Minimally Invasive Dentistry

SDF, GIC, and SMART

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Disclosures

I have served the ADA but today's opinions are solely mine.

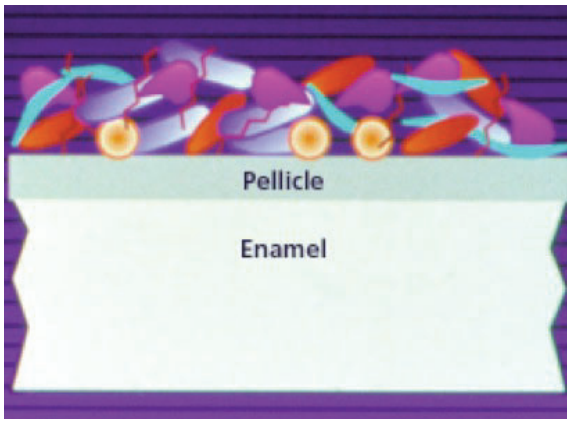
- ADA Council of Scientific Affairs (2012-2016)
- A cariology consultant for the ADA (2012-present)

Financial relationships:

- GC America
- Elevate Oral Care
- Oral BioTech

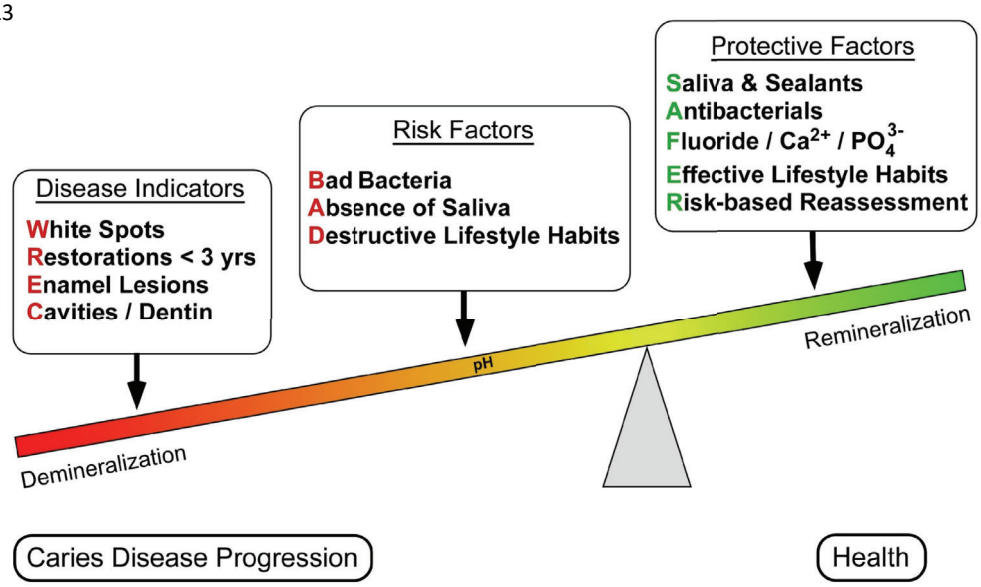
The Caries Process

BAD Risk Factors



Young and Featherstone Community Dent Oral Epidemiol 2013

The Caries Balance / Imbalance

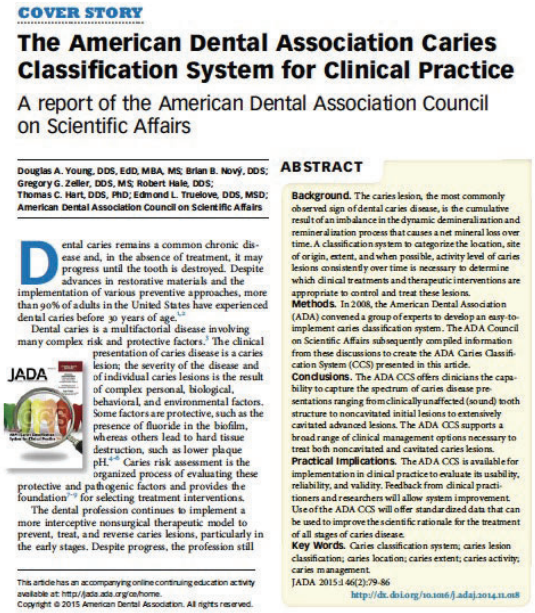


Assumption:
You have already treate

- Complete exam
- Caries risk assessment (CRA)
- Developed a caries risk management plan
  - Motivational interviewing and shared decision making
  - Behavioral change
  - Implemented interventions (products)
    - Biofilm modification
    - Halting demineralization
    - Enhancing remineralization

Caries Management at the Tooth Level

JADA Feb 2015



COVER STORY

The American Dental Association Caries Classification System for Clinical Practice

A report of the American Dental Association Council on Scientific Affairs

Douglas A. Young, DDS, EdD, MBA, MS; Brian B. Novy, DDS; Gregory G. Zeller, DDS, MS; Robert Hale, DDS; Thomas C. Hart, DDS, PhD; Edmond L. Truelove, DDS, MSD; American Dental Association Council on Scientific Affairs

Dental caries remains a common chronic disease and, in the absence of treatment, it may progress until the tooth is destroyed. Despite advances in restorative materials and the implementation of various preventive approaches, more than 90% of adults in the United States have experienced dental caries before 30 years of age.[1,2]

Dental caries is a multifactorial disease involving many complex risk and protective factors.[3] The clinical presentation of caries disease is a caries lesion; the severity of the disease and of individual caries lesions is the result of complex personal, biological, behavioral, and environmental factors. Some factors are protective, such as the presence of fluoride in the biofilm, whereas others lead to hard tissue destruction, such as lower plaque pH.[4-6] Caries risk assessment is the organized process of evaluating these protective and pathogenic factors and provides the foundation[7-9] for selecting treatment interventions.

The dental profession continues to implement a more interceptive nonsurgical therapeutic model to prevent, treat, and reverse caries lesions, particularly in the early stages. Despite progress, the profession still

ABSTRACT

Background. The caries lesion, the most commonly observed sign of dental caries disease, is the cumulative result of an imbalance in the dynamic demineralization and remineralization process that causes a net mineral loss over time. A classification system to categorize the location, site of origin, extent, and when possible, activity level of caries lesions consistently over time is necessary to determine which clinical treatments and therapeutic interventions are appropriate to control and treat these lesions.

Methods. In 2008, the American Dental Association (ADA) convened a group of experts to develop an easy-to-implement caries classification system. The ADA Council on Scientific Affairs subsequently compiled information from these discussions to create the ADA Caries Classification System (CCS) presented in this article.

Conclusions. The ADA CCS offers clinicians the capability to capture the spectrum of caries disease presentations ranging from clinically unaffected (sound) tooth structure to noncavitated initial lesions to extensively cavitated advanced lesions. The ADA CCS supports a broad range of clinical management options necessary to treat both noncavitated and cavitated caries lesions.

Practical Implications. The ADA CCS is available for implementation in clinical practice to evaluate its usability, reliability, and validity. Feedback from clinical practitioners and researchers will allow system improvement. Use of the ADA CCS will offer standardized data that can be used to improve the scientific rationale for the treatment of all stages of caries disease.

Key Words. Caries classification system; caries lesion classification; caries location; caries extent; caries activity; caries management.

JADA 2015;146(2):79-86

http://dx.doi.org/10.1016/j.adaj.2014.11.018

Activity

Characteristics of active and inactive caries lesions[27]

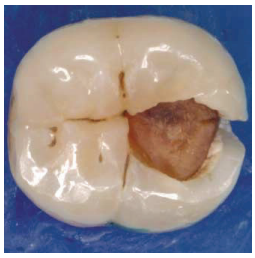
Activity Assessment Factor	CARIES LESION ACTIVITY ASSESSMENT DESCRIPTORS	
	Likely To Be Inactive/Arrested	Likely To Be Active
Location of the Lesion	Lesion is not in a plaque stagnation area	Lesion is in a plaque stagnation area (pit/fissure, approximal, gingival)
Plaque Over the Lesion	Not thick or sticky	Thick and/or sticky
Surface Appearance	Shiny; Color: brown-black	Matte/opaque/loss of luster; Color: white-yellow
Tactile Feeling	Smooth, hard enamel/hard dentin	Rough enamel/soft dentin
Gingival Status (If the Lesion is Located Near the Gingiva)	No Inflammation, no bleeding on probing	Inflammation, bleeding on probing

Young DA, Novy BB, Zeller GG, et al. The American Dental Association Caries Classification System for Clinical Practice: A report of the American Dental Association Council on Scientific Affairs. J Am Dent Assoc 2015;146(2):79-86.

The Importance of Cavitation

Bacteria are too big to penetrate the enamel

When do you drill a tooth?



When it is fully cavitated

TABLE 2

American Dental Association Caries Classification System.

	AMERICAN DENTAL ASSOCIATION CARIES CLASSIFICATION SYSTEM			
	Sound	**Initial**	**Moderate**	**Advanced**
Clinical Presentation	No clinically detectable lesion. Dental hard tissue appears normal in color, translucency, and gloss.	Earliest clinically detectable lesion compatible with mild demineralization. Lesion limited to enamel or to shallow demineralization of cementum/dentin. Mildest forms are detectable only after drying. When established and active, lesions may be white or brown and enamel has lost its normal gloss.	Visible signs of enamel breakdown or signs the dentin is moderately demineralized.	Enamel is fully cavitated and dentin is exposed. Dentin lesion is deeply/severely demineralized.
Other Labels	No surface change or adequately restored	Visually noncavitated	Established, early cavitated, shallow cavitation, microcavitation	Spread/disseminated, late cavitated, deep cavitation
Infected Dentin	None	Unlikely	Possible	Present
Appearance of Occlusal Surfaces (Pit and Fissure)*,†	ICDAS 0	ICDAS 1 ICDAS 2	ICDAS 3 ICDAS 4	ICDAS 5 ICDAS 6
Accessible Smooth Surfaces, Including Cervical and Root‡				
Radiographic Presentation of the Approximal Surface§	E0¶ or RO# No radiolucency	E1¶ or RA1# E2¶ or RA2# D1¶ or RA3# Radiolucency may extend to the dentinoenamel junction or outer one-third of the dentin. Note: radiographs are not reliable for mild occlusal lesions.	D2¶ or RB4# Radiolucency extends into the middle one-third of the dentin	D3¶ or RC5# Radiolucency extends into the inner one-third of the dentin

* Photographs of extracted teeth illustrate examples of pit-and-fissure caries.
† The ICDAS notation system links the clinical visual appearance of occlusal caries lesions with the histologically determined degree of dentinal penetration using the evidence collated and published by the ICDAS Foundation over the last decade; ICDAS also has a menu of options, including 3 levels of caries lesion classification, radiographic scoring and an integrated, risk-based caries management system ICCMS. (Pitts NB, Ekstrand KR. International Caries Detection and Assessment System (ICDAS) and its International Caries Classification and Management System (ICCMS): Methods for staging of the caries process and enabling dentists to manage caries. *Community Dent Oral Epidemiol* 2013;41(1):e41-e52. Pitts NB, Ismail AI, Martignon S, Ekstrand K, Douglas GAV, Longbottom C. ICCMS Guide for Practitioners and Educators. Available at: https://www.icdas.org/uploads/ICCMS-Guide_Full_Guide_US.pdf. Accessed April 13, 2015.)
‡ "Cervical and root" includes any smooth surface lesion above or below the anatomical crown that is accessible through direct visual/tactile examination.
§ Simulated radiographic images.
¶ E0-E2, D1-D3 notation system.[33]
# R0, RA1-RA3, RB4, and RC5-RC6 ICCMS radiographic scoring system (RC6 = into pulp). (Pitts NB, Ismail AI, Martignon S, Ekstrand K, Douglas GAV, Longbottom C. ICCMS Guide for Practitioners and Educators. Available at: https://www.icdas.org/uploads/ICCMS-Guide_Full_Guide_US.pdf. Accessed April 13, 2015.)

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Practical implementation of caries disease management in the era of CAMBRA: a guide for the general dentist

Douglas A. Young, DDS, EdD, MBA, MS ■ Ryan L. Quock, DDS ■ Susie Goolsby, DDS, MSHA
Martha McComas, RDH, MS ■ Steven Powell, DDS ■ Gregory G. Zeller, DDS, MS
Allen Wong, DDS, EdD ■ Brian B. Novy, DDS

Although the philosophy of caries management by risk assessment (CAMBRA) is widely accepted as an essential part of comprehensive disease management, its implementation in daily clinical practice has historically been hindered by a lack of concise guidance that bridges the gap between scholarly research and the logistics of patient care. With the aim of guiding comprehensive disease management for dental caries by integrating available evidence-based systems such as the American Dental Association Caries Classification System (ADA CCS) and caries risk assessment (CRA), this review presents clinical strategies in a functional format. Clinical caries management strategies that integrate the ADA CCS with CRA were compiled and evaluated by clinicians representing a variety of practice settings. Examples of clinical protocols were selected to illustrate the use of CRA at the patient level and ADA CCS lesion classification at the tooth level to comprehensively manage caries lesions in a high-caries-risk population. Comprehensive caries management combines the clinical use of CRA and caries lesion classification to guide clinical decisions and to support tooth preservation in high-risk populations. These strategies should be individualized and fulfill evidence-based clinical practice criteria with oral health as the primary outcome. Person-centered comprehensive caries management integrating CRA and classification of caries lesions has the potential to improve patient outcomes by addressing the underlying causes of caries disease. Documenting and measuring the processes at the tooth, patient, and practice levels are essential for generating outcomes that will drive future approaches aimed at improving patient health.

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Keywords: caries classification system, caries management, caries risk assessment, caries risk management, clinical protocols, dental caries, oral health

The respect for comprehensive disease management as a whole, and caries management by risk assessment (CAMBRA) as a leading philosophy, has continued to increase among payers, educators, clinicians, organized oral healthcare, and the US Health Resources and Services Administration. Yet in an era of evidence-based clinical decision-making, the adoption of these concepts by more clinicians seems to be stalled by a lack of practical translational strategies that are urgently needed for the improvement of patient health. This is not to say that the underlying science is lacking or that research has failed to show any positive health outcomes from these approaches. Instead, the situation highlights the hurdles that make it difficult to evaluate and adopt the vast array of available information in the form of effective clinical protocols. Given that dental caries is one of the most common diseases treated in dentistry, it could be argued that every general dentist functions as a practical cariologist, requiring actionable information. This summary of clinical cariology based on the philosophy of CAMBRA is meant to provide guidance for general dentists to implement disease management concepts in daily practice and improve the oral health of the patients they treat.

Terminology

The term *caries* by itself is open to several interpretations, and *caries* is colloquially used to describe both the disease and the resulting symptomatic lesion; this may create confusing variations in diagnosis and treatment. Adoption of high-level consensus terminology, such as that described jointly by the International Association for Dental Research Cariology Research Group, the European Organization for Caries Research, and the International Caries Consensus Collaboration is recommended for more precise diagnosis, treatment, and communication.[1-3] For example, the term *dental caries* is used to describe the actual disease process, while *caries lesion* describes the clinical manifestation of the disease; the 2 terms are closely related yet distinct.

Caries management is defined as "...actions taken to interfere with mineral loss at all stages of the caries disease, including nonoperative and operative interventions/treatments."[4] The term *nonoperative* refers to treating the lesion without tooth structure removal by employing the following strategies: surface protection (including barriers or sealants), biofilm modification, remineralization via chemotherapeutics, saliva supplementation, and behavioral modification, including changes in diet and lifestyle.

Table 5. Example hard tissue preservation strategy based on the ADA CCS category using current tooth-preserving (tooth-level) and behavior management (patient-level) strategies.

Characteristics	Sound	Initial	Moderate	Advanced
Infected dentin (full cavitation)	None	Unlikely	Possible	Present
Occlusal				
Clinical presentation	 ICDAS 0	 ICDAS 1  ICDAS 2	 ICDAS 3  ICDAS 4	 ICDAS 5  ICDAS 6
Insidious caries lesion; few lesions, slow progression	Consider GIC sealant for primary prevention (no preparation)	Place GIC sealant (no preparation)	Place GIC sealant (no preparation)	Place MID GIC restoration (selective caries removal)
Rampant or aggressive caries lesion; multiple lesions, aggressive progression	Place GIC sealant (no preparation)	Arrest with SDF; place GIC sealant (no preparation)	Arrest with SDF; place GIC sealant (no preparation)	Consider SDF; place MID GIC restoration (selective caries removal)
Facial/lingual				
Clinical presentation	 ICDAS 0	 ICDAS 1  ICDAS 2	 ICDAS 3  ICDAS 4	 ICDAS 5  ICDAS 6
Insidious caries lesion; few lesions, slow progression	Follow CRM protocol for primary prevention	Arrest and remineralize using risk-based CRM	Arrest and remineralize using CRM; consider GIC surface protection (no preparation) for deeper microcavitations and/or SDF per patient wants	Place MID GIC restoration (selective caries removal)
Rampant or aggressive caries lesion; multiple lesions, aggressive progression	Follow CRM protocol for primary prevention	Arrest and remineralize using risk-based CRM; consider SDF	Arrest and remineralize using CRM; consider GIC surface protection (no preparation) and/or SDF	Consider SDF; place GIC restoration (selective caries removal)
Approximal				
Clinical presentation	 E0* or R0*	 E1* or RA1*  E2* or RA2*  D1* or RA3*	 D2* or RB4*	 D3* or RC5*
Difficult to assess insidious vs aggressive progression	Follow CRM protocol for primary prevention	Arrest and remineralize using CRM; consider SDF	Consider SDF, orthodontic separation, surface protection with no preparation, and/or MID restoration with selective caries removal with or without SDF	Place MID GIC restoration (selective caries removal) with or without SDF

CRM protocol: topical fluoride; pH neutralization; biofilm modification; saliva supplementation with calcium and phosphate based on caries risk; and behavioral modification (healthy diet and lifestyle choices and good oral hygiene).

Abbreviations: ADA CCS, American Dental Association Caries Classification System; CRM, caries risk management; GIC, glass ionomer cement; ICDAS, International Caries Detection and Assessment System; MID, minimally invasive dentistry; SDF, silver diamine fluoride.

Agd.org/generaldentistry; Young DA, Quock RL, Goolsby S, et al. Practical implementation of caries disease management in the era of CAMBRA: a guide for the general dentist. *Gen Dent*. 2025;73(6):56-66.

How to Assess and Treat the Occlusal Site

Practical implementation of caries disease management in the era of CAMBRA: a guide for the general dentist

Table 5. Example hard tissue preservation strategy based on the ADA CCS category using current tooth-preserving (tooth-level) and behavior management (patient-level) strategies.

Characteristics	Sound	Initial	Moderate	Advanced
Infected dentin (full cavitation)	None	Unlikely	Possible	Present
Occlusal				
Clinical presentation	ICDAS 0 	ICDAS 1  ICDAS 2 	ICDAS 3  ICDAS 4 	ICDAS 5  ICDAS 6 
Insidious caries lesion; few lesions, slow progression	Consider GIC sealant for primary prevention (no preparation)	Place GIC sealant (no preparation)	Place GIC sealant (no preparation)	Place MID GIC restoration (selective caries removal)
Treat the disease with appropriate caries risk management (CRM)	Low/Moderate risk = Behavioral modification including healthy diet & lifestyle choices, good oral hygiene, OTC F, Xylitol to replace table sugar High risk = add antibacterial & pH neutralization, Extreme risk = add to Ca & PO4 supplementation and pH neutralization			

Agd.org/generaldentistry; Young DA, Quock RL, Goolsby S, et al. Practical implementation of caries disease management in the era of CAMBRA: a guide for the general dentist. *Gen Dent*. 2025;73(6):56-66.

Slide courtesy of Dr. Douglas Young

EBD Guidelines JADA 2016

1. Seal over non-cavitated occlusal lesions
2. Not enough evidence to recommend one material over another (free to choose)

Evidence-based clinical practice guideline for the use of pit-and-fissure sealants

A report of the American Dental Association and the American Academy of Pediatric Dentistry

John T. Wright, DDS, MS; James J. Crall, DDS, MS, ScD; Margherita Fontana, DDS, PhD; E. Jane Gillette, DDS; Brian B. Novy, DDS; Vineet Dhar, BDS, MDS, PhD; Kevin Donly, DDS, MS; Edmond R. Hewlett, DDS; Rocio B. Quinonez, DMD, MS, MPH; Jeffrey Chaffin, DDS, MPH, MBA, MHA; Matt Crespin, MPH, RDH; Timothy Iafolla, DMD, MPH; Mark D. Siegal, DDS, MPH; Malavika P. Tampi, MPH; Laurel Graham, MLS; Cameron Estrich, MPH; Alonso Carrasco-Labra, DDS, MSc, PhD(c)

ABSTRACT

Background. This article presents evidence-based clinical recommendations for the use of pit-and-fissure sealants on the occlusal surfaces of primary and permanent molars in children and adolescents. A guideline panel convened by the American Dental Association (ADA) Council on Scientific Affairs and the American Academy of Pediatric Dentistry conducted a systematic review and formulated recommendations to address clinical questions in relation to the efficacy, retention, and potential side effects of sealants to prevent dental caries; their efficacy compared with fluoride varnishes; and a head-to-head comparison of the different types of sealant material used to prevent caries on pits and fissures of occlusal surfaces.

Types of Studies Reviewed. This is an update of the ADA 2008 recommendations on the use of pit-and-fissure sealants on the occlusal surfaces of primary and permanent molars. The authors conducted a systematic search in MEDLINE, Embase, Cochrane Central Register of Controlled Trials, and other sources to identify randomized controlled trials reporting on the effect of sealants (available on the US market) when applied to the occlusal surfaces of primary and permanent molars. The authors used the Grading of Recommendations Assessment, Development, and Evaluation approach to assess the quality of the evidence and to move from the evidence to the decisions.

Results. The guideline panel formulated 3 main recommendations. They concluded that sealants are effective in preventing and arresting pit-and-fissure occlusal carious lesions of primary and permanent molars in children and adolescents compared with the nonuse of sealants or use of fluoride varnishes. They also concluded that sealants could minimize the progression of noncavitated occlusal carious lesions (also referred to as initial lesions) that receive a sealant. Finally, based on the available limited evidence, the panel was unable to provide specific recommendations on the relative merits of 1 type of sealant material over the others.

Conclusions and Practical Implications. These recommendations are designed to inform practitioners during the clinical decision-making process in relation to the prevention of occlusal carious lesions in children and adolescents. Clinicians are encouraged to discuss the information in this guideline with patients or the parents of patients. The authors recommend that clinicians reorient their efforts toward increasing the use of sealants on the occlusal surfaces of primary and permanent molars in children and adolescents.

Key Words. Pit-and-fissure sealants; clinical recommendations; guideline; occlusal caries; caries prevention; caries arresting.

JADA 2016:147(8):672-682

http://dx.doi.org/10.1016/j.adaj.2016.06.001

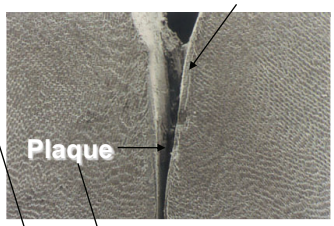
Pit-and-fissure sealants have been used for nearly 5 decades to prevent and control carious lesions on primary and permanent teeth. Sealants are still underused despite their documented efficacy and the availability of clinical practice

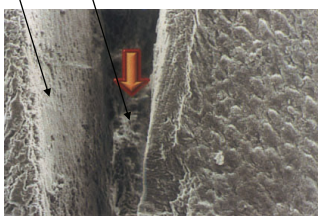
Supplemental material is available online.

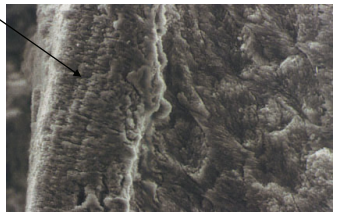
guidelines.[1,2] New sealant materials and techniques continue

Aprismatic Enamel will not Acid Etch

Amorphous or aprismatic enamel







Debris and Aprismatic Enamel

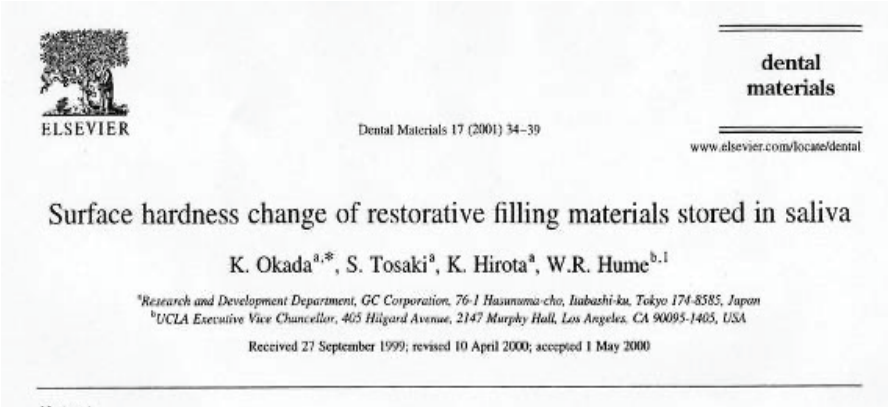
= poor resin bond.

The micromechanical bond of resin is best if prisms are at right angles.

The chemical bond of GI bonds equally well to aprismatic enamel.

Secondary maturation of GIC

- Maturation of GIC's more efficient in saliva (in vivo) than in water (in vitro)



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Dental Materials 17 (2001) 34–39

dental materials

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Surface hardness change of restorative filling materials stored in saliva

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Research Article

In situ transformation of glass-ionomer into an enamel-like material

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ABSTRACT: ***Purpose:*** To assess the nature of clinically detectable alterations in glass-ionomer after long-term clinical service. ***Methods:*** In addition to clinical macro pictures, SEM was carried out on replicas and on two sectioned primary molars SEM-EDAX analysis was performed to determine chemical transformation in the glass-ionomer. Also with SEM-EDAX, the composition was determined of a partially removed half-year old sealant. ***Results:*** The clinically observed altered optical aspect and increased hardness could be related with surface structure changes as identified by SEM. The changed glass-ionomer showed a continuous integration with the adjacent enamel. The SEM-EDAX analysis revealed an increase of calcium and phosphorus in the surface layer, tentatively suggesting a sort of additional "mineralization" of the material. This phenomenon was only observed for restorations that had minimally 2-3 years *in vivo* dwell time. (*Am J Dent* 2004;17:223-227).

CLINICAL SIGNIFICANCE: Straightforward application of conventional glass-ionomer restorative materials can lead to the formation of an extremely hard, glassy material, which remains in the fissure as a hard, enamel-like structure well-integrated with the natural tooth.

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GI becomes enamel-like after 2 years

Introduction

Thanks to their applicability under humid conditions and direct bonding to tooth enamel, inorganic glass-ionomers are practical alternatives for resin fissure sealing. Although bond strength of glass-ionomer to tooth structure is inferior to that of resin-based materials, the adaptation is reported to be superior.[1,2] However, a disadvantage of glass-ionomers is their declared low wear resistance, which causes the sealant to be

Low Viscosity Glass Ionomer

For Sealants and Surface Protection.

3 years….no wear

How long do GI sealants last?

8 Year old GI sealant.

12 Year old GI sealant.

238 **An Atlas of GI by Graham Mount**

24-year-old sealants and counting

My youngest son
Tyler Young, DDS
Now 30 years old

Tyler Young, DDS

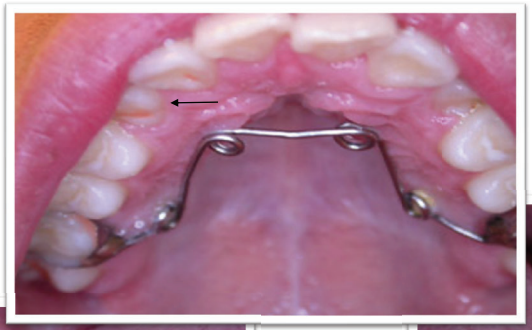
20

Tyler Age 13

Tyler Age 30
(scan taken 8/23)

21

27 year old sealants and counting



My oldest son
Now 33 years old
Kyle Young, DDS

22

27 year old sealants and counting

Kyle at age 33
Photo taken Feb. 2023

GI Sealant and Aerosol Tips

- Mark occlusion with articulating paper (no GI there)
- Suction bite block device
- Work in quadrants or half of the mouth (i.e. UR & LR)
- Defocused air abrasion, pumice slow-speed, pumice on cotton, acid etch (depending on level of aerosol concern)
- Always use polyacrylic acid (cavity conditioner), rinse, blot
- Moist cotton applicator (saturated then rolled on 2X2 gauze) to move or remove excess GIC
- Low viscosity is easier and faster than high viscosity GIC

How to Assess and Treat the Facial/Lingual Site

Root Caries (hardest to restore)

Consider fluoride, SDF, and Glass Ionomer

- is increasing in the elderly
- caused by the same bacteria (Ellen 1985, Zambon 1995)
- similar demin/remin chemistry as enamel
- some can be prevented by fluoride or SDF
- poorly restored even with contemporary materials

Remineralization is an option

Demin → **Remin**

dull + rough = active decay

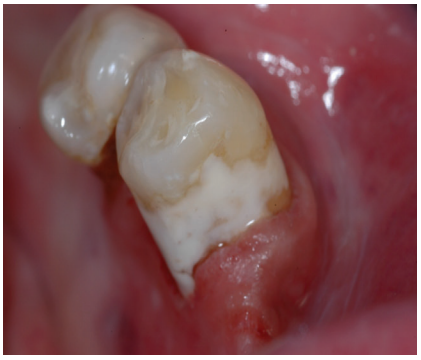
Smooth + shiny = inactive

SDF is an option

time 0 | 1 day | 1 week

J Dent Res 88:116

“Surface Protection” is an option (with Low Viscosity GIC)



Practical implementation of caries disease management in the era of CAMBRA: a guide for the general dentist

Table 5. Example hard tissue preservation strategy based on the ADA CCS category using current tooth-preserving (tooth-level) and behavior management (patient-level) strategies.

Facial/lingual							
Clinical presentation	ICDAS 0 	ICDAS 1 	ICDAS 2 	ICDAS 3 	ICDAS 4 	ICDAS 5 	ICDAS 6 
Insidious caries lesion; few lesions, slow progression	Follow CRM protocol for primary prevention	Arrest and remineralize using risk-based CRM		Arrest and remineralize using CRM; consider GIC surface protection (no preparation) for deeper microcavitations and/or SDF per patient wants		Place MID GIC restoration (selective caries removal)	

Treat the disease with appropriate caries risk management (CRM)	Low/Moderate risk = Behavioral modification including healthy diet & lifestyle choices, good oral hygiene, OTC F, Xylitol to replace table sugar High risk = add antibacterial & pH neutralization, Extreme risk = add to Ca & PO4 supplementation and pH neutralization

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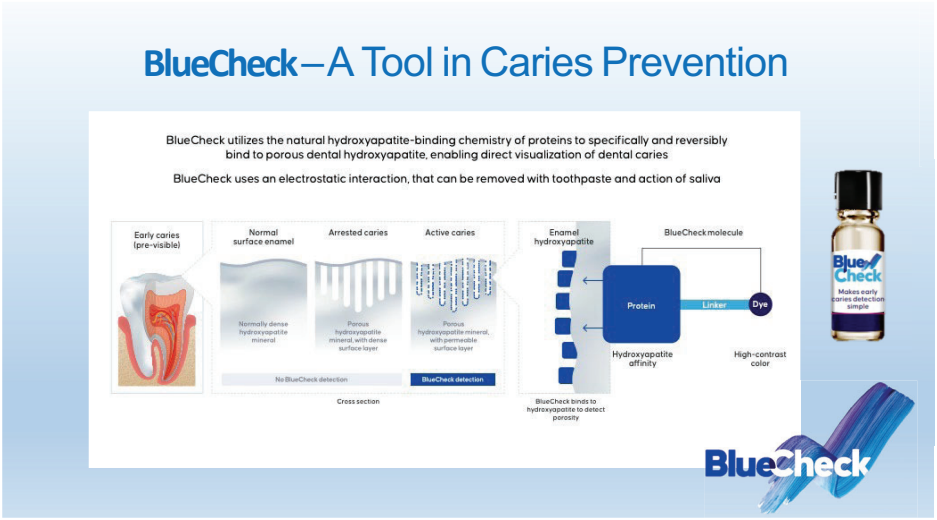
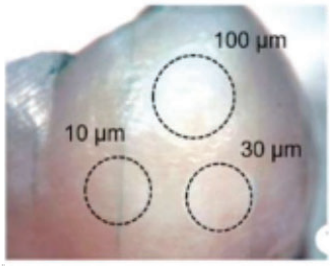
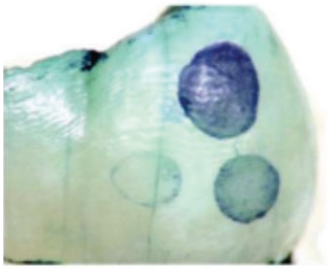
Slide courtesy of Dr. Douglas Young

Early Detection



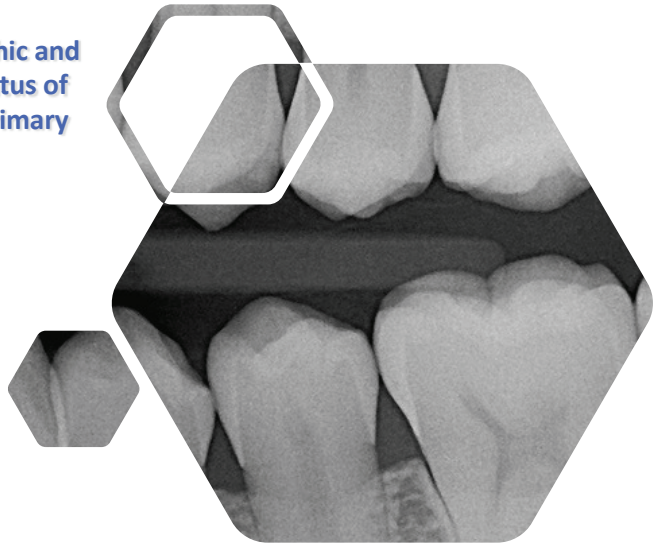




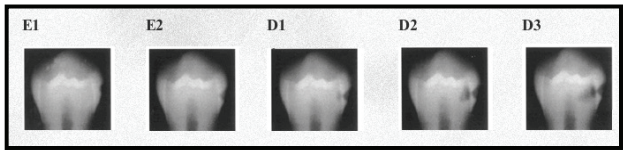
How to Assess and Treat the Approximal Site

An in vivo Comparison of Radiographic and Directly Assessed Clinical Caries Status of Posterior Approximal Surfaces in Primary and Permanent Teeth

N. B. Pitts and P. A. Rimmer
Caries Research, 1992

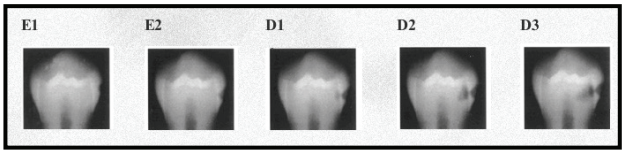


Secondary Teeth



Pitts N.B., Rimmer M.A. Caries Res 1992;26:146-152.

Primary Teeth



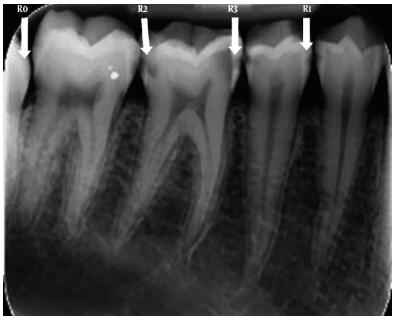
0% **2.9%** **28.4%** **48%**

% Cavitation

Pitts N.B., Rimmer M.A. Caries Res 1992;26:146-152.

Muñoz-Sandoval C, Gambetta-Tessini K, Botelho JN, Giacaman RA. Detection of Cavitated Proximal Carious Lesions in Permanent Teeth: A Visual and Radiographic Assessment. Caries Res. 2022;56(3):171-178.

- 508 proximal surfaces:, 22.2% were cavitated
- E1: n=4 2.1% were cavitated
- E2: n=9 9.8% were cavitated
- D1: n=50 35.5% were cavitated
- D2: n=22 41.5% were cavitated
- D3: n=28 84.8% were cavitated



Treatment of Initial Approximal Lesions (E2-D1)

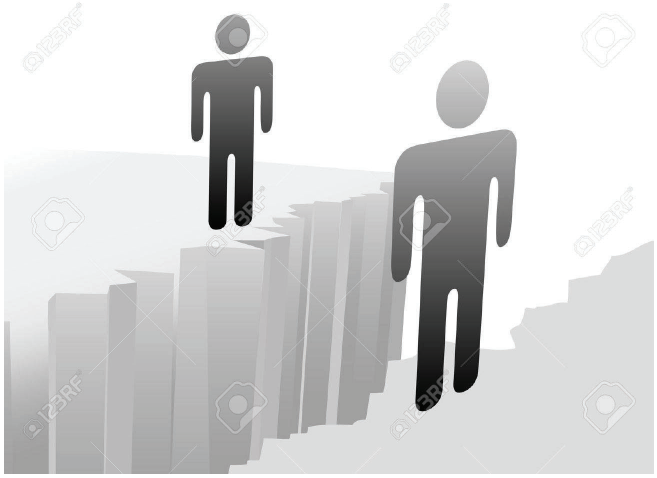
Learning the hard way

vs

Learning the easy way

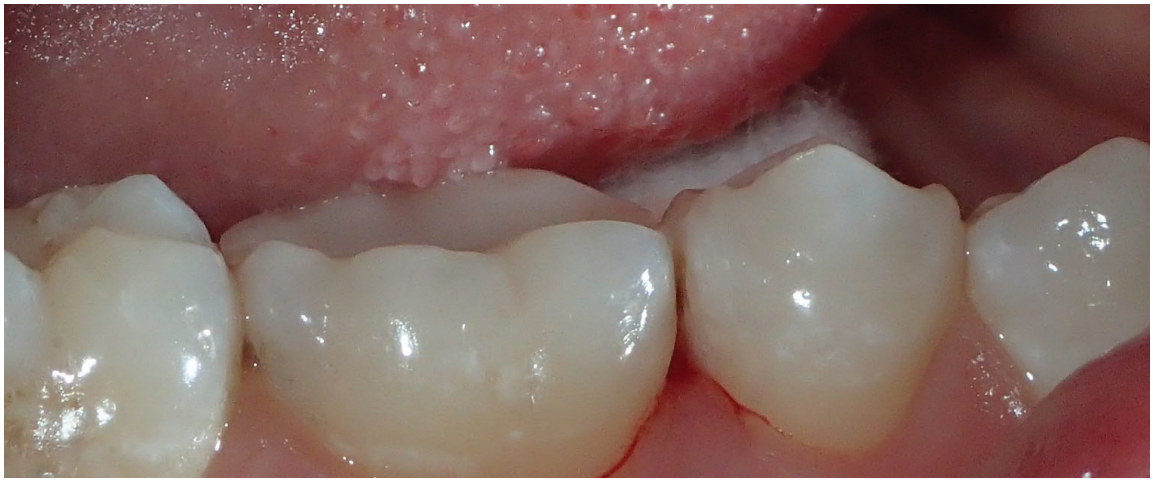
This is a First Year Dental Student
Would you cut the distal of #20?

Non-invasive Elastomeric Separation

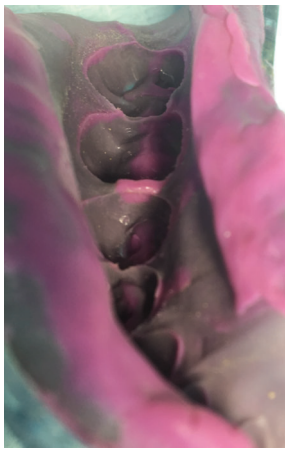


2 Day Ortho Elastic in Contact Area

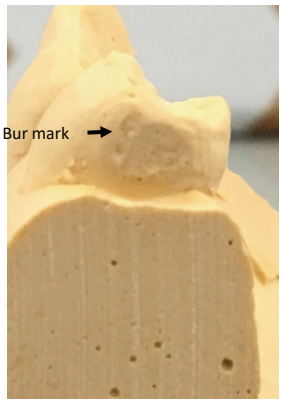
Non-cavitated
Arrested Brown Spot Lesion



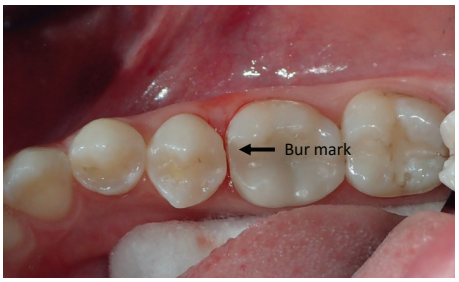
Impression



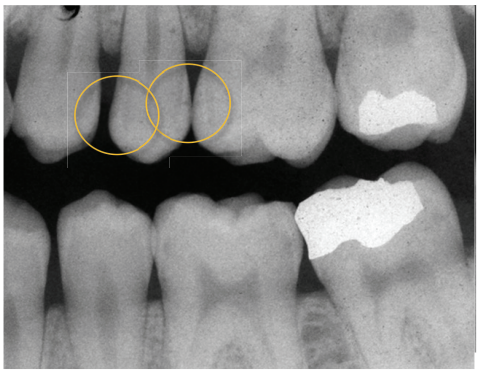
Stone Model
Showing No Cavitation



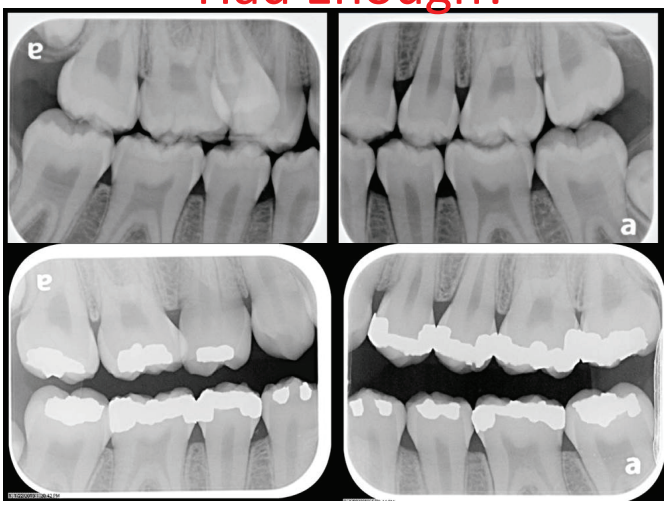
Occlusal View



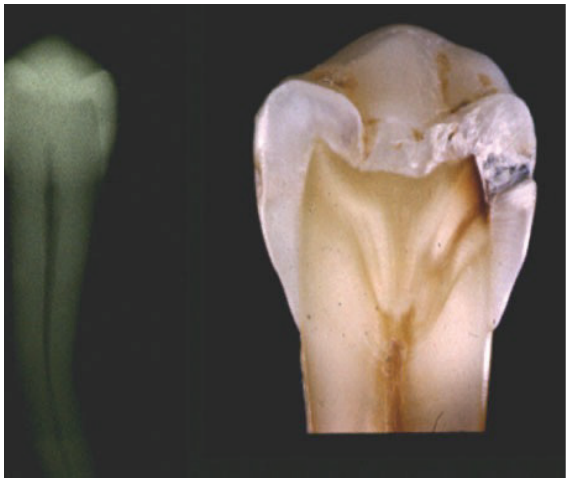
Root Canal is now needed
Used for a Board Lesion.



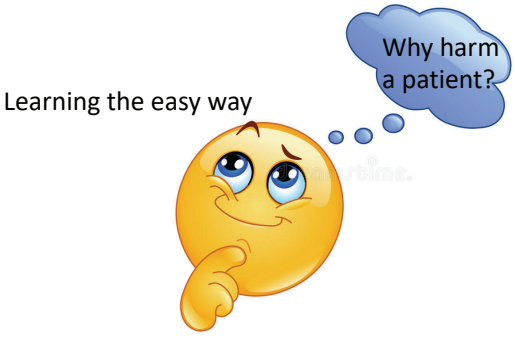
Overtreatment
See any D2 or D3 (cavitated)?
Had Enough?



A Fully Cavitated Lesion



Why not just take an BW radiograph of a non-cavitated lesion on an extracted tooth?



Practical implementation of caries disease management in the era of CAMBRA: a guide for the general dentist

Table 5. Example hard tissue preservation strategy based on the ADA CCS category using current tooth-preserving (tooth-level) and behavior management (patient-level) strategies.

Approximal						
Clinical presentation						
	E0[1] or R0[4]	E1[1] or RA1[4]	E2[1] or RA2[4]	D1[1] or RA3[4]	D2[1] or RB4[4]	D3[1] or RC5[4]
Difficult to assess insidious vs aggressive progression	Follow CRM protocol for primary prevention	Arrest and remineralize using CRM; consider SDF			Consider SDF, orthodontic separation, surface protection with no preparation, and/or MID restoration with selective caries removal with or without SDF	Place MID GIC restoration (selective caries removal) with or without SDF

Agd.org/generaldentistry; Young DA, Quock RL, Goolsby S, et al. Practical implementation of caries disease management in the era of CAMBRA: a guide for the general dentist. *Gen Dent*. 2025;73(6):56-66.

Treat the disease with appropriate caries risk management (CRM)	Low/Moderate risk = Behavioral modification including healthy diet & lifestyle choices, good oral hygiene, OTC F, Xylitol to replace table sugar High risk = add antibacterial & pH neutralization, Extreme risk = add to Ca & PO4 supplementation and pH neutralization

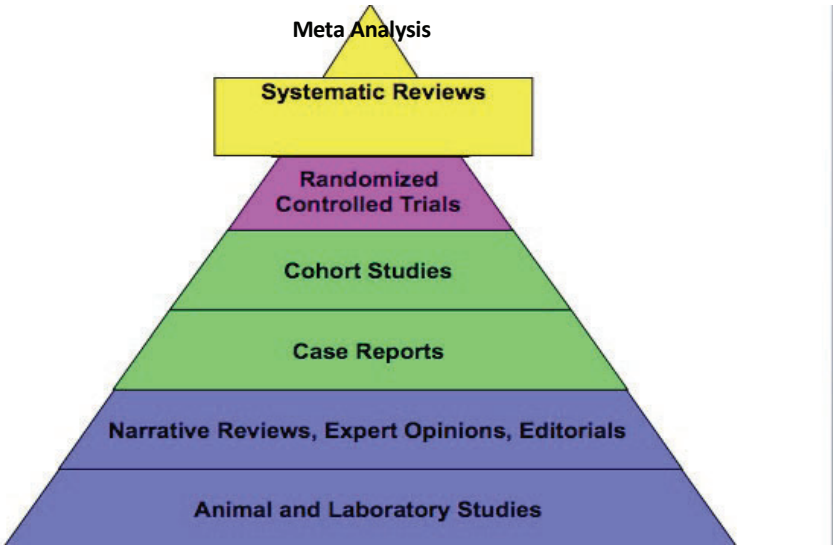
Slide courtesy of Dr. Douglas Young

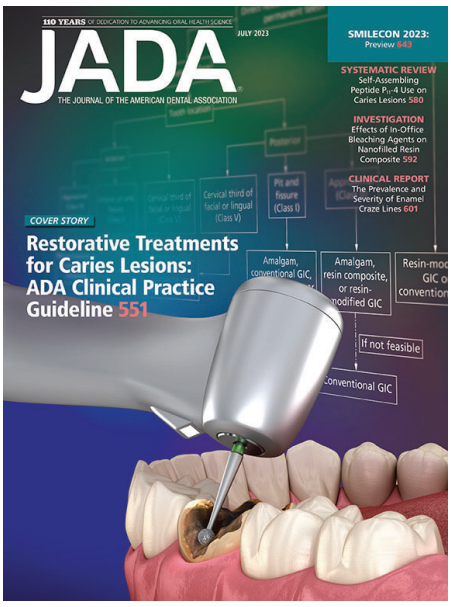
Leaving Decay?
Selective Caries Removal?
What is the evidence?

Evidence for Selective Caries Removal

ADA EBD Guidelines

Critical Summaries





July 2023

"More conservative carious tissue removal may decrease adverse effects"

Clinical Practice Guideline

Cover Story

Evidence-based clinical practice guideline on restorative treatments for caries lesions

A report from the American Dental Association

Vineet Dhar, BDS, MDS, PhD; Lauren Pilcher, MSPH; Margherita Fontana, DDS, PhD; Carlos González-Cabezas, DDS, MSD, PhD; Martha Ann Keels, DDS, PhD; Ana Karina Mascarenhas, BDS, MPH, DrPH; Marcelle Nascimento, DDS, MS, PhD; Jeffrey A. Platt, DDS, MS; Gregory J. Sabino, DDS, PhD; Rebecca Slayton, DDS, PhD; Norman Tinanoff, DDS, MS; Douglas A. Young, DDS, EdD, MBA, MS; Domenick T. Zero, DDS, MS; Sarah Pahlke, MS; Olivia Urquhart, MPH; Kelly K. O'Brien, MLIS; Alonso Carrasco-Labra, DDS, MSc, PhD

ABSTRACT

Background. An expert panel convened by the American Dental Association (ADA) Council on Scientific Affairs together with the ADA Science and Research Institute's program for Clinical and Translational Research conducted a systematic review and developed recommendations for the treatment of moderate and advanced cavitated caries lesions in patients with vital, non-endodontically treated primary and permanent teeth.

Types of Studies Reviewed. The authors searched for systematic reviews comparing carious tissue removal (CTR) approaches in Ovid MEDLINE, Embase, Cochrane Database of Systematic Reviews, and Trip Medical Database. The authors also conducted a systematic search for randomized controlled trials comparing direct restorative materials in Ovid MEDLINE, Embase, Cochrane Central Register of Controlled Trials, ClinicalTrials.gov, and the World Health Organization International Clinical Trials Registry Platform. The authors used the Grading of Recommendations Assessment, Development, and Evaluation approach to assess the certainty of the evidence and formulate recommendations.

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Practical Implications. The evidence suggests that more conservative CTR approaches may decrease the risk of adverse effects. All included direct restorative materials may be effective in treating moderate and advanced caries lesions on vital, nonendodontically treated primary and permanent teeth.

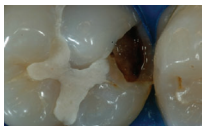
Key Words. Evidence-based dentistry; clinical practice guideline; direct restorative materials; caries; general dentistry; pediatric dentistry; American Dental Association.

JADA 2023:154(7):551-566
https://doi.org/10.1016/j.adaj.2023.04.011

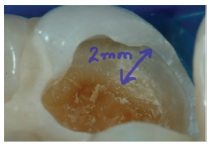
Selective Caries Removal
Know when to stop!

- **Clean the perimeter** of the lesion using the 2mm rule to **avoid pulp exposure**
- Rationale: demineralization precedes bacterial penetration of dentinal tubules, so removing most of the **soft & wet** dentin will remove most of the infected tissue
- Glass ionomer will **seal out nutrient sources** from entering. Thus no acid or demineralization will occur

Courtesy of Dr. Hien Ngo

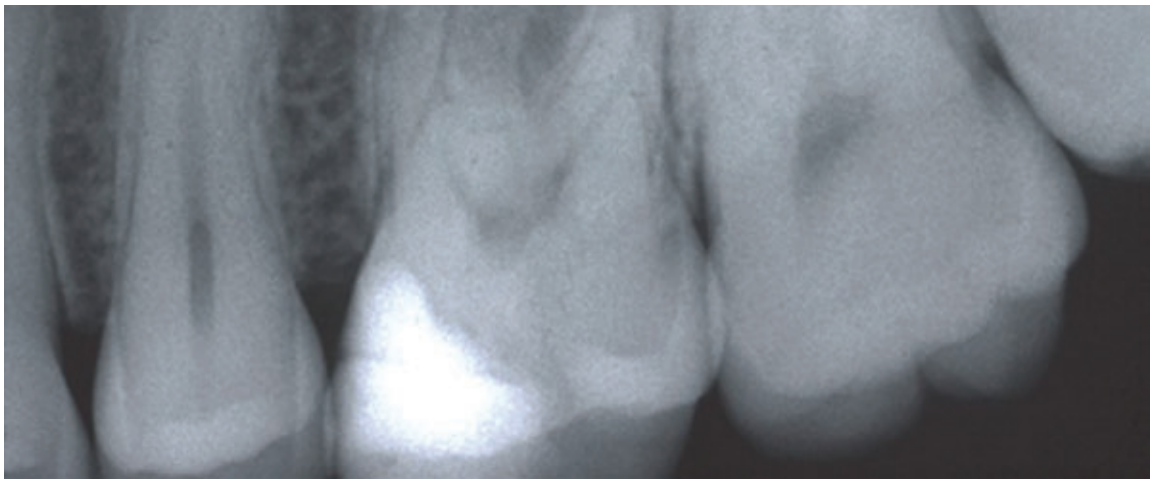


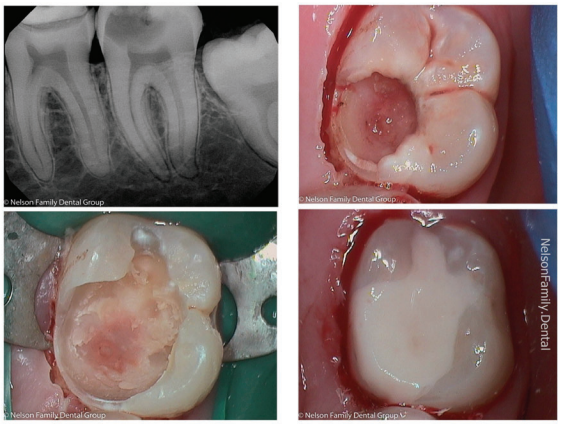
Wet & Soft



Dry & Soft

Selective caries removal will leave a radiolucency on the radiograph





Glass Ionomer – Equia Forte
Deepest Excavation with Smooth Side of an Explorer
January 2019

Mike Nelson, DDS
www.NelsonFamily.Dental

Chemomechanical Caries Removal (CMCR)

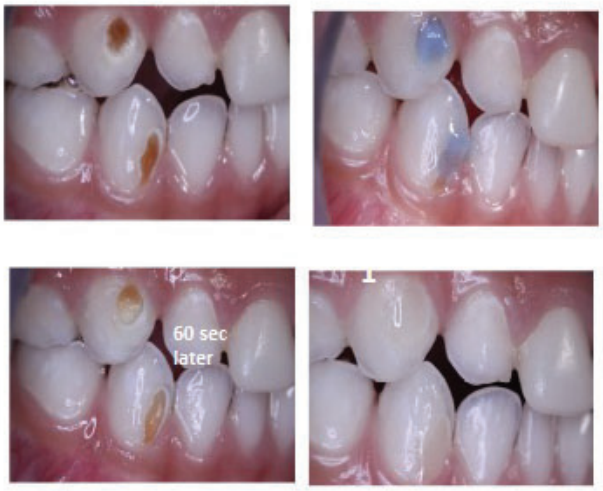
- Chemical softening of carious dentin with a chemical agent, followed by mechanical removal with non-cutting hand instruments.

11/18/25

94

Slide courtesy of Elevate Oral Care

Papacari Duo: an enzymatic caries remover



Slide courtesy of Elevate Oral Care

CLINICS

CLINICAL SCIENCE

Efficacy of Papacarie® in reduction of residual bacteria in deciduous teeth: a randomized, controlled clinical trial

Lara Jansiski Motta,[I] Sandra Kalil Bussadori,[I] Ana Paula Campanelli,[II] André Luis da Silva,[II] Thays Almeida Altaya,[III] Camila Haddad Leal de Godoy,[I] Maria Fidela de Lima Navarro[II]

[I]Universidade Nove de Julho, Mestrado em Ciências de Reabilitação, São Paulo/SP, Brazil. [II]University of São Paulo, Bauru School of Dentistry, Bauru/SP, Brazil. [III]Federal Fluminense University, Dental Clinic Post-Graduate Program, Odontotécnicos, São Gonçalo/RJ, Brazil.

OBJECTIVES: The aim of the present study was to analyze the efficacy of Papacarie® gel compared with the traditional method (low-speed bur) in reducing the counts of total bacteria, Lactobacillus, total Streptococcus and Streptococcus mutans group.

METHODS: A randomized, controlled clinical trial with a split-mouth design was performed. The sample comprised 40 deciduous teeth in 20 children (10 males and 10 females) aged four to seven years. The teeth were randomly allocated to two groups: G1, or chemomechanical caries removal with Papacarie Duo®, and G2, or the removal of carious dentin tissue with a low-speed bur. Infected dentin was collected prior to the procedure, and the remaining dentin was collected immediately following the removal of the carious tissue. Initial and final counts of bacterial colonies were performed to determine whether there was a reduction in the number of colony-forming units (CFUs) of each microorganism studied. ClinicalTrials.gov: NCT01811420.

RESULTS: Reductions were found in the numbers of total bacteria, total Streptococcus and Streptococcus mutans group following either of the caries removal methods ($p<0.05$). A reduction was also noted in the number of Lactobacillus CFUs; however, this difference did not achieve statistical significance ($p>0.05$).

CONCLUSION: Papacarie® is an excellent option for the minimally invasive removal of carious tissue, achieving significant reductions in total bacteria, total Streptococcus and *S. mutans* with the same effectiveness as the traditional caries removal method.

KEYWORDS: Dental Caries; Papain; *Streptococcus mutans*; Bacteria.

Motta LJ, Bussadori SK, Campanelli AP, Silva AL, Altaya TA, Godoy CH, et al. Efficacy of Papacarie® in reduction of residual bacteria in deciduous teeth: a randomized, controlled clinical trial. Clinics. 2014;69(5):319-322.

Received for publication on August 10, 2013; First review completed on September 10, 2013; Accepted for publication on September 27, 2013

E-mail: sandra.jk@gmail.com

Tel.: 55 11 3383-9222

2013
Randomized Clinical Trial
Clinics

"Papacarie® is an excellent option for the minimally invasive removal of carious tissue, achieving significant reductions in total bacteria, total Streptococcus and S. mutans with the same effectiveness as traditional caries removal."

2025
Randomized Clinical Trial
The Scientific World Journal

Research Article

A Randomised Controlled Trial Comparing Chemomechanical (Carie-Care™) Versus Conventional Caries Removal for Atraumatic Restorative Treatment

Saloni Gupta, Kalyana Chakravarthy Pentapati, and Shashidhar Acharya

Department of Public Health Dentistry, Manipal College of Dental Sciences, Manipal Academy of Higher Education, Manipal 576104, Karnataka State, India

Correspondence should be addressed to Shashidhar Acharya; sh.acharya@manipal.edu

Received 28 September 2023; Revised 11 May 2024; Accepted 24 December 2024

Academic Editor: Cornelis H. Pameijer

Objective: This study aimed to evaluate and compare the clinical effectiveness of chemomechanical caries removal (CMCR) using Carie-Care™ versus conventional caries removal for atraumatic restorative treatment (ART).
Methods: The study included 32 children aged 6–15 years with one or more one-surface cavitated carious lesions on the occlusal surface of permanent dentition. A total of 82 restorations were placed in permanent molars. The teeth were randomly assigned to two groups and monitored for 18 months after the intervention. For Group 1, Carie-Care™ gel was applied directly to the carious lesion, followed by cavity washing and gentle excavation using hand instruments. For Group 2, caries was removed using the mechanical method only. The success rate of the restorations, as well as the time taken and pain reactions measured by the sound eye motor (SEM) scale, were assessed between the two groups.
Results: The SEM scores were significantly higher ($p < 0.05$) in the conventional ART group than in the Carie-Care™ group. The mean time taken for caries removal in the Carie-Care™ group (731.15 ± 197.48 s) was significantly higher than in the ART group (596.66 ± 158.96 s) ($p < 0.001$). However, there was no significant difference in the clinical performance of Type IX restoration between the groups ($p = 0.69$).
Conclusions: The success rates of the restorations were similar between the two methods. However, the added advantage of less trauma associated with using a chemomechanical agent such as Carie-Care™ makes it an attractive option for community health and school dental programs.

-No difference in recurrent caries with papain based vs. conventional excavation

-Patients showed less signs of pain & trauma during papain- based enzymatic caries excavation

Randomised Controlled Trial Comparing Chemomechanical (Carie-Care™) vs Conventional Caries Removal for Atraumatic Restorative Treatment , Gupta, et

Use glass ionomer as a chemical treatment for caries

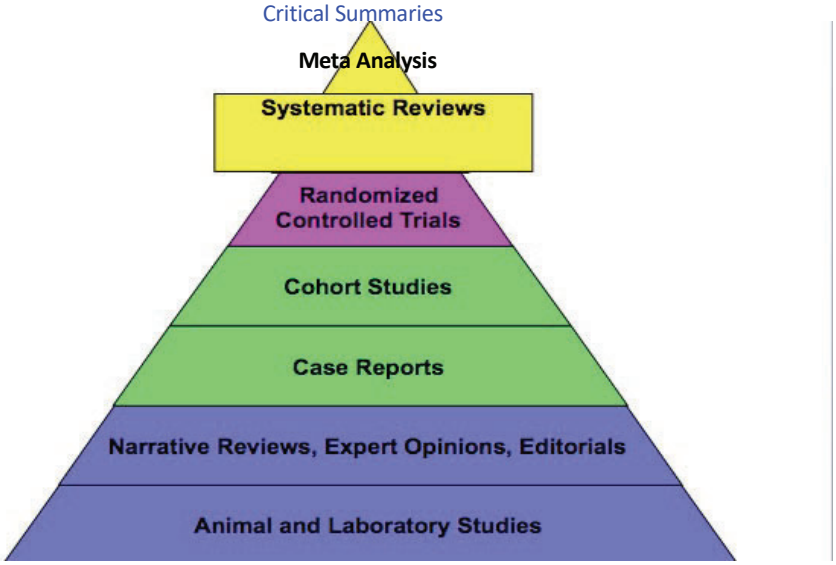
Acknowledgements for images

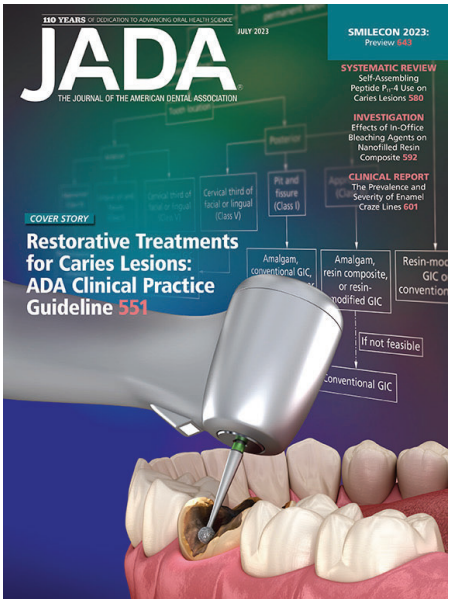
Hien Ngo
Graham Mount
Graeme Milicich

Evidence for GIC

ADA EBD Guidelines

Critical Summaries





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JADA 2023:154(7):551-566
https://doi.org/10.1016/j.adaj.2023.04.011

Cariostatic Properties of GI

Absence of carious lesions at margins of glass-ionomer and amalgam restorations: a meta-analysis

S. MICKENAUTSCH, V. YENGOPAL, S.C. LEAL*, L.B. OLIVEIRA**, A.C. BEZERRA*, M. BÖNECKER**

Abstract *Aim* To report on the absence of carious lesions at margins of glass ionomer cement (GIC) and amalgam restorations. *Methods* Six Englishbase and 1 Lusophone databases were searched for articles up to 3 January 2008. *Inclusion criteria for articles were:* (i) title/abstracts relevant to topic; (ii) published in English, Portuguese or Spanish language; (iii) reporting on a randomised control trial. *Exclusion criteria were:* (i) insufficient random allocation of study subjects (ii) operator and subject not blinded, where appropriate; (iii) not all entered subjects accounted for at trial conclusion; (iv) subjects of both groups not followed up the same way. Articles were accepted only if they complied with all the criteria. Ten articles complied with the inclusion criteria and were selected for review. From these 4 were rejected and 6 articles reporting on 5 separate studies accepted. Due to aspects of heterogeneity, studies were sub-grouped before meta-analysis. Results Significantly less carious lesions were observed on single-surface GIC restorations in permanent teeth after 6 years as compared to restorations with amalgam (OR 2.64 • CI 95% 1.59 – 3.83; p= 0.001). No studies investigating multiple-surface restorations on permanent teeth were identified. Studies investigating carious lesions at margins of restorations in primary teeth showed no difference between both materials after 3 and 8 years. *Conclusions* Carious lesions at margins of single-surface GIC restorations are less common than with amalgam fillings after 6 years in permanent teeth. No difference was observed in primary teeth. More trials are needed in order to confirm these results.

Key words: Glass ionomer cement; Amalgam; Caries; Meta-analysis.

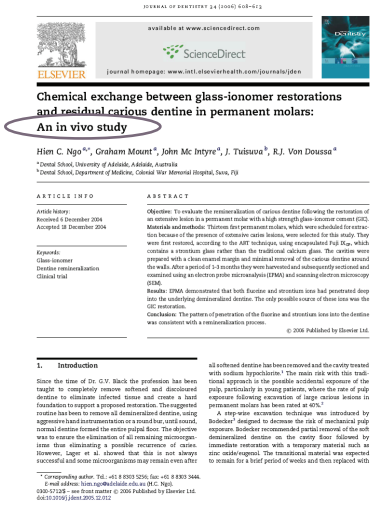
Introduction

Carious lesions associated with the margins of tooth restorations have previously been defined as recurrent or secondary caries [Mjör, 2005]. In recent years it has been suggested that placing a filling does not cure caries and that the "recurrence" of lesions on restoration margins results from neglecting to treat caries as disease before placing a restoration [White and Eakle, 2000]. Part of the treatment of caries is to encourage remineralisation in the cavity walls [Tyas et al., 2000]. Ten Cate and van Duinen [1995] have shown, in-situ, a hyper-remineralisation effect in demineralised tooth tissues bordering glass ionomer cement (GIC) type restorations. In contrast, tissues bordering amalgam showed further extensive demineralisation. The significant remineralisation potential of GIC has been ascribed to the release of fluoride ions, facilitated by a hydrophilic environment [Aasmiaea et al., 2002]. In addition, the release of strontium by GIC and its diffusion into demineralised tooth tissue, thus further aiding remineralisation, has been observed [Ngo et al., 2006]. Several trials have compared the clinical success rates of GIC and amalgam restorations in vivo [Thifour et al., 2002; Rahimtoola and van Amerongen, 2002; Thifour et al., 2003; Mandari et al., 2003; Qvist et al., 2006; Frankken et al., 2007]. During these trials marginal integrity, anatomic form, material loss at surface and carious lesions at the restoration margins were assessed. Qvist et al. [1990] established that carious lesions were the main cause of failures of amalgam restorations in permanent teeth. In contrast, it has been suggested that carious lesions are rarely the cause of GIC restoration failures [Mjör, 2005].

So far no meta-analysis has been conducted to this topic. One narrative review, lacking a systematic methodology for literature search and article inclusion- and exclusion criteria, concluded that the effect of fluoride release of materials, such as GIC,

Division of Public Oral Health, University of the Witwatersrand, Johannesburg, South Africa
*School of Dentistry, University of Brasília, DF, Brazil
**Department of Orthodontics and Pediatric Dentistry, Faculty of Dentistry, Universidade de São Paulo, São Paulo, Brazil
E-mail: mone@global.co.za

- Glass ionomer restorations have less recurrent decay than amalgam after six years in permanent teeth



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Chemical exchange between glass-ionomer restorations and residual carious dentine in permanent molars: An in vivo study

Hien C. Ngo [a,*], Graham Mount [a], John Mc Intyre [a], J. Tuisuva [b], R.J. Von Doussa [a]

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ABSTRACT

Objectives: To evaluate the remineralisation of carious dentine following the restoration of an extensive lesion in a permanent molar with a high strength glass-ionomer cement (GIC).
Materials and methods: Thirteen first permanent molars, which were scheduled for extraction because of the presence of extensive caries lesions, were selected for this study. They were first restored, according to the ART technique, using encapsulated Fuji IX_{GP}, which contains a strontium glass rather than the traditional calcium glass. The cavities were prepared with a clean enamel margin and minimal removal of the carious dentine around the walls. After a period of 1–3 months they were harvested and subsequently sectioned and examined using an electron probe microanalysis (EPMA) and scanning electron microscopy (SEM).
Results: EPMA demonstrated that both fluorine and strontium ions had penetrated deep into the underlying demineralized dentine. The only possible source of these ions was the GIC restoration.
Conclusions: The pattern of penetration of the fluorine and strontium ions into the dentine was consistent with a remineralisation process.

1. Introduction

Since the time of Dr. G.V. Black the profession has been taught to completely remove softened and discoloured dentine to eliminate infected tissue and create a hard foundation to support a proposed restoration. The suggested routine has been to remove all demineralized dentine, using aggressive hand instrumentation or a round bur, until sound, normal dentine formed the entire pulpal floor. The objective was to ensure the elimination of all remaining microorganisms thus eliminating a possible recurrence of caries. However, Lagor et al. showed that this is not always successful and some microorganisms may remain even after all softened dentine has been removed and the cavity treated with sodium hypochlorite.[1] The main risk with this traditional approach in the possible accidental exposure of the pulp, particularly in young patients, where the rate of pulp exposure following excavation of large carious lesions in permanent molars has been rated at 40%.[2]

A step-wise excavation technique was introduced by Bodecker[3] designed to decrease the risk of mechanical pulp exposure. Bodecker recommended partial removal of the soft demineralized dentine on the cavity floor followed by immediate restoration with a temporary material such as zinc oxide/eugenol. The transitional material was expected to remain for a brief period of weeks and then replaced with

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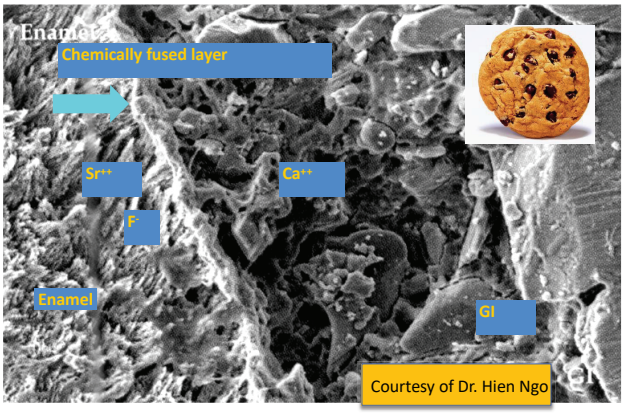
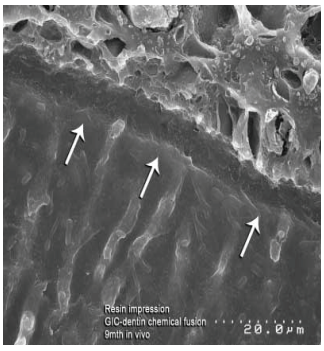
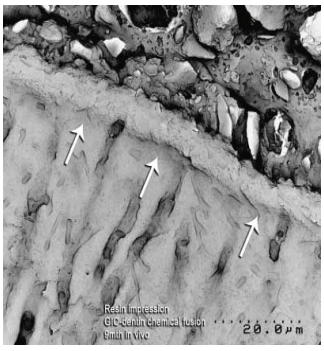
doi:10.1016/j.jdent.2005.12.012

"Electron probe microanalysis demonstrated that both fluorine and strontium ions had penetrated deep into underlying demineralized dentin. The pattern was consistent with remineralization. The only source of these ions was the glass ionomer restoration."

Studies by Dr. Hien Ngo
The "Chemically Fused Layer"
Internal Remin/Acid Resistant?







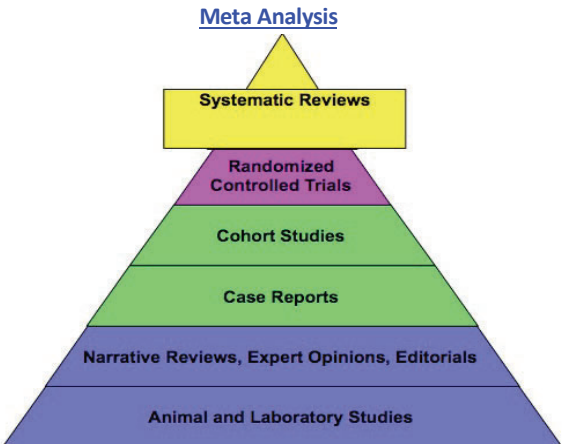
Courtesy of Dr. Graeme Milicich

A resin impression SEM technique for examining the glass–ionomer cement chemical fusion zone.
Milicich G.
Journal of Microscopy, Vol. 217, Pt 1 January 2005, pp. 44–48

How long will the remin protective layer last?

Evidence for GIC Posterior Restorations

GIC vs. Amalgam



RESEARCH REPORTS
Biomaterials & Bioengineering

GIC = Amalgam

Effectiveness of Single-surface ART Restorations in the Permanent Dentition: A Meta-analysis

J.E. Frencken[1]*, M.A. van 't Hof[2], W.E. van Amerongen[3], and C.J. Holmgren[1]

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J Dent Res 83(2):120-123, 2004

ABSTRACT

Over the past few years, there has been an increase in the number of studies reporting on various aspects of the Atraumatic Restorative Treatment (ART) approach. Five randomized clinical trials in which ART restorations with glass ionomers were compared with amalgam restorations in permanent teeth for a maximum period of 3 yrs constituted the database. This meta-analysis divided the publications into 'early' (1987-1992) and 'late' (1995-) studies on the basis of improvements in the approach. The analysis showed that, in the 'early' studies, single-surface amalgam restorations survived statistically significantly longer than comparable ART restorations after 1, 2, and 3 yrs. This trend did not continue into the late group of studies; no statistically significant difference between the 2 types of restorations was found. Based on the available data, it appears that there is no difference in survival results between single-surface ART restorations and amalgam restorations in permanent teeth over the first 3 yrs.

INTRODUCTION

The Atraumatic Restorative Treatment (ART) approach involves the removal of infected tooth tissues with hand instruments, followed by filling the cleaned cavity and associated pits and fissures with an adhesive restorative material (Frencken *et al.*, 1996a). ART is considered one of the minimally invasive operative approaches in the concept of minimal intervention dentistry (Tyas *et al.*, 2000). This relatively new approach requires neither electricity nor plumbed water and, therefore, can be applied in almost any setting. Because a hand-mixed glass ionomer does not require electrically driven equipment, this restorative material was the initial choice of the range of adhesive restorative materials. However, ART does not seem to be confined to places where electricity is absent. Recently, Louw *et al.* (2002) reported survival of ART restorations produced in dental clinics using a compomer. ART has also been shown to be less painful than conventional approaches (Rahimtoola *et al.*, 2000; Schriks and van Amerongen, 2003), and local anesthesia is rarely required (Phantumvanit *et al.*, 1996; Frencken *et al.*, 1996b; Ho *et al.*, 1999; Mickenautsch *et al.*, 1999; Holmgren *et al.*, 2000; Lo and Holmgren, 2001; Taifour *et al.*, 2003).

Since its inception in the mid-1980s, the ART approach has been subjected to research. In the beginning, researchers were interested in the length of survival of ART restorations (Phantumvanit *et al.*, 1996; Frencken *et al.*, 1998a,b). These studies also served to obtain information on technical aspects of the process of removing infected dentin and enamel, and on handling characteristics of the glass ionomer used to provide a sealant

Failure rate of high-viscosity GIC based ART compared with that of conventional amalgam restorations - evidence from an update of a systematic review

SADJ August 2012, Vol 67 no 7 p329 - p331

S Mickenautsch[1], V Yengopal[2]

GIC = Amalgam

ABSTRACT

Introduction: Atraumatic Restorative Treatment (ART) involves using only hand instruments for removing carious tooth tissue and then restoring the resulting cavity with an adhesive restorative material.

Objective: To answer the question as to whether, in patients with carious cavities of any class in primary and permanent teeth, ART restorations with high-viscosity glass-ionomer cement (GIC) have a higher failure rate than amalgam restorations placed after drilling, in tooth cavities of the same size, dentition and follow-up period.

Methods: Thirteen databases were searched for relevant trials up to January 2012. Hand-searching was performed for non-indexed journals. References of included trials were checked. Prospective, clinical controlled trials with a follow-up period of at least one year were selected. The investigated outcome was restoration failure. Meta-analysis was conducted and internal trial validity was assessed in-depth.

Results: Twenty trials were accepted for review. The majority of the results show no differences between the types of intervention. The current evidence indicates that the failure rate of high-viscosity GIC/ART restorations is not higher than, but is similar to that of conventional amalgam fillings after periods longer than six years. There is a risk that these results are affected by bias and confirmation by further trials is recommended.

INTRODUCTION

In 2009, the authors of this paper published a quantitative systematic review in the *Clinical Oral Investigation* journal (online), which presented an appraisal of the longevity of Atraumatic restorative treatment (ART) placed with high-viscosity glass-ionomer cement (GIC) in comparison with amalgam fillings.[1] The results of this systematic review showed no difference between the performance of these types of restorations. In 2012, that systematic review was updated in-depth by the authors as part of the SYSTEM* initiative.[2] While the protocol of the original review was not registered, the protocol of that update was registered with the International Prospective Register for Systematic Reviews (PROSPERO) on 05 January 2012, under registration number CRD42012001887.[3] It differed from the original review mainly in change of focus from the comparative success rates to that of the comparative failure rates of ART and amalgam restorations; the extension of the systematic literature search to further databases; the inclusion of hand-searching of additional journals identified as not being indexed in these databases and the extension of the search cut-off date to January 2012. Previous language restrictions

Do glass ionomer cements prevent caries lesions in margins of restorations in primary teeth?

A systematic review and meta-analysis

Daniela Prócida Raggio, DDS, MSc, PhD; Tamara Kerber Tedesco, DDS, MSc, PhD; Ana Flávia Bissoto Calvo, DDS, MSc, PhD; Mariana Minatel Braga, DDS, MSc, PhD

ABSTRACT

Background. Fluoride released from glass ionomer cements (GICs) is capable of preventing caries lesions. However, the preventive effect in margins of occlusal and occlusoproximal restorations have not been proved. The aim of this study was to evaluate the ability of GIC to prevent caries lesions in margins of occlusal and occlusoproximal restorations in primary teeth compared with that of other restorative materials.

Types of Studies Reviewed. The authors conducted a literature search in PubMed and MEDLINE to verify the clinical trials available on the outcome of caries lesions. The inclusion criteria were that the subject related to the scope of this systematic review, the study had a follow-up, and the study was not performed in specific groups. The authors performed all meta-analyses by considering the secondary caries rates for the restorations in clinical trials.

Results. The search strategy identified 450 potentially relevant studies, and the authors included 8 of them in the review. The main reasons for exclusion were that the studies were not related to the scope of this review or were not longitudinal trials. The secondary caries rate of the occlusal restorations was not different among the restorative materials (odds ratio, 1.2; 95% confidence interval, 0.5-3.1). For occlusoproximal analysis, GIC was associated significantly with better ability to prevent caries lesions (odds ratio, 1.7; 95% confidence interval, 1.2-2.5).

Conclusions and Practical Implications. Because new caries lesions in the margins of restorations are the main reason for failure and replacement of restorations in primary teeth, it is important to know whether there is a benefit in using GICs in both occlusal and occlusoproximal cavities.

Key Words. Dental caries; glass ionomer cements; fluoride.

JADA 2015:■(■):■-■

http://dx.doi.org/10.1016/j.adaj.2015.09.016

New caries lesions in restoration margins are a frequent concern in dentistry, especially when there is no patient compliance. Thus, this problem has been seen as the main reason for failure and replacement of restorations in primary teeth,[1] with reports showing approximately 8.6% of restoration failures even within 5 years when these caries lesions are filled with polyacid-modified resin composite (PMRC), resin composite (RC), or amalgam.[2,3]

These restorative materials, in the same way as glass ionomer cements (GICs), have shown satisfactory performance in restorations of primary teeth.[4-6] However, conventional GIC—a low-viscosity restorative material—has a shorter longevity than do the other materials.[4] Results of a previous systematic review showed that there is a higher number of failed restorations with the atraumatic restorative treatment (ART) technique when it was performed with conventional GIC, whereas the longevity of ART restorations performed with high-viscosity GIC (HVGIC) is higher.[6] HVGIC is also a material for which setting is an acid-based reaction; however, HVGIC performed similarly to the other materials in both occlusal and occlusoproximal restorations.[7,8] Conversely, resin-modified GIC (RMGIC)—a GIC with addition of hydroxyethylmethacrylate, similar to HVGIC—also can be considered an alternative to restore dentinal caries lesions.[3]

Fluoride interferes with the processes of demineralized and remineralization of caries lesions, and some authors suggest that the fluoride released from GICs is capable of preventing caries.[9,10] Investigators in previous

GIC better prevention at margins

The 10 Steps for GI Success

Amanda Heydari, DDS

The 10 Steps for GI Success

1. **Remove biofilm and pellicle** with pumice or defocused air abrasion or with cotton products if using microbial aerosol precautions in the surrounding area of the lesion to be treated (GIC has no chemical bond to biofilm or pellicle).
2. **Clean the perimeter of the lesion** using your preferred technique (rotary handpiece, air abrasion, or hand instruments such as hand drills or spoon excavators).
3. **Condition the lesion and surrounding areas with 20% polyacrylic acid** for 10 seconds (removing the smear layer and activating the surface for ionic exchange).

The 10 Steps for GI Success

4. **Rinse with water for 10 seconds and blot dry** (leaving a moist "glossy" surface).
5. **Place a matrix and wedge if needed.**
6. If any contamination occurs, rinse briefly again with water and blot dry with cotton **(leave a moist "glossy" surface).**
7. **Mix the GIC or (RMGI)** for 10 seconds and apply immediately to the cavitation to prevent voids.
8. **Work quickly to place, shape, and remove excess,** since any increase in temperature will greatly decrease manufacturer's stated working time**. Avoid over-manipulating the GIC** once initial gel crosslinking has begun (when the setting GIC begins to lose its gloss).

The 10 Steps for GI Success

9. **Protect from water loss or water gain.** Do not allow the GIC to dry out or become diluted with water/saliva. Some options used for preventing excess water loss or water gain from or to the GIC include; turning suction isolation systems down or off during set, and/or coating the surface of the GIC with a microbrush dipped in unfilled resin, using a damp (not drenched) cotton-tip applicator, or gloved finger re-moisten with water/saliva.
10. **Do not disturb the restorative material while it is setting (approximately 2.5-3.5 minutes for GIC or until RMGI is light cured).** Once set, if placing anatomy, or finishing and polishing, use water to prevent desiccation.

DO YOU NEED A 5-10 MINUTE BREAK ?

If it works here it will work anywhere.

Pre-Op

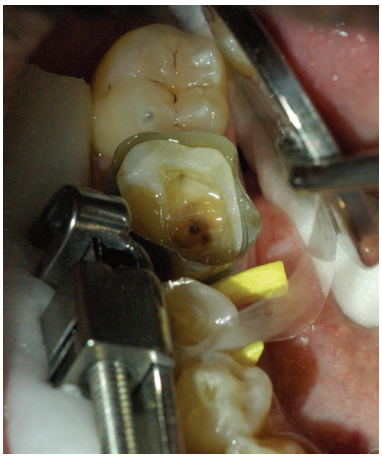
Remove Old Composite

Remove Biofilm and Pellicle From All Surfaces

Cavity Conditioner (Polyacrylic Acid)

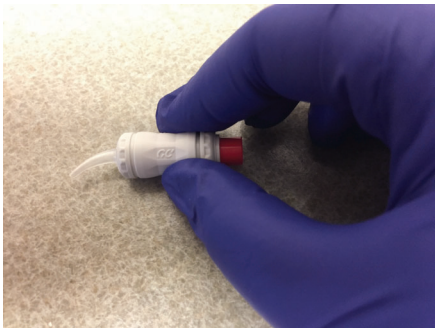
- Apply and scrub the entire tooth with microbrush for 10 seconds before matrix ba e is placed
- Rinse with water ds
- Blot dry (surface shiny)

Band and Wedge

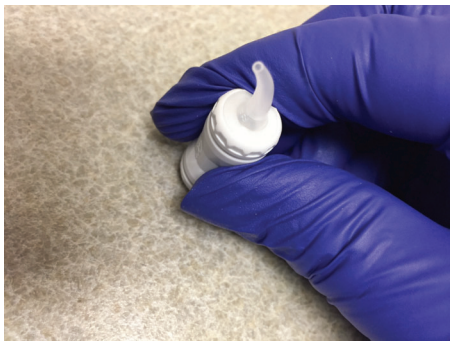


Basic Glass Restorative Capsule Mixing Steps

1. Tap foil packet on the counter to fluff up the powder in the capsule
2. Remove from wrapper immediately before use



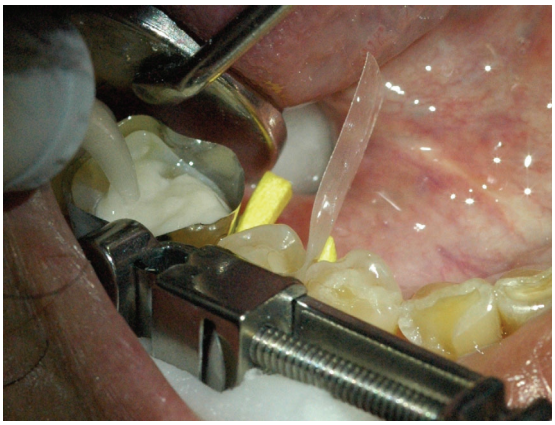
3. To activate the capsule, push the plunger until it is flush with the main body and hold it down for 2 seconds



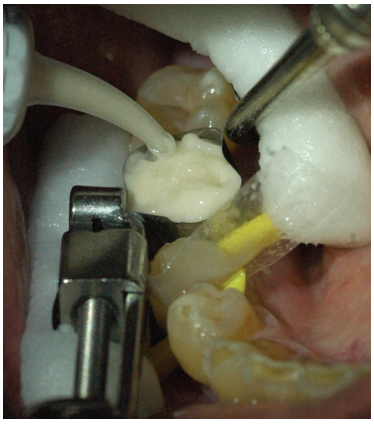
7. Set a timer for 2 minutes, 30 seconds

Apply to Moist Surface

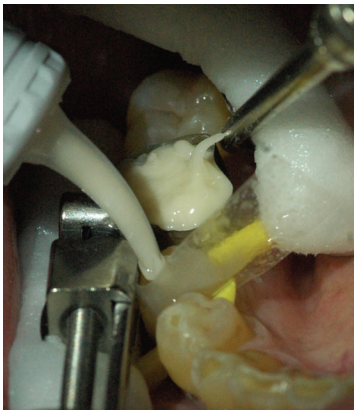
Backfill With No Voids



Over-bulk



Move on to the next tooth



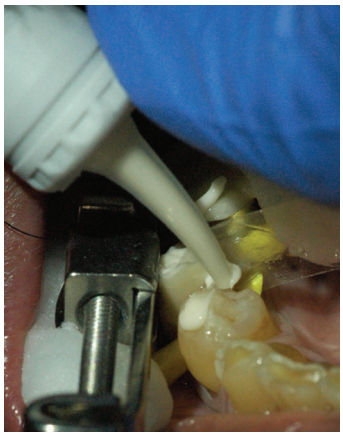
Note, I did not have the correct shade...but what else is wrong?

But what else is wrong?

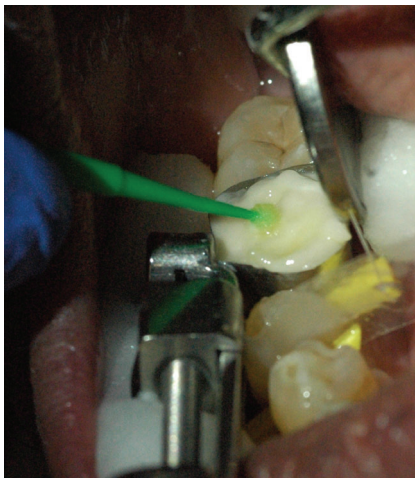
I was too slow;
GI started to set

1 Month Post OP
The incisals fell
out.

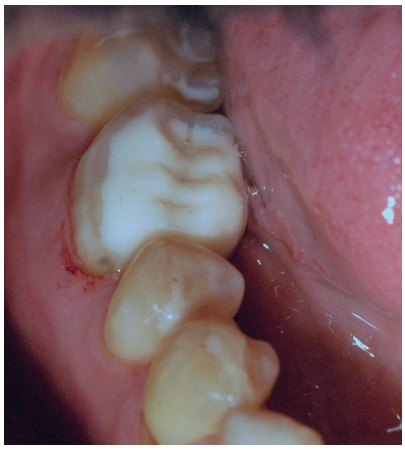
Work Quickly



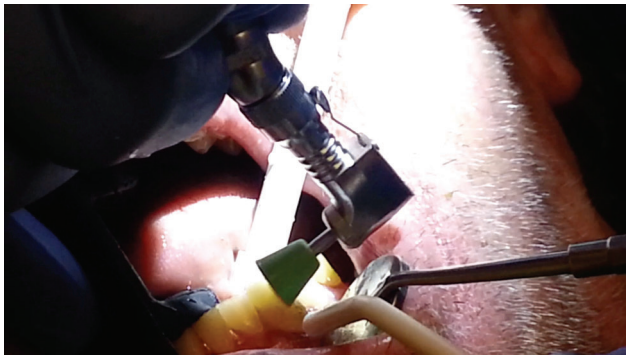
Unfilled resin to prevent water loss or water gain.



Cut back with profuse water spray. Polish with Ultradent Jiffy Kit with profuse water.



Finish and polish with profuse water!



Check Occlusion Carefully

No EQUIA Coat Applied Yet
Incorrect Shade

Immediate Post op

Facial View

Lingual View

1 Month Post Op

3 Month Post OP

6 Month Post OP

Compare

Immediate Post op

6 Mo Post op

Favorite Burs and Polishers

Subgingival

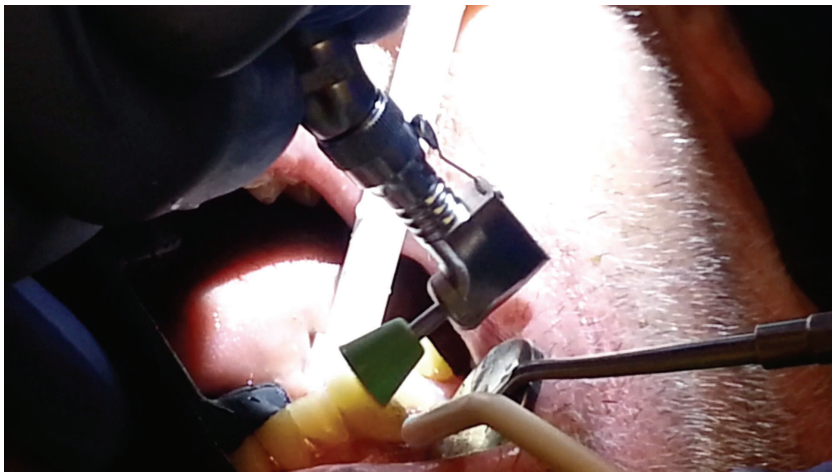
Course (green)

Occlusal Anatomy

Don’t “ditch or gouge” the GI when polishing

- Use a light touch with lots of water or the edge will gouge or ditch the GIC because it is not set yet

Finish and polish with profuse water!



GI Compression Test

Courtesy of Douglas Young and Jordan A. Jew

Can GIC Really be used for Esthetics and Chewing?

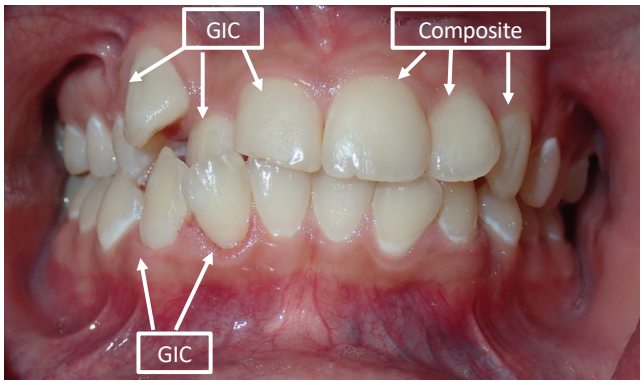
Can anybody do it ?

Here are cases from others….

Would you choose GIC or Composite for esthetics and longevity?

Before

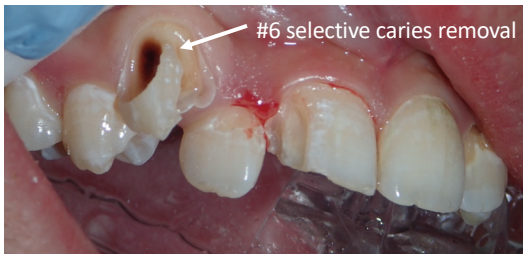
After



Amanda Heydari, DDS

Pre-op

Intra-op

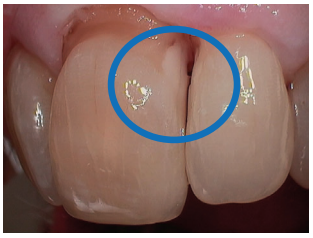


Amanda Heydari, DDS

Outline Form: make no bigger

Pre-op

Post-op

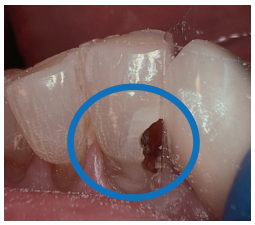


GIC Equia Forte HT

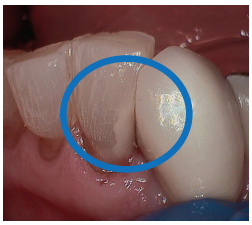
Courtesy of Dr. Mike Nelson

Outline Form: make no bigger

Pre-op

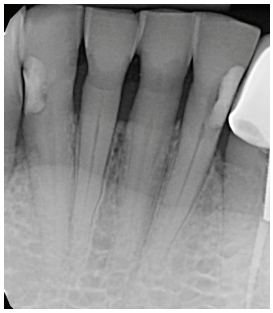


Post-op

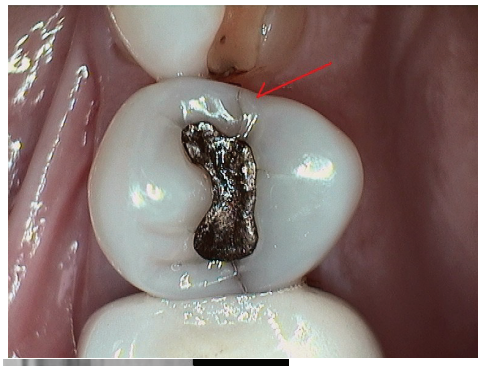


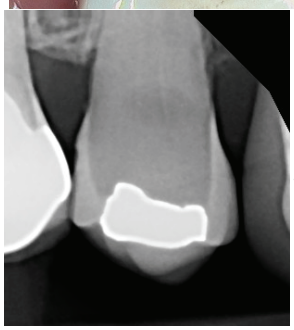
GIC Equia Forte HT

No Anesthetic
No Need for Root Canal Therapy
No Need to Bevel/Remove
Undermined Enamel



Courtesy of Dr. Mike Nelson



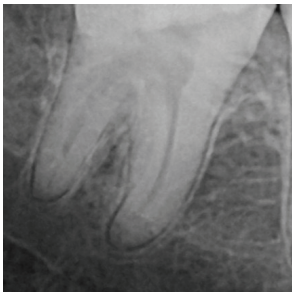


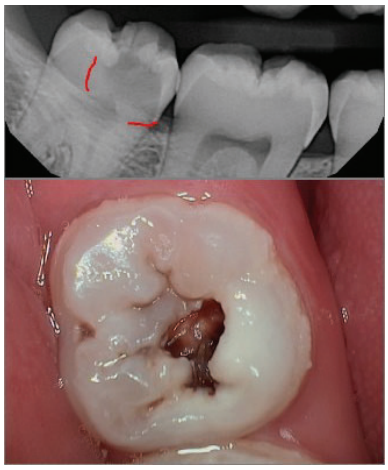
Glass Ionomer
Treatment of Fractured Tooth

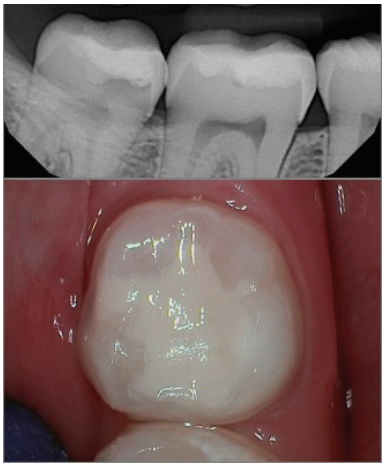
Conservative Preparation/Extension
Taking Advantage of Caries Preventing
Properties of GIC

Equia Forte HT

Courtesy of Dr. Mike Nelson







Glass Ionomer – Equia Forte
Slight Percussion Sensitivity – No Cold Response
Asymptomatic Post-op

Courtesy of Dr. Mike Nelson

#5-MOB GI repair of #3-5 All-Ceramic FPD

Pre op

Caries removal & air abrasion

Final #5-MOB Shade A3 GI Restoration

Silver Diamine Fluoride (SDF)

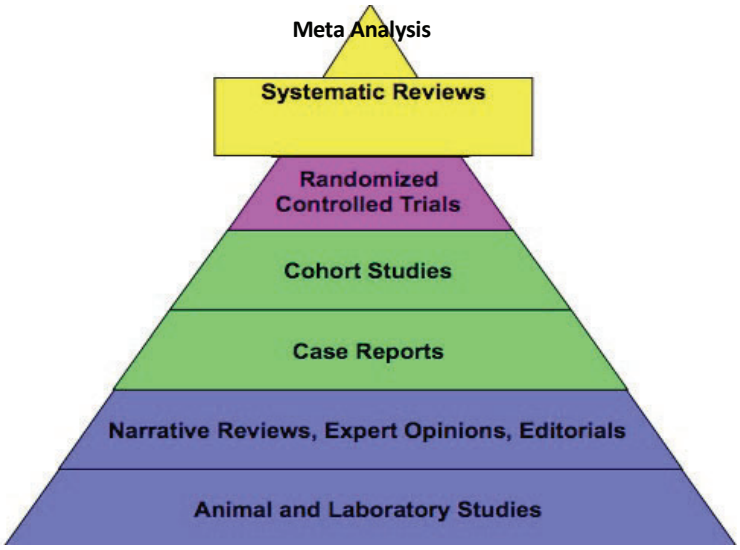
Acknowledgements for this presentation

Jeremy Horst
John Frachella
Steve Duffin
Jeanette MacLean
Judy Bendit

Evidence for Silver Diamine Fluoride

ADA EBD Guidelines

Critical Summaries



Oct 2018

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

ABSTRACT

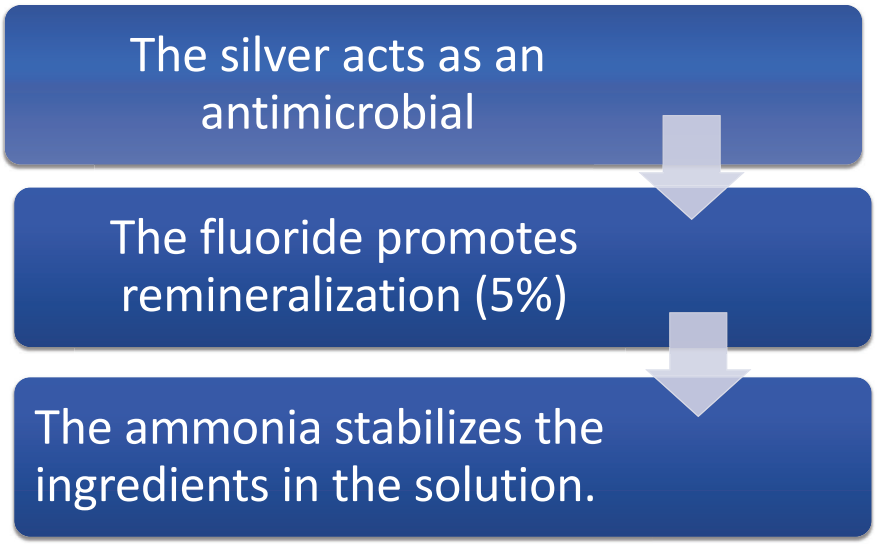
Background. An expert panel convened by the American Dental Association Council on Scientific Affairs and the Center for Evidence-Based Dentistry conducted a systematic review and formulated evidence-based clinical recommendations for the arrest or reversal of noncavitated and cavitated dental caries using nonrestorative treatments in children and adults.

Types of Studies Reviewed. The authors conducted a systematic search of the literature in MEDLINE and Embase via Ovid, Cochrane CENTRAL, and Cochrane database of systematic reviews to identify randomized controlled trials reporting on nonrestorative treatments for noncavitated and cavitated carious lesions. The authors used the Grading of Recommendations Assessment, Development and Evaluation approach to assess the certainty in the evidence and move from the evidence to the decisions.

Results. The expert panel formulated 11 clinical recommendations, each specific to lesion type, tooth surface, and dentition. Of the most effective interventions, the panel provided recommendations for the use of 38% silver diamine fluoride, sealants, 5% sodium fluoride varnish, 1.23% acidulated phosphate fluoride gel, and 5,000 parts per million fluoride (1.1% sodium fluoride) toothpaste or gel, among others. The panel also provided a recommendation against the use of 10% casein phosphopeptide–amorphous calcium phosphate.

Conclusions and Practical Implications. Although the recommended interventions are often used for caries prevention, or in conjunction with restorative treatment options, these approaches have shown to be effective in arresting or reversing carious lesions. Clinicians are encouraged to prioritize use of these interventions based on effectiveness, safety, and feasibility.

What is in SDF and how it works

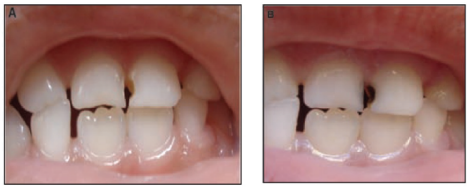


How it works

- Forms silv**er-protein conjugates** in decayed surfaces
- **Promotes remineralization** and decreases. lesion depth [5]
- **Fluoroapatite Increases resistance** to acid dissolution and enzymatic digestion.[11]
- **Silver ions** have **antimicrobial action** by breaking membranes, denaturing proteins, and inhibiting DNA replication.[13,14]
- **Inhibits the proteins** that break down the exposed dentin organic matrix: matrix metalloproteinases;[11] cathepsins;[12] and bacterial collagenases.[5]
- **Silver and fluoride ions penetrate** ~25 microns **into enamel**,[16] and 50-200 microns into **dentin**.[17] Fluoride, and silver is available for upon release by re-acidification.[18]

Courtesy of Jeremy Horst

SDF Side Effects = staining of the lesion



time 0 1 day 1 week

J Dent Res 88:116

Instructions for SDF

Compendium of Continuing Education in Dentistry

[redacted]

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Compendium
June 2021
Volume 42, Issue 6

Clinical Instructions for Using Silver Diamine Fluoride (SDF) in Dental Caries Management

Douglas A. Young, DDS, EdD, MBA, MS; Ryan L. Quock, DDS; Jeremy Horst, DDS, PhD; Roopwant Kaur, BDS, MS; Jeanette K. MacLean, DDS; John C. Frachella, DMD; Steve Duffin, DDS; Adriana Semprum-Clavier, DDS, MS; and Andrea G. Ferreira Zandona, DDS, MSD, PhD

Abstract

Background: Manufacturer instructions for 38% silver diamine fluoride (SDF) are limited to current FDA clearance for tooth desensitization. There is a need for instructions to provide best-practice recommendations for off-label use of SDF for caries prevention and arrest. Methods: The authors considered existing clinical approaches to the use of 38% SDF at pH 10 for the prevention and arrest of active dental caries, in light of the best current evidence. Application of SDF, with or without subsequent direct restoration, is included. The content was reviewed by stakeholders including but not limited to those listed on the consensus statement (Appendix A, below). Results: 38% SDF for the prevention and arrest of active caries lesions, as well as compatibility with common direct restorative materials, such as glass-ionomer cement and resin composite, has a foundation in the scientific literature. A practical decision-flow diagram and accompanying best practices for treatment of caries lesions, based on clinical access and intention to restore, were developed based on available evidence and expert clinical observation when no evidence was available. Conclusions: Based on the best available evidence, a logical approach can be adopted regarding the practical use of 38% SDF for caries prevention and arrest. Practical implications: SDF used as per these instructions for prevention on high-risk tooth surfaces and arrest of active caries lesions has a place in the practitioner's dental caries management armamentarium. When SDF is applied to active lesions, it can be used with or without subsequent restoration, depending on clinical context, expert judgment, and patient input.

Figure 1

Figure 2

Figure 3

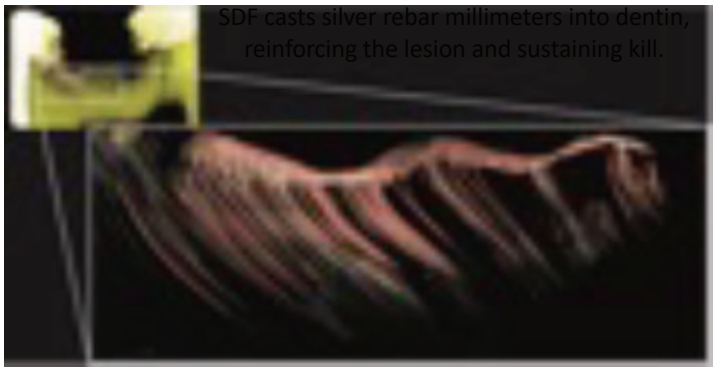
Figure 4

- https://www.aegisdentalnetwork.com/cced/2021/06/clinical-instructions-for-using-silver-diamine-fluoride-sdf-in-dental-caries-management

How to place SDF (summary)

1. **Use personal protective equipment (PPE)** for patient and operator
2. **Dispense SDF** into a plastic dappen
3. **Optional extra-oral protection** can be used for the lips and surrounding area using petroleum jelly or lip balm.
4. **Isolate tooth surfaces to be treated and protect other areas at risk for unwanted staining**
5. **No caries removal** is necessary prior to applying SDF.
6. **Dry** the area to be treated
7. **Saturate the lesion with SDF** using a microbrush and allow the lesion to absorb the SDF by capillary action for at least one minute.
8. **Apply a fluoride varnish on top of the SDF (optional)** If a restoration is going to be placed on the same day as SDF application, do NOT complete this step**.**
9. **Clean up**

SDF: penetration & less need for local anesthesia



Courtesy of Dr. Jeremy Horst

When to use what technique????

- GIC alone
- SDF alone
- SDF arrest first, wash out period, followed by GIC
- SDF and GIC on the same day (SMART)

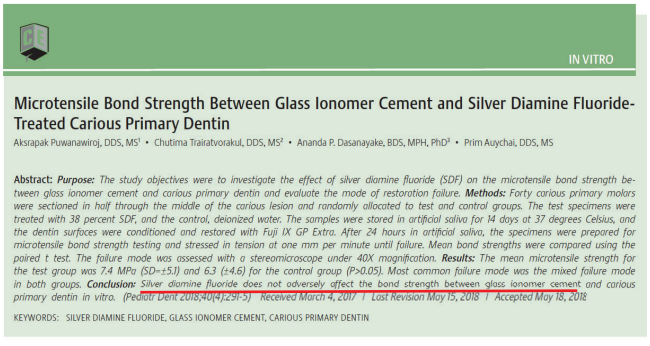
ART
Atraumatic Restorative Technique

Silver Modified Atraumatic Restorative Technique (SMART)

SDF + GIC on the same appointment

The ideal method is to use clean perimeter margins (partial caries removal) after SDF placement. Then no systematic reviews will be violated.

SDF-GIC Bond Strength Unaffected



IN VITRO

Microtensile Bond Strength Between Glass Ionomer Cement and Silver Diamine Fluoride-Treated Carious Primary Dentin

Aksrapak Puwanawiroj, DDS, MS[1] • Chutima Trairatvorakul, DDS, MS[2] • Ananda P. Dasanayake, BDS, MPH, PhD[3] • Prim Auychai, DDS, MS

Abstract: ***Purpose:*** *The study objectives were to investigate the effect of silver diamine fluoride (SDF) on the microtensile bond strength between glass ionomer cement and carious primary dentin and evaluate the mode of restoration failure.* ***Methods:*** *Forty carious primary molars were sectioned in half through the middle of the carious lesion and randomly allocated to test and control groups. The test specimens were treated with 38 percent SDF, and the control, deionized water. The samples were stored in artificial saliva for 14 days at 37 degrees Celsius, and the dentin surfaces were conditioned and restored with Fuji IX GP Extra. After 24 hours in artificial saliva, the specimens were prepared for microtensile bond strength testing and stressed in tension at one mm per minute until failure. Mean bond strengths were compared using the paired t test. The failure mode was assessed with a stereomicroscope under 40X magnification.* ***Results:*** *The mean microtensile strength for the test group was 7.4 MPa (SD=±5.1) and 6.3 (±4.6) for the control group (P>0.05). Most common failure mode was the mixed failure mode in both groups.* ***Conclusion:*** *Silver diamine fluoride does not adversely affect the bond strength between glass ionomer cement and carious primary dentin in vitro.* *(Pediatr Dent 2018;40(4):259-5) Received March 4, 2017 | Last Revision May 15, 2018 | Accepted May 18, 2018*

KEYWORDS: SILVER DIAMINE FLUORIDE, GLASS IONOMER CEMENT, CARIOUS PRIMARY DENTIN

Pre-op (wet)

Courtesy of Vu Le

Pre-op (desiccate with air)

Courtesy of Vu Le

Apply SDF 1-2 mins

Clean Perimeter with bur or spoon

Place GIC and Check Occlusion

Extremely SMART
Pre-op (too sensitive to brush)

Note: advanced lesions #12 &27

Before restoration

Preparation

Upper GICs, Lower preps

2 years, no failures

Original Contributions

JADA 2018

Case Report

Secondary Sjögren syndrome

A case report using silver diamine fluoride and glass ionomer cement

Douglas A. Young, DDS, EdD, MBA, MS; Annikka Frostad-Thomas, DDS; Jaana Gold, DDS, MPH, PhD, CPH; Allen Wong, DDS, EdD, DABSCD

ABSTRACT

Background and Overview. The authors describe dental treatment for a patient with a complex medical history of secondary Sjögren syndrome with systemic lupus erythematosus and rheumatoid arthritis.

Case Description. An 18-year-old woman's rheumatology group referred her for oral evaluation; she had secondary Sjögren syndrome, systemic lupus erythematosus, and rheumatoid arthritis. The patient had multiple advanced carious lesions, extreme sensitivity, and hyposalivation. The patient selected a minimally invasive treatment plan that focused on silver diamine fluoride (SDF), partial caries removal, and glass ionomer cement (GIC) restorations. The SDF treatment and GIC restorations were successful in arresting carious lesions and restoring form and function but may not completely prevent new carious lesions from forming in the future.

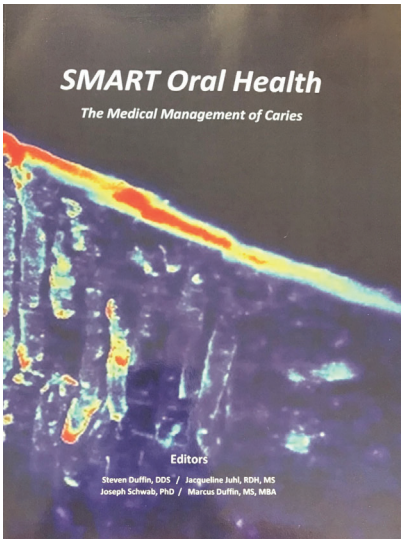
Conclusions and Practical Implications. The case shows that using less invasive treatments, such as SDF and GIC restorations can be used to manage complex cases involving extreme caries risk and be preferable to endodontic treatment and extractions.

Key Words. Sjögren syndrome; xerostomia; caries; silver diamine fluoride; glass ionomer cement.

JADA 2018:149(8):731-741

https://doi.org/10.1016/j.adaj.2018.03.021

SMART Textbook (Amazon)



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QUESTIONS?
&
DISCUSSION