



NCC Pediatrics Continuity Clinic Curriculum: **Dental Health II: Special Topics** *Faculty Guide*

Goals & Objectives:

- Understand the physiology of tooth eruption, as well as the causes of delayed eruption.
- Recognize the symptoms of teething and identify acceptable therapies.
- Describe the 7 categories of tooth injury and their evaluation, basic management, and possible sequelae. Provide anticipatory guidance for oral injury prevention.
- Discuss why children with special needs are at increased risk for caries and suggest techniques for optimizing oral care in children with special needs.

Pre-Meeting Preparation:

- “Teething: Facts and Fiction” (*PIR, 2009*)
- [AAP Oral Injury Presentation](#) (*click on link*)
- [AAP Special Needs Dental Care Presentation](#) (*click on link*)
- “AAP Recommends Fluoride to Prevent Dental Caries”

Conference Agenda:

- Review Dental Health II Quiz
- Complete Dental Health II Cases
- **Round Table Discussion:** What is the most common question/chief complaint you hear pertaining to oral health? Have you seen any cases of acute oral trauma? If so, what did you do? How have you addressed dental care in your special needs continuity patients?

Post-Conference: Board Review Q&A

Extra-Credit:

- [A Caregivers Guide to Good Oral Health for Persons with Special Needs](#) (*Special Olympics*)
- [Special Care: Oral Health Professional’s Guide to . . . Special Health Care Needs](#) (*modules*)
- [AAP Oral Health “Protecting All Children’s Teeth”\(PACT\)](#)—*training program*
- [CDC website: Oral Health](#)—*links for providers and parents*
- [Fluoride and Dental Caries Prevention in Children](#) (*PIR 2014*)

Teething: Facts and Fiction

Lisa Markman, MD*

Author Disclosure
Dr Markman has disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

Objectives After completing this article, readers should be able to:

1. Understand normal tooth anatomy and the physiology of tooth eruption as well as causes of delayed eruption.
2. Be aware of the historic beliefs about the effects of teething and therapies that have been used in the past.
3. Recognize the manifestations ascribed to teething today by parents and health professionals.
4. Describe the effects of teething.
5. Discuss the acceptable therapies for relief of the symptoms of teething.

Introduction

Teething is a process that all children experience. Most children get their first tooth around 6 months of age and have a complete set of 20 deciduous teeth by 30 months of age. Parental perceptions and beliefs about teething often influence the symptomatology a child experiences with tooth eruption. From medical professionals to grandmothers, everyone seems to have a list of symptoms they believe are linked to teething. “Teething, like colic, is an ill-defined nonevidence-based entity for which parents receive much advice.” (1) It is important to remember that during this same time period of an infant’s life, passive immunity due to maternal antibodies wanes and exposure to a wide variety of childhood illnesses occurs. Due to this temporal relationship, teething often is blamed for symptoms such as changes in sleep and eating patterns, rhinorrhea, drooling, rash, fussiness, and diarrhea. Medical professionals need to be educated about teething to provide reasonable explanations to concerned caregivers.

Teeth have two distinct parts, the crown and the root, and are composed of four different tissues (Fig. 1). The crown, which is made of enamel, lies above the gum line and covers the sensitive root, which lies below the gum line. The root makes up two thirds of the tooth’s total length, goes through the periodontal ligament, and attaches into a socket in the alveolar bone of the jaw.

The four tissues that make up a tooth are:

- Enamel: durable white covering of a tooth
- Dentin: soft bonelike material that supports the enamel and carries some nerve fibers
- Pulp: center of the tooth that contains blood, lymph vessels, and nerves
- Cementum: covers the root of the tooth; the periodontal ligament sits between the cementum and the jaw bone and helps connect the two

Teeth form embryologically from neuroectoderm, which is the portion of embryonic ectoderm that develops into the central and peripheral nervous systems. Tooth development begins in the fetus around 28 days, but mineralization does not occur until 14 weeks in utero. Tooth eruption occurs when the formation and mineralization of the crown are almost complete, but before the roots are fully formed.

Tooth Eruption

Tooth eruption or teething is the process by which a tooth moves from the pre-eruptive position in the alveolar bone through the mucosa into the oral cavity. It is believed that the dental follicle (sac containing the developing tooth and its odontogenic organ) rather than the tooth itself plays the essential role in this process. The dental follicle is a source of

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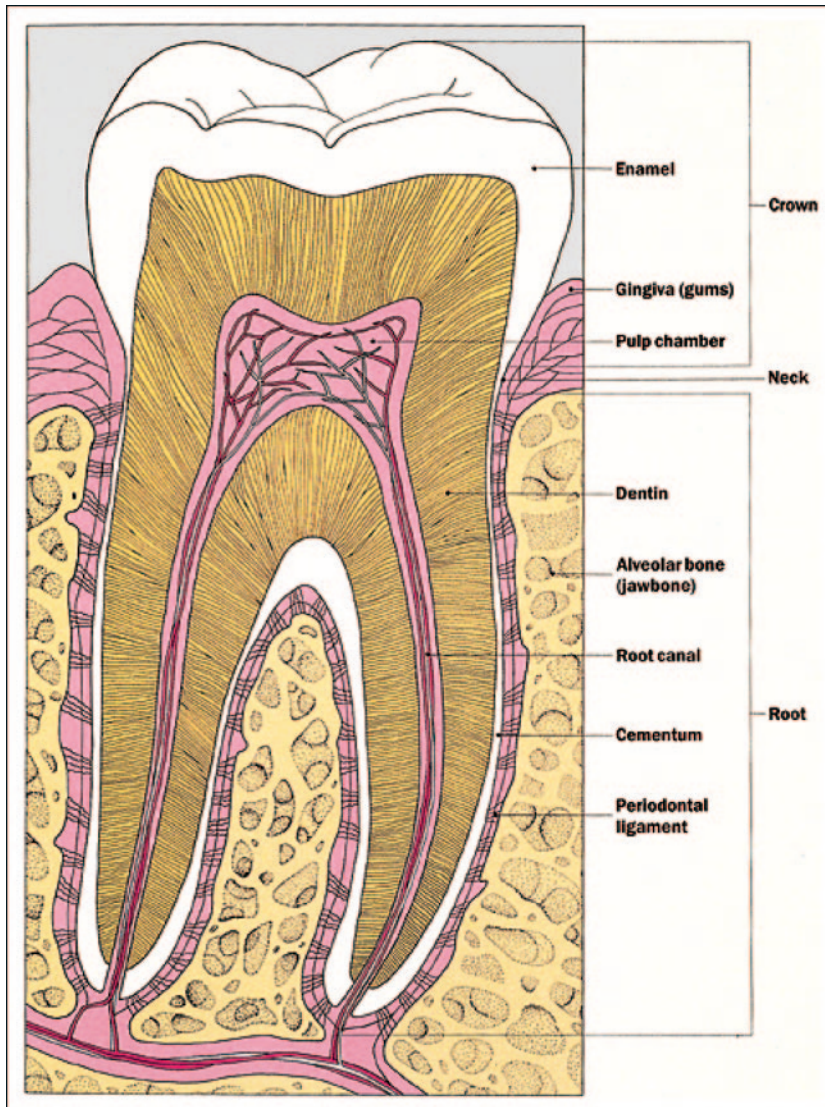


Figure 1. Tooth anatomy. © American Dental Association. Used with permission.

eicosanoids, cytokines, and growth factors and, thus, may contribute to some of the localized symptoms seen with teething.

Prior to erupting, the crown of the tooth is covered by reduced enamel epithelium. As the tooth moves upward in the jaw, the enamel epithelium and oral epithelium of the gingiva fuse over the advancing tooth; this area of fused epithelium subsequently breaks down, and the tooth erupts into the mouth. Prior to tooth eruption, the gingiva may appear bluish and swollen as a result of a transient hematoma. In rare cases, an eruption cyst develops (Fig. 2).

Primary teeth, also known as deciduous teeth or milk teeth, comprise 8 incisors, 4 canines, and 8 molars for a

total of 20 teeth (Fig. 3). Beneath the primary teeth, 20 permanent (succedaneous) teeth are developing. The timing of tooth eruption varies widely, although most children get their first deciduous tooth around 6 months of age and their last between 24 and 30 months of age. The lower central incisors usually erupt first and the molars last. Teeth tend to emerge in pairs, with the lower teeth erupting prior to the upper teeth, and girls often get their teeth earlier than do boys. The average child acquires one tooth per month between 6 and 30 months of age. The average number of teeth a child should have is roughly his or her age in months minus 6 until 24 months of age. Of note, preterm infants acquire their teeth at a later chronological age but the same postconceptional age as term infants.

A number of pathologic conditions are associated with a delay in tooth eruption (Table 1).

History of Teething Lore

Hippocrates claimed that children experiencing teething suffered from itching gums, fever, convulsions, and diarrhea, especially when cutting their eye teeth (canines). These beliefs were shared by many other philosophers of his time, and the belief that teething was a deadly disease was widely accepted until the late 19th century. Teething was known as “*dentition difficilis*,” Latin for pathologic dentition or difficult dentition.



Figure 2. Eruption cyst. Permission to use from Homer Sedighi, DMD.

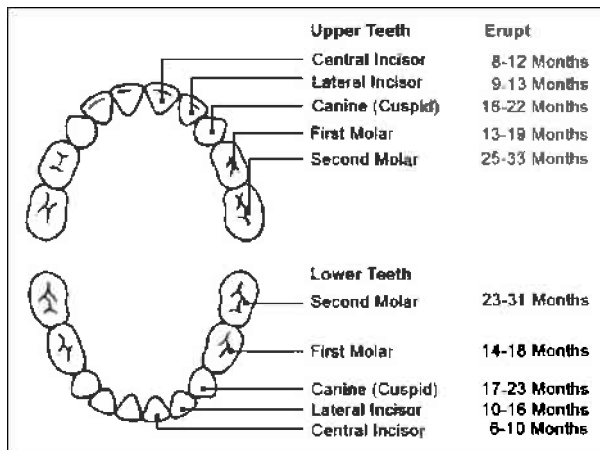


Figure 3. Primary teeth eruption chart. © American Dental Association. Used with permission.

The belief that teething caused disease was not based on scientific fact, but rather on the theory that the nervous system acted as a link between the noxious stimulus of tooth eruption and systemic disease. An infant's nervous system was believed to be very sensitive, and teething was believed to alter this fine balance, resulting in illness and death.

Historically, it was presumed that children who survived a difficult teething period would be less likely to succumb to other illnesses. Infant mortality was extremely high in previous centuries, typically peaking at 6 months to 4 years of age, a time period temporally corresponding to tooth eruption. Thus, it is not surprising that teething was believed to be the cause of death. Symptoms attributed to teething included fever, convulsions, diarrhea, vomiting, paralysis, cholera, tetanus, meningitis, insanity, and penile discharge. In 1839, 5,016 childhood deaths in England were attributed to teething, and teething was the cause of death of record for 12% of all deaths of children younger than 4 years of age. From the 16th to the 19th century in France, 50% of all infant deaths were attributed to teething. In 1894, Dr Thrasher, a well-known dentist, wrote in *Dental Cosmos*, "so deadly has teething become that one third of the human family die before 20 deciduous teeth have fully appeared." (2)

Compounding this widespread association of infant mortality with teething was that many common treatments and medications prescribed for teething were poisonous and contributed directly to the high morbidity and mortality of teething infants and children. In the 6th century, treatments for teething included eating or placing hare brains on the gums, drinking dog's milk, and employing charms and amulets. In the 18th and 19th centuries, pur-

gatives and emetics were common treatments, even if the child presented with vomiting and diarrhea. Other common remedies included opiates, lead, mercury salts, bromide, honey, and salt (Table 2). Such remedies no longer are used or recommended because of their well-known toxicities.

Autopsies of young children often revealed their deciduous teeth under their gums, further boosting a practitioner's supposition that teething was the cause of death. It soon became universal practice to assist children in the teething process to save their lives. Lancing of the gums became widely accepted and was considered a lifesaving procedure. As medical professionals became more advanced in their understanding of normal growth and development as well as in the pathophysiology of disease, this practice fell out of favor and was discontinued in most, but not all places.

Table 1. Causes of Delays in Tooth Eruption

Impacted Teeth

Impedance of tooth eruption by adjacent or overlying tooth or bone.

Down Syndrome

The first tooth usually erupts at 12 to 24 months of age, but may be delayed up to 24 months. It is common for children who have Down syndrome to be 4 to 5 years of age before they have a complete set of deciduous teeth.

Cleidocranial Dysplasia

An autosomal dominant disorder affecting the clavicle (cleido) and causing cranial and facial abnormalities, including delayed eruption of deciduous teeth.

Congenital Hypothyroidism

Failure of the thyroid gland to develop properly, resulting in a low concentration of thyroxine, leading to abnormal growth and development.

Gaucher Disease

Lysosomal storage disease (missing glucocerebrosidase).

Osteopetrosis

Syndrome caused by the failure of the osteoclasts to resorb bone; a defect in bone resorption can lead to delayed tooth eruption.

Rickets

Nutritional deficiency of vitamin D that leads to failure of the proper mineralization of bone and affects tooth eruption.

Table 2. Historical Teething Remedies

Teething Treatment	Adverse Effects
Emetics, purgatives, and salts	Dehydration
Honey	Tetanus
Opiates	Somnolence, respiratory depression
Lead	Paralysis, encephalopathy, seizures
Mercury	Vomiting, diarrhea, renal failure
Bromide	Seizures, hallucinations

Many of the historical misconceptions about teething and the related dangerous remedies persist. Because diarrhea with dehydration continues to be the leading cause of childhood mortality in developing countries, the belief that teething causes diarrhea remains commonplace. In some rural areas of Eastern Africa, the gum swelling that precedes tooth eruption is believed to be the cause of diarrhea, vomiting, and fever. Treatment of these symptoms often involves removal of teeth (ebinyo), hot nails pressed into the gums, and lancing of the gum tissue. These remedies are believed to relieve the pathologic tension on the gums, thereby alleviating diarrhea and vomiting.

The complications of these types of procedures can be disfiguring and deadly. Traditional healers or village elders often use unsterilized equipment, leading to localized and systemic infections. Lancing or tooth removal can cause enamel defects, malformed teeth, and altered mandible size. Clinicians who care for children who have emigrated from these areas and are found to have missing or malformed canines and lateral incisors should ask about these practices. Affected children should be referred to a dentist and consideration given to testing such children for human immunodeficiency virus and hepatitis B and C because of the common practice of using unsterilized equipment. Continued worldwide education about teething and diarrhea is needed to ensure that infants and children are treated appropriately and safely.

Teething Today

In 1975, RS Illingsworth wrote, “Teething produces nothing but teeth.” (3) This simple statement is a straightforward summation of the actual process of teething, but it still is not universally accepted.

Parents and caregivers today attribute a wide variety of signs and symptoms in young children to teething. Often, the diagnosis of teething seems to help alleviate parental anxiety. Parental surveys have found that caregivers attribute symptoms and behaviors such

as fever, pain, irritability, sleep problems, mouthing/biting, drooling, red cheeks, decreased oral intake, gum inflammation, runny nose, and diarrhea to teething. Such parental beliefs are consistent worldwide, across all education levels, and for both first-time and experienced parents.

Among medical professionals, pediatricians ascribe the fewest symptoms to teething and nurses attribute the most. Dentists also are more likely to attribute a greater variety of symptoms, including diarrhea, to teething. This practice likely is due to a lack of exposure to young children and that the differential diagnosis of diarrhea is not part of dental training. Dentists, however, are likely seeing more young children because the American Dental Association and the American Academy of Pediatric Dentistry now recommend that all children establish a dental home by 1 year of age. The purpose of this early intervention is to help establish good dental hygiene and decrease the risk of dental caries; however, parents are bound to discuss teething with the dentist when their children are evaluated.

Results of studies undertaken to determine which symptoms are caused by teething are varied. Most have relied on caregiver questionnaires, which have the potential for reporter bias. The teething period has been described as an 8-day window, including the 4 days before tooth eruption and the 3 days following. The two most recent prospective cohort studies found only a weak, if any, association between teething and many previously reported symptoms. The symptoms seen most consistently were biting/mouthing, drooling, gum rubbing, and irritability. Decreased appetite for solid foods and mild temperature elevation ($<38.9^{\circ}\text{C}$) also have been reported in many studies. No group of symptoms, however, can predict the emergence of a tooth. (4)(5)

There is agreement on the signs and symptoms that should not be attributed to teething. Teething does not cause systemic manifestations such as decreased appetite for liquids, congestion, sleep disturbances, diarrhea/loose stools, vomiting, cough, body rash, or fever greater than 38.9°C . The belief that teething causes systemic symptoms is unfounded, but localized symptoms and low-grade fever may be seen.

Treatment

With the understanding that teething causes localized symptoms, the best treatments are those that relieve these complaints. The expression “born with a silver spoon in his mouth” has its origin as a teething remedy. This expression referred to wealthy 19th century parents who would give their teething children a silver spoon to bite on to relieve discomfort. Unlike many historical teething remedies, the

“silver spoon” treatment was effective and still is used. Most silver spoons, however, have been replaced by more affordable textured or cold teething rings. The cold temperature of the object causes localized vasoconstriction, which decreases the inflammation, and biting on the object gives further relief by applying pressure to the gums.

Liquid-filled teething rings should be chilled in the refrigerator, not in the freezer, and should not be sterilized in boiling water or in the dishwasher (unless specified by the manufacturer). The extremes of temperature can disrupt the plastic material and lead to leakage of the fluid. Recent reports have cited fluid-filled teethingers being contaminated with bacteria such as *Pseudomonas*.

The use of diisononyl phthalate in plastic teethingers, which is a chemical used as a softening agent during the manufacturing process, also has been of recent concern. Animal studies have shown a variety of toxicities, including fetal demise, reproductive problems, and carcinogenesis. No human studies are available. The Consumer Product Safety Commission has advised parents to dispose of phthalate-containing plastic products that children place in their mouths. In response to this potential risk, many manufacturers have stopped using phthalates in their products. It is important to check product information on items that are not manufactured in the United States to avoid inadvertent exposure.

Other treatments, such as teething biscuits, teething bagels, or frozen or cold food such as waffles or vegetables, work by creating pressure on the gums. Such remedies should not be used in children who are not yet taking solid foods, and foods that have a high sucrose content are not recommended. Supervision is needed to ensure that small pieces of food do not break off and pose a choking hazard.

Homeopathic Remedies

Although homeopathic and natural remedies are widely used and reported to aid in relieving teething discomfort, sufficient evidence does not exist to recommend their use. It is important, however, for clinicians who care for children to be aware of the types of products that are available and used by parents.

Amber is a traditional European remedy for teething and is worn by the child as a necklace, bracelet, or anklet. Amber is believed to be a natural analgesic, and when worn, small amounts of oil are released onto the skin, which is believed to relieve the discomfort of teething. Amber is not an oral remedy, and the beads are not to be sucked or chewed. Other natural or homeopathic remedies include application of oils and herbs to the gums, including diluted clove oil, natural licorice sticks (not candy), fennel, green onion, olive

oil, ginger root, and vanilla. Many over-the-counter homeopathic remedies contain chamomile. Chamomile is purported to be especially helpful if the child is suffering from diarrhea, irritability, or red cheeks.

Medications

The conservative use of acetaminophen and ibuprofen can aid in the discomfort caused by teething. It is important that parents know the correct dosage for their children and maintain awareness of the differences between the infant drops and the regular suspension.

Benzocaine is the active ingredient in some of the most popular over-the-counter teething remedies. Benzocaine should be used with caution and generally is not recommended because of the risk of methemoglobinemia.

Methemoglobinemia

It is well established that benzocaine, a known oxidizing agent, can lead to methemoglobinemia. Young children are particularly susceptible to this complication because cellular mechanisms that protect against oxidative stress have not yet matured.

Methemoglobinemia has been seen, even when therapeutic and subtherapeutic doses of benzocaine are used. Anxious parents can become overzealous and apply more medication or a stronger preparation, increasing the likelihood of potential adverse effects. Benzocaine works well as a topical anesthetic because of its low water solubility and low absorption. Absorption is increased, however, when benzocaine is ingested or when there is inflammation, increasing the risk of methemoglobinemia.

Acquired methemoglobinemia occurs when the hemoglobin iron molecule is oxidized from its resting ferrous form (Fe^{++}) to the ferric form (Fe^{+++}). In the ferric form, hemoglobin is incapable of oxygen transport. Methemoglobinemia occurs when the oxidation of hemoglobin exceeds the enzymatic rate of hemoglobin reduction. The ferric heme groups also affect nearby ferrous heme groups by impairing their release of oxygen. The oxygen/hemoglobin curve shifts to the left because methemoglobin cannot transport oxygen or carbon dioxide.

The symptoms of methemoglobinemia include sudden cyanosis and ultimately hypoxia. Whereas normal blood turns bright red when exposed to oxygen, blood containing methemoglobin appears chocolate brown. Such blood discoloration can give the patient's mucous membranes a brownish hue, and the patient may appear cyanotic prior to becoming hypoxic. Treatment includes providing supportive care, discontinuing the inciting agent, and administering methylene blue and ascorbic acid.

Summary

- Historically, many of the treatments and remedies for teething have been dangerous and have contributed to the high morbidity and mortality attributed to teething.
- Today, teething treatments range from teething rings and cold washcloths to homeopathic oils and topical benzocaine. Although many of these treatments are benign, others have the potential to lead to serious disease or pose a choking risk. Vigilance and caution should be used when physicians prescribe treatment and when parents choose to use nontraditional remedies.
- Young children are exposed to a wide variety of situations, environments, and illnesses and virtually are guaranteed to have multiple episodes of fever, congestion, and diarrhea. Physicians and caregivers need to be aware of the temporal relationship between teething, exposure to infection, and normal childhood illnesses. This perspective will help ensure that teething is not used as a blanket diagnosis to explain both potentially serious illness and normal childhood behavior.
- Parents need to be educated that local symptoms may occur, but systemic symptoms are not caused by teething.

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Suggested Reading

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AAP Recommends Fluoride to Prevent Dental Caries

8/25/2014

For Release: Aug. 25, 2014

Dental caries – or tooth decay -- is the most common chronic disease in children in the U.S., a silent disease that disproportionately affects poor, young, and minority populations. In a new clinical report by the American Academy of Pediatrics (AAP) “[Fluoride Use in Caries Prevention in the Primary Care Setting](#),” published online Aug. 25 in the September 2014 Pediatrics, the AAP states that fluoride is effective for cavity prevention in children. The AAP is issuing the following new recommendations:

- Fluoridated toothpaste is recommended for all children starting at tooth eruption, regardless of caries risk.
- A smear (the size of a grain of rice) of toothpaste should be used up to age 3. After the 3rd birthday, a pea-sized amount may be used. Parents should dispense toothpaste for young children and supervise and assist with brushing.
- Fluoride varnish is recommended in the primary care setting every 3–6 months starting at tooth emergence.
- Over-the counter fluoride rinse is not recommended for children younger than 6 years due to risk of swallowing higher-than-recommended levels of fluoride.

Because fluoride is available in many sources, including food and tap water, and may be administered at home and professionally applied, pediatricians should be aware of the risks and benefits of various fluoride modalities to appropriately advise families to achieve maximum protection against dental caries, and to help counsel patients about proper oral health.

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The American Academy of Pediatrics is an organization of 62,000 primary care pediatricians, pediatric medical subspecialists and pediatric surgical specialists dedicated to the health, safety and well-being of infants, children, adolescents and young adults. For more information, visit www.aap.org.

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Dental Health II Quiz

1a. Most children develop their first tooth around **6 months** of age. Total # of deciduous/ “baby” teeth = **20** and most children have a complete set by **30 months** of age. The average number of teeth a child should have = **age in months- 6 (until 24mo)**.

1b. List a differential diagnosis of delay in tooth eruption:

- Impacted Teeth
- Down Syndrome
- Cleidocranial Dysplasia
- Congenital Hypothyroidism
- Gaucher Disease
- Osteopetrosis
- Rickets

2a. What is the code for “Teething Syndrome” in AHLTA? **K00.7**

2b. Do you agree that this is a true “billable” diagnosis? Potential association between teething and biting/mouthing, drooling, gum rubbing, irritability, decreased PO for solids, and low-grade temps. No association with systemic symptoms (e.g. runny nose, fever > 38.9 degC, diarrhea).

2c. If so, what is the best remedy? Conservative use of Tylenol and Motrin for discomfort; teething rings or wet washcloths, chilled in the fridge. *No evidence* for Amber teething necklaces. Benzocaine-containing products (see FDA List) carry risk of methemoglobinemia.

3. The teeth most common in dental trauma are the **central maxillary incisors (>50%)**

4. Complete the following Dental Trauma Table:

Injury	Dental Structures Injured	Follow-up
Concussion	Supporting structures; no loosening	Non-urgent dental eval
Subluxation	Supporting structures; loosening; no displ	Non-urgent dental eval
Lat'l luxation	Tooth & support structures; displacement	Prompt dental referral
Intrusion	Tooth pushed into socket/bone	1°: eval in 1wk; 2°: imm referral
Extrusion	Tooth partially displaced from socket	Prompt dental referral
Avulsion	Tooth completely out of socket	1°: do not reimplant, refer in 24h 2°: reimplant, URGENT referral
Fracture	5X: enamel → dentin → pulp → cementum → root	Dental referral in 12-24hrs.

5. List reasons why children with special needs have an increased caries risk (*be specific*):

- Diet: prolonged and frequent feeds, sugar-laden meds, uncoordinated chewing
- Xerostomia: decreased saliva production due to meds
- Poor oral hygiene: uncoordinated tongue, malocclusion, difficulty with brush/floss (gagging, oral defensiveness, behavioral)
- Dental anomalies: adontia, hypodontia, enamel hypoplasia/discoloration
- GERD/ vomiting
- Gingival hyperplasia: due to AEDs; leads to gingivitis, diff chewing, delayed eruption

Dental Health II Cases

Case 1:

You are serving as the physician in charge of the local soccer league. One Saturday, you are at the field and a mother comes rushing up to you with her son whose mouth is full of blood. The patient is a 10-year old goalkeeper who “forgot his mouth guard at home today”. There was a group of players in front of the goal, and he went out to get the ball. Nobody really knows what happened, but he ended up with what he thought was a cleat to the mouth followed by a mouth full of blood.

What other historical information do you want?

- Timing of injury (i.e., how long ago did it occur)
- Any other injuries, particularly head injuries
- Primary versus permanent teeth

What should your physical examination focus on?

- Assess ABC's first, then do a complete NEURO exam to r/o generalized head trauma.
- Examine soft tissues for edema, tenderness, and lacerations.
- Examine bony structures for pain or malocclusion. Assess patient's ability to open the mouth and laterally deviate the jaw. Examine the tooth ridge for “step-offs”.
- Examine teeth for tenderness and mobility. Check for missing, loose, or displaced teeth.

You find that the incident took place 5 minutes ago and he is without concerning neurologic signs/symptoms. His primary complaint is pain in his left jaw. The blood is coming from a laceration on his left lip. He does not know if any teeth are missing or came out on the field. When you perform his physical exam, you note that his left 2nd molar is loose and slightly displaced. You do not believe that it is fractured, but the left teeth are certainly maloccluded. He has point tenderness at the angle of his left jaw and has difficulty fully opening his mouth.

What are you concerned about for this athlete?

- There are 7 main categories of tooth injury: concussion, subluxation, lateral luxation, intrusion, extrusion, avulsion, and fracture (5 types). This patient most likely has **lateral luxation**: injury to the tooth and its supporting structures, resulting in tooth displacement.
- Also concern for possible **jaw fracture**, given tenderness and difficulty opening mouth.

What do you do now?

- Lateral luxation poses a risk for pulpal necrosis and root resorption. This type of injury requires **prompt referral to dentist** (or via ER) for repositioning of the injured tooth. *Primary teeth also need evaluation, b/c underlying permanent teeth may be injured.*
- Jaw fracture also necessitates ER visit for films/ dental consult.
- Finally, if you are concerned about a missing tooth, do NOT assume that it was lost on the field (could be swallowed, aspirated, intruded into the alveolar bone). **Radiographs (soft tissue & CXR) should be done to look for missing teeth.**

What would you do if the parent had brought you a permanent tooth that had been knocked out?

- This is an **avulsion** of a permanent tooth and is a **dental emergency!**
- If you have the tooth, carefully **rinse it off with saline or milk**. Hold tooth by crown and avoid touching the root. **Gently re-implant**, ASAP (within 20 minutes, best if within 5). Instruct the patient to bite on gauze to hold the tooth in place.
- If unable to re-implant, **transport the tooth in tooth storage solution**, warm milk, saline or saliva— NOT water (this decreases the chance of ligament survival).
- **Send patient to dentist** or OMFS immediately for XR, splinting, and abx prophylaxis.
- *If this was a baby tooth*—do NOT re-implant, as this may damage the underlying permanent tooth. Instead, refer to a dentist w/in 24hrs.

If you are this child's PCM, what anticipatory guidance will you give him at his next visit?

Wear a **mouthguard**—protect teeth and soft tissues of the mouth from injury; also may reduce the risk and severity of a concussion. Mandatory for football, ice-hockey, lacrosse, field hockey, and boxing. Recommended for soccer, basketball, and wrestling (mandated by some states).

Case 2:

Georgios is a 7yo male with Trisomy 21 who presents for a well-child check. He is the dependent of a Greek foreign-military-officer, and this visit is his first at a U.S. MTF. Mother reports that his past medical history is significant for congenital hypothyroidism, for which he takes Synthroid. She denies a history of congenital heart disease, gastrointestinal atresias, or other significant comorbidities. He attends 1st grade in Montgomery County and is in a mixed mainstream and Special Education classroom.

What questions will you ask to determine Georgios' caries risk? Use the Oral Health Risk Assessment Tool from Dental Health I as a guide.

- Has his mother or primary caregiver had active decay in last 12mo or no dental provider?
- Is he a frequent snacker? Sippy cup user?
- Does he have special health care needs? (YES)
- Does he have an existing dental home?
- Does he drink fluoridated water? Does he brush his teeth daily?

Given what you know about special needs children in general and Trisomy 21 specifically, what additional dental risk factors may Georgios have?

- Delayed/ irregular tooth eruption due to both Down Syndrome and hypothyroidism
- Hypotonia may lead to less efficient chewing and natural cleansing of the teeth.
- Midface hypoplasia/ relative macroglossia lead to open bite/ open-mouth breathing, which in turn may lead to xerostomia (reduces natural cleansing).

Mom reports that Georgios eats a gluten-free diet, due to her concern for risk of celiac disease; he is not a frequent snacker and uses a regular cup. He drinks about 16oz of juice per day, 8oz of whole milk, and tap water. He does not have a dental home in the U.S.; however, he did see a dentist yearly in Greece starting at age 3 or 4. Mother tries to brush Georgios' teeth, but he frequently resists her, so she often allows him to do it himself.

By U.S. standards, when should Georgios have received his first dental visit?

12 mo per AAP Dental Home recommendations. For special needs children, earlier visit may be warranted if caries or dental anomalies are noted.

Do a dental screening exam. What will you evaluate specifically? What difficulties might you encounter?

Special Needs children may have oral defensiveness, increased gag, and oral-motor hypotonicity. Attempt to examine the following:

- Oral-facial anomalies (e.g. micognathia, cleft palate, injuries)
- Teeth (e.g. enamel hypoplasia, demineralization, malocclusion, missing or abnormally shaped teeth, dental caries)
- Gingiva (e.g. erythema, swelling, bleeding, hyperplasia)

On your exam, you note that Georgios has mild oral defensiveness, but is able to relax when positioned for the knee-to-knee exam. You take particular care to avoid hyperextension or hyperflexion of his cervical spine, given potential atlanto-axial instability. He has midface hypoplasia and relative macroglossia, as expected, but no other oral-facial anomalies. You count 20 primary teeth, but note some microdontia and malformed teeth. His gingiva are pink.

What follow-up will you recommend? What anticipatory guidance will you give?

- Recommend prompt establishment of a dental home. Georgios is eligible for Pediatric Dentistry at WR-B due to his special healthcare needs, as well as his FMO-dep status.
- Educate on proper oral hygiene. Acknowledge that home-care may be difficult both due to intellectual impairment and decreased manual dexterity. *See Extra Credit links* for recommendations on how to make brushing and flossing easier (e.g. floss holder, mechanical tooth brush).
- Educate on risk factor reduction (e.g. decrease juice, snacking, etc.)
- Consider in-office topical fluoride treatment given increased caries risk.

Historically, dental decay in persons with Down Syndrome has been reported to be low; some speculate this may be due to delayed eruption of the teeth, increased spacing between teeth, or differences in chemical content of the saliva.

(Source: <http://www.down-syndrome.org/reviews/84/reviews-84.pdf>)

Dental Health II Board Review

1. You receive a telephone call from the parents of a 10-month old infant who are concerned that their baby does not yet have any teeth. A review of the infant's growth chart reveals that the patient's weight, length, and head circumference are at the 50th, 25th, and 25th percentiles respectively. The infant's developmental milestones are normal.

Which would be the most appropriate course of action?

- (A) Refer the patient to a pediatric dentist.
- (B) Refer the patient to a geneticist.
- (C) Reassure the parents that their infant's pattern of dental eruption is within normal range.**
- (D) Order radiographs to assess the patient's bone age.
- (E) Order radiographs of the patient's oral cavity.

Although the average age of initial tooth eruption is 6 months, there is a wide range of normal variability, ranging from 3 months to 16 months. Delayed dental eruption is defined as primary eruption after 16 months of age and may be related to endocrine disorders (hypothyroidism and hypopituitarism) or to genetic syndromes (Down Syndrome and ectodermal dysplasia) or may be familial.

2. A 2 year-old girl is brought to the office because she injured her mouth 30 min ago when she fell while running up the porch steps. Her mother reports that she knocked out her lower front teeth when she fell. She has brought the teeth with her in a plastic bag. On examination, the girl is tearful but awake and alert, she has swelling of her lower lip, and her 2 lower central incisors are missing. The bleeding has been controlled with pressure and ice. The other teeth are not loose.

Of the following, the MOST appropriate next step is to

- (A) Obtain mandibular radiographs
- (B) Pack the teeth in ice
- (C) Place the teeth in milk
- (D) Reassure the mother and tell her to make an appointment to see a dentist**

The child in the vignette has avulsed 2 primary teeth. While avulsion of a permanent tooth is a true dental emergency, primary tooth avulsion should be managed by referring the child to a dentist for nonurgent follow-up after careful physical examination confirms the absence of mandibular fractures, maxillary fractures, or other facial injuries. Mandibular or facial radiographs are not routinely indicated. Primary teeth should not be emergently reimplanted, and attempts to do so can injure the nascent permanent tooth bud. Since reimplantation is not indicated, the primary teeth do not need to be preserved.

More aggressive intervention is indicated for permanent tooth avulsion to maximize the likelihood of tooth survival and to decrease the future need for dental restoration. The ultimate prognosis of permanent tooth avulsion is directly related to the method used to preserve the tooth and the time elapsed before reimplantation of the avulsed tooth in the socket. A permanent tooth that is reimplanted within 5 minutes of avulsion has an 85-95% chance of survival; a tooth reimplanted after 1hr is unlikely to remain viable.

An avulsed permanent tooth should be temporarily reimplanted while awaiting emergent dental attention. Temporary reimplantation is a relatively simple procedure and can be performed by any available adult, including a parent, coach, teacher, or pediatrician. The adult should hold the tooth by the crown and insert the tooth into the socket with gentle pressure. The child should be directed to hold the tooth in place manually during transport. Before reimplantation, the tooth should be rinsed gently but never rubbed or scrubbed because vigorous manipulation can damage the periodontal ligament fibers.

If a tooth cannot be reimplanted immediately because of significant damage to the alveolar tissues or inability of the child to cooperate, the tooth and the child should be transported to a facility that can perform reimplantation (e.g. dentist's office or an emergency department).

The tooth should be preserved in a medium that maintains the viability of the periodontal ligament fibers; this will maximize the likelihood of ultimate tooth survival. Solutions that have been shown to support periodontal ligament survival in vitro for several hours include cell culture media and balanced salt solutions. Alternatives include milk, saliva (the cooperative child can hold the tooth in the buccal vestibule), or isotonic saline. If no other alternatives are available, tap water is preferred over transporting a dry tooth, although the low osmolality of the water causes periodontal cell death within minutes. Transporting the tooth in chilled media is preferred but not directly on ice, which can freeze the ligamentous fibers.

3. A 14-year-old boy presents for a preparticipation sports evaluation for baseball. He plays shortstop. His mother is very concerned about his playing because of the injuries she has heard about in professional and collegiate athletes. You explain to her that appropriate equipment, including a batting helmet, is needed to provide protection for her son.

Of the following, the LARGEST percentage of baseball injuries can be prevented by also using

- (A) a mouth guard**
- (B) a protective cup
- (C) elbow pads
- (D) knee pads
- (E) polycarbonate goggles

More than 50% of all high school students participate in athletics, and injury prevention should be a mainstay of sports participation for youth. Both parents and coaches should provide and insist on the use of equipment and safety rules to prevent injury in young athletes. Mouth injuries, along with other head injuries, account for the majority of injuries (48%) sustained by youth in baseball. Injuries generally are caused by contact with sports equipment (eg, the bat, the ball, and the base). Most serious injuries result from being struck by a batted ball and are more common among infield players. Other injuries include those to the leg and groin as well as the chest. Although these are uncommon, use of a protective cup in all sports is recommended to prevent testicular injury.

Dental and facial injuries may be prevented best by using a mouth guard both in the field and at the plate in baseball to avoid injury by pitched and batted balls. Plastic and metal helmets with face protection have been available for batters for several years but are used uncommonly in high school athletics. Clearly, use of a helmet with face protection is important to prevent cranial injuries for the catcher. Even with the use of a helmet, mouth guards protect further against injuries of teeth and from teeth to the oral mucosa. The American Association of Orthodontists recommends that mouth guards be used for baseball, football, soccer, basketball, wrestling, softball, ice and field hockey, volleyball, and lacrosse.

Elbow and knee pads may be helpful in prevention of abrasions and other minor injuries, but they are unlikely to prevent serious injury. Polycarbonate goggles are recommended for batting, but evidence for their routine use in fielding is lacking. Eye protection is afforded by most helmets with face protection.

4. A 15-year-old girl presents to your clinic on the weekend with a complaint of left lower jaw pain that developed over the past 24 hours. She also describes increased sensitivity to hot and cold on that side. On physical examination, you note tenderness localized to a lower left molar and a tender 1.5-cm submandibular lymph node on that side. She has otherwise been well and has no known drug allergies. You advise her to see her dentist the next day.

Of the following, the MOST appropriate antibiotic for treating this infection pending dental evaluation is

- (A) azithromycin
- (B) cefdinir
- (C) doxycycline
- (D) penicillin VK**
- (E) trimethoprim-sulfamethoxazole

The acute onset of dental pain with hot and cold sensitivity described for the girl in the vignette raises concern for a dental abscess arising from bacterial invasion of the dental pulp complicating caries. With such infection, regional lymphadenitis may occur. Trismus and dysphagia can be seen with more severe infection.

Odontogenic infections are polymicrobial, comprising a mixture of oral anaerobic gram-negative rods and gram-positive organisms, including streptococcal species. The involved oral anaerobes are *Bacteroides*, *Fusobacterium*, *Peptococcus*, *Peptostreptococcus*, and *Prevotella*. Pending dentist evaluation and a possible drainage procedure, penicillin is the drug of choice for such an infection.

Emergence of beta-lactamase-producing bacteria may lead to decreased penicillin efficacy, but this has not been clearly demonstrated to date. Azithromycin may be an acceptable alternative for the penicillin-allergic patient, but it is not the drug of choice. Clindamycin is a better alternative for covering these organisms in the penicillin-allergic patient. Doxycycline, trimethoprim-sulfamethoxazole, and cefdinir all have poor activity against these anaerobic organisms.

Complications of odontogenic infections may occur with extension of infection to adjacent spaces in the head and neck. The clinical presentation of such rare complications depends on the location of the teeth involved. Infection of a mandibular incisor can extend to the submental space below the mandible; abscess in a maxillary molar or bicuspid tooth can lead to buccal extension with periorbital swelling.

5. A 6-year old boy will be entering first grade next month, and the parents are concerned that his ongoing thumb sucking will cause problems. He is a healthy child with appropriate growth and development. He gets along well with his siblings and cousins and has no other unusual behaviors.

Of the following, you are MOST likely to advise the parents that

- (A) aversive treatments may be useful for this problem**
- (B) dental appliance use is the only effective approach to thumb sucking
- (C) habit reversal training is an appropriate approach only for preverbal children
- (D) no intervention is needed at this time because there are no dental consequences until after 8 years
- (E) social stigma is not an indication for treatment

Digit sucking and pacifier use are forms of nonnutritive sucking that are extremely common in young children. Estimates are that 60-90% of children engage in nonnutritive sucking, of whom 10% to 34% are digit suckers, and the greatest number of children are 2 years of age or younger. As children grow older, the prevalence of digit sucking steadily decreases (81% at 6 months of age, 31% at 12 months, and 12% at 4 years). Pacifier use is a more common form of nonnutritive sucking in very young children; it may be

replaced by digit sucking as children move toward preschool age. Some studies indicate that digit sucking is more prevalent in children who are from more affluent families, who have no older siblings, and whose mothers are older and have greater education levels.

Complications of digit sucking may affect the skin, teeth, and self-esteem. Derm consequences include paronychia, herpetic whitlow, or dermatitis. Dental complications are the greatest concern of many parents. The risk of dental malocclusion is related to the duration and intensity of the sucking behavior and the genetic predisposition. While the risk of bite abnormalities increases as the behavior persists to older ages, there is no definite “safe” age before which dental consequences can be avoided. Traditionally, many practitioners have recommended treatment if finger sucking persists after 4 years of age, while the American Academy of Pediatric Dentistry advises referral if the behavior persists beyond 3 years old. A recent longitudinal cohort study from the UK documented dental abnormalities at 4 and 5 years of age in children who were digit suckers at 36 months. In that study, the most common abnormalities were changes in upper labial teeth spacing and anterior open bite. In other studies, posterior crossbite (as the jaw closes, posterior maxillary teeth touch the inner aspects of the mandibular molars rather than the outer aspects) occurred in 22% of nonnutritive suckers, although this was greater with pacifier use than digit sucking. School-aged children may experience teasing and social stigma.

Treatment for digit sucking should be individualized and according to the patients’ age and developmental level, the intensity of the habit, and the social stigma experienced. Negative reinforcement (e.g. criticizing the child when caught in the behavior) could promote rather than extinguish the habit by providing attention to the child and increasing stress that is relieved by sucking. Positive reinforcement (e.g. providing attention when the child is not engaged in the behavior) may be a better approach. It may also involve star charts and other behavior modification methods. Aversive treatments, including the application of nontoxic, unpleasant tasting substances to fingers, have been successful. Other aversive treatments include use of gloves, splints, adhesive bandages, and even alarms. Competing responses such as squeezing a ball when the child feels the urge to suck a finger is another approach to treatment. Habit reversal therapy may be useful in verbal children. This approach involves a structured program of awareness training, competing response, and social support. Lastly, a variety of dental appliances have been successfully used to eliminate this habit.