# **Saving and Rejuvenating Enamel**

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## What is "MI"?

Minimum Intervention / Minimally Invasive or "MI" Dentistry is the modern medical approach to the management of decay as opposed to the surgical model of drill and fill dentistry. In dentistry, we should be diagnosing, screening and treating the causes of CARIES the disease and not the LESIONS / CAVITIES, or side effects (symptoms) of the disease alone. Caries is a bacterial infection and multi-factorial process. It can be prevented when we recognize which patients are more at risk for disease, treating the patient's individual risk factors before the HOLES or LESIONS develop. MI Dentistry is EVIDENCE BASED.

## MI Dentistry is based on 3 principles:

**Identify** what the risks are for dental disease to progress through a Risk Assessment. Visit ADA.org for the ADA Risk Assessment form.

**Prevent further** demineralization of tooth structure by determining the best preventive protocol and the optimal path for patient oral health through diagnosis (including saliva and plaque), risk assessment, CAMBRA, treatment planning and patient education.

**Restore** the natural tooth structure with biomaterials, such as Glass Ionomer, that mimic and enhance the tooth across a wide range of indications while complementing the clinical preferences of dentists.

## What is CAMBRA?

Caries Management by Risk Assessment. Although dental decay significantly declined in the United States from the 1960s through the 1980s, it is still a major problem in adults and children. The dramatic reductions in levels of decay observed from 1960 to 1990 were undoubtedly related initially to the introduction of fluoride into the drinking water and subsequently to topical fluoride applications, especially through fluoridated dentifrice use and dental office topical fluoride. However, fluoride "alone" is only successful up to a point, and we now must be thinking of moreaggressive ways to deal with dental caries as a bacterially based transmissible infection.

To place this into perspective, a published survey on the dental health of California's children, from data that was accumulated in 1993 and 1994, reported that:

\* 27 percent of preschool children have untreated decay;

- \* 55 percent of 6- through 8-year-olds have untreated decay;
- \* Up to 75 percent of minority high school students need dental care.

## 4 Main Principles of CAMBRA:

- Modification of the oral flora to favor health.
- Patient education and informed participation.
- Remineralization of non-cavitated lesions of enamel and dentin/cementum.
- Minimal operative intervention of cavitated lesions and defective restorations.

## **Evolution of Enamel**

Enamel develops in stages. These stages greatly influence the ability to resist acid challenges, decay and erosion.

**Hydroxyapatite** – Over time (2+ years) and exposure to calcium and phosphate rich saliva the enamel matures. It becomes stronger and more acid resistant. The critical pH of hydroxyapatite (the point at which enamel begins to dissolve / demineralize) is 5.5.

**Fluorapatite** is created when we additionally incorporate fluoride to the oral environment through rinses and dentifrices. Fluorapatite enamel is the strongest most acid resistant enamel that can be achieved.

The critical pH of fluorapatite is 4.5, meaning the enamel is less soluble / vulnerable to acid exposure.

## **Caries defined**

"Dental caries is an infectious, microbiological disease of the teeth that result in localized dissolution and destruction of the calcified tooth tissue."

Roberson, T.M. Heymann, H.O.Swift, E.J. (2002). Sturdevant's Art & Science of Operative Dentistry (4th edition). St. Louis, MO: Mosby, Inc

#### According to Dr. Steven Steinberg:

Children 6 months to 30 months can become infected by Strep Mutans by salivary exchange. Strep M. can colonize the mouths of infants. Early colonization of Strep M. is a major risk factor for future caries experience.

- Tooth decay is 4X more common than asthma in 14-17 year olds
- Moms with dental disease place children at greater risk
- Bacteria is passed through saliva and can occur before the first tooth appears.

There is a continuous exchange of ions between the tooth structure and the oral environment. **Demineralization**: Acid driven! Mineral is lost from the matrix or tooth tissue. Early stages of demineralization / white spot lesions / potential caries can almost certainly be remineralized and healed if not yet cavitated.

**Remineralization**: Mineral driven! Lost mineral is replaced. Concept of remineralization is to take the components of saliva and add fluoride. Ultimate goal is to create fluorapatite enamel reducing risk of caries.

**Important Spit to remember!!!** – Fluoride is a negatively charged ion. In order for fluoride to penetrate enamel it requires a positively charged calcium ion to drive it in. Without saliva....quantity and quality....fluoride has limited effect. Many of our patients need calcium and phosphate in addition to fluoride in order to keep their teeth healthy and mineralized!

Fluorapatite enamel consists of 10 calcium ions, 6 phosphate ions and 2 fluoride ions.

## Importance of pH levels / bacteria flora in mouth

Hydroxyapatite will dissolve with pH of 5.5, fluorapatite with pH of 4.5. When pH is lowered it allows for chemical erosion of enamel surfaces. An acidic pH also allows destructive bacteria to thrive in the oral cavity.

Pregnant women, bulimics, patients with GERD or gastric reflux, xerostomia patients, chemotherapy or Radiation patients are all at risk for caries process / erosion. Low pH levels in the mouth and low saliva

flow increases the risk.

Long term care facility patients are on an average of 8 medications that can influence the side effect of xerostomia.

Patients with low saliva flow are at a risk from starch exposure that leads to fermentation. Athletes are often at risk due to high energy demands, potential dehydration from training programs and frequent ingestion of energy drinks with a low pH.

"Evaluating patient's saliva gland function is important due to the strong association between decreased saliva flow and susceptibility to erosive tooth wear."

Zero, Domenick T. and Lussi, Adrian (2005). Erosion – chemical and biological factors of importance to the dental practitioner. *International Dental Journal*. 55, 285-290.

#### Saliva Assessment

- Saliva dysfunction is common
- Frequently undiagnosed
- Patient's symptoms are not indicator of salivary gland function
- Patients are rarely aware of diminished saliva until resting flow rate is less than half of normal

#### Who to Perform Salivary testing on?

- New patient base-line
- Current patient presents with new oral health problems
- Prior to extensive restorative treatment
- Prior to orthodontic treatment
- Medically compromised

#### Who is at Risk?

- Lifestyle
- Socioeconomic status
- Medical History Medications
- Dental History
- Diet
- Saliva Composition
- Fluoride Exposure

#### Xerostomia

Xerostomia is the condition of not having enough saliva, or spit, to keep your mouth wet. Aside from the sensation of dryness in your mouth, xerostomia may result in:

- a sticky, dry feeling in the mouth
- trouble chewing, swallowing, tasting, or speaking
- a burning feeling in the mouth
- a dry feeing in the throat
- cracked lips
- a dry, tough tongue
- mouth sores
- an infection in the mouth

#### **Root Caries**

- 38% of patients between the ages of 55-64 have root caries (Winston)
- 47% of patients between the ages of 65-74 have root caries (Winston)
- Critical pH of dentin is 6.7 (level where dentin can start to demineralize) (Surmount)
- Root caries can progress at twice the rate of coronal caries

#### Example of Protocol that can be used to prevent root caries:

• Initial Salivary evaluation (Saliva Check)

One strategy to combat root caries is to improve salivary rates. Need to establish baseline.

• Obtain accurate list and dosages of all medications. Evaluate medications for dry mouth potential consult with physician to evaluate if possible to reduce xerogenic medications

• Initial microbiological evaluation (Saliva Check Mutans)

Studies show primary etiologic agent in root caries is S. mutans

• Gross carious lesions should be excavated quickly as possible and restored with a fast-setting, selfcured glass ionomer restorative material (Fuji IX)

• Prescribe 0.12% chlorhexidine gluconate mouth rinse (Sunstar has a non-alcohol rinse) Rinse 30 seconds, 2x a day for two weeks

- Re-check microbial levels (Saliva Check Mutans)
- If bacterial levels are reduced, discontinue CHX
- Apply 5% sodium fluoride (NaF) to all exposed root surfaces

Repeat every 3 months

- Use SLS-Free Fluoride prescription toothpaste (Prevident 5000 Dry Mouth)
- Evaluate patient's diet for refined carbohydrates

Instruct patient to only use sugar-free mints

GC America's Dry Mouth Gel<sup>™</sup> (Neutral pH) can be used to lubricate safely throughout the day

- Recommend Electric toothbrush
- Recommend xylitol gum 3x a day for 5 minutes (Trident XtraCare, Spry, Epic)
- MI Paste<sup>™</sup> should be applied by finger to all exposed root surfaces after brushing. Contains both calcium and phosphate to help remineralize tooth surfaces.
- Restore all carious lesions with resin-reinforced glass ionomer. (Fuji II LC)
- 3 month maintenance recalls

Winston, A.E., Bhaskar, S.N., Caries Prevention in the 21st Century. J Am Dent Assoc. 1998;129:1579-87

Surmount, P.A., Martens, L.C. Root surface Caries: An Update. Clin Prev Dent. 1998;11:14-20

Donovan, T., Swift, E.J., Jr. Critical Appraisal. Protocol for the Prevention and Management of Root Caries. *Journal Compilation* ©2008. Wiley Periodicals, Inc. Nov. 6, 2008;20:405-411

Chalmer, J.M. Minimal Intervention in Dentistry: Part 1. Strategies for addressing the new caries challenge in older patients. J Can Dent Assoc. 2006;72:427-31

#### Modify the Ecology of Biofilm

- Optimize Oral Hygiene Techniques
- Increase oral pH
- Increase bioavailable calcium and phosphate
- Increase fluoride
- Introduce antibacterial strategies
- Reduce frequency of fermentable carbohydrates

Fluoride alone	Calcium, Phosphate and Fluoride
Discourages demineralization	Remineralizes in depth
If incorporated with the enamel forms fluorapatite (lower critical pH than hydroxyapatite)	Eliminates white spot lesions
Discourages formation of bacterial plaque on tooth surface	Restores full aesthetics to enamel
If present at low levels in saliva, always available during process of remineralization	Resistance to further acid attack
Limitations: superficial only, leaving lower levels of demineralized enamel and dentin, with a degree of porosity and incomplete mineralization	Superior to fluoride use alone

#### More Important Spit to Remember:

In order for the fluoride ion to penetrate into the enamel surface it needs to work in conjunction with a calcium ion to carry it... Without saliva there is very little if ANY calcium to allow fluoride to be effective!

Fluoride can help prevent mineral loss, it cannot promote remineralization without adequate levels of calcium and phosphate ions, the building blocks of tooth mineral normally provided by saliva.

The contemporary clinician should be prepared to use surface remineralizing agents, such as those containing fluoride supplemented with calcium and phosphate, to treat surface erosion, abrasion, and hypersensitivity, and to increase the resistance of enamel to food and plaque acids.

#### **Calcium Products**

#### **NOVAMIN®**

- Composed of calcium, phosphorus, sodium and silica (glass)
- Ingredient: sodium-calcium phosphosilicate
- Requires saliva to initiate ion exchange
- 20+ published articles/studies
- Products with NovaMin include: NUPRO<sup>®</sup> NUSolutions, Dentsply, SootheRx<sup>™</sup>, OMNI Oral Pharmaceuticals, 3M ESPE, DenShield, Oravive<sup>™</sup>, Topex<sup>®</sup> ReNew Toothpaste, Sultan Healthcare

#### **Amorphous Calcium Phosphate (ACP)**

- Licensed by ADA Health Foundation
- Fewer peer-reviewed studies
- Ca & PO<sub>4</sub> is not bio-available after the product is rinsed away
- Faster uptake of calcium & phosphate than salivary Ca & PO<sub>4</sub>
- Products with ACP include:

Age Defying, ARM & HAMMER<sup>®</sup>, Enamel Pro<sup>®</sup>, Premier Dental, Aegis<sup>®</sup> Products with ACP, Bosworth Company

#### **Tri-Calcium Phosphate (TCP)**

- 5000 ppm Fluoride (active ingredient)
- TCP activated by saliva
- Claims surface hardness
- Contains: sodium lauryl sulfate
- Safety issues: Do Not Swallow
- Use once daily
- Products include: Clinpro<sup>™</sup> 5000

#### Recaldent

- CPP-ACP & CPP-ACPF
- 140 peer-reviewed studies and articles
- Substantivity enhances fluoride uptake
- Subsurface remineralization
- Safe to use several times daily & swallow
- Products include MI Paste & MI Paste Plus and Trident Xtra Gum

#### **Recaldent History**

- Developed in Australia in the late 1980's by Dr. Eric Reynolds
- Over 140 studies in peer reviewed journals on RECALDENT<sup>™</sup> (CPP-ACP) Technology
- Additional aids to the remineralization of tooth structure. *E.C. Reynolds, L.J. Walsh. Textbook: Preservation and Restoration of Teeth - 2nd Edition 2005, p 111-118*

Xylitol can be an important factor in reducing childhood caries and bacterial counts in the mouth.

To find out more about xylitol:

www.xylitol.org www.xlear.com www.aapd.org www.nuvorainc.com www.orahealth.com www.epicdental.com www.xylitolinfo.com

#### **Glass Ionomer Explained**

- Adhere to dentin and enamel
- Reduces microleakage
- Used for bases under composite or amalgam restorations
- Surface protectant / sealants
- Hydrophilic
- No etch
- Self-curing
- Fluoride releasing
- FAIS Fluoro-alumina-silica-glass. Acid/liquid component

#### Paradigm shift in thinking

- Surface protectant goal is to make enamel stronger, more resistant to plaque and dietary acid challenges.
- Dramatically lowering risk for caries.

#### Glass Ionomer, when compared with resin, has several unique characteristics:

- Glass Ionomer, but not resin, is moisture-forgiving (resin requires an absolutely dry field, whereas glass does not).
- GI contains and slowly releases fluoride, providing additional caries prevention.
- GI, being less viscous, flows more deeply into pits and fissures, providing protection even as abrasion wears away the occlusal surface.
- Although GI may not be easily visible, when compared with resin, it can still be very effective.

Yengopal V, Mickenautsch S, Bezerra AC, Leal SC. Caries-preventive effect of glass ionomer and resin-based fissure sealants on permanent teeth: a metaanalysis. *J Oral Sci 2009; 51: 373–382* 

#### Self-bonding

- Tooth-like coefficient of thermal expansion improves staying power and helps maintain marginal integrity
- Do not need to etch with 37% phosphoric acid
- Fewer steps
- More cost effective in time and materials

"Understanding the role of saliva in maintaining health, as well as its relation to oral disease, is vital to the competent dental practitioner."

Featherstone, J.D.B. (2004). The Continuum of Dental Caries – Evidence for a Dynamic Disease Process. *Journal of Dental Research*. 83 (Special Issue C), C39-C42.

#### Summary

Current standards in caries management emphasize risk assessment and appropriate therapeutic interventions, detection of early non cavitated lesions, diagnosis of severity and activity of lesions, and minimally invasive surgical intervention only when needed using the optimum dental materials based on the patient's problems.

Collaboration among research, education, industry, dental health care workers, and patients, along with the use of evidence-based treatment recommendations, dental caries infections can be prevented and controlled.

Caries, the most common chronic disease of our children, and virtually universal among adults, is both curable and preventable.

For more information on MI Dentistry, visit the following websites:

www.MIDentistry.org www.wcmid.org www.ADA.org www.cdafoundation.org www.gcamerica.com – For Free Webinars. CE> Webinars> Register and click on the courses you wish to view. Relevant to this course: Dr Hien Ngo, Dr. Brian Novy, & Dr. Scott Dillingham.

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