Washington State Dental Association’s
2016 Pacific Northwest Dental Conference

Presents

The Erosion Explosion – Effects of a Modern Day Witch’s Brew
Anne Guignon, RDH

Thursday, June 16, 2016
2:00 p.m. – 5:00 p.m.

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The Erosion Explosion.... effects of a modern day witch's brew

Anne N. Guignon, RDH, MPH, CSP

Learning outcomes
1. Appreciate the role of pH and titratable acidity in erosion.
2. Compare “new drink” ingredients to legacy soft drinks.
3. Learn why sugar-free drinks still damage teeth.
4. Understand market trends in beverage sales.
5. Discover how beverages and dry mouth create trouble.
6. Learn how to combat dry mouth issues.

When faced with this.......

I don't want to revert to this......
- no magnification or headlights
- marshmallow on a stick chairs
- no gloves, masks, shields
- paper charts, pencil entries
- surface disinfection alcohol on gauze
- heavy corded handpieces
- real cotton gauze
- “cold sterile” - only autoclaved surgical instruments

The price of doing the same old thing is far higher than the price of change. BILl CLINTON

Standing
- neutral pelvic posture
- healthy lumbar curve
- even disc pressure

Traditional seating
- rotated pelvis
- flattened lumbar spine
- uneven disc pressure

Saddle seating benefits
- sit closer and higher
- center balanced
- increased range of motion
- safer reach
- ease of movement

Goldilocks Principle
- adjust height
- distribute weight evenly
- tilt seat - neutral pelvis
- adjust patient height
- gradually increase time

Conversation starters!
- health benefits
- save money, time, comfort
- offer alternatives
Conversation startders!
oral health to general health
* get the facts
* coaching not scolding
* develop positive energy
* create a legitimate spin

What do we owe our patients?
* current, in-depth health history
* assess total needs
* tell the truth
* provide all options

Skills!
* interviewing
* educating
* motivating
* counseling
Dental hygiene - most frequent health care service
Follow-up - an important part dental practice

Why dental professionals?

What is erosion?

Erosion - a multifactorial condition

Bioceramics masterpieces

Erosion
* progressive loss of hard tissue
* chemical loss - not bacterial
* most important factor - hypersensitivity
* erosive lesions – generally sensitivity

Erosion vs. caries
* surface-softening lesion
* non-bacterial - extrinsic and intrinsic acids
* complicated by attrition and abrasion
* remineralization difficult
* prevalence - increases with age

www.wonderhowto.com/how-to-explore-atomic-structure-tooth-160130/

Erosion - a multifactorial condition

Bioceramics masterpieces

Erosion vs. caries

What is erosion?

Erosion - a multifactorial condition

Bioceramics masterpieces

Erosion vs. caries

Bioceramics masterpieces

Erosion vs. caries

What is erosion?
How does erosion happen?

Biofilm attachment

How does erosion happen?

Acid erosion

Erosion - surface softening

Salivary pH - impact on tooth structure

Critical pH

- critical pH - a dynamic number
- dependent - salivary calcium and phosphorus
- average resting salivary pH 6.4 – 7.

When do teeth melt???

- root structure - pH 6
- enamel - between pH 5 and 5.5
- fluorapatite - pH 4.5

Early erosion.......one year

Dawes C. What is the critical pH and why does tooth dissolve in acid? J Can Dent Assoc 2003;69(11):722–4
Stookey GK. The effect of saliva on dental caries. JADA 2008 May;139;11S-17S.
Sensitivity

Dentinal hypersensitivity
- common
- transient pain
- short, sharp sensations
- exogenous stimuli


Stimulus
- thermal stimulus (cold) 75%
- tactile stimulus 25%
- osmotic stimulus (sweet) 16%
- air blast 9%

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- osmotic stimulus (sweet) 16%
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Dental hypersensitivity
- two conditions are necessary
  - exposed dentin via loss of enamel or periodontal tissues
  - open dentin tubules - patent to the pulp – loss of smear layer


Structural differences between sensitive and non-sensitive

Continued tubule exposure
- poor plaque control
- excess oral acids
- cervical decay
- toothbrush abrasion
- tartar control toothpaste

Hidden hypersensitivity
- apprehension
- negativity
- unwilling to schedule
- broken appointments
- arriving late

Verbal and non-verbal
- women/younger - more anxious
- tense bodies
- foot on the floor
- “I’d rather be anywhere but here”
- patient expectations
- previous dental experiences

Listen to patients......
- acknowledge their concern
- not that many hypochondriacs
- believe in their discomfort
- partner in the diagnosis

A golden opportunity
- what is really bothering them
- discomfort triggers—temperature, air, galvanic, acidity
- feeling—sharp, dull, profound, achy, electric
- alternative procedure?

Rule out other conditions
- occlusal trauma
- cracked tooth syndrome
- caries—new and recurrent
- pulpal pathology
- gingival sensitivity
- layered sensitivities

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

Root sensitivity - periodontal therapy
Fischer et al. (1991)
- 9% - before tx
- 55% - 1 week after

Tammaro et al. (2000)
- 23% - before tx
- 54% - 1 week after

Hypersensitivity- bleaching
- history of sensitivity
- length of exposure to solution
- solution concentration
- solution pH

Erosion – periodontal therapy
Regurgitation
- reflux
- bulimia
- chemotherapy
- pregnancy
- alcoholism
- pectic ulcers
- gastritis
- drug side effects

OTC supplements
- chewable vitamin C
- cough drops
- fizzy liquid medications
- gummy bear supplements

Erosion – complicating medical conditions
GERD – gastric esophageal reflux
- 7% adults - daily episodes
- 36% monthly
- children also experience GERD
Anorexia
- 47% - binge/purge subtype
- refuse to maintain normal weight
Bulimia
- typically normal weight
- self-induced vomiting after eating
Eating disorders – behaviors and findings

- vomiting - palatal surfaces - maxillary teeth
- eroded surfaces - smooth/glossy
- erosion - 2+ years of self-induced vomiting
- active lesions - smooth/unstained
- inactive lesions - stain over time


Eating disorders – Common behaviors and findings

- erosion – 2+ years - self-induced vomiting
- excessive - acidic beverages and fresh fruits
- antidepressants - cause dry mouth
- binge/purge – high carbohydrate intake
- anorexia - often poor oral hygiene


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 many looks of erosion

- Early erosion
- Bruxism plus erosion - two years of canned soda drinks
- Advanced occlusal erosion


Erosion – Extrinsic factors

- diet
  - drinks, fruits, candies, pickled foods
- environmental
  - occupational (acid vapors from industrial electrolytic processes / wine tasing)
  - recreational (swimming pools)*


Erosion – Dietary intake

- acidic foods – pickles, vinegar, citrus
- carbonated beverages
- sports and energy drinks
- flavored waters
- wine – particularly dry varieties
- beer


Erosion – Dietary intake

- high carbohydrate foods
- fruit juices
- fruits, especially citrus
- sour candies and powders
- breath mints
- sugar free candies containing citric acid
- Erika Feltham's paper erikafeltham@mac.com


The science behind erosion– pH and titratable acidity


**Chemical erosion via soft drinks**

- beverage changed daily
- 14 days = 14 years drinking exposure
- microscopic and SEM evaluations

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**Erosive potential of four soft drinks**

**Study drinks**

- Red Bull
- Classic coke
- Diet coke
- Gatorade

**Measured pH**

*Titratble acidity*

Listed all ingredients found in the beverage


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**Chemical erosion via soft drinks**

- decay-free human molars
- imbedded in acrylic
- enamel exposed
- half surface – nail polish coating
- remaining surface - exposed to beverage


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**Post immersion photos – 20x magnification**

**Classic Coke**

**Diet Coke**

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**Post immersion photos – 20x magnification**

**Note:** Chalky, dull enamel

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**2004 Landmark study**

<table>
<thead>
<tr>
<th>Beverage</th>
<th>Container</th>
<th>pH</th>
<th>1-day weight loss (mg)</th>
<th>30-day weight loss (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>Bottle</td>
<td>3.8</td>
<td>2.48</td>
<td>4.74</td>
</tr>
<tr>
<td>Diet Coke</td>
<td>Bottle</td>
<td>3.8</td>
<td>2.48</td>
<td>4.74</td>
</tr>
<tr>
<td>Classic Coke</td>
<td>15 oz</td>
<td>3.8</td>
<td>2.48</td>
<td>4.74</td>
</tr>
<tr>
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Total acid content of beverages

- **pH-initial acidity**
  - measures hydrogen ion concentration
- **TA-titratable acidity**
  - measures total acid molecules / erosive potential
  - higher TA = longer time to neutral, safe pH value / salivary clearance

What’s different about these non-carbonated drinks?

- multiple organic acids
- added sucrose and glucose
- TA off the charts! Requires more titration

Red Bull – 250x SEM

What’s different about these non-carbonated drinks?

- citric acid - binds (chelates) calcium - higher pH
- net effect – accelerates calcium loss
- maintains pH below 5.5, causing erosion


Low acid content

- Carbonated water
- Lager
- Beer

Medium acid content

- Cola
- Carbonated orange
- White wine
- Grapefruit juice

High acid content

- Apple juice

More news on acidity

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Legacy drinks today’s consumption patterns

Legacy drinks……
today’s consumption patterns

Soft drinks USA – average annual consumption

- 25% of all drinks consumed
- *American* - 100 gal/year
- *three bath tubs full!*
- *teen boys* - 160 gal/year

Beverage consumption

Fast Facts........

1977 - 2001 - children age 6 - 11

- increased  decreased
  - 137% soda consumption  39% milk consumption
  - 54% fruit juice
  - 69% fruit drink
  - sugar sweetened beverages - 11% total calories

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Consumption... patterns and habits

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

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Bottled water!!!
P pH levels of 5-5.5 are common

Mouth rinses!!!
P pH levels 3.5 to 5

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)

What a brew!

sodium citrate
gum arabic
erthyorbic 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
• Crystal Light 'on the Go' - raspberry ice flavor - pH 2.6

The scoop....

Propel....now vitamin and calcium enhanced

• Vitamin B 5
• Vitamin B 6
• water
• sucrose syrup
• Vitamin B 12
• flavors
• Vitamin D
• citric acid
• sodium citrate
• potassium citrate
• One 8 oz contains
• 35 mg of sodium
• 3 g of carbohydrates
• 2 g of sugar
• Splenda (sucrolose)
• acesulfame potassium
• calcium disodium EDTA

Flavored waters....fitness waters

Soda, juice and other drinks.....

Tea - brewed teas

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

Tea - brewed teas

• citrus and fruity teas - greatest lesion depths
• pH inversely associated with depth
• titratable acidity positively associated with depth
Tea - ready to drink

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

Smoothies

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

Digestive aids / trends

- apple cider vinegar
- 2 tsp twice daily
- sweeten with honey
- pH 2.8 - 3.0

- 24 oz warm water
- juice of 1 lemon
- pH approx. 2.4
- Kombucha tea fermented
- fermented - tea + sugar + yeast + bacteria
- contains vinegar
- pH 2.8 - 3.2

- And it’s not just soft drinks!

- Energy drink consumption - worldwide 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

- Adding calcium to juices

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

- Digestive aids / trends

- Kombucha tea fermented
- fermentation - tea + sugar + yeast + bacteria
- contains vinegar
- pH 2.8 - 3.2

- Energy and sports drinks…… composition and consumption

- Energy drink consumption - worldwide 2006–2012
### Contents and rebranding

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

Rebranding as a beverage

- ✓ no injury or death reports to FDA
- ✓ purchased with food stamps
- ✓ must list ingredients

### Energy shots

- specialized, concentrated
- smaller, 50ml bottles
- same total - caffeine, vitamins, functional ingredients
- marketed - low calorie, “instant energy”, one swallow
- 5x more caffeine than an 8oz cola

### Energy drinks - overdose

2005 to 2009
- ✓ 10X increase U.S. ER visits
- ✓ related to energy drink intake

2007
- ✓ caffeine overdoses (5448)
- ✓ 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 - Troops

- ✓ Monster - top seller - military PX
- ✓ 44% deployed troops - one daily
- ✓ 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

### Energy drinks risks

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

### Energy drinks - Adults

2010 National Health Interview Survey
- ✓ 31.3% - 1 drink past 7 days
- ✓ 11.5% - 3+ per week
- ✓ age 18 - 24 10x more likely to consume than those age 40+

- ✓ younger adults
- ✓ non-Hispanic blacks & Hispanics
- ✓ male
- ✓ live in South or West
- ✓ current smokers
- ✓ engaged in leisure-time physical activity
- ✓ unmarried
- ✓ highly satisfied with their social activities/ relationships

### Acids with equivalent tastes

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

### pH and titratable acidity values

<table>
<thead>
<tr>
<th>Beverages</th>
<th>Initial pH</th>
<th>Titratable acidity (amount of NaOH) up to pH 3.5</th>
<th>Shorter titratable acidity values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fanta</td>
<td>3.46</td>
<td>0.4 ml</td>
<td></td>
</tr>
<tr>
<td>Lime</td>
<td>3.09</td>
<td>1.7 ml</td>
<td></td>
</tr>
<tr>
<td>Thums Up</td>
<td>3.26</td>
<td>2.1 ml</td>
<td></td>
</tr>
<tr>
<td>Apple juice</td>
<td>3.78</td>
<td>4.4 ml</td>
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<td>4.00</td>
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<tr>
<td>Black tea</td>
<td>4.09</td>
<td>0.2 ml</td>
<td></td>
</tr>
<tr>
<td>Pilsen</td>
<td>7.31</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Equin</td>
<td>7.20</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
**Erosion - lesion depths**

Enamel and dentin erosion lesion depths following exposure to various beverages.

- **Enamel**:
  - Initial erosion:
    - Soft drink: 0.4 ± 0.4 µm
    - Regular drink: 0.4 ± 0.4 µm
    - Modified drink: 0.4 ± 0.4 µm
  - Final erosion:
    - Soft drink: 0.4 ± 0.4 µm
    - Regular drink: 0.4 ± 0.4 µm
    - Modified drink: 0.4 ± 0.4 µm

- **Dentin**:
  - Initial erosion:
    - Soft drink: 0.4 ± 0.4 µm
    - Regular drink: 0.4 ± 0.4 µm
    - Modified drink: 0.4 ± 0.4 µm
  - Final erosion:
    - Soft drink: 0.4 ± 0.4 µm
    - Regular drink: 0.4 ± 0.4 µm
    - Modified drink: 0.4 ± 0.4 µm

**Table 1: Means and standard deviations of physical-chemical properties**

- **Physical-chemical property**
  - **Beverage**
    - Soft drink: 0.4 ± 0.4 µm
    - Regular drink: 0.4 ± 0.4 µm
    - Modified drink: 0.4 ± 0.4 µm

**Erosion - lesion depths**

- **Enamel** versus **dentin**
- **✓ energy drinks - higher titratable acidity (TA)**
- **✓ energy drinks - more significant enamel loss - 2x higher**
- **✓ TA significant predictor of enamel dissolution**
- **✓ weight loss greatest = high TA + low pH**

**Beverage viscosity**

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

**Marketing to children and teens**

- **Marketing to children and teens**
- **Industry growth analysis**
  - **U.S. LIQUID REFRESHMENT BEVERAGE MARKET CHANGE IN VOLUME BY SEGMENT 2000 - 2011**
  - **% Change**
    - Energy Drinks: 15.4%
    - RTD-Coffee: 9.8%
    - Sparkle Beverages: 6.9%
    - RTD-Tea: 4.3%
    - Bottled Water: 4.1%
    - Carbonated soft drinks: 1.7%
    - Value-added water: 1.7%
    - Fruit-juices: 1.1%
    - TOTAL: 0.6%

**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 trends**

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2013 - Brand Market Share - Energy drinks

Red Bull - $3.4 BILLION
Monster - $3.1 BILLION


Marketing - 2013

Top Selling Energy Drink Mixes

<table>
<thead>
<tr>
<th>Brand</th>
<th>2013 Sales (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD Energy</td>
<td>55</td>
</tr>
<tr>
<td>Crystal Light Energy</td>
<td>39.5</td>
</tr>
<tr>
<td>Private Label</td>
<td>36.7</td>
</tr>
<tr>
<td>Propel Energy Drink Mix</td>
<td>23</td>
</tr>
<tr>
<td>Zilfit</td>
<td>12.5</td>
</tr>
<tr>
<td>65 Energy Rush</td>
<td>9.3</td>
</tr>
<tr>
<td>Good Energy</td>
<td>1.5</td>
</tr>
<tr>
<td>Splash</td>
<td>.34</td>
</tr>
</tbody>
</table>

Effects on dental materials

- dental ceramics - surface roughness -
- 168 hour (7 day) exposure
- citrate buffer solution, pineapple juice, green mango juice
- surface roughness evaluated - 24, 96, and 168 hours
- added - typically citric acid
- microhardness decreased significantly (p<.05)

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 (7days)
- GI cement highest roughness (p<.05) > by resin modified GI cement
- minor changes to other materials
- mango juice - greatest degradation

Saliva - The magic fluid

- Digestion
- Cleansing
- Lubrication
- Scavenging
- Antibacterial activity

Saliva functions and benefits

- Protection
  - dilution
  - lubrication
  - cleansing
  - increase pH
Protection

- buffering-neutralizes
- remineralization
- anti-microbial
- healing

Saliva – Fast facts........

- peak flow - late afternoon
- during sleep - near zero flow
- acid substances - salivary flow rates
- parotid gland – 50% of stimulated saliva

Stimulated saliva

80 - 90% of daily saliva production
- mechanical
- gustatory
- olfactory
- pharmacological

Multiple terms – quality of life

- dry mouth syndrome
- hyposalivation-clinical
- xerostomia-subjective

Prevalence

- 30% population
- more women
- 10% early 30s
- over age 50

Healthy saliva – composition

- also contains
- proteins
- enzymes
- mucins
- buffering compounds

99% water


90% - whole saliva
- parotid
- sub-mandibular
- sub-lingual

10% - minor salivary glands

<table>
<thead>
<tr>
<th>Parotid Gland</th>
<th>Submandibular Gland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saliva glands</td>
<td></td>
</tr>
</tbody>
</table>


Saliva - Fast facts.......
Clinical complaints

‣ sore mucosa
‣ burning sensation
‣ stickiness
‣ halitosis
‣ metallic taste

Visual observations

‣ red, glossy, parched
‣ pebbled tongue
‣ cracking in commissures
‣ chapped lips
‣ thick, foamy,ropy saliva

Additional complaints

‣ difficulty talking
‣ problems chewing/swallowing
‣ taste alterations
‣ dental hypersensitivity

Insufficient flow

‣ subtle changes
‣ 50% decrease - noticeable
‣ pH decreases
‣ increased demineralization

Insufficient saliva

‣ increased acidogenic microbes
‣ decreased buffering capacity
‣ aciduric microbes thrive
‣ sticky plaque biofilm

Lifestyle

‣ smoking
‣ stress
‣ recreational drugs
‣ prolonged speaking/singing
‣ C-Pap machine
‣ caffeine
‣ alcohol
‣ exercise
‣ dehydration

Lifestyle - diet

‣ high sodium intake
‣ processed foods

Lifestyle - sodium intake

‣ Too much salt!

Medical and environmental conditions
Medical conditions

- diabetes
- HIV/AIDS
- Sjogren’s syndrome
- laxative abuse
- autoimmune disorders
- eating disorders
- chronic renal failure
- Parkinson’s disease

Respiratory

- sleep apnea
- mouth breathing
- asthma
- seasonal allergies
- facial anatomy
- dust / wind

Pathology and sequela

- salivary gland dysfunction
- radiation treatment
- hormone imbalance
- OTC and RX meds
- HBP, anxiety, depression, pain,
  appetite control, nausea, seasonal allergies

Climate

- air conditioning
- central heat
- desert climates
- cold temperatures

Diagnostic protocol for dental erosion – historical data

Improving the patient’s outcome

Individual clinical expertise
Best external evidence

Patient values & expectations

EBM

http://med.fsu.edu/index.cfm?page=medicalinformatics.ebm/tutorial

Microbial adaptation

- “good” bacteria mutate / adapt
- become acid producers to survive
- adapt in 30 minutes to survive acidic pH

Dry mouth – a microbial biofilm paradise


False/a ML, Klein MI, Symbiotic relationship between Streptococcus mutans and Candida albicans synergizes virulence of plaque biofilms in vivo.

Diagnostic protocol for dental erosion – physical evaluation

- Pattern: physical examination - ideas for further tests:
  - Head and neck examination
  - Vibration and noise
  - Check for sensitivity
  - Check for pain
  - Check for swelling

- Methods of examination:
  - Visual inspection
  - Palpation
  - Radiography
  - Biopsy
  - Other diagnostic tests

- Examination findings:
  - Loss of enamel
  - Loss of dentin
  - Presence of bacterial plaque
  - Presence of caries

- Treatment:
  - Prevention
  - Early treatment
  - Late treatment

Solutions

- Target putative pathogens (difficult)
  - Antimicrobial agents
  - Probiotics

- Stimulate saliva
  - Xylitol
  - Salivary substitute
  - Sialogogues

- Raise pH
  - Use buffers
  - Administer pH boosters

- Limit sugar intake
  - Use artificial sweeteners
  - Avoid sugars

Ecological plaque hypothesis – caries

- Frequent snacking
  - Acidic foods and drinks

- Acquire dental plaque
  - Bacterial metabolism

- Increase in caries
  - Decrease in pH

- Acidic foods and drinks
  - Sweets

- Alkaline agents
  - Buffering agents

Improving saliva, neutralizing acids, reducing hypersensitivity

The magic of xylitol

- Interferes with Strep Mutans metabolism
- Disrupts biofilm integrity
- Promotes neutral pH
- Stimulates salivary 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

Comparing Xylitol

<table>
<thead>
<tr>
<th>SWEETENER</th>
<th>% RELATIVE SWEETNESS VS SUCROSE</th>
<th>CALORIES (KCAL/GRAM)</th>
<th>LAXATION THRESHOLD (GRAMS/DAY)</th>
<th>U.S. REGULATORY STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorbitol</td>
<td>60</td>
<td>2.6</td>
<td>50</td>
<td>GRAS</td>
</tr>
<tr>
<td>Xylitol</td>
<td>100</td>
<td>2.4</td>
<td>0-90</td>
<td>Food additive</td>
</tr>
<tr>
<td>Sucrose</td>
<td>100</td>
<td>4.0</td>
<td>&gt; 100</td>
<td>GRAS</td>
</tr>
<tr>
<td>Fructose</td>
<td>187</td>
<td>4.0</td>
<td>50-70</td>
<td>GRAS</td>
</tr>
</tbody>
</table>

* Adapted with permission of OMT Polymed
* GRAS: Generally regarded as safe

Solutions

- Anti-adhesion - xylitol
- Non-fermentable sweeteners
- Metabolic inhibitors - fluoride

More xylitol products

- Xylitol.org
**Washington state xylitol innovations!**
- Slow release
- Adhesive back
- Stick and stay
- US birch xylitol
- 18 flavors
- One tin = 1 week

**Chewing gum!**
- Stimulates saliva - bicarbonates neutralize acids
- Xylitol gum
- Gum with xylitol and green tea extract
- Gum with Recaldent (CPP/ACP)

**Arginine**
- Surface negatively charged
- Attracts arginine’s positive charge
- Arginine and calcium carbonate
  - CaCO₃ promotes precipitation into tubules
- Arginine - raises pH to 7

**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**
- Visibility
- Ergonomics
- Reach
- Access

**Arginine - mode of action**
- Exogenous source of arginine - toothpaste
- Enhances alkaline pH in saliva and plaque
- 4 weeks - arginine toothpaste
- Alkaline production higher - plaque samples caries active (CA) subjects
- CA subjects - shift in bacterial composition - healthier

**Brand new!!**
Arginine bicarbonate calcium carbonate - keeping saliva neutral

Basic Bite Chew
★ 20 calories
★ 20% RDA calcium
★ 2g of sugar alcohols
★ 0 fats
★ 5g carbohydrates
★ Kosher
★ Gluten-free

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

Remineralization strategies

Tubule occlusion
- Stannous fluoride
- High fluoride
- Precipitating salts
- Restorative materials
- Laser

Fluoride platforms

Professional
- one minute foams / rinses not endorsed
- gels – four minutes application
- varnish application
  - every six months
  - effective caries prevention
  - children, adolescent and adult dentition

Home
- two or more per year
- effective caries prevention
- high risk populations
- less time
- less patient discomfort
- greater patient acceptance than gels
- ideal for preschool children


Varnish recommendations

Fluoride treatment recommendations

Varnish and surface protectants

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
- contraindicated with milk allergy

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

Hydroxyapatite paste
- powder + liquid = 15 sec paste
- apply paste for 30 sec
- creates HAp layer
- fast relief
- kind to soft tissue
- tetracalcium phosphate, dicalcium phosphate, and water

Silver diamine fluoride 38%
- off label - arrests caries
- less than $1 / 1-2 teeth - 8ml bottle
- can be applied by anyone who can apply fluoride

Supportive strategies-
Slowing down erosion

Silver diamine fluoride 38%
- natural antibacterial
- hypersensitivity relief
- carious dentin lesion turns black
- no anesthesia

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

Understanding labels
- “use” words - sugar
- “ate” words - acid
- corn syrup
- ascorbic acid

July 27, 2015
New label proposal
FDA proposing to include a percent daily value for added sugars!

Slow down erosion
- use a straw
- drink quickly
- beverages during meals
- add ice
- avoid snacks/drinks

Slow down erosion
- brush before morning juices, etc.
- rinse with water - reduces titratable acidity, not pH
- soft bristle brushes / low abrasion paste

Slowing down erosion
- chocolate, dairy or cheese after acidic intake
- xylitol gum, mints, lozenges or spray
- chew gum
- bicarbonates - rinse, paste or lozenge

Summary - factors that affect erosion
- chemical - FI 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?
- current, in-depth health history
- assess total needs
- tell the truth
- provide all options

What do we owe our patients?
- current scientific information
- patients must make the final choice
  \textit{How would you treat your Mom?}

What’s the take home message?
investigate and understand
- dietary intake / patterns
- saliva composition / bacterial risk
- intervention and remineralization
- every patient is unique