD, MS, MBA; Domenick T. Zero, DDS, MS;
Malavika P. Tampi, MPH; Lauren Pilcher, MSPH; Laura Banfield, MLIS, MHSc;
Alonso Carrasco-Labra, DDS, MSc

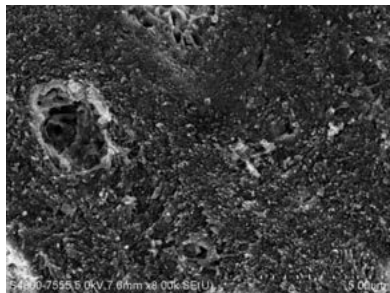
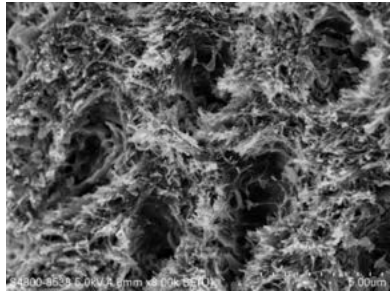


Lesion(s) should be monitored (e.g., hardness/texture, color, radiographs) periodically throughout the course of treatment





38% Silver Diamine Fluoride (SDF)



Mei et al., 2014

DEPARTMENT OF HEALTH AND HUMAN SERVICES Food and Drug Administration	Form Approved: OMB No. 0910-0120 Expiration Date: January 31, 2017 See PRA Statement below.
Indications for Use	
510(k) Number (if known) K102973	
Device Name Silver Dental Arrest	
Indications for Use (Describe) Treatment of Dental Hypersensitivity. For use in adults over the age of 21.	

2014

Breakthrough Therapy Status in 2016

Thus, use for caries control is “off label”

(FV use in the US is also “off label”, but indications are different)

Advantage Arrest

- Elevate Oral Care, LLC – Advantage Arrest
 - 38% SDF [$\text{Ag}(\text{NH}_3)_2\text{F}$]

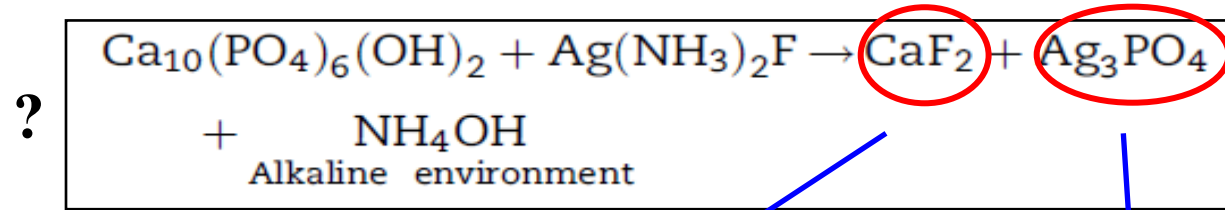


Riva Star

- SDI- Riva Star
 - 2 step process: 38% SDF and Potassium Iodide (KI)
 - April 2018 : approved by the FDA (substantially equivalent)



38% SDF (~44,800 ppm F)



Yamaga et al., 1972; Chu and Lo, 2008

Research Reports: Biological

Formation of Fluorohydroxyapatite with Silver Diamine Fluoride

Journal of Dental Research
2017, Vol. 96(10) 1122-1128
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for Dental Research 2017
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DOI: 10.1177/0022034517709738
journals.sagepub.com/home/jdr

M.L. Mei¹, F. Nudelman², B. Marzec², J.M. Walker², E.C.M. Lo¹,
A.W. Walls³, and C.H. Chu¹

Helps with caries control



- **Ag precipitate** (weakly soluble; turns black with sunlight or reducing agents)= **Black, hard layer**
- **Silver is antimicrobial** (long-term this effect might be lost; Mitwalli et al., 2019)
- **Silver affects dentin metalloproteinases, cathepsins, etc. (involved in dentin degradation)** (Zhao et al., 2017)

Indications

Teeth:

- **Cavitated accessible soft lesions (coronal or root caries)**
- **No signs or symptoms of irreversible pulpitis**
- **Sensitivity**



Patients:

- **Increased caries risk**
- **Restorative treatment challenged by behavioral or developmental disorders, finances, or other**
- **Interim or definite non-restorative caries management**



Meta-analysis of studies using 38% SDF to arrest dentin caries

To arrest advanced cavitated carious lesions on any coronal surface of primary teeth, the expert panel recommends clinicians* prioritize the use of 38% silver diamine fluoride (SDF) solution (biannual application) over 5% sodium fluoride varnish (application once per week for 3 weeks).†

Moderate	Strong
----------	--------

To arrest advanced cavitated carious lesions on any coronal surface of permanent teeth, the expert panel suggests clinicians* prioritize the use of 38% silver diamine fluoride (SDF) solution (biannual application) over 5% sodium fluoride varnish (application once per week for 3 weeks).†

Low	Conditional
-----	-------------

JADA, 2018

- Meta-analysis (5 papers); SDF= overall proportion of arrested dentin caries was 65.9 %

Gao et al., 2016

- Meta-analysis (8 papers) using 38 % SDF on primary teeth= overall proportion of arrested dentin caries was 81 %

Gao et al., 2016b

Oral Hygiene Effect

- Lesions with visible plaque have a lower chance of being arrested (Fung et al., 2016)
- Caries lesions might reactivate within the year if salivary function and oral hygiene is **poor** (Deutsch, 2016)
- Anterior and buccal/lingual surfaces more likely to become arrested (Zhi et al., 2012)

Evidence on Root Caries

To arrest or reverse noncavitated and cavitated carious lesions on root surfaces of permanent teeth, the expert panel suggests clinicians* prioritize the use of **5,000 ppm fluoride (1.1% sodium fluoride) toothpaste or gel** (at least once per day) over 5% sodium fluoride varnish (application every 3-6 months), 38% SDF + potassium iodide solution (annual application), 38% SDF solution (annual application), or 1% chlorhexidine + 1% thymol varnish (application every 3-6 months).^{†,‡}

Low **Conditional**

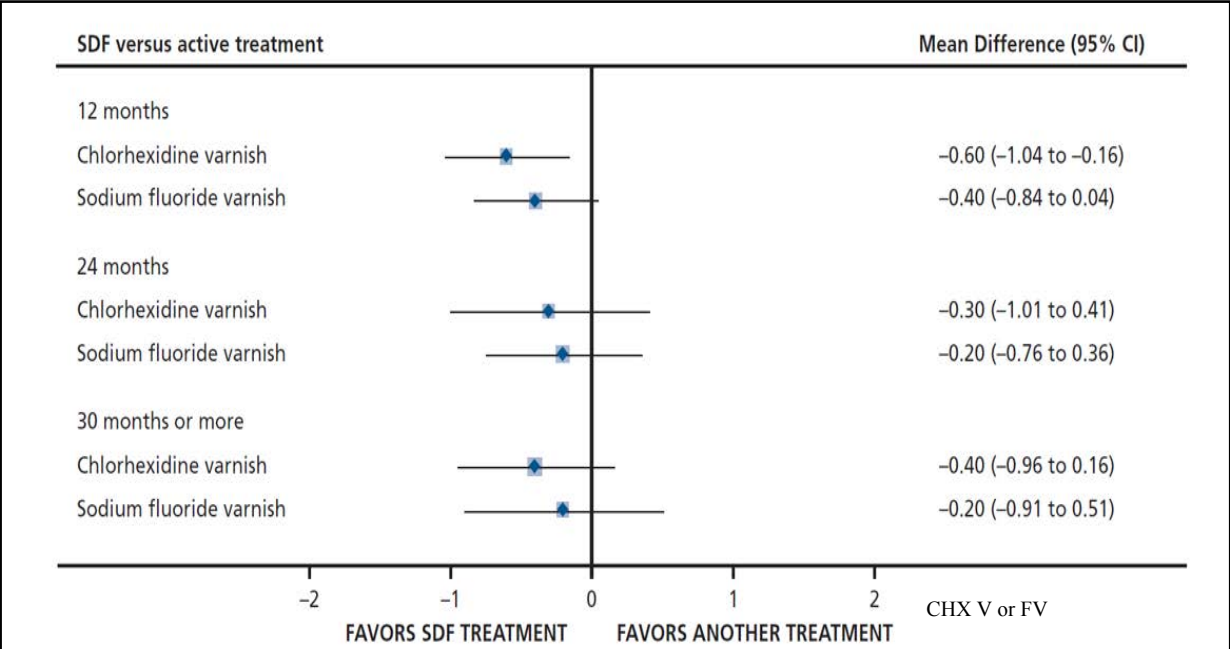
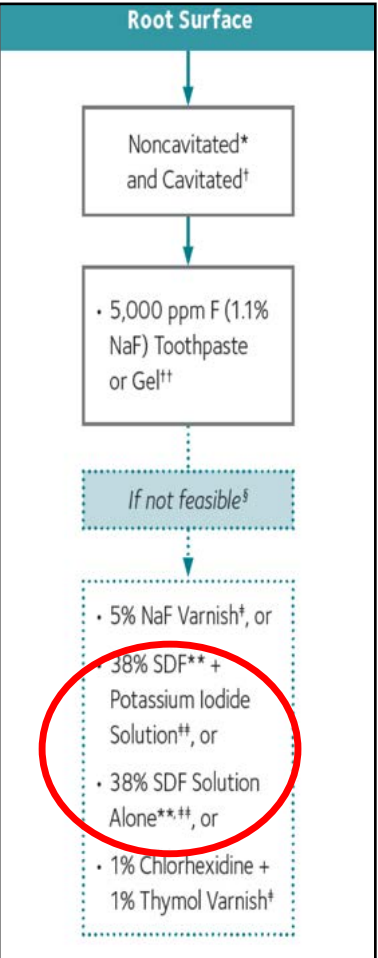


Figure 5. Comparisons of the mean increment in the number of decayed or filled root surfaces of permanent teeth in the silver diamine fluoride (SDF) and active treatment groups according to duration of follow-up (12, 24, or 30 months or more). CI: Confidence interval. WMD: Weighted mean difference.

Mode of Use

<https://www.youtube.com/watch?v=a0HH7GifdM4>

(search SDF and ADA video)



1. **Informed consent (staining side-effect)**
2. **Clean the lesion to remove visible plaque and food (there is no need to remove carious tissue). Do not use vaseline!**
3. **Isolate and dry the lesion (to avoid diluting the SDF)**
4. **Dip the microbrush into the SDF and paint the liquid onto the lesion (one drop can treat many lesions)..at least 10 sec rubbing it in the lesion**
6. **Remove excess SDF (e.g., blot dry excess)**
7. **Reapply every 6 months if possible, if not repeat annually (or reapply sooner if lesion is still soft, regardless of color)**
8. **Patient should be instructed to continue to manage their caries risk at home with EBD strategies, and every effort should be made to keep the cavity clean. (Moderate and high risk patients should be receiving other F recommendations in office and at home)**

Limitations and Other Considerations

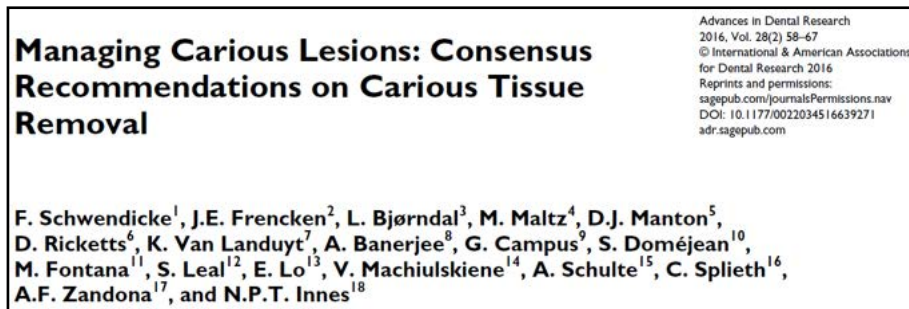
- “Halo” preventive effect?



For coronal carious lesions *prevention*, it is noteworthy that the number and quality of studies included in the systematic reviews was low which questions the evidence base around SDF for coronal carious lesions prevention.

- SMART Technique?

ART works. Is ART + SDF better?

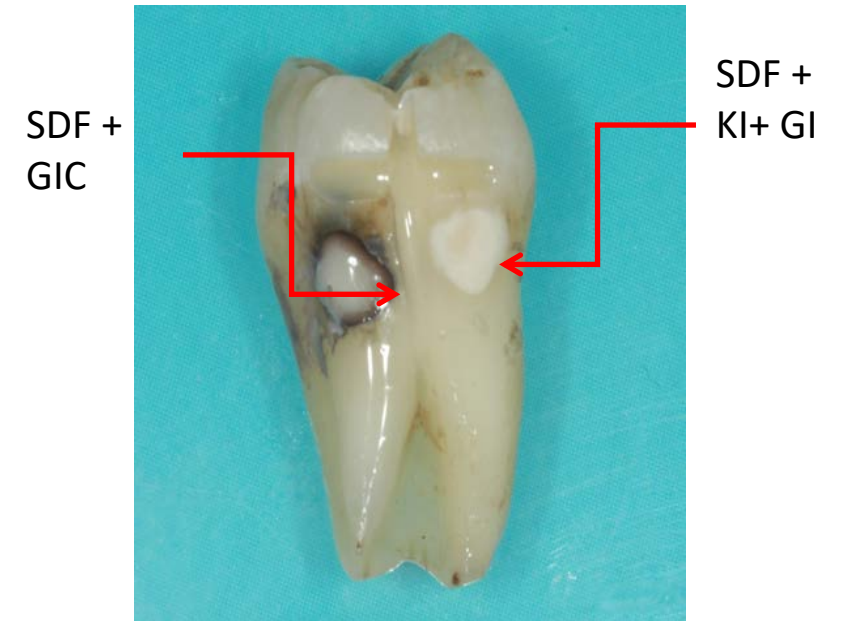


Lesion Type	Removal Threshold	Strength of Evidence
Non-cavitated lesion	Do not remove tissue or restore: Seal!	Strong
Shallow/moderately deep CAVITATED lesion	Selectively remove to firm dentin (previously called affected dentin)	Weak
Deep CAVITATED lesions (pulpal third/quarter of dentin); vital pulp	Selectively remove to soft dentin (primary or permanent), or stepwise removal to leathery dentin (permanent)	Strong

Does previous application of silver diammine fluoride influence the bond strength of glass ionomer cement and adhesive systems to dentine? Systematic review and meta-analysis

Conclusions: Previous application of SDF does not influence the dentine bond strength of glass ionomer cement, but compromise the bonding of adhesive systems.

Frohlich et al., 2019



6 week submersion in water & in direct sunlight
Courtesy of Dr Geoff Knight (SDI)

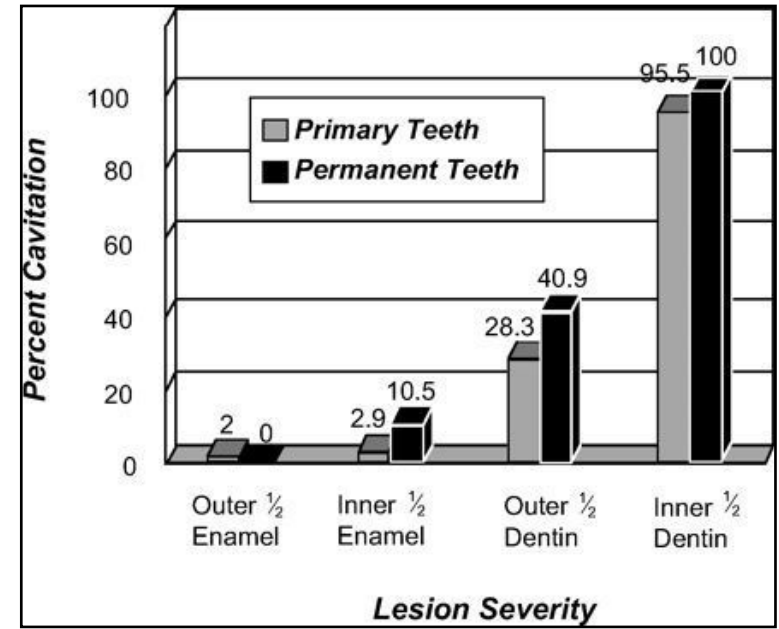


Mitwalli et al., 2019

- Interproximal lesions?
F works. Is SDF better?

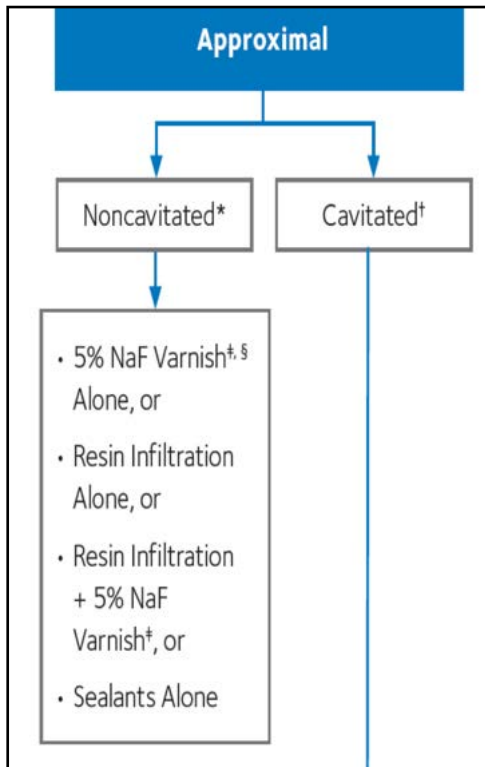


Rating	% Cavitated
Enamel lesions	6.7%
Dentin lesions	34%



Krasnoff et al., 2020 (submitted)

Pitts and Rimmer, 1992



JADA 2018

Managing Carious Lesions: Consensus Recommendations on Carious Tissue Removal

Advances in Dental Research
2016, Vol. 28(2) 58-67
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for Dental Research 2016
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DOI: 10.1177/0022034516639271
adr.sagepub.com

F. Schwendicke¹, J.E. Frencen², L. Bjørndal³, M. Maltz⁴, D.J. Manton⁵,
D. Ricketts⁶, K. Van Landuyt⁷, A. Banerjee⁸, G. Campus⁹, S. Doméjean¹⁰,
M. Fontana¹¹, S. Leal¹², E. Lo¹³, V. Machiulskiene¹⁴, A. Schulte¹⁵, C. Splieth¹⁶,
A.F. Zandona¹⁷, and N.P.T. Innes¹⁸

Non cavitated caries lesions should not have tissue removed

American Dental Association

- D1354 interim caries arresting medicament application - **per tooth**
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.
- Coverage added in 14 states

Kyle Norman

Bureau of Medicaid Policy, Operations & Actuarial Services

Medical Services Administration

Medicaid Policy

- MSA 16-38 Interim Caries Arresting Medicament Application
Effective January 1, 2017
Covered benefit for **all ages**
Billable **once** per date of service
Maximum of **five** teeth per visit
Six applications per lifetime
*SDF **can be** billed on same date of service as other fluoride applications
Fee-For-Service Rate \$13.23





Sealant prevalence increased by 35% among children

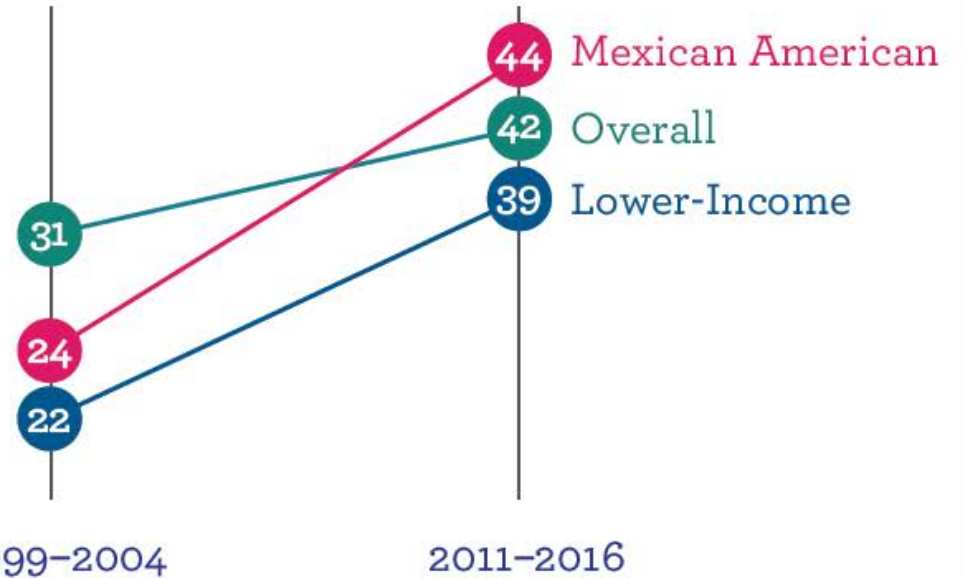


4 in 10 children aged 6–11 years **had dental sealants** on permanent teeth.

Sealant prevalence among **Mexican American** and **lower-income** children **nearly doubled**.

<http://bit.ly/OralHealthReport>

Percentage of children aged 6–11 with sealants



Trends in Dental Caries and Sealants,
Tooth Retention, and Edentulism, United States
1999–2004 to 2011–2016

Sealants on Sound Surfaces (PREVENTION)



Simonsen 2011

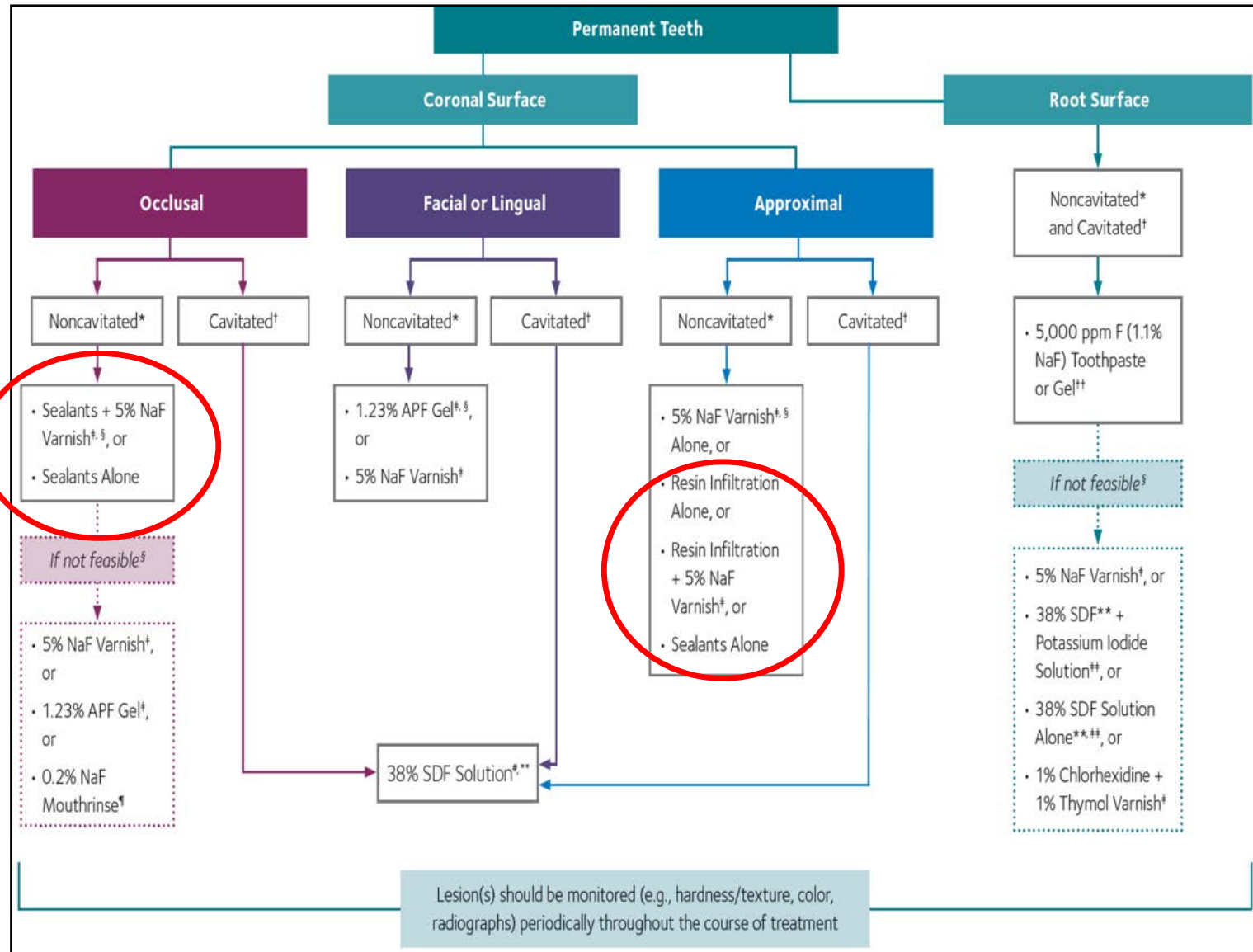
Strong evidence for prevention (when used on sound surfaces)

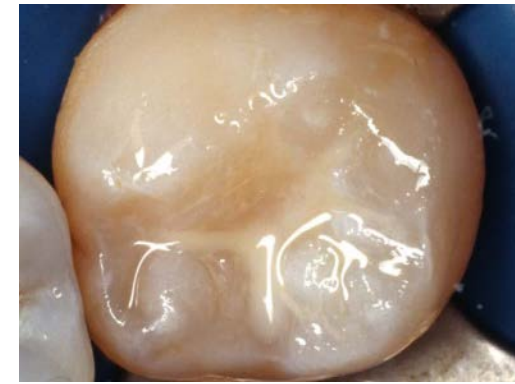
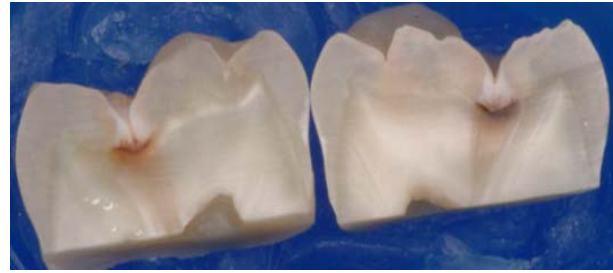
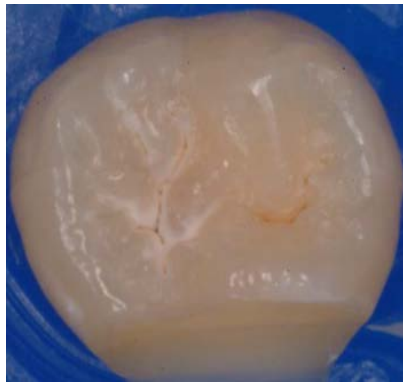
- **PF on sound teeth ~80% at 12 months (both in private and school-based settings)**
- **Sealants need to be monitored overtime and repaired when needed**



Ahovuo-Saloranta et al., 2004, 2008, 2013, 2017

Dental Sealants on Caries Lesions (ARREST)





To arrest or reverse noncavitated carious lesions on occlusal surfaces of primary teeth, the expert panel recommends clinicians* prioritize the use of **sealants + 5% sodium fluoride varnish** (application every 3-6 months) or **sealants alone** over 5% sodium fluoride varnish alone (application every 3-6 months), 1.23% acidulated phosphate fluoride gel (application every 3-6 months), resin infiltration + 5% sodium fluoride varnish (application every 3-6 months), or 0.2% sodium fluoride mouthrinse (once per week).[†]

Moderate

Strong

To arrest or reverse noncavitated carious lesions on occlusal surfaces of permanent teeth, the expert panel recommends clinicians* prioritize the use of **sealants + 5% sodium fluoride varnish** (application every 3-6 months) or **sealants alone** over 5% sodium fluoride varnish alone (application every 3-6 months), 1.23% acidulated phosphate fluoride gel (application every 3-6 months), or 0.2% sodium fluoride mouthrinse (once per week).[†]

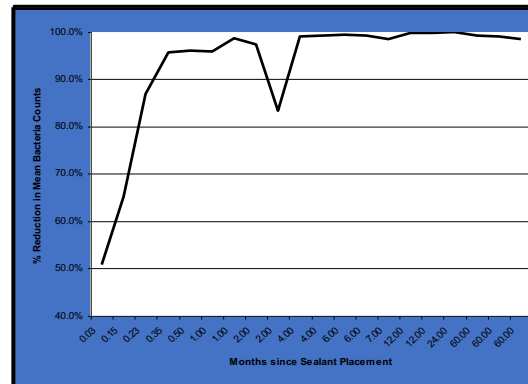
Moderate

Strong

JADA 2018

- **PF on carious teeth ~71%**

Griffin et al., 2008



- **Bacterial reductions ~99%**

Oong et al., 2008

Type of Material to Choose

- **Unclear if one sealant material is superior to another**
- **Take into account the likelihood of experiencing lack of retention when choosing the type of material**
 - **If dry isolation is difficult, such as a tooth that is not fully erupted, then a material that is more hydrophilic (e.g., GI) would be preferable**
 - **If the tooth can be isolated to ensure a dry site and long-term retention is desired, then a resin-based sealant is preferable.**
- **Monitor sealants over time, especially sealants showing a higher risk of experiencing retention loss (i.e., GI)**



Placement Techniques

- **Routine mechanical preparation of enamel before acid etching is not recommended**

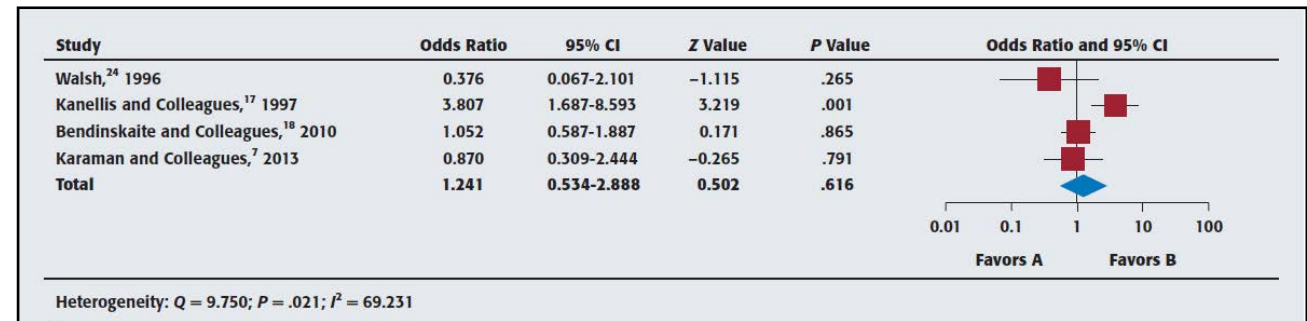
Wright et al., 2016

Preparation before acid etching in fissure sealant therapy: yes or no?

A systematic review and meta-analysis

JADA, 2016

Retention is the same after acid etching or tooth preparation (thus tooth preparation is not needed)



A: Tooth Preparation
B: Acid-etch only

Can you seal in moderate lesions?



Pre-Sealant
ICDAS 4; x-ray
D1

Post-Sealant (12-
months)
ICDAS 4; x-ray D1

Post-Sealant (24-
months)
ICDAS 4; x-ray D1

Post-Sealant (32-
months)
ICDAS 4; x-ray D1

M. Fontana^{1*}, J.A. Platt², G.J. Eckert³,
C. González-Cabezas¹, K. Yoder⁴,
D.T. Zero⁴, M. Ando⁴, A.E. Soto-Rojas⁴,
and M.C. Peters¹

¹Department of Cariology, Restorative Sciences, and
Endodontics, University of Michigan School of Dentistry, Ann

Monitoring of Sound and Carious Surfaces under Sealants over 44 Months

J Dent Res 2014

- Sealed sound, initial and moderate lesions in a very high risk population
- Sealants were 99% effective in arresting caries for almost 4 years (annual repairs if needed)
- Excellent retention (89% at 1-y; 78% at 2-y; 72% at 3.8 y)

BUT

7-y survival on moderate lesions was:

- 37% for sealants (without repair) vs.
- 91% for MI restorations.

If sealed, might need frequent repair

Schwandicke et al., 2016

Qvist et al., 2016

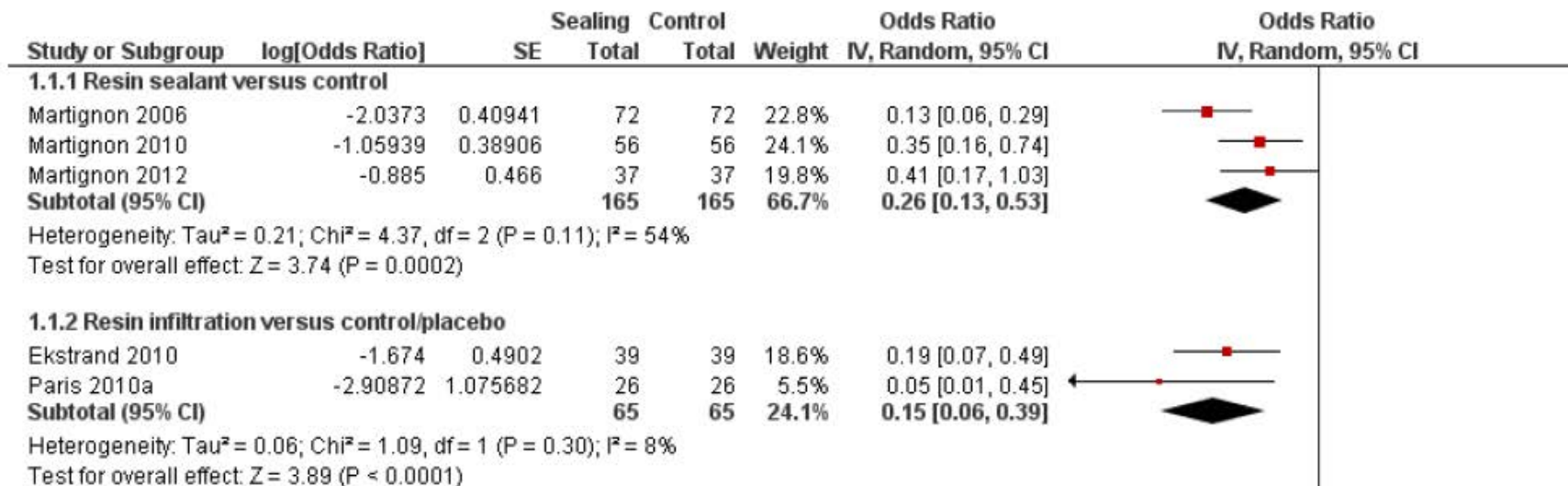
RESEARCH

Can we Seal Interproximal Caries Lesion?



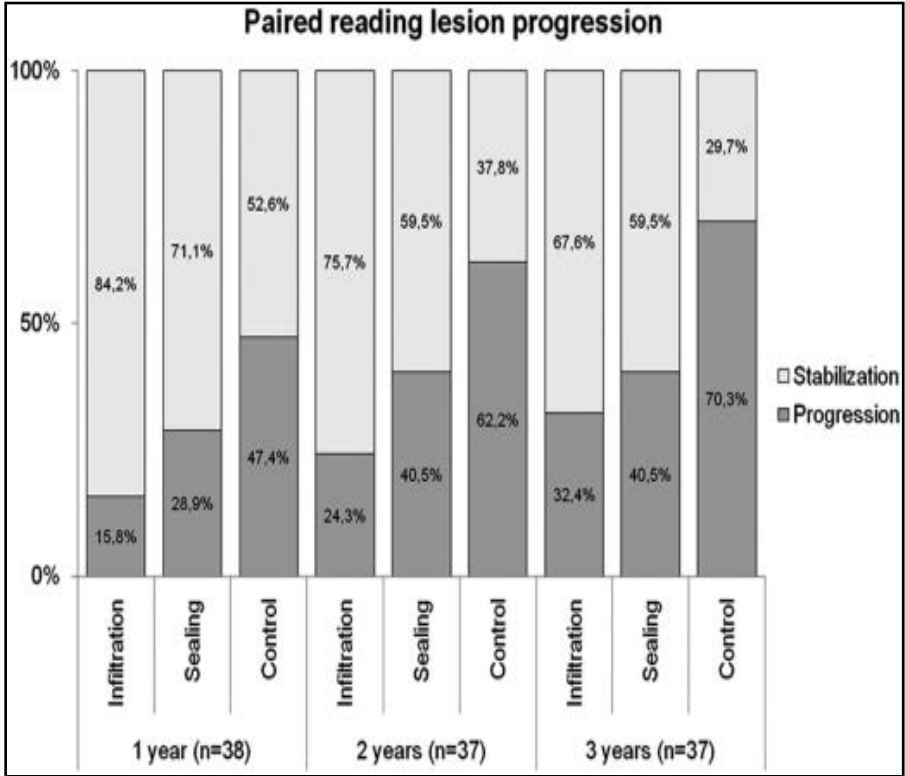
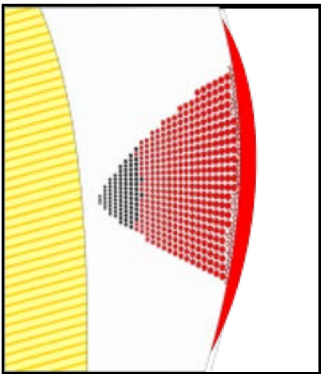
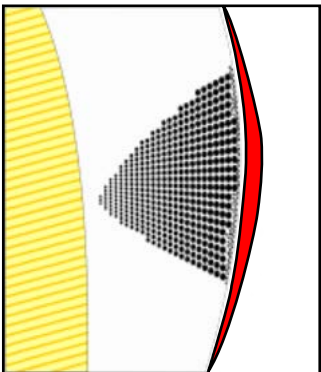
N. Innes

Figure 4. Forest plot of comparison: I Proximal sealing versus control/placebo, outcome: I.I Caries progression follow-up 12 to 36 months - DSR>Pairwise>Scoring



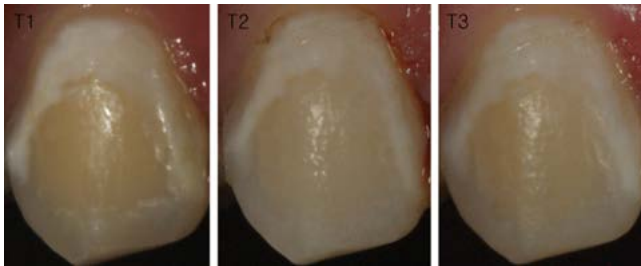
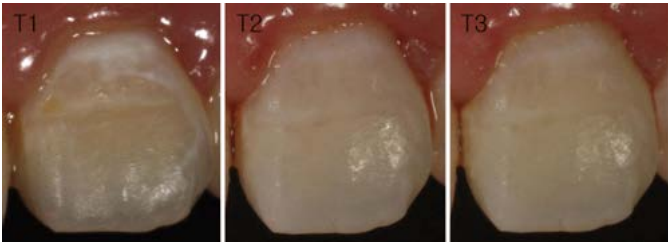
Dorri et al., 2015

Infiltration (ICON)

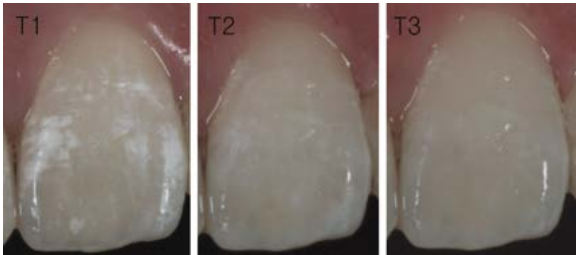
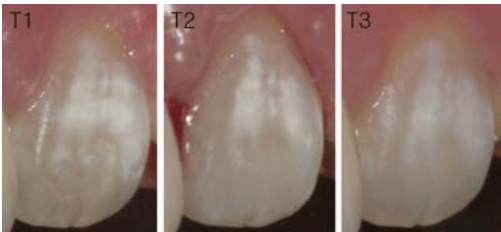


Infiltrating/Sealing Proximal Caries Lesions : A 3-year Randomized Clinical Trial
 S. Martignon, K.R. Ekstrand, J. Gomez, J.S. Lara and A. Cortes
J DENT RES 2012 91: 288 originally published online 17 January 2012
 DOI: 10.1177/0022034511435328

“White spots” Post-Orthodontics



Hypoplasia-Fluorosis



Non-Operative Management Options

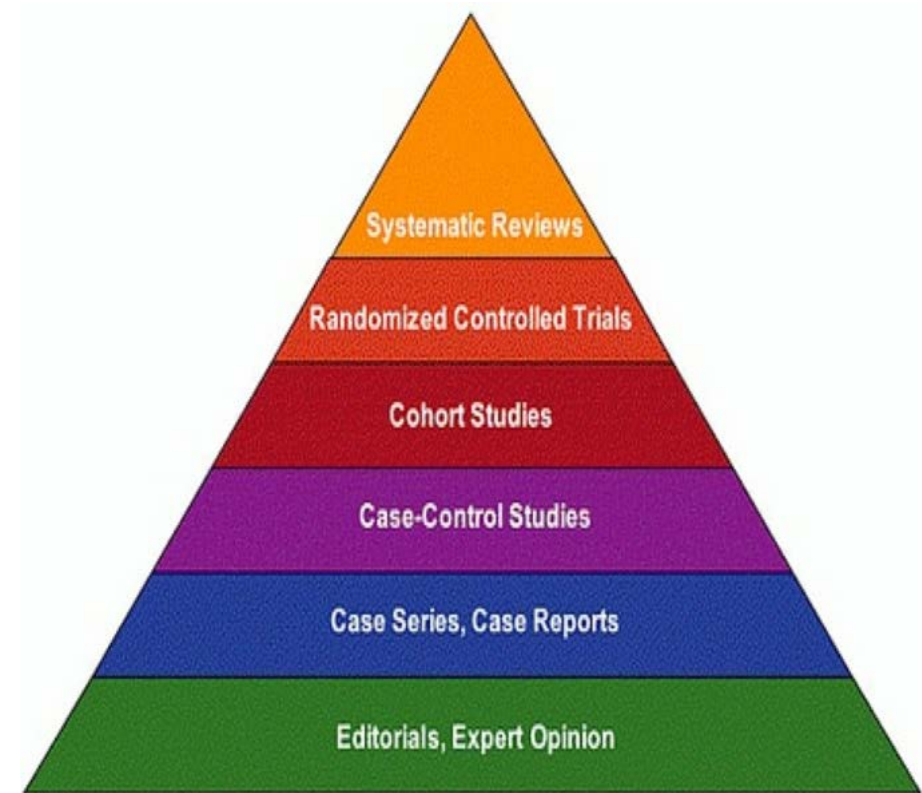
Fluorides
Sealants



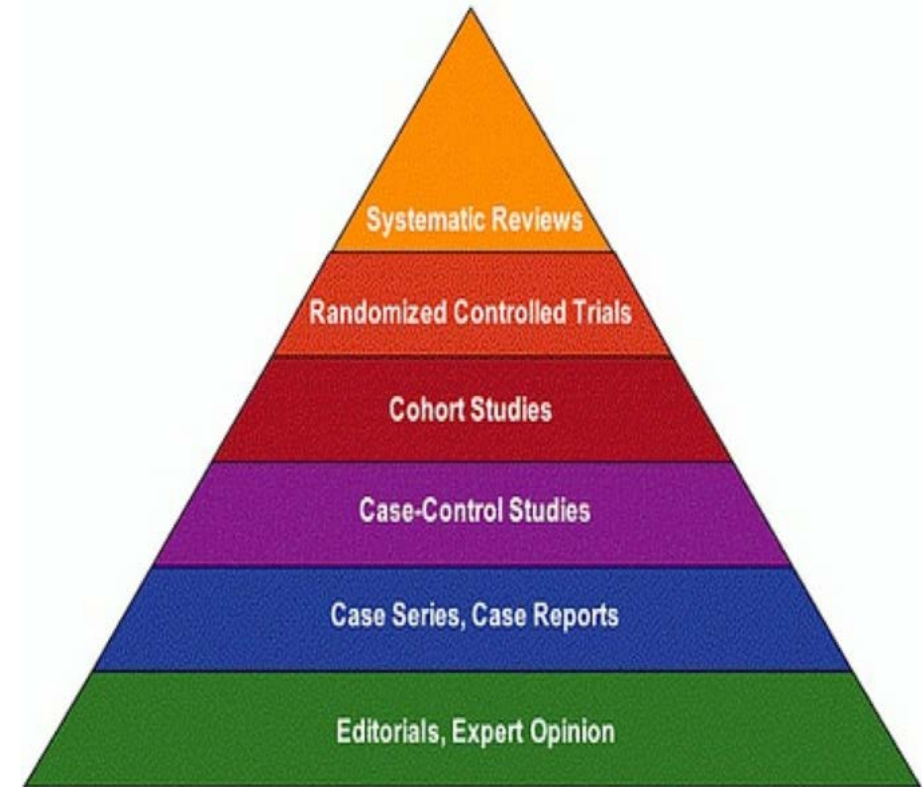
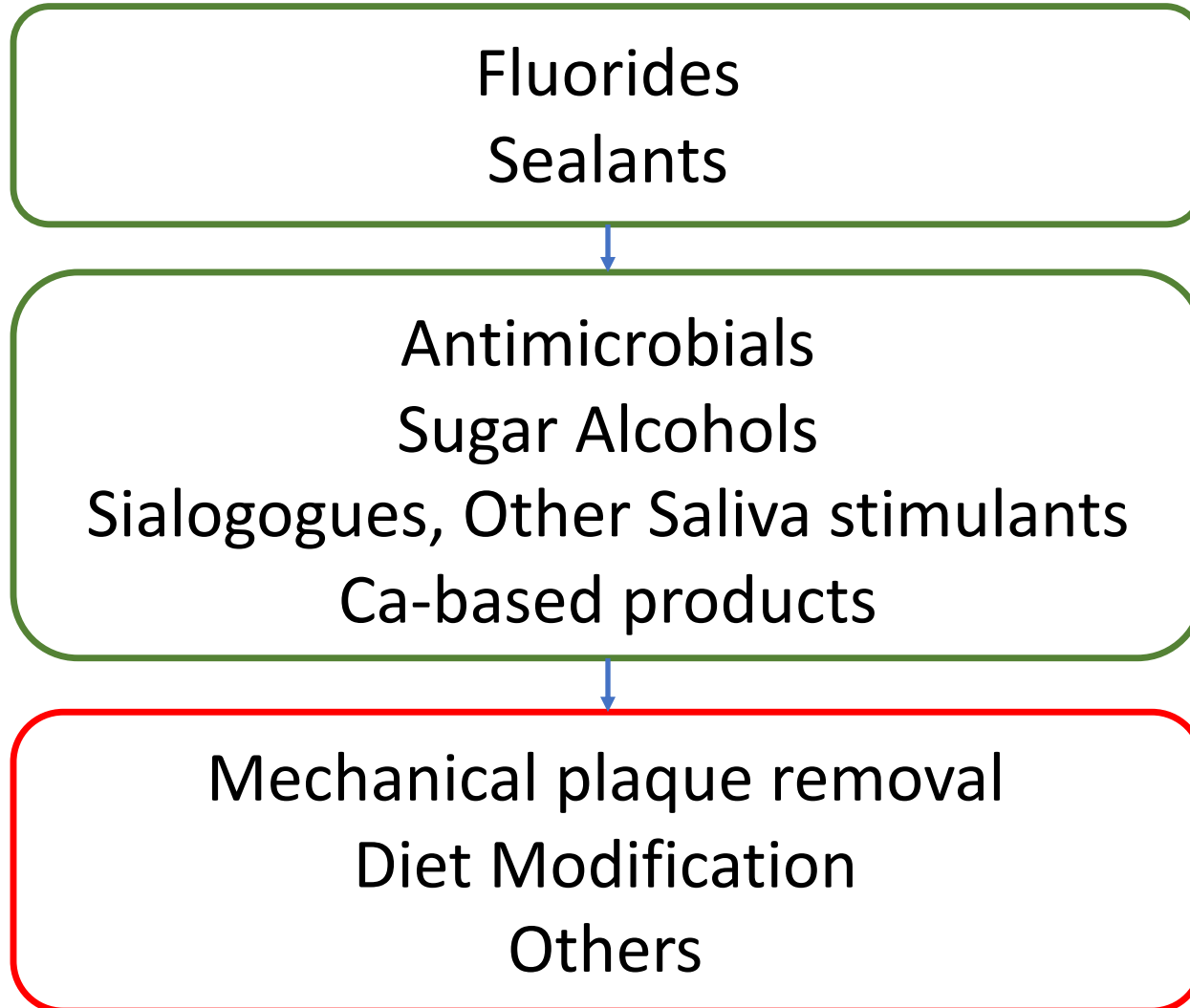
Antimicrobials
Sugar Alcohols
Sialogogues, Other Saliva stimulants
Ca-based products



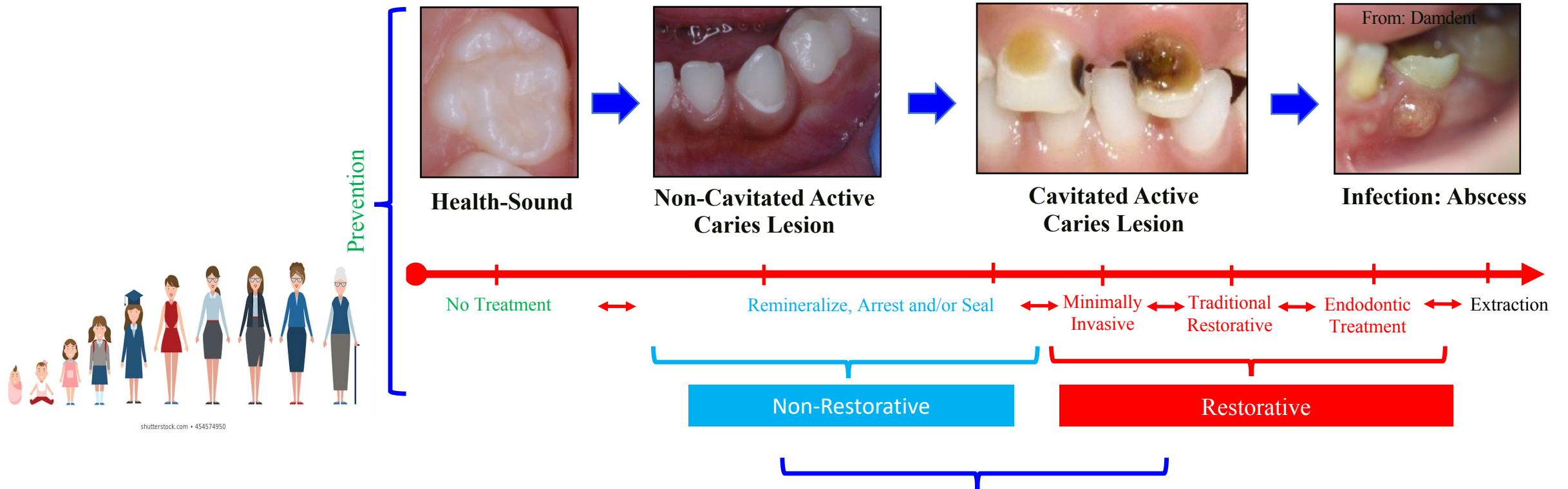
Mechanical plaque removal
Diet Modification
Others



Non-Operative Management Options














Personalized Caries Management



- **Best evidence**
- **Risk-Based; Person-Centered**
- **Focus on prevention and remineralization**
- **MI**

Goal: Advance health and preserve tooth structure

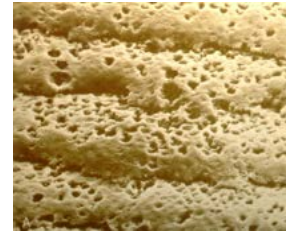
	0 Sound tooth surface	Sound	Sound
	1 First visual change in enamel		
	2 Distinct visual change in enamel		
	3 Localized enamel breakdown due to caries with no visible dentin	Moderate Lesion ICDAS 3 ICDAS 4  	
	4 Underlying dark shadow from dentin +/- localized enamel breakdown		
	5 Distinct cavity with visible dentin	Advanced Lesion ICDAS 5 ICDAS 6  	
	6 Extensive distinct cavity with visible dentin		

ICDAS.org

ADA

MiDENT

You MUST record lesions and classify them (severity and activity)... THIS IS THE ONLY WAY TO MONITOR THEM AND THE SUCCESS OF NON-RESTORATIVE TREATMENTS OVERTIME



Initial (Non-Cavitated; White Spot) Lesion:

- **Tissues are not infected**



Fejerskov & Kidd, 2008

A. Stump, M. Fontana, C. Gonzalez-cabezas, S.D. Cho, L.H. Willis, J.A. Platt, And G. Eckert, 2011

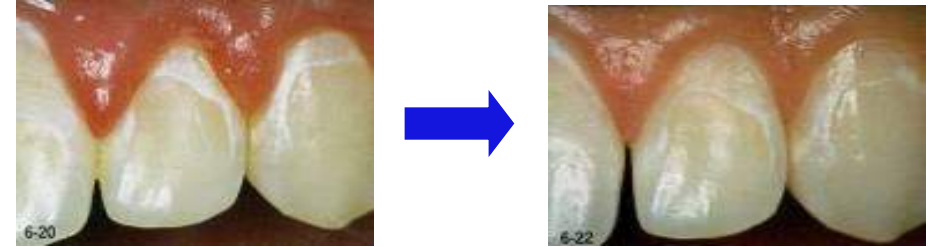
Cavitated Lesion (Cavity):

- **Carious tissues are infected**

Caries Lesion Activity

How to assess over time?

- Increase # of lesions/time
- Increase of lesion (size, etc.)



How to assess in one appointment?

Activity		SOUND (ICDAS 0)	ICDAS 1-4	ICDAS 5-6
	Active	None		Enamel is rough, in plaque stagnation area, opaque, can be whitish or brownish
Inactive	Smooth, not in plaque stagnation area, shiny, translucent			Dentin is hard and shiny on gentle probing



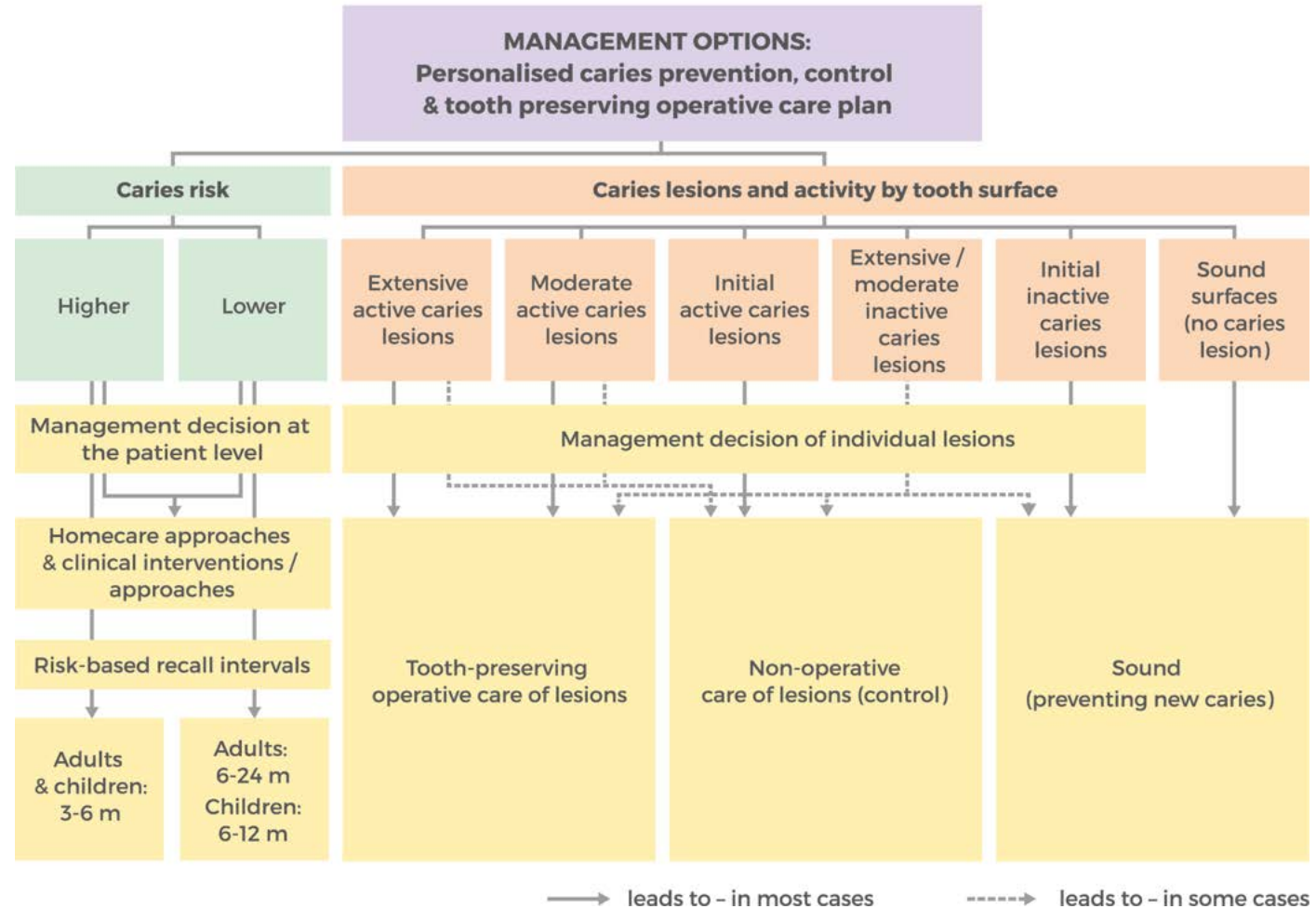
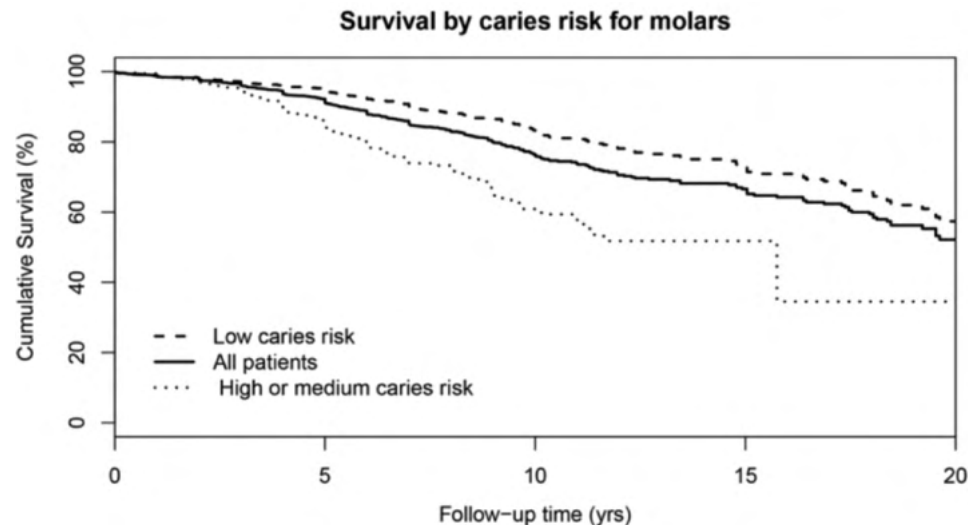


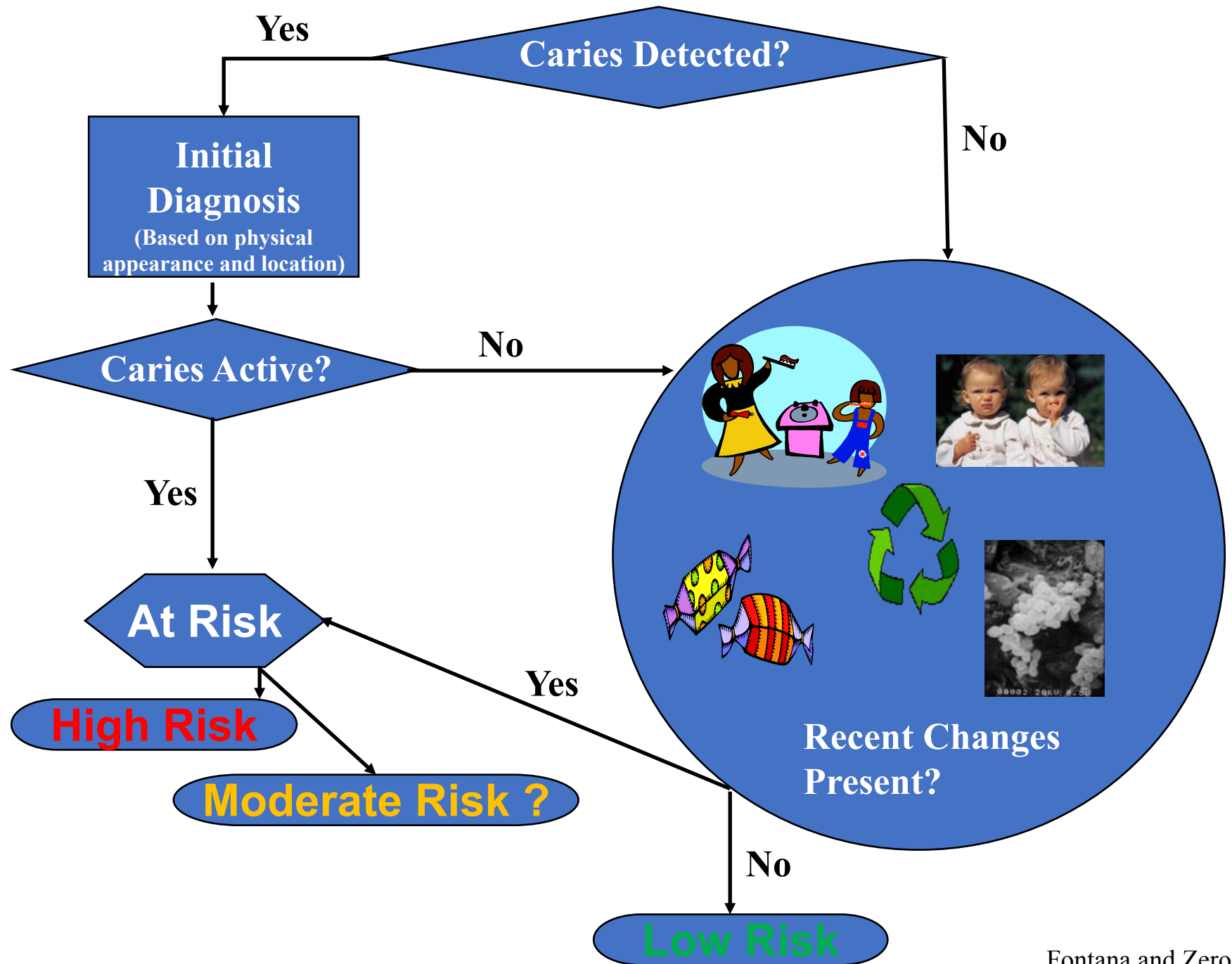
Figure 5. Patient's Care Plan Decision Flowchart.

Risk Assessment:

- Caries risk must be assessed regularly (i.e., risk may change over time) to aid in prognosis
- Caries risk forms may also identify modifiable risk factors
- Document it (at UoM it is mandatory this be done for every patient!)
- Use it to inform the frequency of patient recall, prevention and treatment strategies, and inform prognosis or restorative and non-restorative care



Caries experience (especially recent) is the strongest risk factor



Steps suggested for salivary screenings

1. Identify complaint (history of the problem, symptoms)... (use Fox et al., 1987 questions)

- Does your mouth feel dry when eating a meal?
- Do you sip liquids to aid swallowing dry foods?
- Do you have difficulty swallowing any foods?

2. Medical history (Possible cause: medications, diseases, etc.)

3. Clinical evaluation of signs: soft and hard tissues



4. Further diagnostic

Unstimulated: < 0.1 ml/min
Stimulated: <0.5-0.7 ml/min



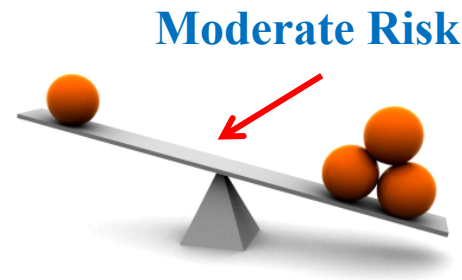
In Progress Tx History Perio Forms Attachments Labs Medications	
Change Date 01/27/2016	
Caries Risk Caries Management	
Form Question	Answer
<input checked="" type="checkbox"/> Does the patient have any signs of caries experience? (clinical + radiographically)	Y
Active non-cavitated caries lesions	Y
<input checked="" type="checkbox"/> Are factors present related to recent caries experience or increased risk?	Y
<input checked="" type="checkbox"/> 2.1 (Stagnant) plaque in caries susceptible sites	Y
Deep pits/fissures	Y
<input checked="" type="checkbox"/> 2.2 Saliva	Y
<input type="checkbox"/> Salivary Flow Tested (Additional Assessment for at Risk Patients)	Y
Unstimulated flow test	Schimer < 10ml / 3min
Stimulated flow test	Less than 0.7ml/min
<input type="checkbox"/> 2.3 Diet	Y
Frequency of fermentable carbohydrates snacks between meals, including candies or lozenges with sugar	More than 3x/day
<input type="checkbox"/> 2.4. Inadequate Protective Modifying Factors	Y
Frequency of brushing	Less than 1x/day
Frequency of flossing	Never
<input checked="" type="checkbox"/> 2.5 Conditions that affect compliance	Y
Physical (motor coordination/pain)	Y
<input type="checkbox"/> Is this a re-assessment?	N
Caries Risk	High

In Progress Tx History Perio Forms Attachments Labs Medications	
Change Date 01/27/2016	
Caries Risk Caries Management	
Form Question	Answer
Based on the identified patient's problems, please provide a treatment plan that will address problems listed and increase protective factors.	
<input checked="" type="checkbox"/> 1. Fluorides (If patient is Moderate to High risk. Additional Fluoride MUST be added.)	
<input type="checkbox"/> Prescription high concentration F 5,000 ppm (e.g., Prevident, ClinPro)	Y
Directions for use	Use in place of regular toothpaste
<input checked="" type="checkbox"/> 2. Daily Oral Hygiene	
Brush at least twice daily (with fluoride toothpaste)	Y
<input checked="" type="checkbox"/> 3. Diet	
Reduce frequency of sweetened beverages	Y
<input checked="" type="checkbox"/> 4. Sugar-free gum	
<input checked="" type="checkbox"/> 5. Antibacterial products	
<input checked="" type="checkbox"/> 6. Additional management	
Restorative treatment	Y
Prescription salivary stimulants	Y

- These 2 forms need to be completed for every patient, and re-assessed over time based on risk status
- Close to 90% of patients with an initial exam had the CRA done! Reassessments?
- Clinical test cases and OSCE associated with this!
- **54% high risk, 25% moderate risk, 21 % low risk** (Brons-Piche et al., 2018)



Low Risk



Moderate Risk



High Risk

Predictive Validity of a Caries Risk Assessment Model at a Dental School

Emily Brons-Piche, George J. Eckert, Margherita Fontana

J Dent Educ 2019

Table 2. Percentage of patients in each caries risk category based on number of caries lesions developed during follow-up period

Number of New Lesions	High Caries Risk	Moderate Caries Risk	Low Caries Risk
≥1 new lesion	65%	46%	41%
≥2 new lesions	45%	23%	20%
≥3 new lesions	32%	15%	10%

Note: Relative rates were adjusted for different follow-up times. Number of new lesions were categorized as yes/no: ≥1 or ≥2 or ≥3.

Model (AUC: 0.82); Significant (p<0.001) factors:

- Past/current caries experience (OR 23.7)
- Dietary risk factors (OR 3.2)
- Visible plaque (OR 2.6)
- Salivary risk factors (OR 2.6)
- Conditions that affect compliance (OR 2.4)
- Lack of adequate protective factors (OR 2.1)

Of our high risk patients:

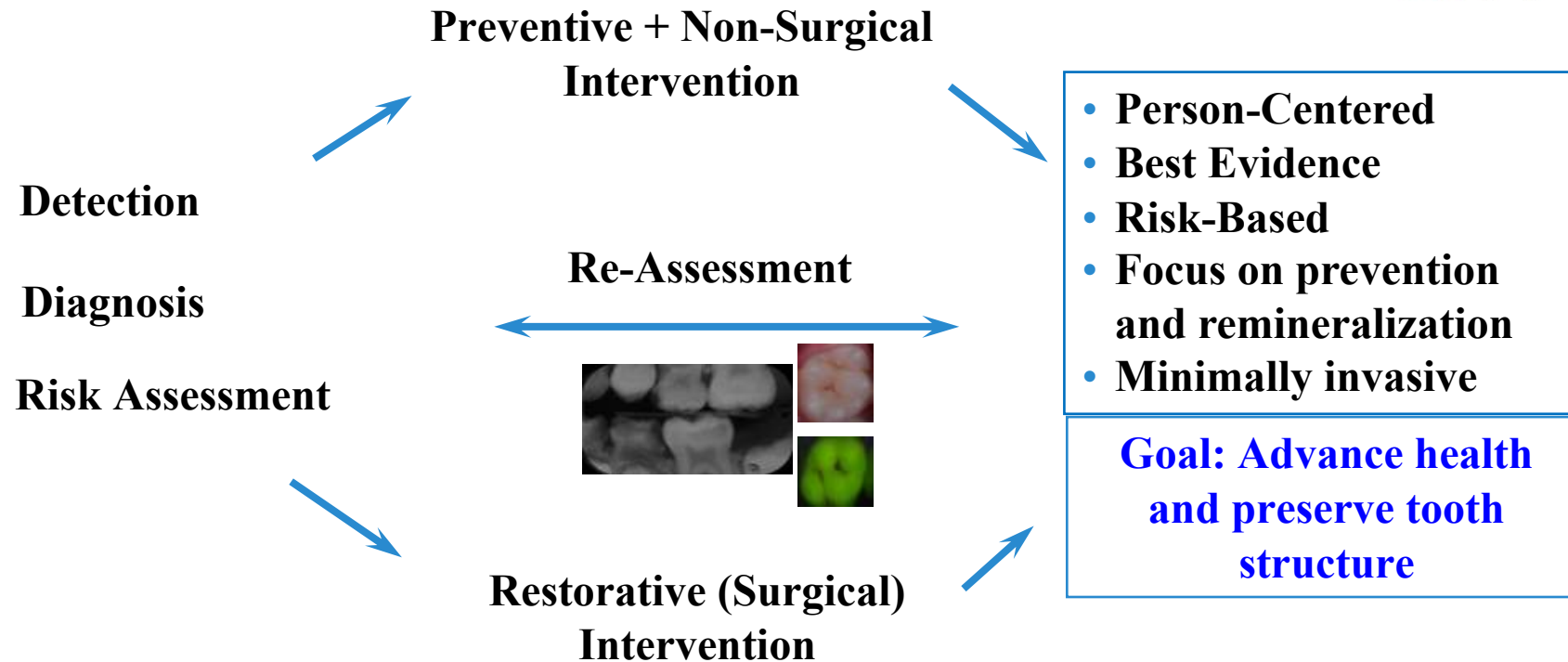
- **9% received fluoride varnish**
- **23% a toothpaste prescription**
- **7% received both**

Jang et al., 2018

Cariology Curriculum



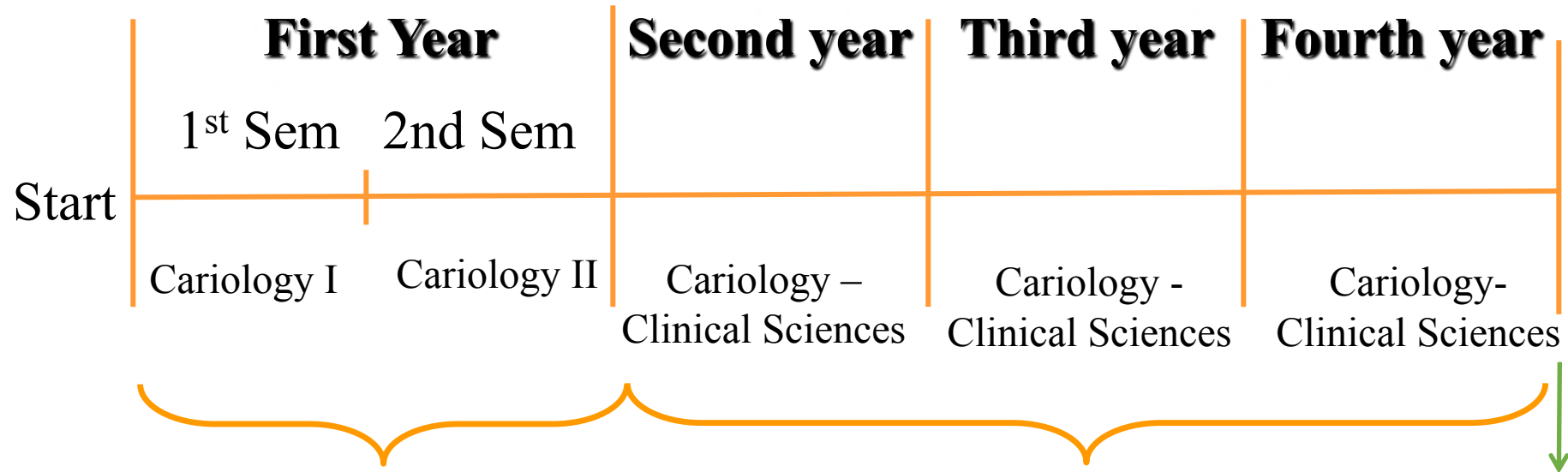
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Development of a Core Curriculum Framework in Cariology for U.S. Dental Schools

Margherita Fontana, Sandra Guzmán-Armstrong, Andrew B. Schenkel, Kenneth L. Allen, John Featherstone, Susie Goolsby, Preetha Kanjirath, Justine Kolker, Stefania Martignon, Nigel Pitts, Andreas Schulte, Rebecca L. Slayton, Douglas Young and Mark Wolff

Journal of Dental Education June 2016, 80 (6) 705-720;



Course Assessments

Clinical Test Cases

OSCE
(Objective
Structured
Clinical
Examination)



519, 522 and 532 Schedules Fall 2018

Week #	519 Course Activities			522 Course Activities		532 Course Activities	
	Mon	Tues	Wed	Thurs	Fri		
9	10/29/2018	10/30/2018	10/31/2018	11/1/2018		11/2/2018	
8 to 9		522 Seminar: Finalize treatment plan for Ms. Smith (draft Tx Plan DUE)				532: 8-10 Introduction to the Use of Fluorides in Caries Management-Part 1 (Gonzalez) G378	
9 to 10		532: PRACTICAL EXAM for Caries Detection (Group B & C) (Gonzalez/Fontana) Sim Lab G360	522: Group D Digital Impression Training in FC				
10 to 11			522 Clinic: Group A assist in clinic				
11 to 12							
Noon							
1 to 2		519 Lec: Class III Composites Preparations and Restorations and Placement of Class I amalgam				519 Lab: SUMMATIVE ASSESSMENT: CARIES REMOVAL INDEPENDENT PROJECT (CRIP)	
2 to 3		519 Lab: Student Study Plan for Caries Excavation, mount teeth for study plan Project #5 Begins		FLEX TIME			
3 to 4							
4 to 5						519 Lab: SUMMATIVE ASSESSMENT: CRIP Instructor Evaluation Completeion	
10	11/5/2018	11/6/2018	11/7/2018	11/8/2018		11/9/2018	
8 to 9		522 Seminar: Begin treatment plan for Mr. Davis (Ms. Smith Tx Plan DUE in MiDent)				532: 8-10 Use of Sealants in Caries Management (Fontana) G378	
9 to 10		532: PRACTICAL EXAM for Caries Detection (Group A & D) (Gonzalez/Fontana) Sim lab G360	522: Group B Assist in Clinic				
10 to 11			522: Group C Digital Impression Training 9 - 12				
11 to 12							
Noon							
1 to 2		519 Lec: Summative Written Exam #2 of #3				519 Lec: Sealant Placement and Infiltration Technique KARL	
2 to 3		519 Lab: Project #5 - Class III Resin Composite Preparations Begin Project #6 Class I Composites		FLEX TIME		519 Lab: Project #7 Begin and End - Patient Treatment Documentation, Etch, Bond and Sealant placement	
3 to 4							
4 to 5							

Cariology I

- Introduction to Cariology
- Nomenclature in Cariology
- Histopathology and physico-chemistry of caries
- Visual Caries detection and diagnosis
- Introduction to radiographic interpretation of caries lesions
- *Caries Detection Lab*
- Role of Saliva in Caries Management
- Role of diet in the etiology and management of dental caries
- Microbiology of Caries
- Mechanical Plaque Removal and Caries Management
- Caries Risk Assessment

Cariology I (cont.)

- *Caries Detection Practical Exam*
- Use of fluorides in caries management
- Use of Sealants (and Hall Crowns, Infiltration) in caries prevention and management (sealing sound and caries lesions; selective caries removal to soft dentin-partial caries removal)
- *Caries Risk Assessment discussion of forms and cases*
- *Clinic experience: detection and risk assessment*

Cariology II

- Virulence determinants, microbial ecology in caries sites, Caries Vaccines, Fate of "sealed" bacteria.
- Clinical Exercise in Saliva Diagnosis and OTC Products Recommendations
- Silver Diamine Fluoride (SDF).
- Sugar Alcohols for caries control.
- Fluoride kinetics and toxicity. Self-applied F products ("refresher").
- Fluoride delivered at community level.
- Clinical Exercise in Caries Prevention Products Professionally Applied or Prescribed
- Role of Antimicrobials in Caries Control.
- New Technologies for Caries Diagnosis.
- Secondary Caries.
- Root Caries.
- Dental Erosion.
- Laboratory Exercise in Detection of Caries/Wear Lesions
- Epidemiology of Dental Caries.
- Calcium-Based and other strategies for caries control.
- Role of Operative Dentistry in Caries. Decision Trees for Management of Caries Lesions.



HEAL_{th} HEALTH EDUCATION THROUGH ACTIVE LEARNING

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Case Files | Medical History | Dental History | Interview

Mary



VIRTUAL CLINIC

Mary is a 24-year-old female, currently not working and has no dental insurance. She is having early sensitivity as she thinks she has some new cavities since her last appointment for a filling last year. She states she usually brushes her teeth and flosses once a day but she has trouble brushing her front teeth and she will be getting married soon.

Health History:

UNIVERSITY OF MICHIGAN



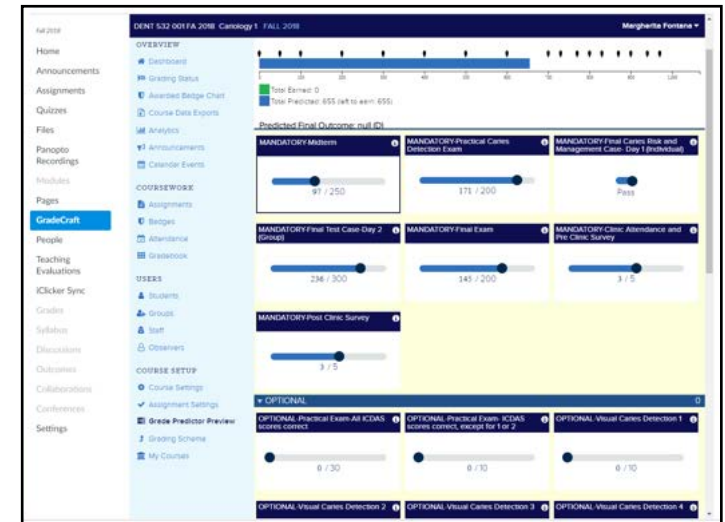
Upon graduation a dentist must be competent in evidence-based detection, diagnosis, risk assessment, prevention, nonsurgical and surgical management of dental caries, both at the individual and community level, and be able to re-assess the outcomes of interventions over time

Promoting critical thinking for clinical-decision making to solve clinical problems?

- **Assessment drives learning**
- **We should assess how we teach (no surprises)**

Didactic:

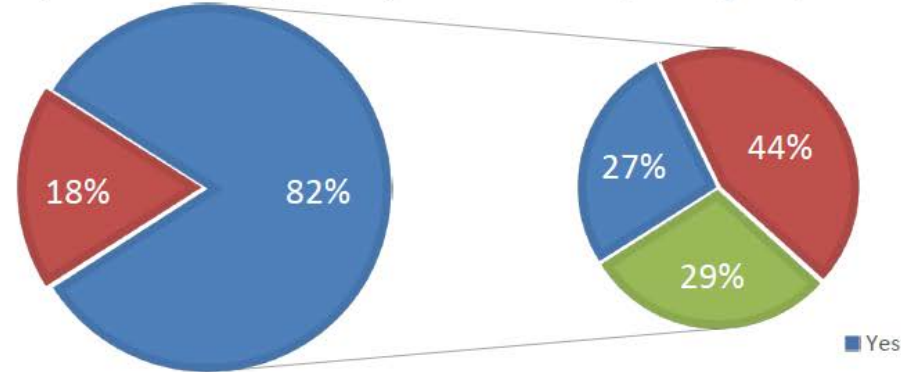
- Clickers
- Case-based learning
- Small groups
- Type of questions in exams (case-based)
- “Hands-on” experiences
- “Gameful learning” (autonomy, etc.)



Cariology Curriculum Framework

Are you aware of recently proposed Cariology curriculum framework (Fontana et al., 2016)?

If yes, do you believe the framework is adequately implemented in your curriculum?



Cariology Education

83.3% Response Rate

Cariology Education – Short Term Impact of a U.S. Cariology Curriculum

TOPICS ADDRESSED IN THE CURRICULUM	2011	2018
Genetics of caries	67%	55%
ICDAS II terminology and criteria	65%	78%
pH neutralization strategies	65%	73%
Radiographic detection of carious lesions	94%	100%
Assessment of readiness for behavioral change	65%	49%
Removal of dental hard tissues affected by caries (general discussion of threshold for removal and how much to remove)	88%	96%
Partial caries removal strategies *	69%	88%
Bacterial cultures or other metrics *	76%	55%
Non-radiographic technology-assisted detection (e.g., fluorescence – based)	76%	67%
ART	43%	57%
Dental erosion epidemiology	57%	63%
SDF *		86%

DO YOU BELIEVE CARIOLOGY CONCEPTS ARE ADEQUATELY BEING IMPLEMENTED IN CLINICS?	2011	2018
Yes	35%	28%
No	33%	30%
Maybe	31%	42%

Take Home Messages

1. Site-specific strategies at the lesion/surface level + Prevention at individual level
2. Use of Latest and Best practice guidelines
3. Risk level → Treatment Plan - Prognosis - Recall
4. ↑ F for most/all at risk patients
5. Dietary control is important - difficult to sustain
6. Most non-cavitated lesions are treated non-restoratively
7. Record and monitor active caries lesions to determine treatment effectiveness
8. Most cavitated lesions are treated restoratively - preserving tooth structure and pulpal health, while reducing discomfort and pain
9. 38% SDF can be used effectively as an alternative non-restorative strategy for control of cavitated lesions and root caries lesions (COVID-19 alternative)

Cariology for the 21st Century

Current Caries Management Concepts for Dental Practice

By Margherita Fontana, DDS, PhD,
Carlos Gonzalez Cabezas, DDS, PhD,
and Mark Fitzgerald, DDS, MS



ICCMS™
CARIES MANAGEMENT
International Caries Classification and Management System

ICCMS™ Guide for Practitioners and Educators

Nigel B. Pitts, FRSE BDS PhD FDS RCS (Eng) FDS RCS (Edin) FFGDP (UK) FFPH¹

Amid I. Ismail, BDS, MPH, Dr. PH, MBA²

Stefania Martignon, BDS, PhD^{1,3}

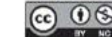
Kim Ekstrand, BDS, PhD⁴

Gail V. A. Douglas, BMSc, BDS, MPH, FDS, PhD, FDS (DPH) RCS⁵


Christopher Longbottom, BDS, PhD¹

Nonrestorative Treatments for Caries: Systematic Review and Network Meta-analysis

Journal of Dental Research
1-13
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Evidence-based clinical practice guideline on nonrestorative treatments for carious lesions

A report from the American Dental Association

Rebecca L. Slayton, DDS, PhD; Olivia Urquhart, MPH; Marcelo W.B. Araujo, DDS, MS, PhD; Margherita Fontana, DDS, PhD; Sandra Guzmán-Armstrong, DDS, MS; Marcelle M. Nascimento, DDS, MS, PhD; Brian B. Nový, DDS; Norman Tinanoff, DDS, MS; Robert J. Weyant, DMD, DrPH; Mark S. Wolff, DDS, PhD; Douglas A. Young, DDS, EdD, MS, MBA; Domenick T. Zero, DDS, MS; Malavika P. Tampi, MPH; Lauren Pilcher, MSPH; Laura Banfield, MLIS, MHSc; Alonso Carrasco-Labra, DDS, MSc

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