What does biofilm have to do with chronic disease, persistent wounds and recurrent infections?
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Conversation starters!
oral health to general health
★ get the facts
★ develop positive energy
★ create a legitimate spin
★ focus on health benefits
★ discuss savings - money, time, comfort
★ offer reasonable alternatives
★ coaching not scolding

Biofilm basics - growing, thriving, surviving

What is a “Biofilm”?
A 3-Dimensional “community” of microbes attached to a surface
• Fluid interaction
• Channels / pores
• Complex structure

Plaque biofilms
• Complex biofilm
• Hundreds of species
• Adherent to tooth
• Irritates tissue
• Grows / Matures / Calcifies
• Influenced by fluid forces

Biofilm growth stages

Emerging Trends in Oral Care - Philips Oral Healthcare Symposium 2003

Microbial biofilms.
Costerton JW, Lewandowski Z, Caldwell DE, Korber DR, Lappin-Scott HM.
Source
Center for Biofilm Engineering, Montana State University, Bozeman 59717, USA.
Abstract
Direct observations have clearly shown that biofilm bacteria predominate, numerically and metabolically, in virtually all nutrient-sufficient ecosystems. Therefore, these sessile organisms predominate in most of the environmental, industrial, and medical problems and processes of interest to microbiologists. If biofilm bacteria were simply planktonic cells that had adhered to a surface, this revelation would be unimportant, but they are demonstrably and profoundly different. We first noted that biofilm cells are at least 500 times more resistant to antibacterial agents. Now we have discovered that adhesion triggers the expression of a sigma factor that derepresses a large number of genes so that biofilm cells are clearly phenotypically distinct from their planktonic counterparts. Each biofilm bacterium lives in a customized microniche in a complex microbial community that has primitive homeostasis, a primitive circulatory system, and metabolic cooperation, and each of these sessile cells reacts to its special environment so that it differs fundamentally from a planktonic cell of the same species.

Emerging Trends in Oral Care - Philips Oral Healthcare Symposium 2003

Illustration by Keith Kasnot, Scientific American, July 2001

What is a "Biofilm"?

Plaque biofilms

Biofilm growth stages

Emerging Trends in Oral Care - Philips Oral Healthcare Symposium 2003

http://www.erc.montana.edu/biofilmbook/MODULE_01/Mod01_Blue/Mod0         Accessed 7/25/09

Dr. Bill Costerton - The "Father" of Biofilms  www.youtube.com/watch?v=M_DWNNFFgHSE

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Biofilm formation

Where do biofilms form?
- On solid sub-stratum in contact with moisture
- On soft tissue surfaces in living organisms
- Liquid-air interfaces - the surface of the ocean

Biofilm facts
✓ millions of interacting micro-organisms
✓ bacteria, spirochetes, protozoa, fungi, viruses
✓ properties not seen in isolated micro-organisms
✓ rapid regeneration via signaling
✓ tenacious - Difficult to remove mechanically
✓ biofilms - higher adhesion to saliva-coated enamel than planktonic

Forming a biofilm
✓ initiated by planktonic bacteria or fragment
✓ attaches to appropriate surface (wound, implant)
✓ divide - form micro-colonies
✓ critical density - release pheromones
✓ quorum sensing
✓ altered environment - phenotypic alterations in microbes

Biofilm strength
✓ Heterogeneity - different protein expression
✓ Inter-species cooperation
✓ Intracellular matrix structure
✓ FEP - functionally equivalent pathogenicity

Mixed biofilm community development -
Candida albicans (opportunist fungal pathogen)
外国人 coaggregation
外国人 coadhesion
外国人 modified by pH, nutrient supply
外国人 salivary factors
外国人 Creates a highly acidic pH

Biofilm facts / characteristics
✓ Plays a role in otitis media, bacterial endocarditis,
外国人 cystic fibrosis and Legionnaire's disease, chronic sinusitis,
外国人 osteomyelitis, catheter infections
✓ 80% infectious diseases
✓ 99% of bacteria in nature - stable, persistent biofilms

Biofilm formation
✓ multi species communities
✓ EPS - extracellular polysaccharide - slime
✓ EPS - polysaccharides, proteins, nucleic acids
✓ 80% of the biofilm is EPS
✓ 20% of biofilm - microbes encased in EPS matrix
✓ heterogenous, dynamic and recalcitrant to antimicrobials and immune system
Liquid flowing through biofilm channels

Moving biofilm “ripples” in mixed species biofilm

Viscoelastic Properties of S. aureus Biofilm

- Commonly found on the skin
- Part of the naturally occurring oral, nasal, and vaginal flora
- Also an opportunistic pathogen
- Commonly associated with nosocomial infections.

Growth and spontaneous detachment of cell cluster

Biofilm Adherence vs. Shear

Biofilm bacteria may break loose when exposed to a moving fluid.

Shear induced creep and failure

Shear induced deformation

Deformation = f(shear)
* Qualitative
* Quantification
Understanding the trouble makers - microbial defenses that make it hard to treat disease

Biofilm layers
* surface microbes - most active - like planktonic
* surface most susceptible to antimicrobials/host defenses
* deeper layers sheltered
* less metabolically active
* more resistant to antimicrobial therapies
* can reconstitute biofilm (persisters)

Biofilm resistance
✓ able to adapt to stresses
✓ resistant to
  * ultraviolet light
  * biocides
  * antibiotics
  * host defenses
✓ biofilm management requires multiple, concurrent strategies

Chronic wounds and biofilm
› biofilm is a barrier to healing
› anaerobic bacteria populate chronic wounds
› molecular techniques show diverse populations
› susceptible to contamination
› available substrate
› surface for attachment
**Host impairment - healing in chronic**

- poor perfusion
- malnutrition
- pressure
- repetitive trauma
- hyperglycemia
- presence of a foreign body
- white blood cell dysfunction

**Chronic wound infections**

- not cleared by host immune system
- resistant to systemic
- topical antimicrobials
- frequent debridement critical
- polymicrobial biofilm forms
- clinical aspects resemble
- other biofilm infections

**Biofilm survival – making inflammation a lifestyle**

**Biofilm - strategies for survival**

- attach within minutes
- 2-4 hours - strongly attached micro-colonies
- 6-12 hours - develop initial EPS
- increasingly tolerant to antibiotics, antiseptics, disinfectants
- 2-4 days - fully mature biofilm
- now highly resistant to biocides / shedding planktonic bacteria
- rapidly recover from mechanical disruption
- reform mature biofilms within 24 hours

**Ecological plaque hypothesis - inflammatory periodontal disease**

**Inflammation**

- Originates as a bacterial assault
- Most of the damage comes from the inflammatory response
- *We used to think*..........

**Periodontitis**

- requires susceptible host
- dysbiotic microbial communities
- inflamo-philic
- inflammation-provides nutrients
- fosters growth of dysbiotic communities
- selects for certain pathogens
- dysbiosis and inflammation support each other

control of inflammation is critical

**Red complex bacteria**

- *P. gingivalis*
- *T. denticola*
- *T. (Bactericides) forsythus*

Difficult to eradicate because of biofilms

- *P. gingivalis* as early as 4 hours after scaling
- found in early, middle and late stage biofilm development

**Polymicrobial synergy**

- *P. gingivalis* and *T. denticola*
- superficial layers of subgingival plaque in chronic periodontitis lesions
- increase in biomass and thickness

- *T. denticola* - motile, creates pores in biofilm matrix
- able to move through highly viscous environment
- pores enhance nutrient flow

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Surviving biofilm disruption

National dental hygiene survey 2012
- Poll - 1,210 respondents - 47 states / 6 provinces
- 65% worked more than 31 hours a week
- 36% reported at least one injury
- Primary injury sites - neck, shoulders, mid and upper back, hands
- 53.1% used OTC medication
- 14.5% prescription medications
- 27% reduced work hours temporarily
- 38% reduced work hours permanently

Solutions
Magnification benefits......properly fitted
Promotes neutral posture - neck, shoulder, back
decreases fatigue
reduces risk for MSDs

Magnifies clinical images
improves clinical outcome

Career longevity!
Reduce injury potential

Hygienists who use magnification
80% would not work without loupes!

Visualize the postural differences

Facial geometry challenges

Precision measurements
The 15 Jobs That Are Most Damaging to Your Health
By Andy Kiersz and Max Nisen December 2, 2013 11:18 AM

#2
Dentists/Dental Hygienists/Assistants/Dental Lab Technicians

Top three health risks:
- exposure to disease and infections: 87.8%
- exposure to contaminants: 76.2%
- time spent sitting: 73.6%

Overall unhealthiness score: 62.9

Hygienists who use illumination
71% would not work without a headlight!

Seating challenges

Adjustment issues

Solutions
Saddle Seating
- wide base of support
- center balanced
- increased range of motion
- safer reach
- ease of movement
- position closer to patient

Salivary dysfunction – etiology and contributing factors
- dehydration
- stress
- smoking
- systemic disease
- recreational drugs
- chronic renal failure
- autoimmune disorders
- asthma
- mouth breathing
- during exercise
- sleep apnea
- C-Pap machines
- salivary gland pathology
- radiation treatment
- hormone imbalance
- laxative/diuretic abuse
- pharmaceutical and OTC medications (over 1,800 meds)
Insufficient saliva –
Oral Desert Storm

- Changes can be subtle
- Often unnoticed until 50% decrease
- Sets the stage for demineralization
- pH decreases


Increasing salivary flow rate - benefits

- More bicarbonate ions
- pH rises towards neutral
- Buffering power of the saliva increases dramatically


How saliva buffers

- Prevents colonization – pathogenic microbes
- Increases biofilm pH - sialin and urea
- Neutralizes acids
- Prevents enamel demineralization


Saliva - The magic fluid

Dissociative + healing
  + Bacteria formation
  + Acid production
  + Antigenic
  + Lysosomal

Protective + digestion
  + Lubrication
  + Neutralization
  + Antimicrobial actions
  + Healing
  + Cleansing

Additional + growth
  + Exopolysaccharides
  + Oligosaccharides
  + Interactions

New ideas - about caries biofilm

Predisposing risk factors

- Medium to high levels of cariogenic bacteria
- Heavy and/or visible plaque accumulations
- Smacking more than three times a day
- New research – caries biofilm more complex

- Dominate bacteria on different surfaces – only fissure plaque dominated by mutants streptococci (WCMIID)


New news about caries biofilm

- Strep mutans not the only organism -
  Different microbes colonize
  - White spots
  - Dentin lesions
  - Root caries
  - Primary and secondary dentition
  - Specific tooth surfaces


**Ecological plaque hypothesis - caries**

- Health - dental plaque in homeostasis
- Species in health differ from disease sites
- Imbalance in resident microflora
- Caries - shift dominates to acidogenic / acidic
- Increase mutants streptococci and lactobacillus
- Regular low pH - select for Ms and Lb

**Ecological plaque hypothesis - solutions**

- target putative pathogens (difficult)
- stimulate saliva
- raise pH
- limit sugar intake
- use non-fermentable sweeteners
- metabolic inhibitors - fluoride
- anti-adhesion - xylitol

**Ecological shifts in dental plaque**

- Homeostatic reequilibration
- Microbial mediation
- Plaque metabolically activity
- Periodontal disease
- Caries-eradicating intervention
- Oral infection/acute inflammatory
- Biofilms – complicated, real life situations

**Chronic wounds and biofilm**

- Gateway to the rest of the body
- Oral disease is complex
- Changing hormone levels
- Medications causing dry mouth
- Genetics
- Immune system
- Lifestyle / environmental factors
- Natural aging process
The links to systemic disease... what can a clinician do?

Evaluate each patient individually
- what are their risks
- what are they willing to do
- can they be motivated to change

Individualize your recommendations
- establish a dialogue with medical provider

Characteristics of biofilm infections

**Oral appliances**
- surface roughness
- Strep and Candida both adhered
- even small scratches reduce cleansability
- retained microorganisms proliferate when appliance is reinserted

**Oral biofilm-associated diseases**

**Health implications**
- Aspirated biofilm
  - cuff on endo tube-biofilm
  - oral health care gel reduced contamination
  - even small scratches reduce cleansability
  - retained microorganisms proliferate when appliance is reinserted

**Orthodontic appliances—expanding patient numbers**
- 60% ortho pts - acquire biofilm-based disease
  - white spot lesions or caries
  - gingivitis or periodontitis
Implants

- titanium implant surfaces - evaluated for hydrophobicity, roughness, composition
- Staph aureus biofilm - biovolume evaluated
- human gingival fibroblasts - adhesion, spreading, growth
- zirconium-oxide attracted most biofilm
- human-gingival-fibroblasts - 80-90% surface all material
- biofilm won race for surface coverage - except on smoothest

In a comprehensive study by the industry leader in ergonomic examination gloves is an essential requirement (e.g. dentists, hygienists, healthcare workers, scientists, etc.).

Problem:

Implants

Do the math!
Reduce
- hand fatigue
- storage space
- landfill waste

- Days per week
- 4.25 hygiene
- 4.25 assisting
- One hour - hygiene appointment

Annual savings $970.80

Cigarettes
- increase C. albicans adhesion/growth/biofilm formation
- metal bands, brackets, acrylic resin, elastic rings
- cigarette smoke condensate
- increased adhesion - S. mutans - bands, acrylic and brackets
- C. albicans - bands, acrylic, brackets, elastics
- increased biomass - S. mutans - only brackets
- C. albicans - on brackets and acrylic
- nicotine-S. mutans - increase growth and ESP


ERGONOMIC CERTIFICATION

What does Ergonomic Certification Mean?
Ergonomic Certification is a recognition of a product or service that has demonstrated, through testing and performance, compliance with criteria established by relevant standards and guidelines. The certification process involves rigorous evaluation of product or service attributes, including human factors, design, usability, and safety. The certification is intended to provide assurance to consumers, employers, and other stakeholders that the product or service meets established ergonomic standards and guidelines, thereby promoting safe, efficient, and comfortable use.

Health history clues

- medications - poly pharmacy
- antibiotics - prolonged use compromise intestinal flora
- acid reducers - alter intestinal tract pH

Classy uniforms
http://twiceasniceuniforms.com/anne

Protecting ourselves

- No-fog Sensitive - Secure fit
- conforms to facial geometry
- 99.9% bacterial filtration @ 3 microns
- 99.9% particle filtration @ 0.1 microns
- breathable
- ASTM Level 3

Rethinking our strategy

- calculus is not causal.
- calculus - biofilm by product
- biofilms grow on any undisturbed surface...... whether prior calculus exists or not!
- biofilms change over time:
  - health associated vs. disease associated
Other reasons to use a polishing handpiece
- applying desensitizing medicaments
- pre-procedural or site specific application
- pre-scaling biofilm reduction
- reduce ultrasonic aerosol bioburden

Meet VERA………and her new partner
New!
- Visibility
- Ergonomics
- Reach
- Access

Structural differences between sensitive and non-sensitive dentin*

<table>
<thead>
<tr>
<th></th>
<th>Non-sensitive</th>
<th>Sensitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of open tubules</td>
<td>x</td>
<td>8 x</td>
</tr>
<tr>
<td>Diameter of tubules</td>
<td>0.43</td>
<td>0.83</td>
</tr>
<tr>
<td>Fluid Flow (Poiseuille’s law)</td>
<td>y</td>
<td>16 y</td>
</tr>
</tbody>
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What is arginine?
- Natural amino acid
- Naturally found in saliva
- Bipolar molecule - both positively and negatively charged groups
- Net positive charge


Colgate Sensitive Pro-Relief
- Tooth surface is negatively charged
- Attracts arginine’s positive charge
- Arginine and calcium carbonate - CaCO3 promotes precipitation of calcium and phosphate ions into tubules
- Arginine - raises pH to 7


Colgate
Clinical benefits of contemporary ultrasonic scalers
- disrupt plaque biofilm and calculus
- reduce bacterial level below immune system threshold
- pocket disinfection
- improved access – complex anatomy, deep, narrow pockets


How cavitation works
cavitation = ultrasonic energy + water
creation of micro-bubbles
acoustic micro-streaming
implosion of micro-Bubbles
destruction of biofilm and calculus
www.shockwaveenergy.ca Images accessed 9-2011

Cavitation / Bubbles
- collapsing into small fragments
- shock waves
- bubble on solid surface
- deforming
- high velocity jet liquid
- pierces and damages

Acoustic microstreaming Amplitude tip displacement
- 10.5 microns
- 47.5 microns

Colgate
Micro Ultrasonics... using today's technology

Blending scaling techniques
- power and hand or hand and power
- factors include: type of power scaler, condition of tips, clinical challenge, type of deposit, patient comfort
- level of skill and familiarity with power scaling techniques

What's the take home message about ultrasonics? Remember to....
- Select the right tip
- Use the proper power level
- Balance handpiece in hand
- Use a probe-like grasp
- Adapt the insert tip to the tooth surface
- Keep the insert moving
- Relax and let the insert do the work!

When are we done?
- when all root surfaces have come in contact with the activated tip
- no more visible debris
- no clinically detectable deposits

Subgingival biofilm disruption - glycine
- glycine powder
- soft, small particle size
- reduced surface damage
- lowers biofilm adhesion

Subgingival biofilm disruption - glycine
- comfortable
- 5-9 mm pockets
- P. gingivalis counts lower
- more effective in removing subgingival biofilm than SCP

Blue Boa suction system
- developed by a dental hygienist
- uses hands-free high volume suction
- lightweight / flexible / adequate length
- can be sterilized
- operates with Hygoformic and Formaject saliva ejectors

Really important... for the non-assisted clinician

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Really important... for the non-assisted clinician
Implant debridement
- ultrasonic scaler
- metal, plastic and carbon tips
- surface roughness - measured confocal SEM
- biofilm from pooled saliva (10) donors
- metal and carbon tips produced more scratches than plastic tips
- brushing with dentifrice helped smooth surface roughness

Making it hard on the bad bugs......
encouraging healthier microflora


Chemotherapeutic enhancers
Mouth rinses – non-selective
✓ Essential oils
✓ Chlorhexidine
Toothpaste – non-selective
✓ Stannous fluoride

Effective home care –
mechanical and chemical
Goal is to reduce pathogenicity,
disrupt biofilm, stimulate salivary flow
and increase pH
✓ brushing - power and manual
✓ Site specific activities – interdental devices, floss
✓ irrigation
✓ therapeutic rinses and paste
✓ Xyliitol – gum, mints, wipes, spray


Mouth rinses
planktonic bacteria and biofilm
biofilm microbes most difficult to affect
CHx and CPC mouth rinses
» most effective against biofilm
» active against most microbes tested


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Plaque Viability Study
Tetracycline/copolymer dentin: plaque viability suppressed for 12 hours after brushing, as indicated by red color
Control (identical formulation, except no tetracycline/copolymer): plaque rapidly regained viability, as indicated by green color

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Oral probiotics!
Re-establishing healthy oral flora


Setting the stage for
healthy biofilm – getting rid of pathogens


Biofilm disruption

Mechanical disruption of biofilm

Shear induced detachment: adhesive failure

Checking out biofilm

More ways to disrupt biofilm

Feel a new level of clean

3 seconds exposure 99.9% removal

"The results were almost impossible for me to believe the first time through," commented. "One of the difficulties with plaque biofilm is that you really can't see it, it's clear. So we didn't have visual evidence of complete removal. But now with these direct methods, the scanning electron microscopy, you apply the Waterpik to plaque on a surface of a tooth and you look with a scanning scope and it's gone. It's simply gone. And that's unequivocal and unarguable."

Dr. Bill Costerton - Founding Director      USC Center for Biofilms

Tongue

**Getting national press**

**Tongue cleaners**
- daily
- effective
- manual
- mechanical

**Removable appliances**
- contaminated with MRSA
- 4 groups - 1% bleach or 2% CHX - 10 min soak or 3 min in microwave
- CHX and microwave - complete disinfection
- 3 min. daily soaking - denture cleaner
- reduced bacterial counts / increased C. albicans levels

**Nocturnal storage - acrylic appliances**
- 51 participants - randomized - 3 groups
- overnight storage - dry, water, water with alkaline peroxide-based tablet
- biofilm samples - day 7 and 14
- tablets significantly decreased - developing and maturing biofilms
- tablets decreased biofilm mass, specific bacteria and C. Albicans
- potential effects on stomatitis and systemic health

**Improving saliva, neutralizing acids**

**Conversation starters!**
- oral health to general health
  - Get the facts
  - Develop positive energy
  - Create a legitimate spin
  - Focus on health benefits
  - Discuss savings - money, time, comfort
  - Offer reasonable alternatives
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**The magic of xylitol**
- interferes with Strep Mutans metabolism
- disrupts biofilm integrity
- promotes neutral pH
- stimulates saliva flow
- shifts equilibrium to enhance remineralization
- increases available calcium and phosphate

**Novel xylitol products**

**Understanding biofilm – impacting lives**
Medical biofilm based wound care

- Debridement: frequent and aggressive
- Selective biocides: Silver, Iodosorb, Hydrofera Blue
- Antibiofilm agents
  - Lactoferrin, Xylitol, Farnasol
  - Plant Products, Fatty Acid Gel
- Antibiotics (25-32% effective)
  - Adjunct: Strong and long

Multiple Concurrent Strategies

Wound healing anti-biofilm agents

- Debridement: frequent and aggressive
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Wound healing antimicrobial agents

- Ionic silver: minute concentration, broad spectrum, used in dressings
- Iodine: prevents wound infection, aids healing, prevents iodine preferred
- Medicinal honey: antibacterial activity

Wound healing anti-biofilm strategies

- Lactoferrin: bacteriocidal, blocks surface attachment, works with PMNs, binds iron even at a low pH
- Xylitol: interferes with biofilm formation
- Enzymes: Dispersin B, causes biofilm detachment
- Gallium, EDTA, hyperbaric oxygen, bacteriophages, glucose oxidase, pulsed electric fields
- Ultrasound/ultrasonics
- No more amputations

Wound healing antimicrobial agents

- Developed for use in space
- EPA registered anti-microbial water line product
- Two dental practices
- Self-contained
- Water collected every 2 weeks for a year
- Reduced CFUs to 0 in a month or less

Water line issues

- Broad spectrum antimicrobial
- Anti-inflammatory
- First recorded use over 4,500 years ago
- Effective against P. gingivalis
- Domestic and Manuka (tea tree plant) honey
- Both planktonic and biofilm organisms
- Inhibited formation and reduced viable numbers - both groups

Honey

- Broad spectrum antimicrobial
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Red wine study
- 5-species supragingival biofilm
- regular red wine/de-alcoholized extract
- regular solutions / and solutions spiked with grape seed extract

Tannins – 72 hour study
• Pseudomonas aeruginosa - opportunistic pathogen
• bacteriostatic
• bacterial membrane damage
• inhibited biofilm formation 6-24 hours
• impaired EPS matrix production

Silver – natural antimicrobial
- natural antibacterial
- bactericidal
- anti-fungal

Silver-coated – orthodontic wires
- titanium and stainless steel wires
- 2 cariogenic species / 3 perio species
- silver ion-coated and non-coated wires
- inhibit - growth and pathogenic activity
- 2mm diameter growth-resistant zones
- zone size larger for caries species
- silver coating did not affect human cell growth

Implants – silver in titanium nanotubes
- TiO2 nanotubes - laced with silver nanoparticles.
- does not damage healthy cells/tissues
- help prevent biofilms
- bone grows more vigorously
- bone adheres better to titanium coated with TiO2 nanotubes
- loaded TiO2 nanotubes with the anti-inflammatory drug sodium naproxen
- gradual release after implant surgery

Sharklet Surface Technology
- Shark skin – resistant to biofilm
- Unique skin pattern
- Micro-topography inhospitable to microorganisms

What do we owe our patients?
- Current, in-depth health history
- Assess a patient’s total needs
- Tell them the truth
- Provide all options
- Patients must make the final choice
- Current scientific information
- Understand technology

What’s the take home message?
Understand.......-
- Biofilms are complex
- Mother Nature rules
- Better health is possible
- Take responsibility for your role
- New information about biofilms emerges every day

The Erosion Explosion
Effects of a modern day witch’s brew
Anne N. Guignon, RDH, MPH

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What is erosion?

Erosion - a multifactorial condition

Tooth wear – erosion

• progressive loss of hard dental tissue
• chemical processes not involving bacterial action
• most important factor in hypersensitivity
• erosive lesions – most likely to be sensitive

Erosion – surface softening

• citric acid pH 2.3
• 6 X 5 min/day
• 10 days
• stored in salt solution

Erosion vs. caries

• surface-softening lesion
• non-bacterial extrinsic and intrinsic acids
• complicated by attrition and abrasion
• resistant to remineralization
• prevalence increases with age

When do teeth melt???

• critical pH – is a dynamic number
• dependent on salivary calcium and phosphorus
• average resting salivary pH 6.4 – 7.2
• root structure - pH 6
• enamel - between pH 5 and 5.5
• fluorapatite - pH 4.5

How does erosion happen?

Intrinsic and extrinsic factors

Regurgitation
• reflux
• bulimia
• chemotherapy
• pregnancy
• alcoholism
• peptic ulcers
• gastritis
• drug side effects

OTC supplements
medications
• chewable vitamin C
• cough drops
• fizzy liquid medications

Erosion – Intrinsic factors

Mount GJ and Hume WJ. Preservation and restoration of tooth structure. Knowledge books and software. 2nd Edition. 2005

Dawes C. “What is the critical pH product does tooth dissolve in?” Car Dent North 2001; 26:589-592


Erosion – complicating medical conditions

GERD – gastric esophageal reflux
- 7% adults experience daily episodes
- 36% monthly
- Children also experience GERD

Anorexia
- 47% are in binge/purging subtype
- Refusal to maintain normal weight

Bulimia
- Typically normal weight
- Self-induced vomiting after consuming food

Eating disorders – Common behaviors and findings

- Vomiting - affects palatal surfaces of maxillary teeth – perimyliosis
- Eroded surfaces - smooth and glossy
- Erosion – after two years of self-induced vomiting
- Active lesions - smooth and unstained
- Inactive lesions - stain over time
- May be only oral manifestation - self-induced vomiting


Erosion – Extrinsic factors

- Diet
  Drinks, fruits, candies, pickled foods

- Environmental
  Occupational (acid vapors from industrial electrolytic processes / wine tasting)

- Recreational (swimming pools)


Erosion from GERD

Loss of occlusal anatomy

Rising amalgams


Erosion – Dietary intake

- Acidic foods – pickles, vinegar, citrus
- Carbonated beverages
- Sports and energy drinks
- Flavored waters
- Wine – particularly dry varieties
- Beer

Erosion – Diet and beverage intake

- Loss of surface gloss and thin enamel
- Loss of occlusal anatomy and rising sealant


Erosion from GERD

Loss of occlusal anatomy

Rising amalgams


The many looks of erosion

Loss of surface gloss and thin enamel

Loss of occlusal anatomy and rising sealant


The science behind erosion – pH and titratable acidity

- Erosion – after two years of self-induced vomiting
- Consume large amounts of acidic beverages and fresh fruits
- Treated with antidepressants - cause dry mouth
- Binge/purge – high carbohydrate intake
- Anorexia - poor oral hygiene

**Soda Pop!**

1950s - 6.5 oz bottle

Today........
12 oz can is standard
20 oz bottle common

- Missouri Dental Association
- Brochure revised 2006
- 573-863-4834
- www.modental.org

**Beverage**

- Soda Pop!
- Diet Coke
- Red Bull
- Gatorade

**1950s**

- 8 oz bottle

**Today**

- 12 oz can is standard
- 20 oz bottle common

**Dissolution of enamel in soft drinks**


**Erosive potential of four soft drinks**

**Study drinks**

- Red Bull
- Classic coke
- Diet coke
- Gatorade

**Measured**

- pH
- Titratable acidity

**Listed all ingredients found in the beverage**

**Post immersion photos** - 20x magnification

- Classic Coke
- Diet Coke
- Gatorade
- Red Bull

**Total acid content of beverages**

- **pH-Initial acidity**
  - measures hydrogen ion concentration

- **TA-Titratable acidity**
  - measures the total number of acid molecules / erosive potential
  - higher TA = Longer time to reach neutral, safe pH value/salivary clearance

**Chemical erosion via soft drinks**

- human molars – free of decay
- imbedded in acrylic - enamel exposed
- half the surface – coated with nail polish
- remaining surface exposed to beverages
- beverages changed daily
- 14 days – compares to 14 years of exposure
- microscopic and SEM evaluations


**Table: Comparative acid content of beverages**

<table>
<thead>
<tr>
<th>Beverage</th>
<th>Container</th>
<th>pH</th>
<th>1 g-Sugar</th>
<th>Titratable acidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coca Cola</td>
<td>Bottle</td>
<td>2.0</td>
<td>12.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Diet Coke</td>
<td>Can</td>
<td>2.0</td>
<td>12.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Diet Coke</td>
<td>Can</td>
<td>2.0</td>
<td>12.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Red Bull</td>
<td>Bottle</td>
<td>2.0</td>
<td>12.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Post immersion photos - 20x magnification**

- Classic Coke
- Diet Coke
- Gatorade
- Red Bull

**Control – Tap water**

- Note-Chalky, dull enamel

**Note:**

What's different about these non-carbonated drinks?

- multiple organic acids
- added sucrose and glucose
- TA off the charts! Requires more titration
- citric acid - binds (chelates) calcium - higher pH
- net effect – accelerates calcium lost from tooth
- maintains pH below 5.5, causing erosion


---

More news on acidity

<table>
<thead>
<tr>
<th></th>
<th>pH</th>
<th>TA</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbonated water</td>
<td>5.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Lager</td>
<td>4.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Beer</td>
<td>3.9</td>
<td>0.6</td>
</tr>
<tr>
<td>MEDIUM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>2.5</td>
<td>0.7</td>
</tr>
<tr>
<td>Cola</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Carob</td>
<td>3.3</td>
<td>4.5</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple juice</td>
<td>3.2</td>
<td>9.3</td>
</tr>
<tr>
<td>Grapefruit juice</td>
<td>3.2</td>
<td>9.3</td>
</tr>
</tbody>
</table>

**Consumption... patterns and habits**

- super sized drinks
- frequent between meal snacking
- prolonged sipping
- swishing, swilling
- holding liquid in the mouth
- baby bottles and sippy cups

**Elise Rose, PhD - Personal communication - August 4, 2009**

**Carbohydrates, Negative Biomass and Dental Erosion**. J. Contemp. Dent. Pract. 2017; 8(4): 794-802


---

**Legacy drinks vs. modern beverages – composition and consumption**

- **USA – average annual consumption**
  - Average American drinks 100 gallons per year – three bath tubs full!
  - Teen age boys drink 160 gal/year
- **One-quarter of all drinks consumed**
  - 450 different types of soda pop
  - 2,500,000 vending machines in the USA

**Jacobsen MF. Liquid candy – How soft drinks are harming Americans' health. Center for Science in the Public Interest. July 2006**

**Int J Paediatr Dent. 2007 Mar;17(2):86-91.** The erosive potential of flavoured sparkling water drinks.

**Brown CJ1, Smith G, Shaw L, Parry J, Smith AJ.**

**And it's not just soft drinks!**

- Flavored waters
- Energy drinks
- Fitness drinks
- Sports drinks
The beverage of choice – kids and teens

Consumption among children has almost doubled in the last ten years

Teenage boys drink 3 or more cans per day
10% of teen males drink 7 or more cans a day

Teenage girls average 2 cans per day
10% of teen females drink more than 5 cans a day

Jonathan MF. Liquid candy – How soft drinks are harming Americans’ health. Center for Science in the Public Interest. July 2005

Teen age diets – Fast Facts............

▪ drank one can or more sugared soda per day - 2011
  M – 31.4%, F – 24.0%

▪ drank 3 or more glasses of milk per day - 2009
  M – 19.8%, F – 8.7%

▪ trying to lose weight - 2009
  M – 28.4%, F – 51.6%

http://apps.nccd.cdc.gov/yrbss Accessed 7/7/2012

What a brew!

Carbonated water
High fructose corn syrup
Concentrated orange juice and other natural flavors
Citric acid
Sodium benzoate (preserves freshness)
Caffeine (55.2 mg/12 oz)

Sodium citrate
Gum arabic
Erythorbic acid (preserves freshness)
Calcium disodium EDTA (protects flavor)
Brominated vegetable oil
Yellow 5

The scoop..... powdered drinks

▪ Bottled water - pH 6.3
▪ Propel Fit Powder ‘vitamins’ - raspberry lemonade flavor - pH 3.2
▪ Kool-Aid Singles - cherry flavor - pH 2.8
▪ Country Time Lemonade ‘On the Go’ - pH 2.5 powder
▪ Crystal Light ‘On the Go’ - raspberry ice flavor - pH 2.6

Beverage consumption
Fast Facts........

▪ For children aged 6 - 11 from 1977 - 2001

▪ Milk consumption dropped 39%
▪ Soda consumption rose 137%
▪ Fruit juice rose 54%
▪ Fruit drink rose 69%
▪ Sugar sweetened beverages - 11% total calories

Soda, juice and other drinks.....

Bottled water!!!
ph levels of 5-5.5 are common

Mouth Rinses!!!
ph levels 3.5 to 5

Propel….. now vitamin and calcium enhanced

▪ Water
▪ Sucrose syrup
▪ Flavors
▪ Citric acid
▪ Sodium citrate
▪ Potassium citrate
▪ Splenda (sucrolose)
▪ Acesulfame potassium
▪ Calcium disodium EDTA
▪ Vitamin B 5
▪ Vitamin B 6
▪ Vitamin B 3
▪ Vitamin B 12
▪ Vitamin D

One 8 oz contains
▪ 10 Calories
▪ 35 mg of sodium
▪ 3 g of carbohydrates
▪ 2 g of sugar

Beverages Ingham, PhD - Food Science Extension Specialist – University of Wisconsin-Madison – July 12, 2008

Soda, juice and other drinks

Beverage consumption

Milk consumption – children and youth


http://apps.nccd.cdc.gov/yrbss
Energy drink consumption - world wide 2006-2012

Non-carbonated energy drinks - What’s different?

- hip names - RockStar, Hype, Tiger, Monster
- branded as dietary supplements
- marketed to students, athletes, seniors
- Coca-Cola Classic - 35 mg of caffeine
- Monster Energy Drink - 120 mg of caffeine

Energy drinks contents and rebranding

- caffeine
- 80–300 mg per 16-oz
- herbs
- guarana (high in caffeine)
- taurine
- ginseng
- ginkgo biloba
- other various ingredients

Energy shots

- specialized, concentrated energy drink
- sold in smaller 50ml bottles
- same total amount of caffeine, vitamins, functional ingredients
- marketed as - low calorie, “instant energy”, one swallow
- 5x more caffeine than a 8oz cola

Energy drinks risks

- heart palpitations
- increases blood pressure
- nausea, stomach upset
- headaches
- psychiatric disturbances
- sleep disturbances
- tooth erosion
- weight gain
- fatigue

Energy drinks - overdose

- 2005 to 2009
- 10X increase U.S. emergency room visits
- related to energy drink intake
- 2007 - U.S
- of caffeine overdoses (5448)
- occurred 46% in persons under age 19

Energy drinks - Teens

- widespread consumption - 30% daily use
- strongly associated - alcohol, cigarette and illicit drugs
- users - heightened risk for substance abuse
- users - more physiologic and behavioral adverse effects

Energy drinks - Adults 2010 National Health Interview Survey

- 31.3% consumed 1 drink past 7 days
- 11.5% more than 3X per week
- age 18 -24 10x more likely to consume than those age 40+
- non-Hispanic blacks & Hispanics
- live in South or West
- engaged in leisure-time physical activity
- highly satisfied with their social activities/relationships

Energy drinks - Troops

- Monster - top seller - military PX
- 44% deployed troops - one per day
- 13.9% three +/day - slept less than 4 hours a day
- Three a day - increase in sleep problems / stress / illness / day time sleepiness during guard duty or briefings

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McLellan TM, Lieberman HR. Do energy drinks contain active components other than caffeine? Nutr Rev. 2012 Dec;70(12):730-44.


Tea - brewed teas

- commercial tea bag flavors: black, green, citrus, fruity, floral
- measured: pH, titratable acidity, fluoride in teas
- human molars soaked for 25 hours - tea refreshed every 5 hours
- teeth sectioned - lesion depths measured

Tea - ready to drink

- low pH values: all below 4.03
- high titratable acidity values
- acidulants added: typically citric acid

Tea - ready to drink

- low pH values: all below 4.03
- high titratable acidity values
- acidulants added: typically citric acid

Tea - brewed teas

- citrus and fruity teas: greatest lesion depths
- pH inversely associated with depth
- titratable acidity positively associated with depth

Smoothies

- kiwi, apple, and lime: most erosion depth
- cranberry, blueberry, cherry, strawberry, and banana: reduced surface microhardness
- smoothie with yogurt: no change in surface hardness
- recommend: consume during meals

Marketing trends

- U.S. liquid refreshment beverage market
- change in volume by segment
- 2010 - 2011

Marketing to children and teens


Industry growth analysis

- U.S. liquid refreshment beverage market
- change in volume by segment
- 2010 - 2011

Marketing to children and teens


Industry growth analysis

- U.S. liquid refreshment beverage market
- change in volume by segment
- 2010 - 2011
They’re on to us

- Wellness is driving growth. The “quintessential wellness” brand image of V8...striking a chord with consumers.
- The core V8® line...household penetration of about 36 percent, rising 6 points in two years.
- A reflection of the loyalty this brand has engendered as a reliable “better-for-you beverage choice.”
- As the health and wellness trend took off, Campbell recognized how well the V8 franchise was positioned to build category sales, and has worked hard to “migrate their positioning.”

Marketing – 2013

Top Selling Energy Drink Mixes

<table>
<thead>
<tr>
<th>Rank</th>
<th>2013 Sales (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MID Energy 55</td>
</tr>
<tr>
<td>2</td>
<td>Crystal Light Energy 39.5</td>
</tr>
<tr>
<td>3</td>
<td>Private Label 36.7</td>
</tr>
<tr>
<td>4</td>
<td>Propri Energy Drink Mix 36</td>
</tr>
<tr>
<td>5</td>
<td>Zolly 12.5</td>
</tr>
<tr>
<td>6</td>
<td>4C Energy Rush 3.3</td>
</tr>
<tr>
<td>7</td>
<td>Ecool 1.5</td>
</tr>
<tr>
<td>8</td>
<td>Splash 0.4</td>
</tr>
</tbody>
</table>

Effects – dental materials

- Glass ceramic veneer and glaze
- Immersion in pH 2, 7 and 10
- Evaluated at 1, 3, 5, 10, 15, 30 days
- Materials susceptible in both low and high pH solutions
- Rougher surfaces more susceptible to abrasive wear from opposing dentition

Effects – dental materials

- GI cement, resin-modified GI cement, resin composite, amalgam
- Citrate buffer solution, pineapple juice and green mango juice
- 37°C for 168 hours (7 days)
- GI cement highest roughness (p<0.05) > by resin modified GI cement
- Minor changes to other materials
- Mango juice - greatest degradation

pH and titratable acidity values

<table>
<thead>
<tr>
<th></th>
<th>Initial pH</th>
<th>Titratable acidity (amount of NaOH 1 M)</th>
<th>Titratable acidity (amount of NaOH 1 M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pina</td>
<td>3.44</td>
<td>0.44 mg/100 mL</td>
<td>0.44 mg/100 mL</td>
</tr>
<tr>
<td>Lime</td>
<td>3.49</td>
<td>2.77 mg/100 mL</td>
<td>2.77 mg/100 mL</td>
</tr>
<tr>
<td>Orange</td>
<td>3.16</td>
<td>2.91 mg/100 mL</td>
<td>2.91 mg/100 mL</td>
</tr>
<tr>
<td>Apple</td>
<td>3.78</td>
<td>4.46 mg/100 mL</td>
<td>4.46 mg/100 mL</td>
</tr>
<tr>
<td>Grape</td>
<td>3.96</td>
<td>4.90 mg/100 mL</td>
<td>4.90 mg/100 mL</td>
</tr>
<tr>
<td>Apricot</td>
<td>5.00</td>
<td>5.00 mg/100 mL</td>
<td>5.00 mg/100 mL</td>
</tr>
<tr>
<td>Green</td>
<td>6.15</td>
<td>0.91 mg/100 mL</td>
<td>0.91 mg/100 mL</td>
</tr>
<tr>
<td>Lemon</td>
<td>4.95</td>
<td>0.31 mg/100 mL</td>
<td>0.31 mg/100 mL</td>
</tr>
<tr>
<td>Black</td>
<td>4.89</td>
<td>0.26 mg/100 mL</td>
<td>0.26 mg/100 mL</td>
</tr>
<tr>
<td>Red</td>
<td>7.21</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Water</td>
<td>7.21</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Koolaid</td>
<td>7.21</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Shorter**

- Titratable acidity values
Beverage viscosity

- Coca Cola, Sprite, orange juice
- regular drinks and modified with hydropropyl cellulose
- bovine teeth exposed to 3ml drop for 10 min
- increasing the viscosity - reduced enamel erosion by 12.6-18.7%.
- erosive potential - dependent chemical properties and viscosity

Acids with equivalent tastes

- human teeth exposed to acids
- malic, tartaric and citric
- phosphoric, ascorbic, lactic - significantly more erosive

Erosion – lesion depths enamel versus dentin

Adding calcium to juices

- calcium containing beverages
- lower enamel demineralization/wear
- beverages - calcium supplement reduces demineralization

Table 1: Means and standard deviations of physiochemical properties.

<table>
<thead>
<tr>
<th>Property</th>
<th>Sparkling drinks</th>
<th>Energy drinks</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoride level (ppm)</td>
<td>3.19 (2.5)</td>
<td>6.30 (1.17)</td>
<td>0.034</td>
</tr>
<tr>
<td>pH</td>
<td>3.90 (0.44)</td>
<td>3.03 (0.33)</td>
<td>0.005</td>
</tr>
<tr>
<td>Titratable acidity (mg/L)</td>
<td>2.59 (0.50)</td>
<td>11.18 (2.70)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Improving the patient’s outcome

- Individual clinical expertise
- Best external evidence
- EBM
- Patient values & expectations

Benefits of saliva

- peak salivary flow - at the end of the afternoon
- salivary flow near zero during sleep
- acid substances increase salivary flow rates
- 80-90% of all saliva is stimulated
- parotid gland secretions – 50% of stimulated saliva

Saliva - The magic fluid

Saliva - Fast facts.....
Stimulated saliva

80% to 90% of daily salivary production
Stimulus that produces saliva
✓ Mechanical
✓ Gustatory
✓ Olfactory
✓ Pharmacological

Dentinal hypersensitivity

- common condition
- transient tooth pain
- short, sharp sensations
- caused by a variety of exogenous stimuli
  ✓ Thermal (cold)
  ✓ Tactile (touch)
  ✓ Osmotic (sweets or drying the surface)

Hypersensitivity

- mechanical
- gustatory
- olfactory
- pharmacological

Reasons for continued tubule

- poor plaque control, i.e., acidic bacterial byproducts
- excess oral acids, i.e., sodas, fruit juice, swimming pool chlorine, bulimia
- cervical decay
- toothbrush abrasion
- tartar control toothpaste

Structural differences between sensitive and non-sensitive

<table>
<thead>
<tr>
<th></th>
<th>Non-sensitive</th>
<th>Sensitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of open tubes</td>
<td>x</td>
<td>8x</td>
</tr>
<tr>
<td>Diameter of tubes</td>
<td>0.43</td>
<td>0.83</td>
</tr>
<tr>
<td>Fluid Flow (Poiseuille’s law)</td>
<td>y</td>
<td>16y</td>
</tr>
</tbody>
</table>

Redheads

- high anxiety
- fear of pain
- avoid dental care
- more sensitive to cold
- subcutaneous lidocaine significantly less effective

Improving saliva, neutralizing acids, reducing hypersensitivity

- Get the facts
- Develop positive energy
- Create a legitimate spin
- Focus on health benefits
- Discuss savings - money, time, comfort
- Offer reasonable alternatives
- Coaching not scolding

Conversation starters!
oral health to general health

★ Get the facts
★ Develop positive energy
★ Create a legitimate spin
★ Focus on health benefits
★ Discuss savings - money, time, comfort
★ Offer reasonable alternatives
★ Coaching not scolding

Dentinal hypersensitivity: From diagnosis to a breakthrough therapy for everyday sensitivity relief.


The magic of xylitol

- interferes with Streptococcus mutans metabolism
- disrupts biofilm integrity
- promotes neutral pH
- stimulates saliva flow
- shifts equilibrium to enhance remineralization
- increases available calcium and phosphate

Can be fatal to dogs and ferrets

Avoid fructose for up to one hour after use


Novel xylitol products

Comparing Xylitol

Using xylitol

- Must be one of first three ingredients
- One piece gum/candy - four times a day for 3-5 minutes
- 4 - 10 grams per day for dental benefits
- Xylitol tooth paste, wipes, pacifier or mouth rinse
- Excessive use – laxative effect


Comparing Xylitol

Using xylitol

- Must be one of first three ingredients
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Spilanthes products

increases salivary flow rate
hydrates the mouth
medications that cause dry mouth


Stoney Brook University School of Dental Medicine - Spring 2014

Arginine - mode of action

Arginine - mode of action

- exogenous source of arginine - toothpaste
- enhances alkaline pH in saliva and plaque
- 4 weeks - arginine toothpaste
- alkali production higher - plaque samples caries active (CA) subjects
- CA subjects - shift in bacterial composition - healthier

Stoney Brook University School of Dental Medicine - Spring 2014

Arginine bicarbonate calcium carbonate - keeping saliva neutral
BasicBite Chew
- 20 calories
- 20% RDA calcium
- 2g of sugar alcohols
- 0 fats
- 5g carbohydrates
- Kosher
- Gluten-free

Finally......an over the counter solution

Years ago we began with fluoride

Professional
Home

5000 PPM Fluoride
- liquid gel formula
- available full strength at delivery site
- dry mouth formula - no SLS (sodium laurel sulfate)
- sensitive formula - 5% potassium nitrate

Tri-calcium phosphate chemistry
- contains fluoride, calcium and phosphate calcium ion
- protective SLS coating - keeps ingredients from binding
- contact with saliva or water - dissolves coating
- components available at delivery site

Tricalcium phosphate action
- Barrier breaks down
- Fluoride, calcium, phosphate - readily available
- Creates fluorapatite

Fluoride treatment recommendations
- One minute foams / rinses not endorsed
- Gels – application should be four minutes.
- Varnish application
  - every six months
  - effective caries prevention
  - children, adolescent and adult dentition

Evidence-Based Clinical Recommendations: Professionally Applied Topical Fluoride
Council on Scientific Affairs American Dental Association May 2006
Fluoride varnish... projects in action

Fluoride varnish recommendations

Varnish application
- two or more per year
- effective caries prevention
- high risk populations

Application benefits
- less time
- less patient discomfort
- greater patient acceptance than gels
- ideal for preschool children

Varnish and surface protectants

Fluoride varnish recommendations

Applicator benefits
- less time
- less patient discomfort
- greater patient acceptance than gels
- ideal for preschool children

ACP – Amorphous calcium phosphate
- releases calcium and phosphorus
- highly soluble compound - prolonged substantivity?
- building block of apatite

CPP-ACP compounds
- contains casein phosphopeptide (Recaldent)
- adheres to soft tissue, plaque, teeth
- calcium and phosphate – released during acid challenge
- coagulated with milk allergy

Smear layer - up

NovaMin technology

- calcium sodium phosphosilicate
- reacts with saliva – elevates pH to 8-8.5
- calcium and phosphorus ions release
- sodium and calcium cause bacterial cell lyses
- demineralized lesions attract Ca2+ and Ps+5
- build hydroxyapatite from bottom up

Theobromine

- theobromine - found in cacao (chocolate) plus minerals
- growth of larger hydroxyapatite crystals (4X larger)
- occlusion - 7 days
- FDA GRAS (generally regarded as safe) status
- does not contain fluoride

Increase in surface micro hardness - 7 days
Supportive strategies—Slowing down erosion

- Medically complex patients
- Challenged immune systems
- Significant chronic health issues
- Multiple lifestyle challenges
- Dry mouth issues and self care challenges
- Compliance issues

Supportive therapy

- Power brushes
- Fluorescent disclosing
- Xylitol gum, mints, wipes
- Sustained release lozenges
- Compound lozenges – xylitol/essential oils

How complicated are our patients?

Supportive therapy

- Power brushes
- Fluorescent disclosing
- Xylitol gum, mints, wipes
- Sustained release lozenges
- Compound lozenges – xylitol/essential oils

Checking out biofilm

- old
- new
- acidic (lt. blue)
- below pH 4.5

Increasing the risk for erosion

- 37 X – Citrus twice daily
- 4 X - Sports drinks weekly or soft drinks daily
- Vomiting once a week or more
- GERD
- Low unstimulated salivary flow rate
Fast Facts........
Loosing tooth structure

› pure abrasion 2,500 years to remove 1 mm
› add toothpaste, 100 years
› acid + toothpaste - 2 years to remove 1 mm
› active erosion will not be stained


Slowing down erosion

• drink with a straw
• limit contact time – drink quickly
• drink beverages during meals
• add ice to drinks
• avoid between meal snacks/drinks


Slowing down erosion

• chocolate, dairy or cheese after acidic intake
• xylitol gum, mints, lozenges or spray
• chew gum to stimulate saliva
• use bicarbonates - rinse, paste or lozenge

Jain$P ,$Hall8May$E,$Golabek$K,$Agus0n$MZ.$A$comparison$of$sports$and$energy$drinks88Physiochemical$proper0es$and$enamel$dissolu0on.$Gen$Dent.$2012$May8Jun;60(3):19087.

Summary – factors that affect erosion

✓ chemical - Fl level, pH, titratable acidity, calcium & phosphorus
✓ biological - saliva composition, flow, buffering capacity, pellicle formation and tooth composition
✓ behavioral - drinking habits, frequency, duration, timing of exposure

What do we owe our patients?

- We can improve their lives
- Current, in-depth health history
- Assess a patient's total needs
- Current scientific information
- Understand technology
- Tell the truth
- Provide all options
- Patients must make the final choice

What's the take home message?
Investigate and understand

- dietary intake and patterns
- saliva composition and bacterial risk
- intervention and remineralization strategies
- every patient is unique
**Product Resources - 2015**

**Magnification & Illumination**
- Loupes / headlights
- SDS Orascoptic
- 800-369-3698
- orascoptic.com

**Operator Seating**
- Crown Seating
  - (800) 417-4122
  - crowneating.com

**Personal Care Products**
- Summit+ GUM toothbrush, PerioBalance Probiotics,
- Soft-Picks, Alcohol free CHx
- sunstaramericas.com

**OTC Consumer Products - Xylitol/Arginine/Theobromine /Splanthes/**
- XyliMelts
- RiteAid, CVS, Amazon
  - 425 451 9876
  - oralhealth.com

**Diagnostics /Therapeutics**
- CariScreen Caries Susceptibility
  - Carefree.com
  - 866-928-4445

**Equipment/Supplies**
- XCEED and UltraForm ergonomic nitrile gloves, NeoGuard
- UltraForm nitrile gloves
  - Microflex.com

**Sales and Dentiva Lozenges**
- nuvorainc.com

**Sonicare Diamond Clean Clean, AirFloss, Tongue scraper**
- philipsoralhealthcare.com

**Software**
- CariScreen Caries Susceptibility
  - Carefree.com
  - 866-928-4445

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- nuvorainc.com

**Veritas Ultra and UltraForm Ergonomic Nitrile Gloves**
- MedActive Gel/Spray/Lozenges
  - 866-887-4867

**Operating Room Gear Cover**
- Mirror gear cover
  - MirrorGearUSA.com
  - 712-352-2151

- Mr. Thirsty
  - 800-328-3899
  - zirc.com

- VERA Angles, Young polishing handpiece, Young Contra Angles
  - 800-325-1881 ext. 3150
  - youngdental.com

- Florida Probe
  - Floridaprobe.com

- Blue Boa Suction System
  - theblueboa.com

- OtcPure Water and Purifying System
  - Ultra No Fog Masks
  - Crosstex.com

- Otis Formajet Saliva Ejectors
  - Schein, Patterson, Benco

- Cetacaine subgingival anesthetic
  - Cetacaine.com

- FlexExplorer
  - LM Dental
  - LM-dental.com

- American Eagle
  - XP Technology/Double Gracey
  - Am-eagle.com

- Twice as Nice uniforms
  - twiceasniceuniforms.com