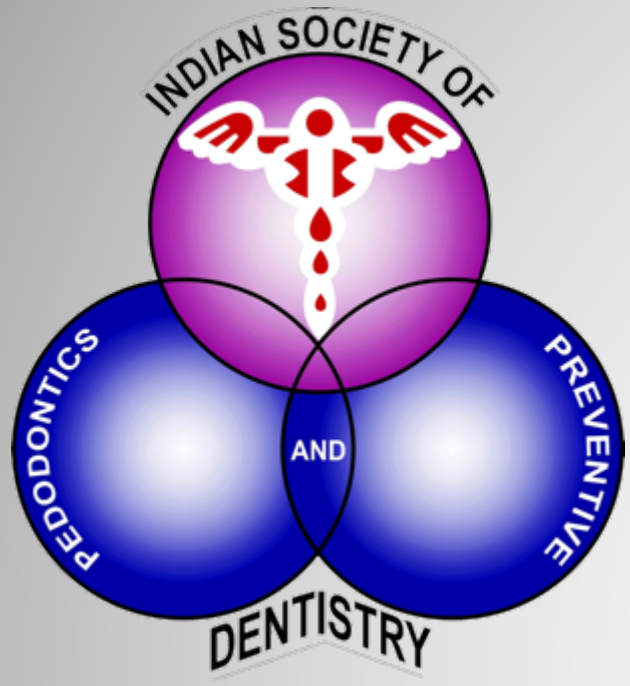


MINIMAL INVASIVE DENTISTRY

Virinder Goyal

DENTAL CARIES

"BIOFILM-MEDIATED, SUGAR-DRIVEN, MULTIFACTORIAL, DYNAMIC DISEASE THAT RESULTS IN THE PHASIC DEMINERALIZATION AND REMINERALIZATION OF DENTAL HARD TISSUES."

Selwitz RH, Ismail AI, Pitts NB. Dental caries. Lancet 2007;369(9555):51-9.

MINIMAL INVASIVE APPROACH CAN BE ORGANIZED INTO THREE MAIN CATEGORIES

- **Recognize**, which means identify patient caries risk
- **Remineralize**, which means prevent caries and reverse non-cavitated caries
- **Repair**, which means control caries activity, maximize healing and repair the damage.

Early caries diagnosis.

Classification of caries depth and progression

Assessment of individual caries risk (high, moderate, low)

Reduction in cariogenic bacteria

Remineralization of early lesions

Assessing disease management outcomes at intervals.

American Academy of Pediatric Dentistry. Caries-risk assessment and management for infants, children, and adolescents. Pediatr Dent 2014;36(special issue):127-34.

EARLY DIAGNOSIS

- The goal is to halt the disease first and then to restore lost structure and function
  - an accurate diagnosis of the disease is mandatory.
- Caries activity cannot be determined at one stage only, it has to be monitored over the time by taking radiographs and clinical checkups.

Cagetti MG, Bonta G, Cocco F, Lingstrom P, Strohmenger L, Campus G. Are standardized caries risk assessment models effective in assessing actual caries status and future caries increment? A systematic review. BMC Oral Health 2018;18(1):123.

HOLISTIC WAY THROUGH A COMPREHENSIVE ASSESSMENT AND PERSONALIZED CARIES CARE PLAN

- Prevent **new lesions** from appearing
- Prevent existing lesions from **advancing further**.
- Preserve tooth structure with **non-operative** care at more initial stages
- **Conservative operative care** at more extensive caries stages

Scientific articles

Australian Dental Journal 1998;43:(3):153-9

A new cavity classifica tion

Graham J. Mount, BDS(Syd), DDSc(Adel), FRACDS*
W. Rory Hume, BDS, PhD, DDSc, FRACDS†

Australian Dental Journal 1998;43:(3):153-9

Abstract

With the development of adhesive restorative materials and a far better understanding of the action of the fluoride ion it is suggested that the time has arrived for a reassessment of the traditional cavity classification as set out by G. V. Black over one hundred years ago. When preventive measures and remineralization fail and a carious lesion has progressed through the enamel into the dentine there is a need to remove the infected dentine, and possibly some of the affected dentine as well, to eliminate cavitation and avoid further accumulation of plaque. In most situations this will involve removal of enamel to achieve access to the infected dentine but, in the presence of fluoride, both enamel and dentine are capable of being remineralized and therefore conserved, at least to a degree.

The principle of minimal extension must be encouraged to allow maximum preservation of natural tooth structure. A new cavity classification is proposed which is designed to make the most of the potential for healing which is inherent in both enamel and dentine. However, it must be accepted that a considerable proportion of restorative dentistry is carried out to replace failed restorations and, in this case, cavity design will be complicated by existing loss of tooth structure.

Key words: New cavity classification, cavity design, fluoride ion, preservation and restoration of tooth structure.

(Received for publication March 1997. Revised June 1997. Accepted June 1997.)

Introduction

Until recent times cavities were designed without the present understanding of the action of the fluoride ion[1] and, in the presence of restorative materials which had no inherent therapeutic properties, were subject to microleakage and were often not aesthetic. Also, in the absence of adhesive restorative materials, it was regarded as essential to remove all unsupported enamel regardless of its location. More importantly, it was often necessary to remove additional sound tooth structure just to make room for the restorative material thus defeating one of the prime purposes of restoration – the preservation of remaining tooth structure.

It is very difficult indeed to reproduce the anatomy and appearance of the original tooth with any of the direct plastic restorative materials, for example, amalgam, composite resin and glass ionomer. However, now that it is possible to develop long-term adhesion to both enamel and dentine in the oral environment, the way is open for a complete reassessment of cavity design. Whilst the materials currently available are still not perfect, they are adequate for the restoration of the smaller initial lesions and, in combination, can be used to restore cavities of moderate size.

When placing plastic restorative materials, reproduction of the original anatomy of the tooth is entirely dependent upon the skill of the operator and

NEW CAVITY CLASSIFICATION

Site / Size	Minimal	Moderate	Enlarged	Extensive
Pit and Fissure 1	1.1	1.2	1.3	1.4
Contact area 2	2.1	2.1	2.2	2.3
Cervival 3	3.1	3.2	3.3	3.4

Australian Dental Journal 1998;43:(3):153-9

NEW CAVITY CLASSIFICATION

- Size 0: Carious lesion without cavitation, can be remineralized.
- Size 1: Small cavitation, just beyond healing through remineralization.
- Size 2: Moderate cavitation not extended to cusps.
- Size 3: Enlarged cavitation with at least one cusp which is undermined and which needs protection from occlusal load.
- Size 4: Extensive decay with atleast one lost cusp or incisal edge

Australian Dental Journal 1998;43:(3):153-9

THE INTERNATIONAL CARIES DETECTION AND ASSESSMENT SYSTEM

0	Clinically sound
1 to 2	Clinically detected “intact” enamel lesions (initial stage decay)
3 to 4	Clinically detectable early, shallow, or micro-cavitations (moderate decay)
5 to 6	Clinically detectable late or deep cavitations (extensive decay)

Criteria Manual: International Caries Detection and Assessment System (ICDASII)International Caries Detection and Assessment System (ICDAS) Coordinating Committee. Workshop held in Baltimore, Maryland. 2005. 12th - 14th March.

Gomez *BMC Oral Health* 2015, **15**(Suppl 1):S3
http://www.biomedcentral.com/1472-6831/15/S1/S3

BMC Oral Health

PROCEEDINGS Open Access

Detection and diagnosis of the early caries lesion

J Gomez

From Prevention in practice - making it happen
Cape Town, South Africa. 29 June 2014

Abstract

The purpose of this manuscript is to discuss the current available methods to detect early lesions amenable to prevention. The current evidenced-based caries understanding, based on biological concepts, involves new approaches in caries detection, assessment, and management that should include non-cavitated lesions.
Even though the importance of management of non-cavitated (NC) lesions has been recognized since the early 1900s, dental caries has been traditionally detected at the cavitation stage, and its management has focused strongly on operative treatment. Methods of detection of early carious lesions have received significant research attention over the last 20 years. The most common method of caries detection is visual-tactile. Other non-invasive techniques for detection of early caries have been developed and investigated such as Quantitative Light-induced Fluorescence (QLF), DIAGNOdent (DD), Fibre-optic Transillumination (FOTI) and Electrical Conductance (EC). Based on previous systematic reviews, the diagnosis of NCCLs might be more accurately achieved in combination of the visual method and the use of other methods such as electrical methods and QLF for monitoring purposes.

Introduction

Dental caries is the most prevalent chronic disease worldwide. When initial lesions are taken into account into the clinical assessment, only few individuals are truly unaffected. In most industrialized countries 60-90% of school-aged children are affected and nearly 100% of the adult population is affected [1]. However, over the recent years, the patterns of disease presentation have changed. The progression of non-cavitated lesions seems to be slower [2], allowing preventive strategies practice and in clinical trials have focused on detecting lesions at a cavitation stage informing only restorative decisions [6].

Several conferences have also been held during the past years focused on caries detection and management. In the last Consensus on Diagnosis and Management of Dental Caries, the inability to accurately identify early caries lesions and the need for a change in the system with respect to the non-surgical management of non-cavitated lesions was highlighted [7]. The Consensus Panel con-

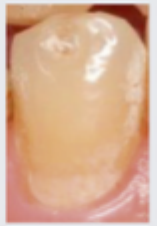
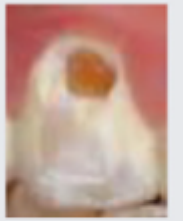
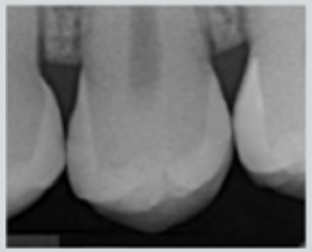
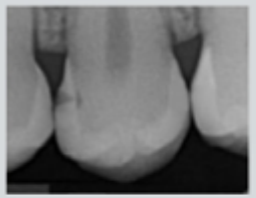
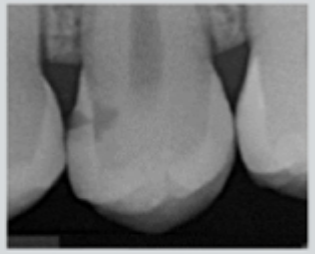
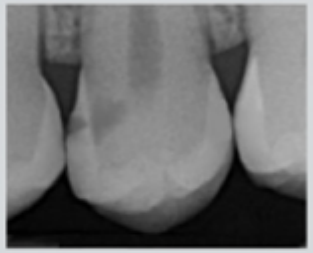
Gomez BMC Oral Health 2015, 15(Suppl 1):S3

LESION SEVERITY CAN BE CLASSIFIED RADIOGRAPHICALLY AS

- E0 (no lesion)
- E1 (lesion within the outer half of enamel)
- E2 (inner half of enamel
- D1 (outer third of dentin)
- D2 (middle third of dentin)
- D3 (inner third of dentin)

Gomez: Detection and diagnosis of the early caries lesion. BMC Oral Health 2015 15(Suppl 1):S3.

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

VISIBLE OCCLUSAL PLAQUE INDEX (VOPI)-TO ESTIMATE CARIES LESION ACTIVITY STATUS ON OCCLUSAL SURFACES

- 0 = no visible plaque identified when carefully running a dental probe on the groove-fossa-system
- 1 = thin plaque: hardly detectable plaque which is restricted to the groove-fossa-system and identified by carefully running a dental probe on the groove-fossa-system
- 2 = thick plaque: easily detectable plaque on the groove-fossa- system identifiable with the naked eye;
- 3 = heavy plaque: occlusal surfaces partially or totally covered with heavy plaque accumulation identifiable with the naked eye

[Carvalho et al., 1989, 1991, 1992, 2014].

ACTIVE LESION”

Papilla Bleeding Index (PBI) score of Saxer and Muhleman (score1, 2, 3, 4).

Bleeding after probing the sulcus is a sign of inflammation.

We accept the hypothesis that when there is inflamed gingiva and papilla, the approximal carious lesions is active.

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

* Source: Ekstrand and colleagues.[28]

CHARACTERIS-TICS OF ACTIVE OR PASSIVE LESIONS

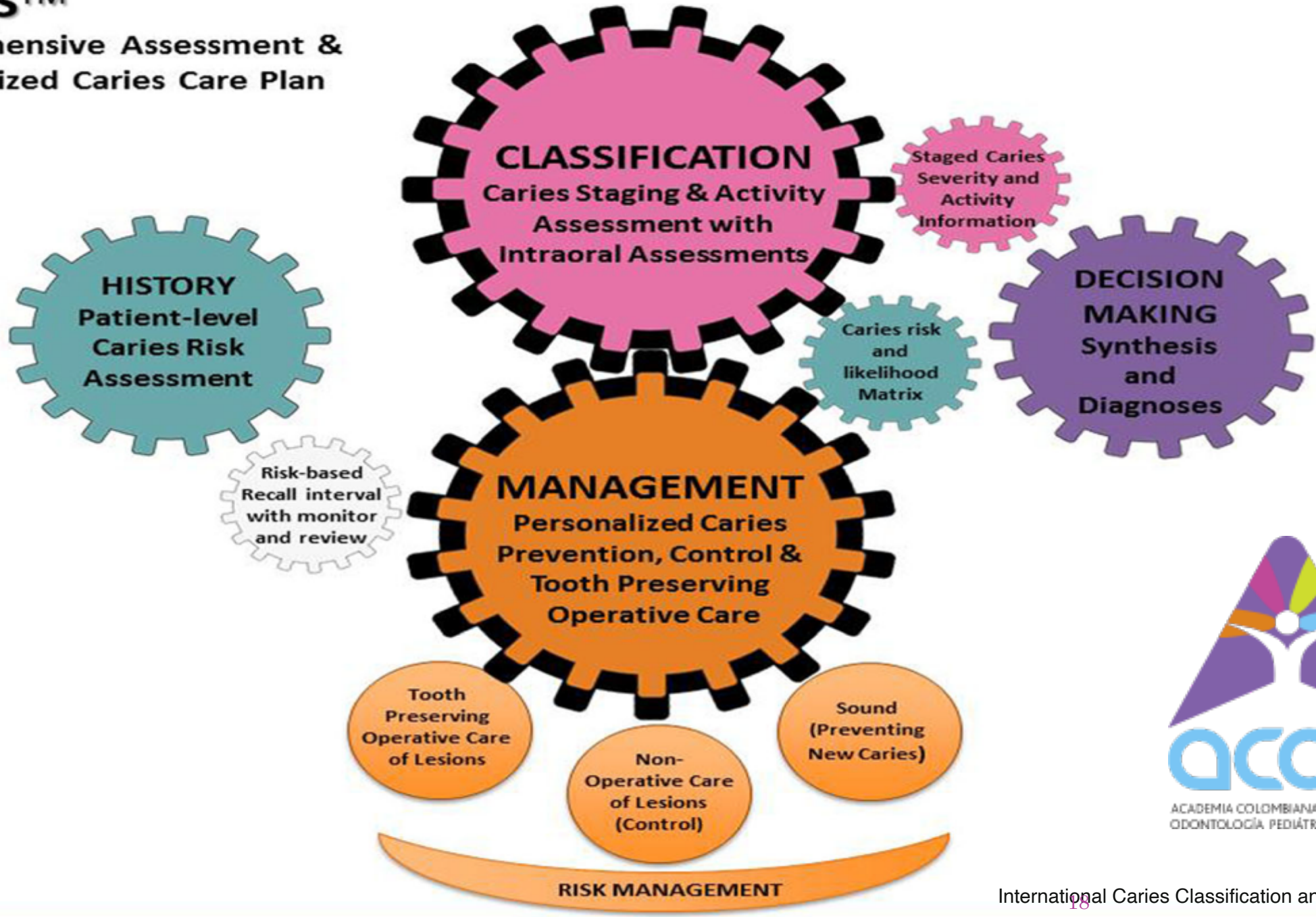
THE INTERNATIONAL CARIES CLASSIFICATION AND MANAGEMENT SYSTEM (ICCMS)

- **Initial patient assessments (collecting personal and risk-based information through histories and systematic data collection)**
- **Lesion detection, activity, and appropriate risk assessment (detection and staging of lesions, assessment of caries activity, and caries risk assessment)**
- **Synthesis and decision making (integrating patient-level and lesion-level information)**
- **Clinical treatments (surgical and nonsurgical) with prevention (ensuring that the treatment planning options available are prevention oriented and include nonsurgical options whenever appropriate).**

*Article can be downloaded

ICCMS™

Comprehensive Assessment & Personalized Caries Care Plan



ACADEMIA COLOMBIANA DE ODONTOLOGÍA PEDIÁTRICA

Diagnosis and Management of Caries lesions in Proximal Coronal Surfaces of Permanent teeth

E1 or E2 Lesion

Low — **Caries Risk ?** — Moderate or High

D1 Lesion

Low or Moderate — **Caries Risk ?** — High

D2 or D3 Lesion

Monitor Lesion
at recall/re-evaluation appointments

lesion arrest (remineralization or lesion infiltration) or proximal sealant & re-evaluate risk status and lesions

No radiographic evidence of lesion progression at 1 year

Restoration
Resin composite restoration (RC)
Resin modified glass ionomer (RMGI)
Sandwich – RMGI at gingival (Dentin)margin & RC on occlusal (Enamel)
Amalgam restoration

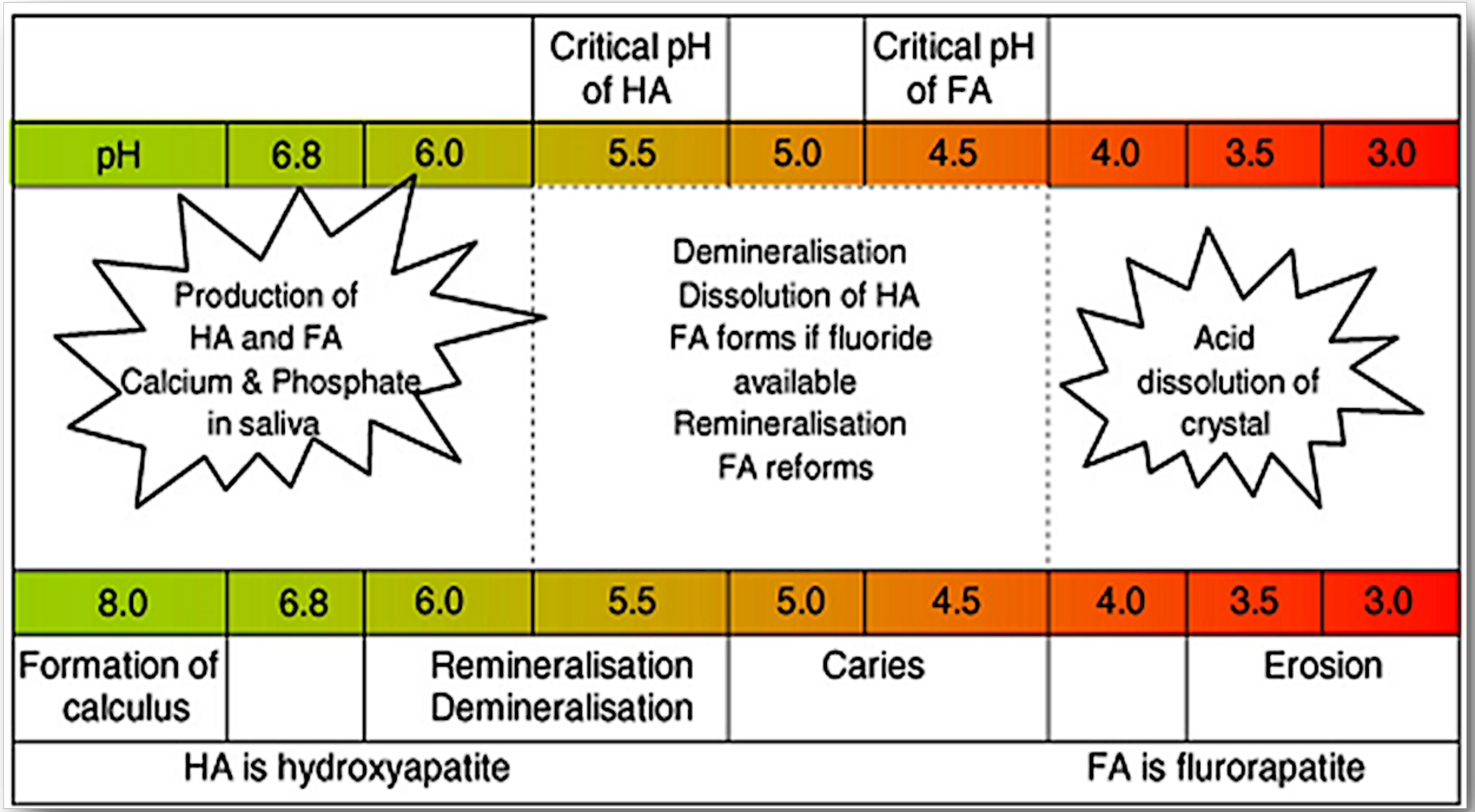
Radiographic classification of lesions
E1 –Less than ½ way through proximal enamel
E2 -More than ½ way through proximal enamel, not penetrating past DEJ
D1 – Slightly past DEJ
D2 – Less than ½ way through dentin towards pulp
D3 - ½ or more through dentin

University of Texas Health Science Center at San Antonio)

REMINERALIZATION OF EARLY LESIONSAND REDUCTION OF CARIOGENIC BACTERIA

- Enamel and dentin demineralization is not a continuous, irreversible process.
- Through a series of demineralization and remineralization cycles, the tooth alternately loses and gains calcium and phosphate ions, depending on the microenvironment.
- It now is well-recognized that it is possible to arrest and even reverse the mineral loss associated with caries at an early stage, before cavitation takes place.

- When the pH is less than 5.5, subsurface enamel or dentin will demineralize.
- Fluoride enhances the uptake of calcium and phosphate ions and can form fluoroapatite.
- Fluorapatite demineralizes at a pH less than 4.5, making it more resistant to demineralization from an acid challenge than hydroxylapatite.


Critical pH of HA
Critical pH of FA
pH
6.8
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Production of HA and FA Calcium & Phosphate in saliva
Demineralisation
Dissolution of HA
FA forms if fluoride available
Remineralisation
FA reforms
Acid dissolution of crystal
8.0
6.8
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Formation of calculus
Remineralisation
Demineralisation
Caries
Erosion
HA is hydroxyapatite
FA is flurorapatite

REMINERALIZATION OF INITIAL LESIONS AND REDUCTION IN CARIOGENIC BACTERIA

- MI treatment on micro or molecular levels starts with fighting the bacterial infection and healing reversible carious lesions.
- The bacterial infection can be controlled using a wide range of treatment methods, which may involve the use of chlorhexidine, diammine silver fluoride, ozone application, triclosan, or cavity seal by chemical material adhesion.

https://calcivis.com/

Bioluminescence, the natural production and emission of light, to use in modern technology.

https://calcivis.com/

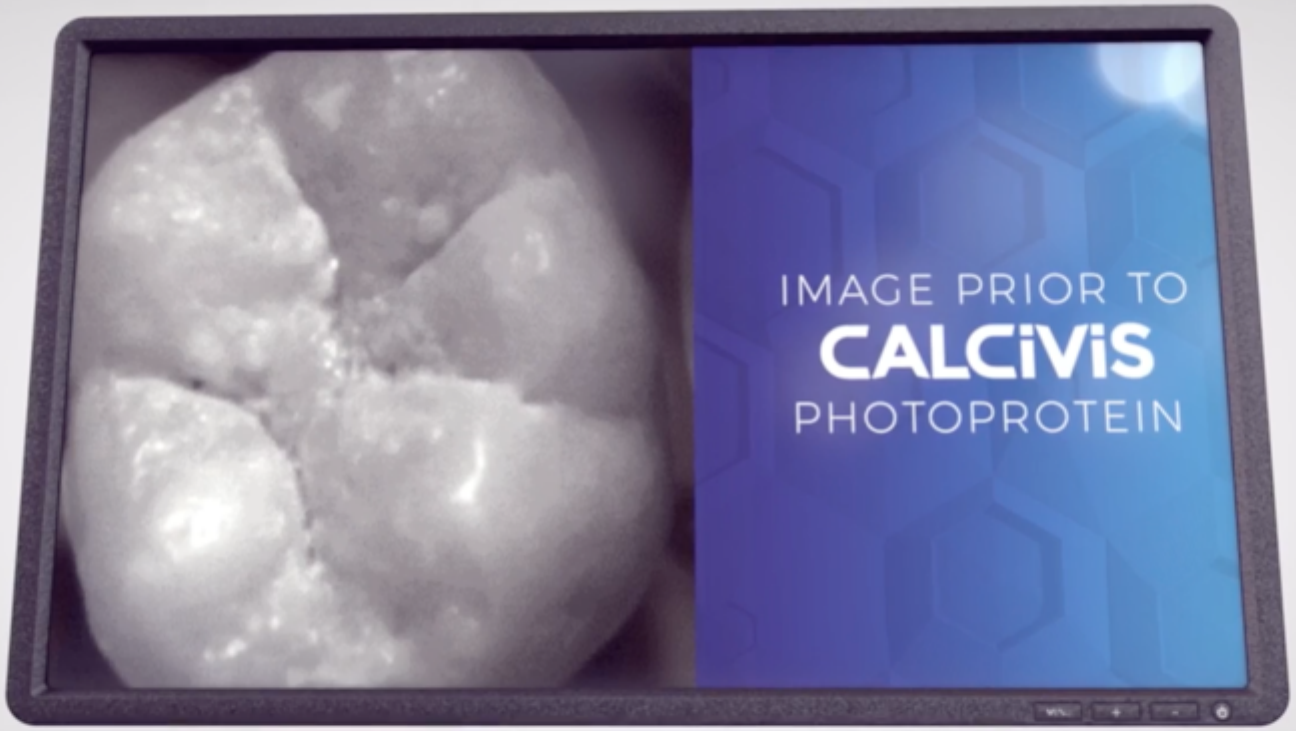
- **When CALCiViS photoprotein contacts free calcium ions, a very short, low-level flash of light (luminescence) is created which is undetectable by the naked eye.**

- **CALCiViS can differentiate between active lesions and inactive lesions/sound tooth surfaces.**

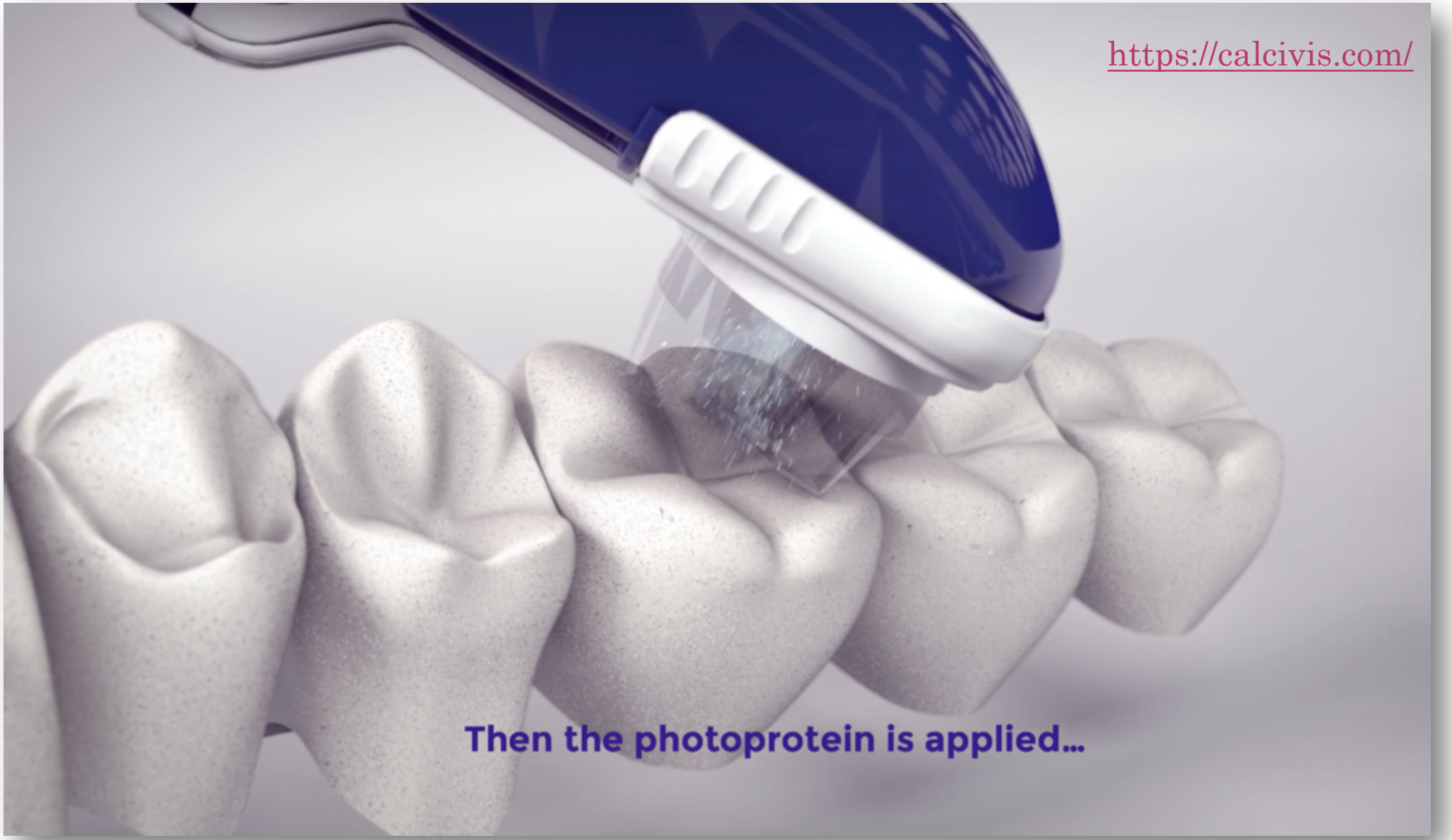
https://calcivis.com/


https://calcivis.com/
First the device captures a visible light image.

https://calcivis.com/



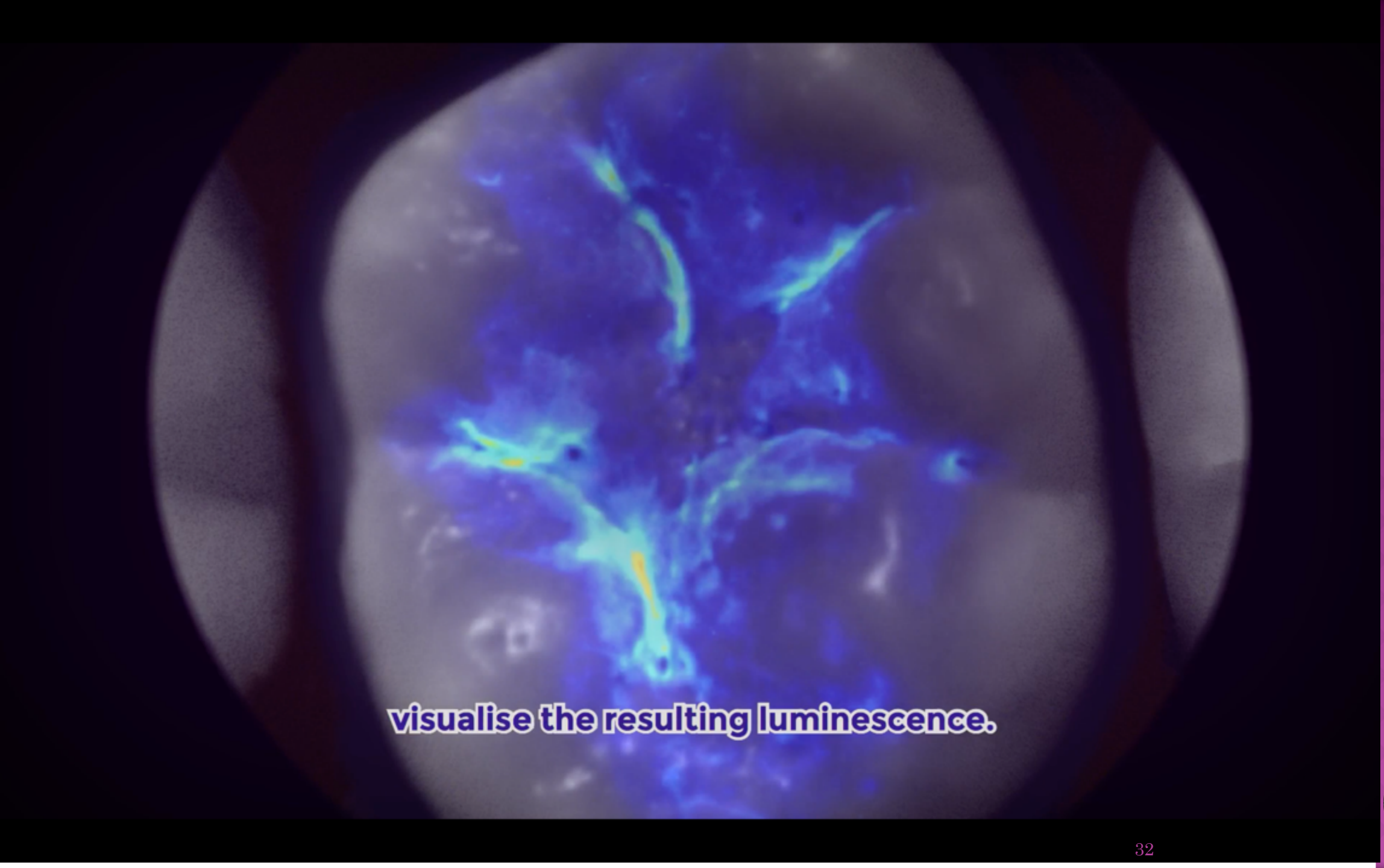
Then the photoprotein is applied...


https://calcivis.com/
Then the photoprotein is applied...


https://calcivis.com/
...allowing the system to almost instantaneously

of high active demineralisation,

https://calcivis.com/


visualise the resulting luminescence.


CALCIVIS
Test Test
ID:
DoB: 5/6/2000
Next Tooth
Session Complete
DELL

REMINERALIZATION

Process whereby calcium and phosphate ions are supplied from a source external to the tooth to promote ion deposition into crystal voids in demineralized enamel to produce net mineral gain

Cochrane NJ, CaiF, Huq NL, Burrow MF, Reynolds EC. New approach to enhance remineralization of tooth enamel. J Dent Res 2010;89:1187-97.]

REVIEW ARTICLE

Recent Advances in Dental Hard Tissue Remineralization: A Review of Literature

Mando K Arifa[1], Rena Ephraim[2], Thiruman Rajamani[3]

Abstract

The dental caries is not simply a continuous and unidirectional process of the demineralization of the mineral phase, but a cyclic event with periods of demineralizations and remineralisation. The remineralization process is a natural repair mechanism to restore the minerals again, in ionic forms, to the hydroxyapatite (HAP) crystal lattice. It occurs under near-neutral physiological pH conditions whereby calcium and phosphate mineral ions are redeposited within the caries lesion from saliva and plaque fluid resulting in the formation of newer HAP crystals, which are larger and more resistant to acid dissolution. Numerous types of remineralizing agents and remineralizing techniques have been researched and many of them are being used clinically, with significantly predictable positive results. The recent researches on remineralization are based on biomimetic remineralization materials, having the capability to create apatite crystals within the completely demineralized collagen fibers.

Keywords: Nanoparticles, Polydopamine, Recent advances, Remineralizaion.

International Journal of Clinical Pediatric Dentistry (2019): 10.5005/jp-journals-10005-1603

Introduction

Dental caries is a pandemic disease affecting the teeth characterized by demineralization and cavitation, eventually leading to discomfort and pain, causing limitations in function and compromised facial aesthetics.[1]

Most of the children acquire the bacteria (predominantly *Streptococcus mutans*) from their mothers or caregivers by salivary contact during the emergence of primary teeth between the ages 6 and 30 months of life and is termed as a discrete window of infectivity.[2,3] Caries is not simply a continuous and unidirectional process of the demineralization of the mineral phase, but a cyclic event with periods of demineralizations and remineralization.[4] When

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

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DOI: 10.1177/0022034518800014
journals.sagepub.com/home/jdr

O. Urquhart[1], M.P. Tampi[1], L. Pilcher[1], R.L. Slayton[2], M.W.B. Araujo[3], M. Fontana[4], S. Guzmán-Armstrong[5], M.M. Nascimento[6], B.B. Nový[7], N. Tinanoff[8], R.J. Weyant[9], M.S. Wolff[10], D.A. Young[11], D.T. Zero[12], R. Brignardello-Petersen[13], L. Banfield[14], A. Parikh[15], G. Joshi[16], and A. Carrasco-Labra[1,17]

Abstract

The goal of nonrestorative or non- and microinvasive caries treatment (fluoride- and nonfluoride-based interventions) is to manage the caries disease process at a lesion level and minimize the loss of sound tooth structure. The purpose of this systematic review and network meta-analysis was to summarize the available evidence on nonrestorative treatments for the outcomes of 1) arrest or reversal of noncavitated and cavitated carious lesions on primary and permanent teeth and 2) adverse events. We included parallel and split-

Recommendations Assessment, Development, and Evaluation (GRADE) approach. Data were synthesized with a random effects model and a frequentist approach. Forty-four trials (48 reports) were eligible, which included 7,378 participants and assessed the effect of 22 interventions in arresting or reversing noncavitated or cavitated carious lesions. Four network meta-analyses suggested that sealants + 5% sodium fluoride (NaF) varnish, resin infiltration + 5% NaF varnish, and 5,000-ppm F (1.1% NaF) toothpaste or gel were the most effective for arresting or reversing noncavitated occlusal, approximal, and noncavitated and cavitated root carious lesions on primary and/or permanent teeth, respectively (low- to moderate-certainty evidence). Study-level data indicated that 5% NaF varnish was the most effective for arresting or reversing noncavitated facial/lingual carious lesions (low certainty) and that 38% silver diamine fluoride solution applied biannually was the most effective for arresting advanced cavitated carious lesions on any coronal surface (moderate to

most effective for arresting or reversing noncavitated facial/lingual carious lesions (low certainty) and that 38% silver diamine fluoride solution applied biannually was the most effective for arresting advanced cavitated carious lesions on any coronal surface (moderate to

Requirements for remineralization process.....

- Sufficient mineral must be present in the saliva
- A molecule of carbonic acid must be produced
- This all has to occur in proximity to a demineralized spot in the HA latticework that requires that exact mineral ion
- That spot of the tooth has to be clean, so that the mineral-deficient spot is accessible.

Int J Dent Case Reports 2011; 1(2): 73-84

REMINERALISING AGENTS

- Fluorides
- Calcium phosphate based
- Calcium Sucrose Phosphate
- Sugar Substitutes
- Hydroxyapatite

REQUIREMENTS OF AN IDEAL REMINERALIZATION MATERIAL

- Diffuses into the subsurface or delivers calcium and phosphate into the subsurface
- Does not deliver an excess of calcium
- Does not favour calculus formation
- Works at an acidic pH
- Works in xerostomic patients
- Boosts the remineralizing properties of saliva.

CASEIN PHOSPHOPEPTIDE AMORPHOUS CALCIUM PHOSPHATE TECHNOLOGY (CPP-ACP).

Proposed mechanism: localisation and supply of calcium, phosphate and fluoride ions in the correct molar ratio at the tooth surface by the CPP to drive diffusion of the ion into the subsurface enamel.

Caries Res 2008;42:88–97

USE OF FLUORIDE VEHICLES CAN REVERSE EARLY LESIONS BUT MOST EFFECTIVE AT THE SURFACE OF THE LESION .
THIS MAY LEAD TO REMINERALIZATION OF THE POROUS SURFACE LAYER, CAUSING THE BLOCKAGE OF ENAMEL PORES AND THEREBY REDUCING THE IONIC EXCHANGE ACTIVITY OF SURFACE ENAMEL AND HINDERING THE REMINERALIZATION OF THE UNDERLYING LESION BODY, MAKING FULL REMINERALIZATION DIFFICULT TO ACHIEVE

ACIDULATED FLUORIDE PRODUCTS

- **Reducing the pH of the fluoridated vehicle, may prolong the ingress of mineral ions into the lesion body by preventing the blockage of enamel pores, thus enabling full remineralization of the lesion.**
- **In addition, at a low pH, there is release of calcium and fluoride associated with bacteria, particularly bacterial lipoteichoic acid, as well as the calcium fluoride deposits in plaque matrix and tooth surfaces.**

SELF-ASSEMBLING PEPTIDES

Curodont™ Repair (Credentis AG, Windisch, Switzerland)

P11-4 monomers applied to an early caries lesion, diffuse into the subsurface micropores of the lesion and assemble under high ionic strength into a 3D-matrix (scaffold), which attracts calcium phosphate from saliva triggering biomimetic mineralization that enables the regeneration of enamel and dentin

Kirkham J, Firth A, Vernals D, Boden N, Robinson C, Shore RC, et al. Self-assembling peptide scaffolds promote enamel remineralization. J Dent Res. 2007;86(5):426–30.

ARGININE TECHNOLOGY

- 1.5 % arginine, insoluble calcium carbonate, and 1450 ppm fluoride as sodium monofluorophosphate
- the amino acids will be deaminated by the arginine deaminase (enzyme) system in saliva, producing ammonia, which is highly alkaline and causes a rise in pH.
- With the sodium monofluorophosphate providing the fluoride ions and the calcium carbonate serving as the calcium source, remineralization is enhanced.

ten Cate JM, Cummins D. Fluoride toothpaste containing 1.5% arginine and insoluble calcium as a new standard of care in caries prevention. J Clin Dent. 2013;24:79–87.

FUNCTIONALIZED TRICALCIUM PHOSPHATE PRODUCTS

Calcium oxides in TCP become protected by the organic materials, thus allowing the calcium and phosphate ions of the TCP to coexist with fluoride ions in an aqueous dentifrice base without premature TCP-fluoride interactions

As the ingredient reaches the tooth surface, the organic materials, which have an affinity for tooth surfaces, carries the calcium to the tooth surface, protected from fluoride ion. Saliva activates the calcium compound, degrading the protective coating, releasing calcium at the tooth surface, resulting in high fluoride and calcium bioavailability on the lesion surface and subsequent diffusion into the lesion to promote remineralization.

Amaechi BT. Remineralisation therapies for initial caries lesions. Curr Oral Health Rep June 2015;2(2):95–101. DOI: 10.1007/s40496-015- 0048-9

BIOACTIVE GLASS PRODUCTS

Delivers o Ca2+, PO4, and F– ions simultaneously in the appropriate amounts to form fluorapatite from a single glass composition

f-BG is engineered to release fluoride over a 12-h period within the oral environment.

f-BG form fluorapatite that is more chemically stable against acid attack.

Earl JS, Leary RK, et al. Physical and chemical characterization of dentin surface, following treatment with NovaMin technology. J Clin Dent 2011;22:2–67

HYDROXYAPATITE PRODUCTS

SANGI COMPANY, TOKYO, JAPAN,AND PERIPRODUCTS LTD, MIDDLESEX, UK.

- nHAP and fluoride
- Nanohydroxyapatite, a bioactive and biocompatible material, functions by directly filling up the micropores in early caries lesions, where it act as a template in the remineralization process by continuously attracting large amount of calcium and phosphate ions from the oral fluids into the lesion, thus promoting crystal growth

Wang ZJ, Sa Y, Sauro S, Chen H, Xing WZ, Ma X, et al. Effect of desensitising toothpastes on dentinal tubule occlusion: a dentine permeability measurement and SEM in vitro study. J Dent. 2010;38(5):400–10.

THEOBROMINE

THEODENT TOOTHPASTE (THEOCORP INC., USA),

Ability to induce increase in crystallite size and improve crystallinity of apatite in the presence remineralizing medium, such as saliva, is the predominant mechanism

Amaechi BT, PorteousN, RamalingamK,Mensinkai PK, Ccahuana-Vasquez RA, Sadeghpour A, et al. Remineralization of artificial enamel lesions by Theobromine. Caries Res. 2013;47:399–405.

COMBINATION OF CALCIUM GLYCEROPHOSPHATE AND SODIUMMONOFLUOROPHOSPHATE

SPRY™TOOTHPASTE AND SPRY™ ORAL RINSE (XLEAR, INC., AMERICAN FORK, UT, USA).

- effectiveness is suggested to be based mainly on its ability to elevate plaque-calcium concentrations, when delivered from toothpaste
- Xlear toothpaste and rinse contain 0.243 % (w/w) sodium fluoride,

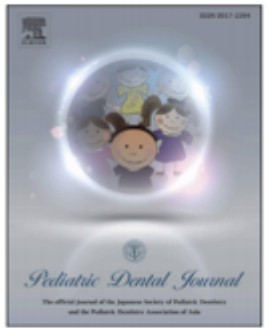
Lynch RJ. Calcium glycerophosphate and caries; a review of the literature. Int Dent J. 2004;54(5 Suppl 1):310–4.

PEDIATRIC DENTAL JOURNAL 28 (2018) 40–45

Available online at www.sciencedirect.com

Pediatric Dental Journal

journal homepage: www.elsevier.com/locate/pdj



Research Paper

Effect of tooth surface coating material containing S-PRG filler on white spot lesions of young permanent teeth

Noriko Wakamatsu, Masaki Ogika, Tetsu Okano, Chika Murabayashi, Tsuguko Kondo, Mitsuo Iinuma*

Department of Pediatric Dentistry, Division of Oral Structure, Function and D
Dentistry, Japan

ARTICLE INFO

Article history:
Received 22 May 2017
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Accepted 29 September 2017

ABSTRACT

Purpose: Pre-cavitation caric
frequently observed on youn
WSLs is needed to prevent nc
coating materials for remine
evaluate the effect of a coatin

5. Conclusion

The present study showed that the application of PRG Barri
Coat as an adjunct to periodic fluoride application can pr
mote beneficial remineralization effects on WSLs.

PRG Barrier Coat is an effective material for remineraliz
tion of enamel with WSLs.

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DOI: 10.2174/1874210601812010811, 2018, *12*, 811-819

RESEARCH ARTICLE

Effectiveness of S-PRG Filler-Containing Toothpaste in Inhibiting Demineralization of Human Tooth Surface

Bennett T. Amaechi[1], Hariyali Kasundra[1], Deepika Joshi[1], Azadeh Abdollahi[1], Parveez A. A. Azees[1]

Conclusion:

Toothpaste containing S-PRG filler can serve as an effective caries control tool. S-PRG filler-containing dentifrice to be more effective in preventing tooth demineralization than 1100 ppm fluoride provided as sodium fluoride.

Received: July 13, 2018 Revised: August 23, 2018 Accepted: October 2, 2018

SURFACE REACTION-TYPE PRE-RELEASED GLASS IONOMER (S-PRG) FILLERS

- An active ingredient with the ability to release and recharge fluoride ion.
- In addition, release five other active ions, Sr2, SiO3 , Na, BO3 , and Al3.
- Causes the surrounding environment to become weakly alkaline upon contact with water or acidic solutions.
- A fluoride-releasing coating material containing S-PRG filler (PRG BarrierCoat®, SHOFU, Japan) was manufactured as a coating material to suppress dentin hypersensitivity and prevent caries on smooth surface areas.

Chewing gums

Numerous studies have demonstrated the caries-preventing qualities of frequent use of chewing gum sweetened by dietary sugar alcohols such as xylitol and sorbitol.

Chewing gum, particularly sugar-free gum, may offer a valuable adjunct to a caries prevention and remineralization program.

Journal of Natural Science, Biology, and Medicine
Wolters Kluwer -- Medknow Publications

Xylitol in preventing dental caries: A systematic review and meta-analyses

Chandrashekar Janakiram, C. V. Deepan Kumar, and Joe Joseph

Additional article information

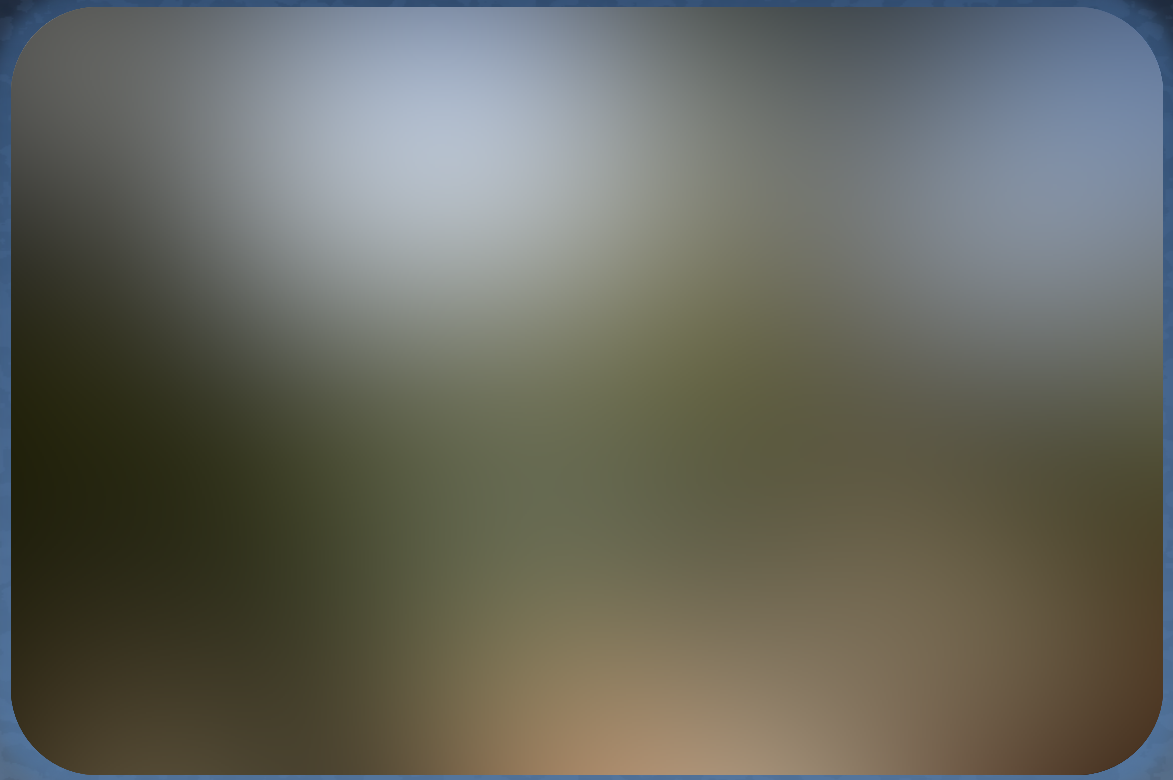
Abstract

Xylitol is a sugar alcohol having the properties that reduce levels of mutans streptococci (MS) in the plaqu... xylitol in preventing dental caries. Sys... developed by Cochrane cooperation w... carried out in PubMed through the per... studies were done on (1) humans (2) p... and as pairs (mother-child) (3) participants using orthodontic appliances (4) xylitol dispensed in any form (5) compare the effect of xylitol on dental caries and on other phenotype that determines the preventive effect on dental caries, such as decayed, missing, and filled (DMF/dmf) and salivary or plaque MS level. Twenty articles of the 477 articles initially identified. Among 20 studies indexed, 16 articles were accessed, systematically reviewed, and the meta-analysis was carried out. The evaluation of quality of the studies was done using risk of bias assessment tool. The quality of the studies was high risk and unclear risk for six and five trials. The meta-analysis shows a reduction in DMF/dmf with the standard mean (SM) of −1.09 (95% confidence interval [95% CI], −1.34, −0.83) comparing xylitol to all controls. The effect of DMF/dmf reduction by xylitol to fluoride ...89, −0.84). The subgroup ...h SM of 0.30 (95% CI, ...s preventive strategies; ...l to be an effective strategy

CONCLUSION

Trials that assess efficacy of xylitol under ideal conditions would be conducive to further RCTs to examine its clinical effectiveness. This review has demonstrated the need for high-quality RCTs in this area. Further trials should be well-designed RCTs and reported according to the Consolidated Standards of Reporting Trials statement or Risk of Bias Assessment Tool. In particular, appropriate control groups should be used, and trials should be designed with adequate power in view of a potential high drop-out rate (>40%) with a follow-up period of at least 3 years.

Dental Materials Used for Minimally Invasive Treatment



Adhesive materials do not require the incorporation of mechanical retention features

GLASS IONOMER CEMENT

- Adhesion to tooth and release of fluoride
- They perform well in low stress areas.
- Set glass ionomer is "rechargeable," take up fluoride from the environment, which is provided by exposure to fluoride treatments and toothpaste

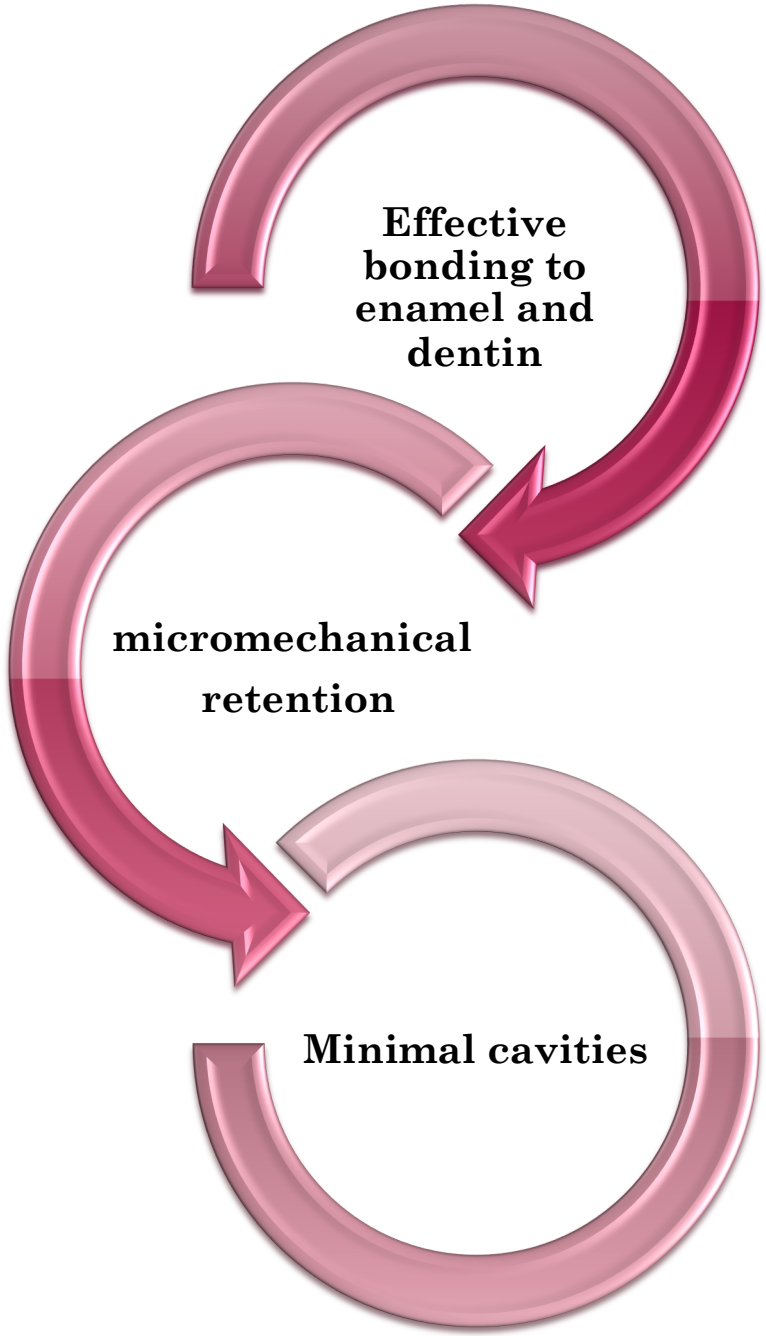
DISADVANTAGES OF GIC

- **Technique sensitivity.**
- **Handling properties and brittleness of the material can be overcome by adding resin to the material.**

The resulting resin-modified glass ionomer cements, or RMGICs, are easier to place, are light-cured, and have improved esthetic qualities.

The glass filler formulation of nano-ionomer makes for a resin-modified glass-ionomer material with high polishability, enhanced tooth shade-matching potential, and better physical properties

COMPOSİTES RESİNS

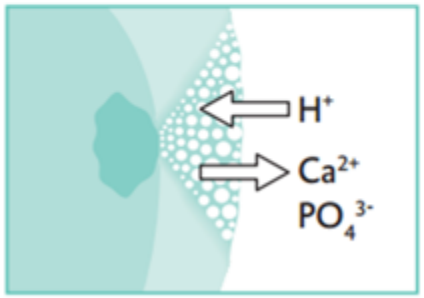



Icon™

ICON™

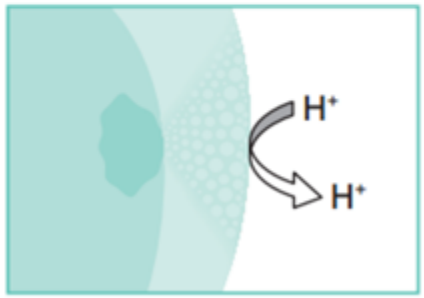
An ingeniously simple principle

The infiltration method works quite simply: After pretreatment with an etching gel, the infiltrant, a highly fluid resin, is applied to the affected area. Capillary action draws the infiltrant deep into the porous enamel, and it is then light-cured. This blocks the penetration of cariogenic acids. The incipient caries can be stopped – without drilling. Healthy tooth structure is preserved.



Incipient caries before treatment

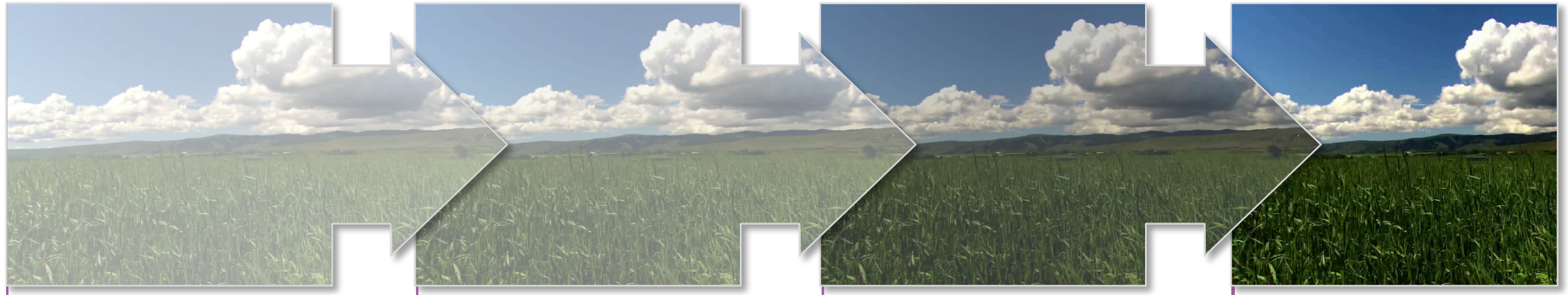
Cariogenic acids attack the enamel and draw out minerals. The tooth becomes porous.



After treatment

By sealing the pore system, acids can no longer penetrate into the lesion, thus stopping the progression of the caries at an early stage.

Minimally Invasive Treatment Options for Cavitated Lesions



- **Atraumatic restorative technique**
- **Sandwich technique**
- Chemomechanical caries removal (CMCR
- Pit and fissure sealants
- **Tunnel, box and slot preparation**
- **preventive resin restorations**
- **Tooth preparation using air abrasion**
- **Tooth preparation using lasers**

ATRAUMATİC RESTORATİVE TECHNİQUE

- Atraumatic restorative technique (ART) was pioneered in mid-1980s in Zimbabwe and Tanzania in the need for basic treatment of carious teeth in communities with limited resources.
- In this excavation of caries is done using hand instruments and then tooth is restored using glass ionomer cement, an adhesive material

Lopez N., Simpser-Rafalin S., Berthold P. Atraumatic Restorative Treatment for Prevention and Treatment of Caries in an Underserved Community. Am. J. Public Health. 2005;95:1338–1339

CHEMO-MECHANICAL CARIES REMOVAL

CHEMOMECHANİCAL CARİES REMOVAL

Carisolv®

- Well documented
- Minimally-invasive, selective and precise
- Minimises the need for the drill and anaesthea and enhances patient comfort
- Makes it possible to avoid drilling close to the pulp
- Carisolv® instruments with sharp yet blunt cutting angles help to protect healthy tissue

Kumar J, Nayak M, Prasad KL, Gupta N. A comparative study of the clinical efficiency of chemomechanical caries removal using Carisolv® and Papacarie® - A papain gel. Indian J Dent Res 2012;23:697.

PAPACARIE

- Papacarie gel was developed in 2003.
- Main components are an enzyme papain, chloramines, toluidine blue.
- Papain is an enzyme extracted from the latex of leaves and fruits of the adult green papaya, Carica papaya.

Jawa D, Singh S, Somani R, Jaidka S, Sirkar K, Jaidka R. Comparative evaluation of the efficacy of chemomechanical caries removal agent (Papacarie) and conventional method of caries removal: An *in vitro* study. J Indian Soc Pedod Prev Dent 2010;28:73-7

PIT AND FISSURE SEALANTS AND PREVENTIVE RESIN RESTORATIONS

PIT AND FISSURE SEALANTS AND PREVENTIVE RESIN RESTORATIONS

- PRR utilizes the invasive and non invasive treatment of borderline or questionable caries.
- The resin placed in the carious areas and adjacent caries susceptible areas, seals them from the oral environment and provides a valuable treatment alternative to conventional restorations like amalgam

INCOMPLETE CARIES REMOVAL

- **Two-step (or "stepwise") caries treatment**
- **One-step incomplete or partial caries removal**

Randomized trial (Maltz et al., 2012, 2013) reported significantly higher success rates of one-step incomplete compared with stepwise excavation (99% and 91% compared with 88% and 61% after 18 and 36 mos, respectively).

SILVER DIAMINE FLUORIDE: A NEW, OLD APPROACH TO DENTAL CARIES MANAGEMENT

Policy on the Use of Silver Diamine Fluoride for Pediatric Dental Patients

Latest Revision

2018

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes that dental caries continues to be a prevalent and severe disease in children. This policy addresses the use of silver diamine fluoride (**SDF**) as part of an ongoing caries management plan with the aim of optimizing individualized patient care consistent with the goals of a dental home. When SDF is indicated, it is essential that the infants, children, adolescents, or individuals with special health care needs receive a comprehensive dental examination, diagnosis, and plan of ongoing disease management prior to placement of the material. The dental profession has long viewed dental caries as an acute disease condition requiring surgical debridement, cavity preparation, and mechanical restoration of the tooth, but increasingly, especially for the infant and child population, practitioners are utilizing individually tailored strategies to prevent, arrest, or ameliorate the disease process based on caries risk assessment. One of these strategies employs application of SDF as an antimicrobial and remineralization agent to arrest caries lesions after diagnosis and at the direction of a responsible dentist of record.

Methods

This document was developed by the Council on Clinical Affairs and adopted in 2017. This policy is a review of current dental and medical literature and sources of recognized professional expertise and stature, including both the academic and practicing health communities, related to SDF and silver nitrate. In addition, literature searches of PubMed®/MEDLINE and Google Scholar databases were conducted using the terms: diamine silver fluoride and caries, Howe's solution, silver nitrate and caries, and silver diamine fluoride; fields: all; limits: within the last 15 years, humans, English, birth through age 99. One hundred eight articles matched these criteria. Papers for review were chosen from this list and from the references within selected articles. Expert and/or consensus opinion by experienced researchers and clinicians also was considered.

Background

Treatment of incipient caries usually involves early therapeutic intervention using topical fluoride, and non-surgical restorative techniques such as dental sealants and resin infiltration. The use and outcomes of these techniques have been well-documented, and there are current policies and guidelines with recommendations for their use in the practice of dentistry.[1-3] In contrast, treatment of caries lesions traditionally requires surgical intervention to remove diseased tooth structure followed by placement of a restorative material to restore form and function. Barriers to traditional restorative treatment (e.g., behavioral issues due to age and/or limited cooperation, access to care, financial constraints) call for other alternative caries management modalities.

Silver topical products, such as silver nitrate and SDF have been used in Japan for over 40 years to arrest caries and reduce tooth hypersensitivity in primary and permanent teeth. During the past decade, many other countries such as Australia and China have been using this compound with similar success.[4,5] As marketed in the United States, SDF is a 38 percent silver diamine fluoride which is equivalent to five percent fluoride in a colorless liquid, with a pH of 10. The exact mechanism of SDF is not understood. It is theorized that fluoride ions act mainly on the tooth structure, while silver ions, like other heavy metals, are antimicrobial. It also is theorized that SDF reacts with hydroxyapatite in an alkaline environment to form calcium fluoride (CaF_2) and silver phosphate as major reaction products. CaF_2 provides sufficient fluoride to form fluorapatite which is less soluble than hydroxy-apatite in an acidic environment.[6,7] A side effect is the discoloration of demineralized or cavitated surfaces. Patients and parents should be advised regarding the black staining of the lesions associated with the application of SDF. Ideally, prior to use of SDF, parents should be shown before-and-after images of teeth treated with SDF. Recently, the U.S. Food and Drug Administration approved SDF as a device for reducing tooth sensitivity, and off-label use for arresting caries is now permissible and appropriate for patients.[8-12]

Many clinical trials have evaluated the efficacy of SDF on caries arrest and/or prevention,[6,10-33] although clinical trials have inherent bias because of the staining (i.e., since the difference between control and treated teeth is obvious to the researcher). However, studies consistently conclude that SDF

ABBREVIATIONS

AAPD: American Academy of Pediatric Dentistry. **CaF_2:** Calcium fluoride. **SDF:** Silver diamine fluoride.

https://www.aapd.org/media/Policies_Guidelines/P_SilverDiamine.pdf

SDF – WHAT IS IT?

- Colorless liquid
- pH around 8.0

- Inexpensive
- Across the age spectrum
- Ease of application and efficacy
- Fluoride - 44,800 ppm
- Ph - 10

- 25% silver: Antimicrobial
- 8% ammonia: Solvent
- 5% fluoride: Remineralization

Fung, MH, Duangthip, D, Wong, MCM, Lo, EC, Chu, CH. 2018. Randomized clinical trial of 12% and 38% silver diamine fluoride treatment. J Dent Res. 97(2):171-178

SDF –WHAT DOES IT DO?

- Arrests dental caries
- Prevents dental caries
- Decreases dentin hypersensitivity

https://www.aapd.org/media/Policies_Guidelines/P_SilverDiamine.pdf

SDF TREATMENT INDICATIONS:

Interim treatment for patients who can't receive traditional restorative treatment for whatever reason: pre-cooperative, special needs, delayed treatment, etc…

Chu, CH, Lo, ECM, Lin, HC. 2002. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese pre-school children. J Dent Res. 81(11):767–770.

SDF – HOW DOES IT WORK?

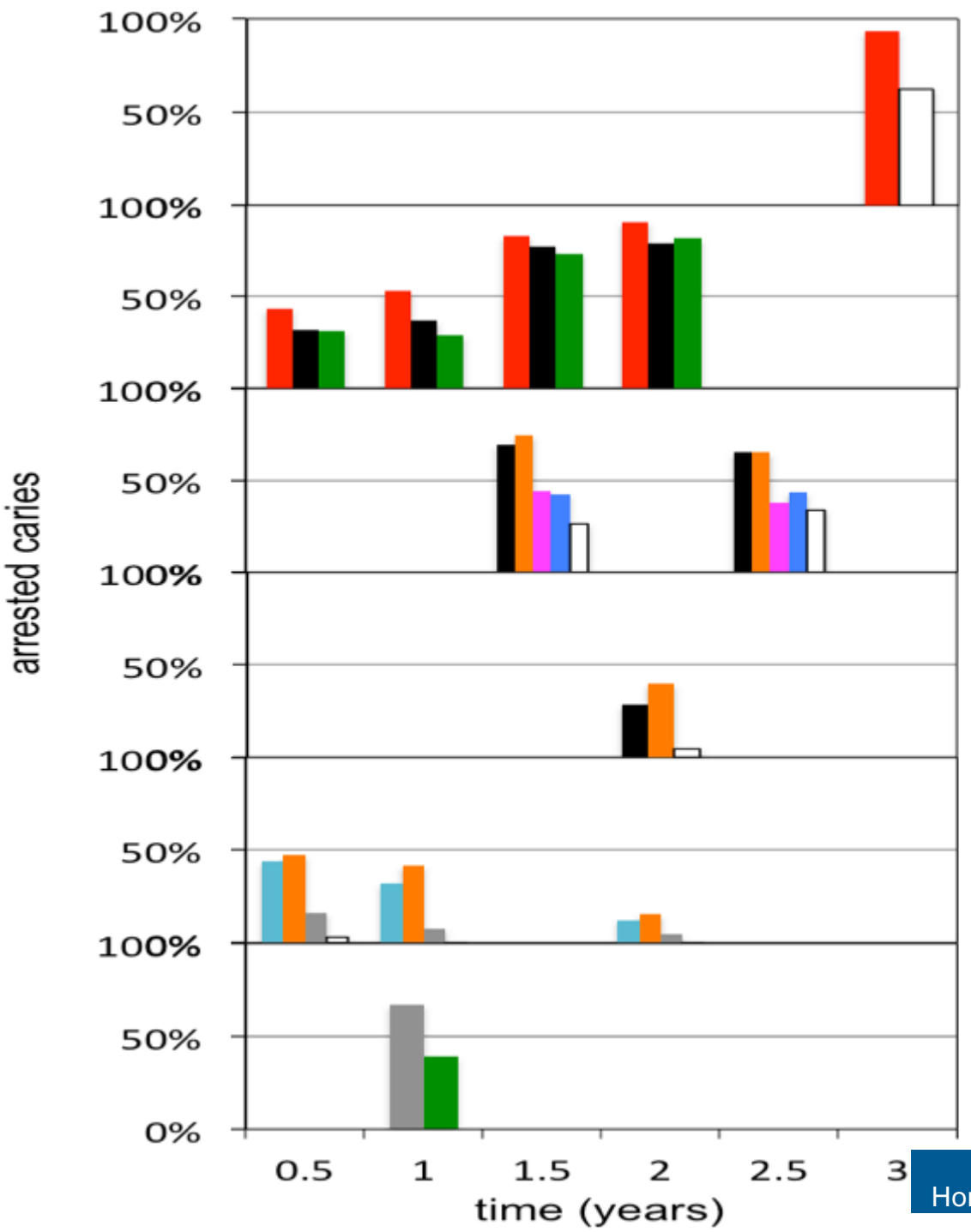
38% SDF contains ~44,800 ppm F and ~253,870 ppm Ag

Sodium fluoride (NaF) & Silver nitrate ($AgNO_3$)

Reacts with hydroxyapatite producing calcium fluoride (CaF_2) and silver phosphate (Ag_3PO_4)

- **CaF_2**
  - **Reservoir of fluoride**
  - **Neutralizes imbalance in demineralization/mineralization**
- **Ag_3PO_4**
  - **Crystal of low solubility in the oral environment**
  - **Yellowish color – darkened by sunlight or reducing agents**
- **SDF inhibits dentin demineralization, preserves collagen and inhibits collagen breakdown, increases dentin hardness**

Caries arrest



SDF q6mon
control

Llodra *et al.*, 2005
373 6 year olds
3.2 lesions at start

SDF q6mon
SDF q1year
GIC q1year

Zhi *et al.*, 2012
181 3-4 year olds
3.4 surfaces at start

SDF q1year
exc SDF q1year
exc NaF q3mon
NaF q3mon
control

Chu *et al.*, 2002
308 3-5 year olds
6 lesions at start

SDF q1year
+ OHI q6mon
control

Zhang *et al.*, 2013
227 60-89 year olds
0.91 lesions at start

SDF once
SDF, tannate
12% SDF once
control

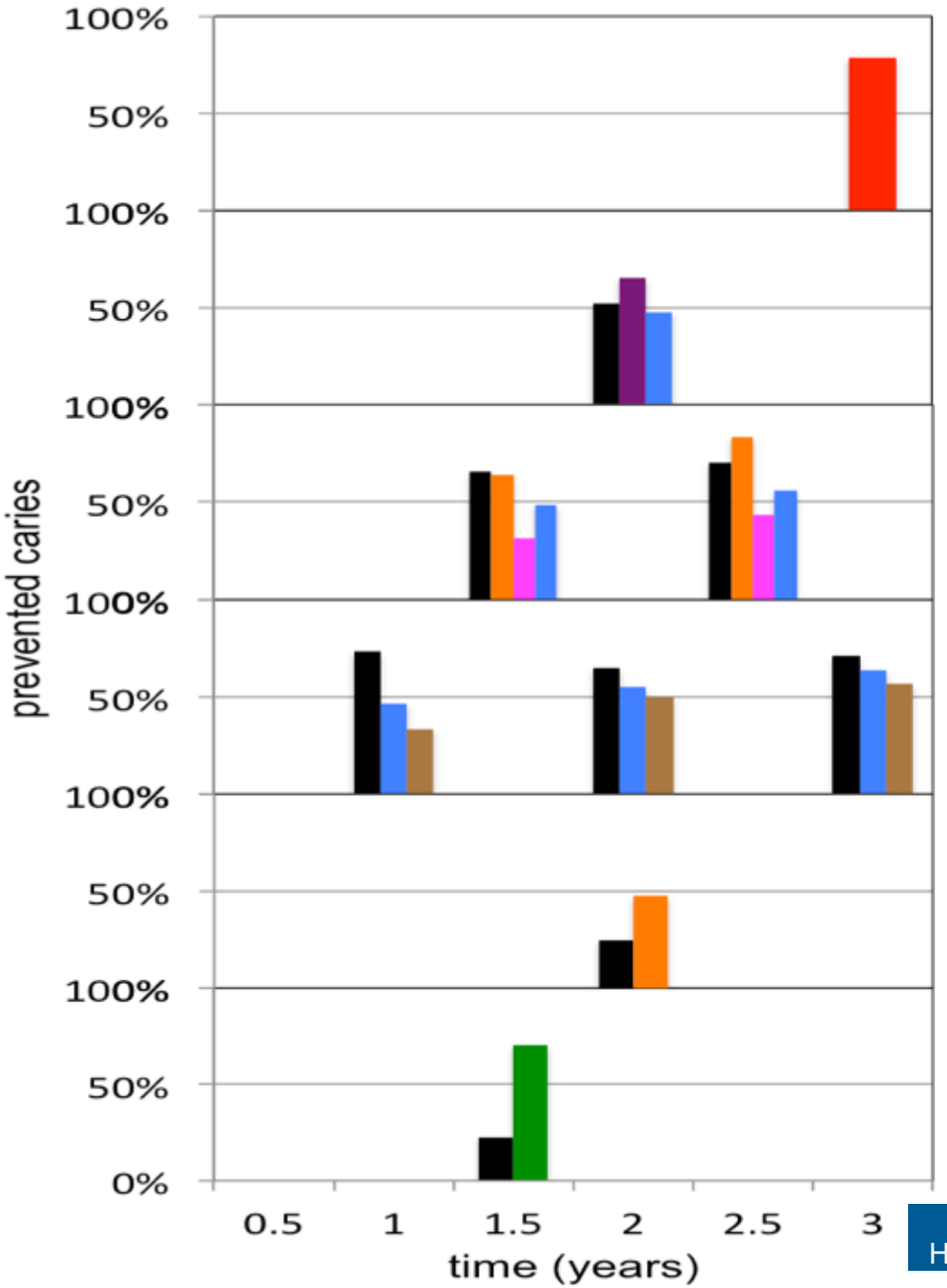
Yee *et al.*, 2009
624 3-9 year olds
6.8 lesions at start

30% SDF once
GIC once

Santos *et al.*, 2014
322 5-6 year olds
3.8 lesions at start

Horst et al. J Calif DentAssoc 2016; 44(1):16-28

Caries prevention



SDF q6mon

Llodra *et al.*, 2005
373 6 year olds
control: 2.5 new lesions
(only applied to lesions)

SDF q1year
Sealant once
NaF q6mon

Liu *et al.*, 2012
482 9.1 year olds
control: 4.6 new lesions

SDF q1year
exc SDF q1year
exc NaF q3mon
NaF q3mon

Chu *et al.*, 2002
308 3-5 year olds
control: 1.6 new lesions
(only applied to lesions)

SDF q1year
NaF q3mon
Chlorhex q3mon

Tan *et al.*, 2010
203 79 year olds
control: 2.5 new lesions

SDF q1year
+ OHI q6mon

Zhang *et al.*, 2013
227 60-89 year olds
control: 1.3 new lesions

SDF once
GIC sealant once

Monse *et al.*, 2012
708 6-8 year olds
control: 0.44 new lesions

Horst et al. J Calif DentAssoc 2016; 44(1):16-28

SDF Systematic Reviews

aries arrest 96%

ıries prevention 70%

F varnish arrest 21%

Prevention 58%

CRITICAL REVIEWS IN ORAL BIOLOGY & MEDICINE

A. Rosenblatt[1*,2,3], T.C.M. Stamford[3], and R. Niederman[1,4]

[1]The Forsyth Institute, 140 The Fenway, Boston, MA 02115, USA; [2]Children's Hospital Medical Center, Boston, MA USA; [3]School of Dentistry, University of Pernambuco, Recife, Pernambuco, Brazil; and [4]Goldman School of Dental Medicine, Boston University, Boston, MA, USA; *corresponding author, arosenblatt@forsyth.org

J Dent Res 88(2):116-125, 2009

Silver Diamine Fluoride: A Caries "Silver-Fluoride Bullet"

ABSTRACT

The antimicrobial use of silver compounds pivots on the 100-year-old application of silver nitrate, silver foil, and silver sutures for the prevention and treatment of ocular, surgical, and dental infections. Ag^+ kills pathogenic organisms at concentrations of < 50 ppm, and current/

INTRODUCTION

With a wealth of fluoride-based caries-preventive agents (Table 1), w might one be interested in yet another fluoride delivery system? T answer lies in silver diamine fluoride's (SDF) hypothesized ability to halt

SDF Meta-Analysis (4 studies)

Original Paper

Caries Research

Caries Res 2017;51:527–541
DOI: 10.1159/000478668

Receive
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Silver Diamine Fluoride Has Efficacy in Controlling Caries Progression in Primary Teeth: A Systematic Review and Meta-Analysis

Ana Cláudia Chibinski[a] Letícia Maíra Wambier[a] Juliana Feltrin[b]
Alessandro Dourado Loguercio[a] Denise Stadler Wambier[a] Alessandra Reis[a]

[a]Department of Dentistry, State University of Ponta Grossa, Ponta Grossa, and [b]Department of Pediatric Dentistry, Federal University of Paraná, Curitiba, Brazil

At 12 months:

SDF caries arrest was 89% higher than other materials or placebo

HOW DO YOU USE IT?

Dry & apply, 2+ times per year

CONSENT FOR SILVER DIAMINE FLUORIDE TREATMENT

Child's Name:_____ Date:_____

Parent's or Caregiver's Name:_____

I understand that my child is having the following treatment performed:

Silver Diamine Fluoride treatment to stop cavities from progressing or treat hypersensitivity

I may refuse this treatment. Other treatment options may include: fluoride varnish, fillings, tooth removal, or advanced procedures.

My dentist will: Dry the tooth. Put a small amount of Silver Diamine Fluoride on the cavity. This will help to stop the cavity.

This may need to be done again at future appointments. I understand that treated teeth may still need other treatments, such as fillings, crowns, or tooth removal.

I will tell my dentist if I might have a silver allergy.
I will tell my dentist if I have had ulcerative gingivitis or stomatitis in the past.

Side effects:

1. The cavity will change color to brown or black. This means the treatment is stopping the cavity. The dark stain is like a scar. Healthy tooth enamel will not stain.
2. Fillings and crowns may also change color if Silver Diamine Fluoride gets on them.
3. If Silver Diamine Fluoride touches the skin or gums, they may turn brown. The stain will not harm my child. The stain will not wash off. It will go away in 1-3 weeks.
4. These side effects may not include all of the possible situations reported by the manufacturer. I will let my dentist know if I notice any other side effects.

After the Silver Diamine Fluoride treatment, I will avoid food and drink for one hour. This will help the treatment to work better.

I AGREE THAT: I HAVE READ AND UNDERSTOOD THIS FORM. MY DENTIST EXPLAINED AND ANSWERED MY QUESTIONS ABOUT THE TREATMENT: BENEFITS, SIDE EFFECTS, AND RISKS. MY DENTIST TOLD ME ABOUT OTHER OPTIONS AND THEIR RISKS AND BENEFITS. I HAVE HAD THE CHANCE TO ASK QUESTIONS. I CONSENT TO THIS TREATMENT.

Date_____ Signature_____

_____

Relationship to patient

Witness:_____

PROTOCOL

- Prophylaxis
- Vaseline – adjacent soft tissue
- Relative isolation: cotton rolls /gauze
- Suction / Drying
- Application using a microbrush for ~2-3 min
- Wash with water
- No specification for number of applications

SDF STAINING

WHEN WOULD YOU USE SDF?

- Extreme caries risk (xerostomia, S–ECC)
- Behavior or medical management challenges
- More lesions than treatable at 1 visit
- Difficult to treat lesions
- Patients without access to care
- Young patients who are wait--listed

Chu, CH, Lo, ECM, Lin, HC. 2002. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese pre-school children. J Dent Res. 81(11):767–770.

HOW SAFE IS SDF?

- No adverse reports in >80 years of use in Japan
- **Contraindication**
  - Silver allergy
  - Tooth that is symptomatic or pulpally involved
- Relative contraindication
  - Significant desquamative processes
    e.g. ulcerative gingivitis, stomatitis

→ Protect by petroleum jelly

Whitford, GM . 1987. Fluoride in dental products: safety considerations. J Dent Res. 66(5):1056–1060.

ADVERSE REACTION

- Metallic/bitter taste
- Temporary staining to skin-- resolves in 2-14 days
- Mucosal irritation/lesions -- resolved within 2 days
- High fluoride concentration (44,800 ppm) of 38% SDF – dental fluorosis -- large doses in young children
- Cytotoxic to fibroblasts (Fancher et al. 2017)-- increased pulp cell death when the remaining dentin thickness is less

Chu CH, Lo EC. Promoting caries arrest in children with silver diamine fluoride: a review. *Oral Health Prev Dent*. 2008;6(4):315-321.

HOW MUCH *CAN* YOU USE?

- One drop (25 μL) -- 9.5 mg silver diamine fluoride.
  - 100% absorption of 20μL drop (9.5 mg SDF) in 10 kg child = 0.95 mg/kg
    - 400–fold LD50 safety margin.
- Published clinical trials -- 4,000 young children worldwide– No reported deaths or systemic adverse effects.
- No Observed Adverse Effect Level for 14 days of daily exposure = 1.3 mg/kg
- **Recommended limit: 1 drop per 10 kg per visit**

PERSON AND CLINICAL PROTECTION

- Permanent dark staining of clinic surfaces and clothes
  - Does not come out after setting (exceptions)
  - Clean immediately with copious water, ethanol, or high pH solvents such as ammonia
- Temporary staining of skin
  - Rinse
  - Will go away in days
  - No harm

COMBINATION WITH GIC

Glass Ionomer Cements (GICs) add the benefit of sustained fluoride release and a seal

Protocol: SDF, then standard GIC protocol.

PEDIATRIC DENTISTRY V 39 / NO 5 SEP / OCT 17

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

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Abstract: Background: *This manuscript presents evidence-based guidance on the use of 38 percent silver diamine fluoride (SDF) for dental caries management in children and adolescents, including those with special health care needs. A guideline workgroup formed by the American Academy of Pediatric Dentistry developed guidance and an evidence-based recommendation regarding the application of 38 percent SDF to arrest cavitated caries lesions in primary teeth.* **Types of studies reviewed:** *The basis of the guideline's recommendation is evidence from an existing systematic review 'Clinical trials of silver diamine fluoride in arresting caries among children: A systematic review.' (JDR Clin Transl Res 2016;1[3]:201-10). A systematic search was conducted in PubMed® (MEDLINE, Embase®, Cochrane Central Register of Controlled Trials, and gray literature databases to identify randomized controlled trials and systematic reviews reporting on the effect of silver diamine fluoride and address peripheral issues such as adverse effects and cost. The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach was used to assess the quality of the evidence and the evidence-to-decision framework was employed to formulate a recommendation.* **Results:** *The panel made a conditional recommendation regarding the use of 38 percent SDF for the arrest of cavitated caries lesions in primary teeth as part of a comprehensive caries management program. After taking into consideration the low cost of the treatment and the disease burden of caries, panel members were confident that the benefits of SDF application in the target populations outweigh its possible undesirable effects. Per GRADE, this is a conditional recommendation based on low-quality evidence.* **Conclusions and practical implications:** *The guideline intends to inform the clinical practices involving the application of 38 percent SDF to enhance dental caries management outcomes in children and adolescents, including those with special health care needs. These recommended practices are based upon the best available evidence to-date. A 38 percent SDF protocol is included in Appendix II. (Pediatr Dent 2017;39(5):E135-E145)*

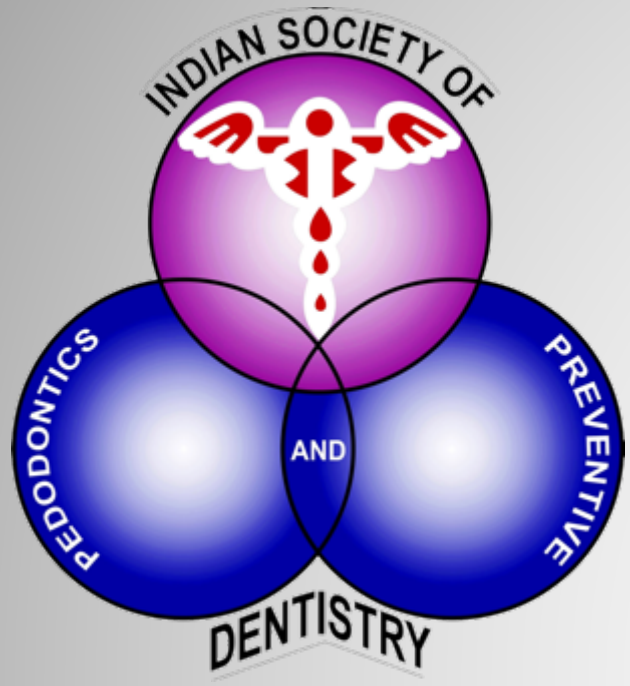
KEYWORDS: SILVER DIAMINE FLUORIDE, CLINICAL RECOMMENDATIONS, GUIDELINE, ANTI-INFECTIVE AGENTS, CARIOSTATIC AGENTS, SILVER COMPOUNDS, CARIES, TOPICAL FLUORIDES

SDF AAPD GUIDELINE

The panel made a conditional recommendation regarding the use of SDF 38% for the arrest of cavitated caries lesions in primary teeth as part of a comprehensive caries management program

SDF TAKE--HOMES

- SDF arrests >90% caries when used 2/year
- Powerful indirect prevention
- Protect, Isolate and Dry before applying SDF
- SDF stains the crap out of everything



"MINIMALLY INVASIVE TREATMENT OPTIONS FOR CAVITATED LESIONS"

Tunnel, Box and Slot Preparation

TOOTH PREPARATIONS USING AIR ABRASION

TOOTH PREPARATIONS USING AIR ABRASION

Kinetic energy is used to remove carious lesion.

- **Powerful fine stream of moving aluminum oxide particles is directed against the surface to be removed.**
- **Abrasive particles hit the tooth with high velocity and a small amount of tooth structure is removed.**
- **Commonly used particle sizes are either 27 or 50 micrometers in diameter.**

TOOTH PREPARATIONS USING AIR ABRASION

- The speed of the abrasive particles when they hit the target depends upon air pressure, size of particles, powder flow, nozzle diameter, the angle of the tip and the distance of tip from the tooth.

- Usually the distance from the tooth ranges from 0.5 to 2 millimeters. As the distance increases, the cutting efficiency decrease

- An added advantage is that tooth preparations achieved using air abrasion show rounded internal contours when compared with those prepared with a handpiece and straight burs.

REPAIR INSTEAD OF REPLACEMENT OF THE RESTORATION

- **When treating an old restoration, one should consider the following options before performing their replacement**
  - Recontour and/or polish
  - Seal margins
  - Repair local defect
  - Replace restoration.

Restoration is indicated for replacement when any of following occurs

- Secondary caries which cannot be removed during repair procedure
- Need for esthetics
- Presence of pulpal pathology

REPAIR INSTEAD OF REPLACEMENT OF THE RESTORATION

- The decision to repair rather than replace a restoration should be based on the patient's risk of developing caries, the professional's judgment of advantages vs. Risks and conservative principles of tooth preparation.

DISEASE CONTROL

DISEASE CONTROL

- Different efforts which must be made in order to decrease the incidence of caries include identification and monitoring of bacterias, diet analysis and modification, use of topical fluorides and antimicrobial agents.
- For caries control, caries vaccines and bacterial replacement therapy have also come up .

OZONE

- Recently Ozone has been proposed as a preventive mode for caries.
- Shown to eliminate bacteria associated with caries; it can also lead to lesion reversal.
- It is delivered to the tooth surface for 10-40 secs ,the Ozone delivery should be followed by remineralization solutions and fluoride rinses.

REVIEW ARTICLE

Current interpretations and scientific rationale of the ozone usage in dentistry: A systematic review of literature

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ABSTRACT

In the era of antibiotic resistance, a naturally occurring substance is needed to completely cure the infection without any toxic side-effects; a responsibility that "O_3 or Ozone" seems to implement sincerely. Ozone gas has a high-oxidation potential and has the capacity to stimulate blood circulation and the immune response. It is a great supplement to conventional therapeutic dental modalities. Treatment may be achieved by increasing the resistance of the tooth against the microbial activity and reducing the extent of microbial activity. In addition to the recent materials and techniques, the therapeutic actions of ozone may provide beneficial results by reducing the demineralization of the tooth. Its bactericide, virucide and fungicide effects are based on its strong oxidation effect with the formation of free radicals as well as its direct destruction of almost all microorganisms. This potentially beneficial agent has been used in dentistry also. Ozone has a wide application in dentistry which includes treatment of carious lesions, root canal disinfection, wound healing impairments after surgical interventions, plaque control, disinfection of dentures, etc., The purpose of this article is to summarize the mechanism of action and different modalities of ozone therapy in the practice of dentistry.

Key words
Heal Ozone, oral microorganism, ozone

HALL TECHNIQUE

Method for managing Carious primary molars where decay is sealed under preformed metal crowns (PMCs) without local anaesthesia, tooth preparation or any caries removal.

The Hall Technique 10 years on: Questions and answers

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In brief

Discusses the development and acceptance of the Hall Technique.	Provides information on where to find out more about the Hall Technique.	Reports an overview of high quality evidence from randomised control trials supporting use of the Hall Technique in day to day practice.

It is ten years since the first paper on the Hall Technique was published in the *British Dental Journal* and almost 20 years since the technique first came to notice. Dr Norna Hall a (now retired) general dental practitioner from the north of Scotland had, for many years, been managing carious primary molar teeth by cementing preformed metal crowns over them, with no local anaesthesia, tooth preparation or carious tissue removal. This first report, a retrospective analysis of Dr Hall's treatments, caused controversy. How could simply sealing a carious lesion, with all the associated bacteria and decayed tissues, possibly be clinically successful? Since then, growing understanding that caries is essentially a biofilm driven disease rather than an infectious disease, explains why the Hall Technique, and other 'sealing in' carious lesion techniques, are successful. The intervening ten years has seen robust evidence from several randomised control trials that are either completed or underway. These have found the Hall Technique superior to comparator treatments, with success rates (no pain or infection) of 99% (UK study) and 100% (Germany) at one year, 98% and 93% over two years (UK and Germany) and 97% over five years (UK). The Hall Technique is now regarded as one of several biological management options for carious lesions in primary molars. This paper covers commonly asked questions about the Hall Technique and speculates on what lies ahead.

Questions

What is the Hall Technique?

The Hall Technique is a method for using preformed metal (also known as stainless steel) crowns to manage carious primary molar teeth, by seating a correctly sized crown over the tooth and sealing the carious lesion in, using a glass ionomer luting cement. Local anaesthesia is not required, tooth preparation is not carried out, and no carious tissue is removed (Fig. 1).

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Although conventional preformed crowns are used to carry out the Hall Technique, and it is simply a different way of using these crowns, crowns fitted this way are usually referred to simply as Hall crowns. More information can be found on Wikipedia (https://en.wikipedia.org/wiki/Hall_Technique, as of 6 March 2017), where there is also a downloadable illustrated PDF manual explaining when to, and how to, carry out the technique from the corresponding author. Table 1 lists the indications and contraindications for the Hall Technique.

How did the Hall Technique come about and when did it start being used?

In the mid-1990s, it was generally accepted that crowns were the most predictable restoration for primary molars, rarely failing. However, in 1996 in Scotland, a total of only 164 crowns were fitted.[1] There is some evidence that this is not a dissimilar situation from other countries. In Australia in 2003, a relatively low usage of crowns was reported in hypothetical case treatment plans, even amongst paediatric dentistry specialists. Tran stated that, 'Mastery of the crown continues to elude thousands of graduating dentists every year who, as a result of their discomfort, shy away from it and rely on huge amalgams to restore primary teeth.'[2] During an audit of paediatric dental service provision in the north east of Scotland in 1997, one general dental practitioner, Dr Norna Hall (hence the name the Hall Technique) was found to be the only dentist, out of 150 in the regional audit, regularly placing preformed crowns in children. During discussion, it became apparent that Dr Hall was using the crowns in an unconventional way – not placing local anaesthesia, removing caries or preparing the tooth. Dr Hall worked in an area with high levels of caries and low treatment acceptance. She had gradually adapted conventional crown placement to this technique in an attempt to respond to the demand for treatment that was quick, and did not involve local anaesthesia.

INDIAN SOCIETY OF PEDODONTICS AND PREVENTIVE DENTISTRY

HALL TECHNIQUE

CONTRA INDICATIONS FOR FITTING HALL CROWNS INCLUDE:

- Irreversible pulpal involvement
- Insufficient sound tissue left to retain the crown
- Parent or child unhappy with aesthetics.

CONCLUSIONS AND PRACTICE IMPLICATIONS

minimally invasive dentistry is based on advances in science.

emerging technologies will facilitate evolution to primary prevention of caries, though technical, cultural and economic obstacles to full implementation in clinical practice still exist

FEW ARTICLES FOR MID

- Caries Management Pages i-i. Guzmán-Armstrong, Sandra, Fontana, Margherita, Nascimento, Marcelle M., and Ferreira Zandona, Andrea G.. DENTAL CLINICS OF NORTH AMERICA October 2019 • Volume 63 • Number 4
- Cochrane NJ, CaiF, Huq NL, Burrow MF, Reynolds EC. New approach to enhance remineralization of tooth enamel. J Dent Res 2010;89:1187-97.
- Chu CH, Lo EC. Promoting caries arrest in children with silver diamine fluoride: a review. Oral Health Prev Dent. 2008;6(4):315-321.
- https://www.oralhealthgroup.com/features/technology-in-minimally-invasive-dentistry/

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THANK YOU ALL