Pediatric Periodontal Disease:
A Review of Cases

Dental Acid Erosion:
Identification and Management

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Silverado Resort & Spa

Napa, California

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## Pediatric Periodontal Matrix

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<table>
<thead>
<tr>
<th>Healthy Bone (no alveolar bone loss)</th>
<th>Diseased Bone (alveolar bone loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Healthy Gingiva</strong> (pink, firm, stippled)</td>
<td>Box 1</td>
</tr>
<tr>
<td><strong>Diseased Gingiva</strong> (erythematous, hemorrhagic)</td>
<td>Box 3</td>
</tr>
</tbody>
</table>

**Box 1** - healthy gingiva and no bone loss

**Box 2** - healthy gingiva and bone loss

- Hypophosphatasia **
- Inconclusive Pediatric Periodontal Disease (LJP) *
- Dentin Dysplasia Type I
- Post Avulsion / extraction
Box 3 - unhealthy gingiva and no bone loss

- Gingivitis
- Mouthbreathing Gingivitis
- Gingival Fibromatosis
- ANUG
- Leukemia (AML / ALL)
- HIV
- Vitamin C deficiency

- Eruption related gingivitis
- Minimally attached gingival
- Herpetic gingivostomatitis
- Thrombocytopenia
- Aplastic anemia
- Acrodynia
- Vitamin K deficiency

Box 4 - unhealthy gingival and bone loss

- Neutrophil quantitative defect: (agranulocytosis, cyclic neutropenia, chronic idiopathic neutropenia)*
- Neutrophil qualitative defect: (Leukocyte adhesion deficiency)*
- Inconclusive pediatric periodontal disease (LJP) *
- Langerhan cell histiocytosis X ***
- Papillon-Lefevre disease *
- Diabetes mellitus *
- Down Syndrome *
- Chediak-Higashi disease *
- Chronic Granulomatous Disease *
- Tuberculosis *
- Ehlers-Danlos (Type VIII) *
- Osteomyelitis *

* bacteriological culture and sensitivity needed

** tooth biopsy needed

*** gingival biopsy needed
Steps to follow to work-up a child presenting with:

Persistent bleeding gums
Prematurely mobile primary teeth usually incisors
Premature exfoliation of primary teeth usually incisors

**Step One:** review the differential diagnoses (see matrix) – this is necessary to know what questions need to be asked, what tests need to be run, what referrals need to be made

**Step Two:** obtain a thorough medical history and family history

- Rule out common to more rare
- Congenital Diagnosis ~ LCH
- Trauma (factitial injury) -- localized
- Viral Illness – Herpetic Gingivostomatitis
- Immune System Failure - recurrent infections (URI, Otitis media), umbilical cord slow to fall off
- Genetics – other family members affected?
  - Papillon-Lefevre Syndrome
  - Chediak-Higashi

**Step Three:** clinical exam – look at the whole body

- Hyperkeratosis of the hands and feet – Papillon-Lefevre Syndrome
- Partial Albinism – Chediak-Higashi
- Pale, thin, lethargic – Immune System Failure

Note Immune system failures can be quantitative (not enough WBCs) – neutropenias or it can be qualitative – where the WBC’s do not function properly ~ LAD

Non-specific leukocyte dysfunction related periodontal disease – LJP, prepubertal, etc

**Step Four:** oral / dental evaluation

- *** localized or generalized problem???
- Assess gingival color and texture
- Check mobility of each tooth
  - Anterior teeth – <6 months neonatal teeth or >6 months – other diagnoses
  - Posterior teeth – Langerhan Cell Histiocytosis
- Estimate pocket depths
- Full mouth radiographs to assess alveolar involvement and other lesions
  - Lytic type – Langerhan Cell Histiocytosis
Document caries – root caries – sign of longstanding periodontal ds ~ Cyclic or Chronic Neutropenia

**Step Five:** Determine Periodontal Pathogens

1) culture the child’s crevicular fluid to determine the periopathogens

2) culture family members and pets

3) send culture for C and S – start the most sensitive antibiotic to the most pathogens
   - Rx antibiotic for 6 weeks

4) reculture in three months, change antibiotic as needed – treat until anaerobes are eradicated

5) initiate comprehensive oral hygiene protocol
   - Toothbrushing – consider electric toothbrush
   - Flossing
   - Irrigating with monojet syringe or waterpik with Chlorhexidine
   - Rinsing with Chlorhexidine
   - Take Antibiotics
   - Be conscious of saliva contacts – avoid reinfection

**Step Six:** discriminating tests

- Tooth biopsy – to assess status of the cementum aplasia = Hypophosphatasia
- Gingival biopsy – look for Birbeck granules/ stain for Langerhan Cell Histiocytosis
- Medical Work-up with Blood Studies
  - WBC – check quantity, serial draws to rule out cyclic neutropenia
  - Immune Function Test – rule out LAD, Papillon-Lefevre
  - Serum – check bone alkaline phosphatase levels to rule out Hypophosphatasia
  - Urine – check phosphoethanolamine levels to rule out Hypophosphatasia

MAKeels 2016
The Keels-Coffield Clinical Severity Scale of Dental Erosion

**Level 0**
**NO EROSION**

Suggested Treatments (specifically for GERD):
None

**Level 1**
**MILD**
Only the cusp tips are affected; shallow “moon craters” are present

- If the child confirms a positive history of GERD symptoms, refer to his/her pediatrician or a GI specialist for testing and management.
- If there is no dental sensitivity, routine fluoride applications and sealants may be adequate.
- If dental sensitivity occurs, protect the teeth with occlusal composite resin build-ups.
- Monitor and document the erosive lesions with photographs and/or casts (as tolerated by the child).

**Level 2**
**MODERATE**
Deep “moon craters” or depressions are present and may coalesce

- Same recommendations as for MILD erosions, however, teeth with MODERATE erosions will require occlusal composite resin build-ups or SSC’s to protect against further loss of tooth structure.

**Level 3**
**SEVERE**
Teeth are slick with little or no anatomy present; possible pulpal exposures

- Same recommendations for MILD and MODERATE erosions, however teeth with SEVERE erosions may require pulp therapy or extraction (if non-restorable).

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Basic Algorithm for Identifying Contributing Factors to Enamel Erosion

Enamel Erosion

Molars
Cusp tips affected; slick moon craters

Incisors
Polished stone appearance

Level 1 Erosion
* Diet is primary concern
  Acidic liquids – sodas, juice, lemonade, Gatorade®
  Acidic foods – pickles, citric fruits
  Candy – Sour Nerds, Skittles, Citrus Altoids®, etc.

* GERD considered as a secondary possibility

Level 2 Erosion
* GERD considered more seriously
* Diet becomes secondary

Level 3 Erosion
* GERD is primary concern
  -- possible synergy with bruxism

Facial – acidic liquids (i.e. sodas)
Facial and Lingual – sodas/Bulimia
Lingual – Bulimia / GERD (tongue thrust)

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Guide for Parents with Children who have Dental Signs of GERD

GER - gastroesophageal reflux
GERD - gastroesophageal reflux disease

The effect of GERD on the teeth: When stomach acid (pH 2) arises into the mouth, the teeth can be affected. We have observed areas of dental erosion in your child's teeth. This takes the form of “reverse architecture” in that what were once cusp tips are now areas of pot holes or moon cratering. These “pot holes” may become sensitive to touch or temperature. These erosion areas can expand and deepen to the point they cause fillings to be washed out. The acid can expose the nerve inside the tooth. Stomach acid also makes untreated cavities worse.

Pediatric Symptoms resulting from GERD
- Child reports burning or acidic taste in mouth
- Child reports frequent "hot burps" or "baby vomit"
- Child reports burning in the area of their heart or a stomach ache
- Child has frequent belching after meals
- Child's breath has an acidic odor especially in the morning before breakfast
- Child is continuously coughing during sleep (usually GERD, not Asthma)
- Child has chronic hoarseness/ laryngitis/ pharyngitis
- Child reports that is painful to swallow

Associated Conditions
- Asthma / ADHD / Cerebral Palsy / Premature birth / Failure to thrive

Dental Manifestations
- Enamel erosion (pot holes or moon craters) from the stomach acid washing over the teeth
- Tooth sensitivity can develop once the enamel covering is gone
- Acid reflux can make untreated cavities worse
- Dental fillings (amalgams or resins) will start to appear taller than surrounding tooth structure
- In severe cases of GERD, the tooth nerve can be exposed - OUCH!

Eliminate other potential causes of enamel erosion
- Do not eat sour candies (sour skittles, sour gummies, sour patch kids, sour war heads, etc)
- Avoid acidic drinks (sodas, juices)

Suggested Dietary Changes to help reduce GERD
- Avoid fried foods, spicy foods, mints, acidic juices (OJ with pulp) and sodas
- Avoid over eating (super sizing) and eating too fast --- enjoy every bite
- Don't lie down after eating (takes 2 hours for the stomach to empty)
- Don't eat near bedtime
- Place a 2x4 under the head of the bed vs. two pillows
Continued GERD info ............

Other Tips
Read up on GERD (On the internet - type “GER” or “GERD” into the search engine)
Work with your child to assist him/her to be able to accurately describe:
- what it feels like when reflux occurs
- how often reflux occurs
- what time of day it occurs (bedtime, after meals, upon awakening, etc)
- whether certain foods trigger reflux (make a list - pizza, spaghetti, fried chicken, sodas)

What to do now:
If you confirm that your child does indeed have symptoms of GERD, then contact your physician for an evaluation. Your physician may recommend trying medication or further diagnostic tests. Your physician may recommend a referral to a Pediatric GI Specialist for diagnostic testing (endoscopy, 24 hour pH probe, etc)

Medical Treatments for GERD may include:
Zantac, Prevacid, Prilosec, Reglan (medications to prevent reflux)
Surgical correction - Nissen fundoplication / pyloroplasty

Long-term Dental Risks - if untreated, GERD can cause irreversible tooth structure loss

Long-term Medical Risks - chronic untreated GERD can lead to esophageal (throat) problems in adulthood

References:


Martha Ann Keels DDS PhD
2016
### DEMINERALIZATION RISK from DRINKS

<table>
<thead>
<tr>
<th>Drink</th>
<th>pH</th>
<th>pH Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Water</td>
<td>7.00</td>
<td>Nestea lemon iced tea 3.04-3.39</td>
</tr>
<tr>
<td>Nestea iced tea</td>
<td>4.63</td>
<td>Snapple lemon iced tea 2.98</td>
</tr>
<tr>
<td>Diet Barq's</td>
<td>4.55</td>
<td>Sunny Delight California style 2.97</td>
</tr>
<tr>
<td>A&amp;W Root Beer</td>
<td>4.41</td>
<td>Gatorade citrus cooler 2.95-2.97</td>
</tr>
<tr>
<td>Barq's root beer</td>
<td>4.2-4.61</td>
<td>Gatorade lemon lime 2.95-2.97</td>
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<tr>
<td>Tazo black iced tea</td>
<td>4.15</td>
<td>Snapple raspberry iced tea 2.95</td>
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<tr>
<td>Snapple plain tea</td>
<td>3.93</td>
<td>Dr. Pepper 2.92-3.05</td>
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<tr>
<td>Lipton's iced tea</td>
<td>3.86</td>
<td>Surge 2.91-3.02</td>
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<tr>
<td>Diet 7Up</td>
<td>3.54-3.67</td>
<td>Lipton's lemon iced tea 2.9</td>
</tr>
<tr>
<td>Diet Rite</td>
<td>3.46</td>
<td>Blue Sky (mandarin orange) 2.85</td>
</tr>
<tr>
<td>Sprite</td>
<td>3.42-3.43</td>
<td>Squirt 2.85-2.89</td>
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<tr>
<td>Diet Coke</td>
<td>3.39</td>
<td>Hawaiian Fruit Punch 2.82</td>
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<tr>
<td>Crystal Light lemon iced tea</td>
<td>3.37</td>
<td>Orange Minute 2.8 Maid Soda</td>
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<tr>
<td>Diet Mountain Dew</td>
<td>3.34</td>
<td>RC Cola 2.62</td>
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<tr>
<td>Grape Minute Maid Soda</td>
<td>3.29</td>
<td>Jolt Cola 2.6</td>
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<tr>
<td>Crystal Light lemonade</td>
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<td>Snapple lemonade 2.56</td>
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<td>Diet Dr. Pepper</td>
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<td>Snapple diet lemon iced tea 2.55</td>
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<tr>
<td>Fresca</td>
<td>3.2</td>
<td>Snapple pink lemonade 2.54</td>
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<tr>
<td>7Up</td>
<td>3.19</td>
<td>Cherry Coke 2.53</td>
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<td>Mountain Dew</td>
<td>3.17-3.22</td>
<td>Coca Cola 2.53-2.62</td>
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<tr>
<td>Orange Slice</td>
<td>3.12</td>
<td>Wild Cherry Pepsi 2.5</td>
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<td>Snapple diet pink lemonade</td>
<td>3.1</td>
<td>Pepsi 2.49-2.63</td>
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<tr>
<td>Sunkist</td>
<td>3.06</td>
<td>Battery Acid 1.00 (yikes)</td>
</tr>
<tr>
<td>Diet Pepsi</td>
<td>3.05-3.12</td>
<td></td>
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Compiled from the laboratory tests of K.A. Baker, M.S. Pharm. and University of Minnesota School of Dentistry, 2000 as provided by the Minnesota Dental Association
Another Source of Demineralization: Sour Candies

<table>
<thead>
<tr>
<th>Sour Candies</th>
<th>Acids</th>
</tr>
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<tbody>
<tr>
<td>Sour Baby BottlePop Candy (pH 2.5)</td>
<td>Malic Acid</td>
</tr>
<tr>
<td></td>
<td>Citric Acid</td>
</tr>
<tr>
<td></td>
<td>Buffered Lactic Acid</td>
</tr>
<tr>
<td>Sour Gummy Worms (pH 3)</td>
<td>Citric Acid</td>
</tr>
<tr>
<td></td>
<td>Lactic Acid</td>
</tr>
<tr>
<td></td>
<td>Fumaric Acid</td>
</tr>
<tr>
<td>Sour Warheads (pH 1.6)</td>
<td>Malic Acid</td>
</tr>
<tr>
<td></td>
<td>Citric Acid</td>
</tr>
<tr>
<td></td>
<td>Ascorbic Acid</td>
</tr>
<tr>
<td>Sour Skittles (pH 2.2)</td>
<td>Citric Acid</td>
</tr>
<tr>
<td></td>
<td>Ascorbic Acid</td>
</tr>
<tr>
<td>Sour Starburst (pH 2.2)</td>
<td>Citric Acid</td>
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<tr>
<td></td>
<td>Ascorbic Acid</td>
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<tr>
<td>Sour LifeSavers (pH 2.4)</td>
<td>Citric Acid</td>
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<tr>
<td></td>
<td>Malic Acid</td>
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<tr>
<td>Sour Patch Kids (pH 2.4)</td>
<td>Citric Acid</td>
</tr>
<tr>
<td></td>
<td>Tartaric Acid</td>
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<tr>
<td>Altoids Tangerine Sours (pH 1.9)</td>
<td>Citric Acid</td>
</tr>
<tr>
<td></td>
<td>Malic Acid</td>
</tr>
</tbody>
</table>

**Most Common Acids Present in Sour Candies**

<table>
<thead>
<tr>
<th></th>
<th>✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓</th>
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<tbody>
<tr>
<td>Citric</td>
<td>✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td>Malic</td>
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</tr>
<tr>
<td>Ascorbic</td>
<td>✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td>Fumaric</td>
<td>✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td>Lactic</td>
<td>✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓</td>
</tr>
<tr>
<td>Tartaric</td>
<td>✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓  ✓</td>
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</table>