The erosion explosion… effects of a modern day witch’s brew

Anne N. Guignon, RDH, MPH, CSP

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Learning outcomes

Understand beverage components and changing consumption patterns.

Recognize how pH and titratable acidity contribute to erosion.

Learn how beverages are marketed to children and adolescents.

The caries epidemic…. staggering numbers

• 28% age 2-5
• 50% age 11
• 68% age 19

low income children - 2 X decay
4 X more common than asthma (42% vs 9.5%)
52,000,000 lost school hours / year - dental disease

The Caries imbalance

Disease indicators
White spots
Restoration > 3 years
Staining/bleeding
Cavitation/debridement

Risk factors
Salivary flow
Fluoride exposure
Dry mouth
Dietary habits (sugar)

Protective factors
Saliva & mutants
Antibiotics
Fluoride
Effective diet

Caries progression

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Microbial adaptation

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

The caries epidemic…. staggering numbers

• 28% age 2-5
• 50% age 11
• 68% age 19

low income children - 2 X decay
4 X more common than asthma (42% vs 9.5%)
52,000,000 lost school hours / year - dental disease

Caries risk assessment

• customized evaluation
• targeted preventive measures
• restore homeostasis

KY High school students - 2015
No dental visit - previous year
M = 32%, F = 29%

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**Ecological plaque hypothesis - caries**

- **Health** = Homeostasis
- Disease sites species differ from health
- Caries - shift - acidogenic / aciduric
- Imbalance in resident microflora


**Types of tooth wear**

- **Attrition**
  - Surface loss
  - Tooth or restoration
  - Tooth to tooth contact
  - Mastication
  - Parafunction (bruxism)

- **Abfraction**
  - Loss at cervical areas
  - Tensile and compressive forces
  - During tooth flexure

- **Abrasion**
  - Hard tissue loss
  - Abrasion by foreign substance.
  - E.g., toothbrush, dentifrice, tooth pick, chew stick, pipe stem

- **Abrasion characteristics**
  - Side dependent
  - Buccal cervical areas
  - Cusps and premolars - most common
  - Angular and “V” shaped lesions
  - Accelerates - brushing after acid attack

Abfraction - Enamel prism fracturing due to stress effect of occlusal load


What is erosion?

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

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

How does erosion happen?

Biofilm attachment

How does erosion happen?

Acid erosion

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

Erosion - surface softening

Salivary pH - impact on tooth structure

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

Critical pH

- root structure - pH 6.7
- enamel - between pH 5 and 5.5
- fluorapatite - pH 4.5

When do teeth melt???

Early erosion......one year later

Intrinsic and extrinsic factors

Erosion – complicating medical conditions

- GERD – gastric esophageal reflux
  - ≥7% adults - daily episodes
  - ≥38% monthly
  - children also experience GERD
- Anorexia
  - ≥47% – binge/purge subcategory
  - refuses to maintain normal weight
- Buiulmia
  - typically normal weight
  - self induced vomiting after eating

Acid erosion

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

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


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

Aranha ACC, Eduardo CP, Cordás TA. Eating Disorders Part I: Psychiatric Diagnosis and Dental Implications. J Contemp Dent Pract 2008 September; (9)6:073-081

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

Eating disorders/Excessive exercise/Suicide risk

- Bulimia
- Over-exercise/suicide relationship
- 1/3 dx bulimics attempt suicide
- Over-exercise predicts pain insensitivity
- Pain insensitivity predicts ACS (acquired capability for suicide)

Exercise caution: Over-exercise is associated with suicidality among individuals with disordered eating.

Erosion – factors

- Regurgitation
- Reflux
- Bulimia
- Chemotherapy
- Pregnancy
- Alcoholism
- Peptic ulcers
- Gastritis
- Drug side effects

Erosion – extrinsic factors

- Diet
  - Drinks, fruits, candies, pickled foods
- Environmental
  - Occupational (acid vapors from industrial electrolytic processes / wine tasting)
  - Recreational (swimming pools)*

Erosion – dietary intake

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

Regurgitation

- Reflux
- Bulimia
- Chemotherapy
- Pregnancy
- Alcoholism
- Peptic ulcers
- Gastritis
- Drug side effects

OTC supplements

- Medications
- Chewable vitamin C
- Cough drops
- Fizzy liquid medications
- Gummy bear supplements


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

Soda Pop!

1950s - 6.5 oz bottle

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

Missouri Dental Association

2004 Landmark study

Table: Beverages called in this study

<table>
<thead>
<tr>
<th>Beverage</th>
<th>Container</th>
<th>pH</th>
<th>In-body weight loss (mg)</th>
<th>In-body weight loss (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>Bottle</td>
<td>3.6</td>
<td>1.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Diet Coke</td>
<td>Bottle</td>
<td>3.73</td>
<td>1.7</td>
<td>5.07</td>
</tr>
<tr>
<td>Diet Pepsi</td>
<td>Can</td>
<td>3.8</td>
<td>1.8</td>
<td>1.00</td>
</tr>
<tr>
<td>Diet Diet Pepsi</td>
<td>Can</td>
<td>3.9</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Mountain Dew</td>
<td>Bottle</td>
<td>3.9</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Mountain Dew (long)</td>
<td>Bottle</td>
<td>3.8</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Sprite</td>
<td>Can</td>
<td>3.7</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Diet Sprite</td>
<td>Can</td>
<td>3.8</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Canada Dry ginger ale</td>
<td>Can</td>
<td>3.8</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>All and more</td>
<td>Can</td>
<td>3.8</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>EK water</td>
<td>Bottle</td>
<td>3.8</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>EK Bold bottle</td>
<td>Bottle</td>
<td>3.8</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Tap water (e.g.)</td>
<td>Bottle</td>
<td>7.7</td>
<td>1.5</td>
<td>2.0</td>
</tr>
</tbody>
</table>


Are you sure you want to drink another soda?

Chemical erosion via soft drinks

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


Chemical erosion via soft drinks

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

Post immersion photos – 20x magnification

Classic Coke

Diet Coke

Control – Tap water

Note-Chalky, dull enamel

Total acid content of beverages

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

Classic Coke

Diet Coke

Gatorade

Red Bull

What’s different about these non-carbonated drinks?

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

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

Chelating – The acid dance - 6 PM

More news on acidity

<table>
<thead>
<tr>
<th>pH</th>
<th>TA</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td></td>
</tr>
<tr>
<td>Lager</td>
<td>5.3</td>
</tr>
<tr>
<td>Beer</td>
<td>3.9</td>
</tr>
<tr>
<td>MEDIUM</td>
<td></td>
</tr>
<tr>
<td>Cola</td>
<td>2.5</td>
</tr>
<tr>
<td>Carbonated orange</td>
<td>2.9</td>
</tr>
<tr>
<td>White wine</td>
<td>2.5</td>
</tr>
<tr>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>Apple juice</td>
<td>3.3</td>
</tr>
<tr>
<td>Grapefruit juice</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Drinks and melting teeth

Elise Rose, PhD – Personal communication - August 4, 2009
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)

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 - pH 2.6

Propel....now vitamin and calcium enhanced

- Water
- Sucrose syrup
- Flavors
- Citric acid
- Sodium citrate
- Potassium citrate
- Splenda (sucralose)
- Acesulfame potassium
- Calcium disodium EDTA

Soda, juice and other drinks.....

<table>
<thead>
<tr>
<th>Carbonated drinks</th>
<th>pH</th>
<th>Zero drinks</th>
<th>pH</th>
<th>Other drinks</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke</td>
<td>7.7</td>
<td>Grapefruit</td>
<td>2.2</td>
<td>Fruit juice</td>
<td>2.9</td>
</tr>
<tr>
<td>Pepsi</td>
<td>2.7</td>
<td>Grapefruit</td>
<td>2.2</td>
<td>Fruit juice</td>
<td>2.9</td>
</tr>
<tr>
<td>7-Up</td>
<td>2.3</td>
<td>Grapefruit</td>
<td>2.2</td>
<td>Fruit juice</td>
<td>2.9</td>
</tr>
<tr>
<td>Sprite</td>
<td>2.6</td>
<td>Apple juice</td>
<td>3.4</td>
<td>Cola</td>
<td>3.3</td>
</tr>
<tr>
<td>Mountain Dew</td>
<td>3.2</td>
<td>Pineapple juice</td>
<td>3.4</td>
<td>Ice tea</td>
<td>3.3</td>
</tr>
<tr>
<td>Sn. Pepper</td>
<td>2.9</td>
<td>Orange juice</td>
<td>3.4</td>
<td>Tea (black)</td>
<td>3.2</td>
</tr>
<tr>
<td>Lipton Iced Tea</td>
<td>3.0</td>
<td>Grape juice</td>
<td>3.4</td>
<td>Tea (black)</td>
<td>3.2</td>
</tr>
<tr>
<td>Diet Coke</td>
<td>3.0</td>
<td>Carrot juice</td>
<td>4.2</td>
<td>Beer</td>
<td>4.0-6.0</td>
</tr>
<tr>
<td>Ginger ale</td>
<td>2.0-4.0</td>
<td>Sweet tea</td>
<td>4.2</td>
<td>Water</td>
<td>2.5-3.8</td>
</tr>
</tbody>
</table>

Tea - brewed teas

- Commercial tea bag flavors - black, green, citrus, fruity, floral
- Measured - pH, titratable acidity and 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

Adding calcium to juices

- Calcium containing beverages
- Lower enamel demineralization/wear
- Beverages - calcium supplement reduces demineralization
**Kombucha**

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

- 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

“This drinking lemon-water does not expose the teeth for excessive amounts of time to high citric acidic levels in the mouth, thereby causing no harm to the enamel. In fact, it improves plaque-stained teeth and bad breath.”

---

**Supplements**

- sip on sweet drinks
- require no chewing / preparation
- high carb nutritional supplements

**Bottled water!!!**

pH levels of 5-5.5 are common

**Mouth rinses!!!**

pH levels 3.5 to 5

---

**And it’s not just soft drinks!**

<table>
<thead>
<tr>
<th>Soft drink</th>
<th>pH</th>
<th>Other considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>2.9-3.5</td>
<td>Good source of Vitamin C</td>
</tr>
<tr>
<td>Grapes</td>
<td>3.4-3.6</td>
<td>High in antioxidants</td>
</tr>
<tr>
<td>Pears</td>
<td>3.7-4.0</td>
<td>High in fiber</td>
</tr>
</tbody>
</table>

---

**Legacy drinks……**

today’s consumption patterns

**Big Gulp**

USA – average annual consumption

- one-quarter of all drinks consumed
- 450 brands
- 2,500,000 vending machines in the USA

**Soft drinks USA – average annual**

- average American - 100 gal/year
- three bath tubs full!
- teen boys - 160 gal/year
The beverage of choice – kids and teens

By 2005 consumption doubled in ten years

- teenage boys
  - 3+ cans daily
  - 10% - 7+ cans a day
  - KY high school - 2015
  - drank 3+ sodas daily
  - M - 13%, F - 13%

- teenage girls
  - 2 cans daily
  - 10% drink more than 5+ cans a day

Sugar-sweetened beverages

- 2015 - National
- Did not drink milk
- M - 19%, F - 34%

1977 - 2001 - children age 6 - 11

- increased
  - 137% soda consumption
  - 54% fruit juice
  - 69% fruit drink

- decreased
  - 39% milk consumption
  - SSB - now 7% daily cal - down from 11%

Links

- osteoporosis
- obesity
- heart disease

Soda - largest user refined sugar
- Can - 100% RDA
- Appetite sensor does not recognize liquid calories
- Teen females - soda drinkers - 5x fracture risk

Consumption…..patterns and habits

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

Changing market shares 1997-2005

Flavored waters…..fitness waters

Energy and sports drinks......

composition and consumption
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

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 - 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

Energy drinks – Adults

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

Energy-sports drinks – Adults

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

pH and titratable acidity values

<table>
<thead>
<tr>
<th>Beverages</th>
<th>Initial pH</th>
<th>Titratable acidity (amount of NaOH required) up to pH 5.5</th>
<th>Titratable acidity (amount of NaOH required) up to pH 7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lapsa</td>
<td>3.46</td>
<td>3.4 mL</td>
<td>6.8 mL</td>
</tr>
<tr>
<td>Jamaica</td>
<td>3.49</td>
<td>2.3 mL</td>
<td>5.7 mL</td>
</tr>
<tr>
<td>Thernp</td>
<td>3.16</td>
<td>2 mL</td>
<td>5.9 mL</td>
</tr>
<tr>
<td>Huppa (green)</td>
<td>2.78</td>
<td>4.4 mL</td>
<td>7.3 mL</td>
</tr>
<tr>
<td>Orange juice</td>
<td>3.1%</td>
<td>4.9 mL</td>
<td>6.1 mL</td>
</tr>
<tr>
<td>Orange fruit</td>
<td>2.7%</td>
<td>5.7 mL</td>
<td>6.9 mL</td>
</tr>
<tr>
<td>Orange juice</td>
<td>3.1%</td>
<td>4.9 mL</td>
<td>6.1 mL</td>
</tr>
<tr>
<td>Pineapple juice</td>
<td>5.0%</td>
<td>6.5 mL</td>
<td>9.3 mL</td>
</tr>
<tr>
<td>Lemon juice</td>
<td>4.9%</td>
<td>0.1 mL</td>
<td>6.5 mL</td>
</tr>
<tr>
<td>Black tea</td>
<td>4.69</td>
<td>0.2 mL</td>
<td>6.5 mL</td>
</tr>
<tr>
<td>Black tea</td>
<td>7.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black tea</td>
<td>7.61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enamel and dentin lesion depths following exposure to selected beverages.

<table>
<thead>
<tr>
<th>Beverage</th>
<th>Enamel 10% Loss</th>
<th>Dentin 10% Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>5.0%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>5.0%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Juice</td>
<td>5.0%</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

Shorter titratable acidity values

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
- 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

Beverage viscosity

Marketing to children and teens

They’re on us

Marketing trends

Industry growth analysis

U.S. Liquid refreshment beverage market change in volume by segment 2010 - 2014

<table>
<thead>
<tr>
<th>Segment</th>
<th>% Change 2010/11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Drinks</td>
<td>14.4%</td>
</tr>
<tr>
<td>Kombucha</td>
<td>5.4%</td>
</tr>
<tr>
<td>Sports Beverages</td>
<td>8.6%</td>
</tr>
<tr>
<td>RTD Tea</td>
<td>4.3%</td>
</tr>
<tr>
<td>Carbonated Sodas</td>
<td>4.6%</td>
</tr>
<tr>
<td>Non-Carbonated Sodas</td>
<td>4.1%</td>
</tr>
<tr>
<td>Water and Dairy Drinks</td>
<td>4.7%</td>
</tr>
<tr>
<td>Meal Replacement</td>
<td>3.1%</td>
</tr>
<tr>
<td>Total U.S.</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Source: Beverage Marketing Corporation

2013 - Brand Market Share - Energy drinks

Red Bull - $3.4 BILLION 
Red Bull - $3.1 BILLION


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.”

retailwire.com
### Marketing - 2013

**Top Selling Energy Drink Mixes**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Drink</th>
<th>2012 Sales (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mtn Energy</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>Crystal Light</td>
<td>29.5</td>
</tr>
<tr>
<td>3</td>
<td>Private Label</td>
<td>56.7</td>
</tr>
<tr>
<td>4</td>
<td>Rock Energy Mix</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>Powerade</td>
<td>12.3</td>
</tr>
<tr>
<td>6</td>
<td>7-Eleven</td>
<td>6.0</td>
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<tr>
<td>7</td>
<td>E10x</td>
<td>5.5</td>
</tr>
<tr>
<td>8</td>
<td>Powerade</td>
<td>3.4</td>
</tr>
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### Effects on dental materials

- Adult cereals: more nutritious, less sugar
- TV Ads: 600-700 per year, poor nutrition brands, targeting black and Hispanic children
- 52% more sugar, 52% less fiber, 50% more sodium

### Effects - dental ceramics

- GI cement highest roughness (p<.05) by resin modified GI cement
- Other materials - minor
- Mango juice - most

### Effects - dental materials

- Glass ceramic veneer and glaze
- Immersed - pH 2, 7, and 10
- Evaluated - day 1/3/5/10/15/30

### Effects on dental materials

- GI cement, resin-modified GI cement, resin composite, amalgam
- 7 day exposure, 38°C
- Citrate buffer solution, pineapple, and green mango juice

### Ecological shifts in dental plaque

- Frequent sugar/low pH challenges
- Plaque community activity
- Periodontal diseases
- Homoeostatic mechanisms

- Hygiene: Plaque control, gingival health
- Immune response: Inflammation, cell-mediated immunity
- Nutritional factors: B vitamins, calcium, phosphorus
Solutions

Improving the patient's outcome

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

EBM

Remineralization strategies

- non-fermentable sweeteners
- arginine products
- metabolic inhibitors - fluoride
- stimulate saliva
- anti-adhesion - xylitol
- raise pH

Sample topics:
- eating better on a budget
- use super tracker your way
- enjoy your food, but eat less
- make better beverage choices
- make celebrations fun, healthy & active
- kid-friendly veggies and fruits
- be a healthy role model for children
- cut back on your kid's sweet treats

10 Tips nutrition education series sheets in English and Spanish!

Tubule occlusion

- Stannous fluoride: toothpaste, gel, rinse
- High fluoride: varnish, gels
- Precipitating salts: calcium phosphate, arginine bicarbonate
- Restorative materials: adhesives, silicates, resins
- Laser: soft laser

Education Series

DG TipSheet No. 1

Choose MyPlate

MyPlate

Food & Paletters

Protein Activity Tracker

My Tip Tracker

My Weight Manager

My Reports

Choose MyPlate

food groups

Drinking milk, water, or fortified juice is important.
Fluoride platforms

Professional

- contains calcium and phosphate
- saliva activates protected calcium
- sweetened with xylitol
- relieves hypersensitivity
- calcium is released for 24 hours

Home

- 0.21% sodium fluoride
  - uses TCP chemistry
  - not an Rx
  - Amazon or 3M ESPE

Varnish recommendations

Varnish application
- 2+ times a year
- caries prevention
- high risk populations

Application benefits
- less time
- less patient discomfort
- patient acceptance
- preschool / adolescents / geriatrics


Stannous Fluoride
- anti-cavity, anti-gingivitis and anti-sensitivity
- bioavailable stannous and fluoride
- protective mineral shield
- natural mineral
- stabilizes stannous fluoride
- optimal fluoride and stannous ions

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

Improving saliva and neutralizing acids
Stimulated saliva
- quality improves - proteins
- increased bicarbonate
- neutralizes acids
- bicarbonate reserves are limited
- Proteins - secondary path - neutralization

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Arginine - mode of action
- Urea - few bacteria
  - saliva & crevicular fluid
  - broken down by urea
  - byproduct-ammonia
- Arginine - many bacteria
  - low in saliva/abundant in peptides
  - ADS - 3 enzyme system
  - byproduct - ammonia
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Supportive strategies - Slowing down erosion
- "ose" words - sugar
- "ate words" - acid
- corn syrup
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New label - portion size
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brush before morning juices, etc.
- rinse with water - reduces titratable acidity, not pH
- soft bristle brushes / low abrasion paste

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

Erosion - a multifactorial condition

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

Thank you!