



NCC Pediatrics Continuity Clinic Curriculum: Dental Health

Pre-Meeting Preparation:

Please read the following enclosures:

- AAP Policy Statement: “Preventive Oral Health Intervention for Pediatricians”
- Oral Health Risk Assessment Tool
- “Teething: Facts and Fiction” (PIR)
- Dental Enrollment at WR-B: How To Guide

Please Skim, in order to answer quiz & cases:

- [AAP Dental Trauma power point](#) (click on link)

Conference Agenda:

- Review Oral Health Quiz: *Staff—skip to the cases, if you are short on time.*
- Complete Oral Health Cases
- **Resident/Preceptor Case Discussion:** Discuss when you start assessing oral health in clinic, and by what means. Have you seen any cases of acute oral trauma—if so, what did you do? What is the most common question you hear pertaining to oral health?

Post-Conference: Board Review Q&A

Extra-Credit:

- [AAP Policy Statement: “Timing and Establishment of the Dental Home”](#)
- [“Recs for Using Fluoride to Prevent and Control Dental Caries in the US” \(MMWR 2001\)](#)
- [CDC website: Oral Health](#)
- [“Proposed HHS Recommendation for Fluoride Concentration in Drinking Water for Prevention of Dental Caries”](#)
- [AAP Oral Health “Protecting All Children’s Teeth”](#)



POLICY STATEMENT

Preventive Oral Health Intervention for Pediatricians

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Section on Pediatric Dentistry and Oral Health

ABSTRACT

This policy is a compilation of current concepts and scientific evidence required to understand and implement practice-based preventive oral health programs designed to improve oral health outcomes for all children and especially children at significant risk of dental decay. In addition, it reviews cariology and caries risk assessment and defines, through available evidence, appropriate recommendations for preventive oral health intervention by primary care pediatric practitioners. *Pediatrics* 2008;122:1387–1394

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

Key Words

pediatric oral health prevention, oral health intervention

Abbreviation

PATF—professionally applied topical fluoride

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PURPOSE/INTRODUCTION

Review of Circumstances Leading to Development of This Policy

Oral health is an integral part of the overall health of children.¹ Dental caries is a common and chronic disease process with significant consequences. As health care professionals responsible for the overall health of children, pediatricians frequently confront morbidity associated with dental caries. Because caries is a nonclassic infectious process (arising from shifts in subpopulation ratios of established normal flora), pediatricians have an opportunity to prevent, intervene, and, in collaboration with dental colleagues, manage this disease.

Justification of Policy

The prevalence of dental caries for the youngest of children has not decreased over the past decade, despite improvements for older children.² Data from the Medical Expenditure Panel Survey revealed that 89% of infants and 1-year-olds had office-based physician visits annually, compared with only 1.5% who had dental visits. Consequently, visits to physicians outnumbered visits to dentists at 250 to 1 for this age group.³ Because the youngest of the pediatric patient population visit the pediatrician more than the dentist, it is critical that pediatricians be knowledgeable about dental caries, prevention of the disease, and interventions available to the pediatrician and the family.

Rationale for Format

This policy statement is an effort to assist the primary care pediatric practitioner in addressing issues of dental caries and general oral health. The statement begins by building a knowledge base regarding the caries process that can serve as a foundation for understanding prevention and intervention strategies. After explaining the science of cariology, assessment of caries risk is described to assist the pediatrician in deciding which preventive and intervention strategies need to be used. Specific prevention and intervention strategies are then described and explained.

In addition, the concept and importance of the dental home as well as strategies for improving the connection of the medical and dental homes are presented. Last, recommendations are provided to assist the pediatrician with implementation of the provided information.

BACKGROUND CONCEPTS

Cariology

The most common oral disease encountered by children is dental caries. Dental caries is a nonclassic infectious disease⁴ that results from an interaction between oral flora and dietary carbohydrates on the tooth surface. To adhere to tooth structure, oral flora utilize dietary sugars to create a sticky biofilm that is referred to as dental plaque. Dietary sugar can change the biochemical and microbiologic composition of dental plaque. In the presence of a high-carbohydrate diet, cariogenic organisms constitute a greater portion of the total bacterial population.^{5,6} Acids

produced by bacterial fermentation of carbohydrates reduce the pH of dental plaque to the point at which demineralization of the enamel occurs. The initial carious lesion appears as an opaque white spot on the enamel, and progressive demineralization results in cavitations of the teeth. Dental caries is a process, and loss of tooth structure (a dental cavity) is an end stage in the process.⁷

Human dental flora, generally regarded as qualitatively stable once established and site specific to human dentition, is believed to consist of more than 1000 different organisms, of which only a limited number are associated with dental caries.⁸ *Streptococcus mutans* is most strongly associated with dental caries and is considered to be an indicator organism of a subpopulation of cariogenic organisms. *S mutans*, like its related cariogenic cohorts, has the ability to adhere to enamel and is uniquely equipped to produce significant amounts of acid (acidogenic) and endure within that acidic environment (aciduric).

Dental flora adheres to the teeth by creating a tenacious and highly complex biofilm referred to as dental plaque. Dental plaque is capable of concentrating dietary sugars; therefore, the chronic consumption of sugary foods and liquids will continually recharge the plaque matrix, resulting in copious supplies of sugars within the plaque matrix. *S mutans* and other cariogenic flora will then ferment available sugars, resulting in high levels of lactic acid, a decreased local pH (~5.0), and demineralization of dental enamel (at an approximate pH of ≤ 5.5). Because *S mutans* and its aciduric cohorts continue to thrive at low pH, the resulting environment selects against nonaciduric flora, creating a shift in the subpopulation ratio of benign to aciduric flora. As this process continues over multiple generations, aciduric organisms incur an upregulation of virulence genes that allow them to thrive at even lower pH (4.0). Diet-mediated shifts in subpopulation ratios of dental flora are instigated by significant sugar intake (environmentally selecting for carious organisms). Therefore, significant sugar intake is a driving cause of the caries process.

Preventive Strategies

An understanding of normal dental flora serves as a foundation for the development of preventive strategies, with 2 important considerations. First, dental flora exists in a symbiosis with the human species. Second, only a small number of the organisms within dental flora cause caries. Therefore, our objective is not to eliminate all dental flora but to suppress the cariogenic bacteria within the flora.

Preventive strategies can be differentiated into 2 distinct categories. Primary prevention involves optimization of maternal dental flora before and during colonization of the oral flora of the infant (during eruption of the primary dentition). This invaluable mode of prevention provides an opportunity for a reduction in the mother's constitutionally virulent, aciduric flora and downregulation of virulence genes within the aciduric flora, decreasing the child's risk of dental decay, and is the basis for first dental visit recommendations at 1 year

or earlier made by various medical and dental organizations. This mode of prevention and its adjuncts are reviewed in detail in a policy statement from the American Academy of Pediatrics, "Oral Health Risk Assessment Timing and Establishment of the Dental Home."⁹

Secondary prevention is the continual and ongoing management of subpopulation ratios of benign and aciduric flora within dental plaque. This mode of prevention consists of managing the balance between causative factors and protective factors and is critical for preventing and reversing the caries process. Secondary preventive strategies are hierarchical and currently consist of dietary counseling, oral hygiene instruction, and judicious administration of fluoride modalities. Therefore, although all preventive modalities are important, modification of diet is most important, followed by oral hygiene compliance and then administration of fluorides.

By controlling risk factors before disease occurs, the probability of preventing disease, both in the immediate future and the long-term, is improved. Preventive strategies for this complex, chronic disease require a comprehensive and multifocal approach that begins with caries risk assessment.

Caries Risk Assessment

Caries risk assessment, based on developmental, biological, behavioral, and environmental factors, evaluates the probability of enamel demineralization exceeding enamel remineralization over time. The goal of risk assessment is to anticipate and prevent caries initiation before the first sign of disease. During the period of 1999–2002, 41% of US children 2 to 11 years of age had caries in primary teeth.² An earlier study noted that 25% of children 5 to 17 years of age had 80% of carious permanent teeth.¹⁰ Assessing each child's risk of caries and tailoring preventive strategies to specific risk factors are necessary for improving oral health in a cost-effective manner.

Caries risk assessment is very much a work in progress. In a systematic review of literature regarding risk factors in primary teeth of children aged 6 years and younger, a paucity of studies of optimal (ie, longitudinal) design was noted.¹¹ A study that evaluated the reliability of multiple risk indicators determined that there is no consistent combination of risk variables that provide a good predictor of caries risk when applied to different populations across different age groups.¹² The authors concluded that the best predictor of caries in primary teeth was previous caries experience, followed by parents' education and socioeconomic status.¹² Although previous caries experience cannot be used as a risk indicator for the predentate or very young child, white-spot lesions, as precursors to cavities, can be considered analogous to previous caries experience when assessing the risk of a very young patient. An analysis of National Health and Nutrition Examination Survey (NHANES) III data revealed that children from households with low income levels are more likely to experience caries and have higher levels of untreated caries than their counterparts from higher-income households.¹³ Collectively, children enrolled in Special Supplemental Nutrition Pro-

gram for Women, Infants, and Children (WIC) programs, Head Start, or Medicaid are at higher risk than are children in the general population.

Caries risk factors unique to infants and young children include perinatal considerations, establishment of oral flora and host-defense systems, susceptibility of newly erupted teeth, dietary transitioning from breast and bottle feedings to cups and solid foods, and establishment of childhood food preferences. Although preterm birth per se is not a risk factor, a child with low birth weight may require a special diet or have developmental enamel defects or disabilities that increase caries risk. Early acquisition of *S mutans* is a major risk factor for early childhood caries and future caries experience.¹⁴ A reduction of the salivary level of *S mutans* in highly infected mothers can inhibit or delay colonization of their infants.¹⁵ Although evidence suggests that children are most likely to develop caries if *S mutans* is acquired at an early age, this may be compensated in part by other factors such as good oral hygiene and a noncariogenic diet.¹¹ High-risk dietary practices seem to be established early, probably by 12 months of age, and are maintained throughout early childhood.¹⁶ In addition to the amount of sugar consumed, frequency of intake is important.¹⁷ Sugar consumption likely is a more significant factor for those without regular exposure to fluorides.¹⁸ Children experiencing caries as infants and toddlers have a much greater probability of subsequent caries in both the primary and permanent dentitions.¹⁹

Early risk assessment targets infants and young children who traditionally have yet to establish a dental home. Unrecognized disease and delayed care can result in exacerbated problems, leading to more extensive, costly, and time-consuming care.

Risk-assessment strategies most applicable for screening purposes include those that are acceptable to patients, reliable, inexpensive, and performed easily and efficiently and require limited equipment/supplies. The American Academy of Pediatric Dentistry (AAPD) has developed a caries risk-assessment tool for use by dentists and primary care practitioners familiar with the clinical presentation of caries and factors related to caries initiation and progression (see www.aapd.org/media/Policies_Guidelines/P_CariesRiskAssess.pdf).²⁰ Radiographic assessment and microbiologic testing have been included in the caries risk-assessment tool but are not required. In addition, the American Academy of Pediatrics has created *Oral Health Risk Assessment Training for Pediatricians and Other Child Health Professionals*, which provides a concise overview of the elements of risk assessment and triage for infants and young children (see www.aap.org/compmpeds/doch/oralhealth/screening.cfm).²¹

The chronic, complex nature of caries requires that risk be reassessed periodically to detect changes in the child's behavioral, environmental, and general health conditions. All available data must be analyzed to determine the patient's caries risk profile. Periodic reassessment allows the practitioner to individualize preventive programs and optimize the frequency of recall and dental radiographic examinations.

SPECIFIC PREVENTIVE STRATEGIES

Dietary Counseling

Dietary counseling for optimal oral health in children should be an essential part of general health counseling. The recent policy statement from the American Academy of Pediatrics on prevention of pediatric overweight and obesity highlighted concerns about health problems in overweight children, including cardiovascular, endocrine, and mental health problems, and the importance of promoting healthy eating behaviors. Consumption of juice and sugar-sweetened beverages has been linked to childhood obesity and caries development.²²⁻²⁵

Sugars are a critical factor in caries development. Caries risk is greatest if sugars are consumed at high frequency and are in a form that remains in the mouth for longer periods.²⁶ Sucrose is the most cariogenic sugar, because it can form glucan, which enables bacterial adhesion to teeth and limits diffusion and buffering of acids. Although starch-rich foods pose a low caries risk, mixtures of finely ground, heat-treated starch and sucrose (eg, cereals, potato or corn chips) are also cariogenic.²⁷

Human milk by itself does not promote tooth decay.²⁸ However, breastfed infants are at risk of caries when they receive sugary liquids or eat foods with sugars and fermentable carbohydrates.²⁶

Parents and caregivers should be counseled on the importance of reducing exposure to sugars in foods and drinks. To decrease the risk of dental caries and ensure the best possible health and developmental outcomes, it is recommended that parents do the following:

- Breastfeed infants during the first year of life and beyond as is mutually desired.²⁹
- After nursing, remove the breast from a sleeping infant's mouth and cleanse the gums and teeth after feedings and before bedtime.
- Discourage a child's sleeping with a bottle; any bottle taken to bed should contain only water.
- Limit sugary foods and drinks to mealtimes.
- Avoid carbonated beverages and juice drinks (juice drinks contain high-fructose corn syrup and <100% natural juice).
- Encourage children to drink only water and milk between meals.
- Encourage children to eat fruits.
- Limit the intake of 100% fruit juice to no more than 4 oz per day.
- Foster eating patterns that are consistent with MyPyramid guidelines from the US Department of Agriculture.³⁰

Optimal Use of Fluorides

Fluoride, a naturally occurring element, has been instrumental in the widespread decrease in dental caries.^{31,32} The mechanisms of fluoride are both topical and systemic, with evidence pointing to a greater topical effect.³³

Fluoride reduces enamel dissolution while it encourages remineralization.³⁴ Antimicrobial effects of fluorides at low pH are also significant.³⁵

The delivery of fluoride includes community-based, professionally applied, and self-administered modalities. Water fluoridation is a community-based intervention that optimizes the level of fluoride in drinking water, resulting in preeruptive and posteruptive protection of the teeth.³⁶ Water fluoridation is a cost-effective means of preventing dental caries, with the lifetime cost per person equaling less than the cost of 1 dental restoration.^{37,38} In short, fluoridated water is the cheapest and most effective way to deliver anticaries benefits to communities.

Professionally applied topical fluorides (PATFs) have their greatest effect preventing caries and must be applied at regular intervals.³⁹ PATFs include gel, foam, in-office rinse, and varnish. PATFs are safe and efficacious, with varnishes having the advantage of adherence to the tooth surface, decreasing likelihood of ingestion, and increasing time of contact between the fluoride and tooth surface.^{37,39} In the primary dentition, varnish effectiveness (measured by percent of caries reduction) ranges from 30% to 63.2%,^{40,41} and an analysis of the number of fluoride-varnish applications received resulted in a dose-response effect that was enhanced when coupled with counseling.⁴² Finally, self-administered fluorides, including dietary fluoride supplementation and fluoridated toothpaste, have proven effective, providing low but protracted elevation of fluoride concentrations.^{35,43} Caries reduction associated with self-administered fluoride supplementation ranges from 32% to 72% in the primary dentition.⁴⁰ In children and adolescents, fluoride toothpastes, mouth rinses, and gels reduce dental caries to a similar extent.⁴⁴

The decision to use fluoride therapies must balance the risk of caries against the risk of enamel fluorosis (hypomineralization of the developing enamel caused by excess fluoride ingestion). Patients determined to be at increased risk of dental caries are candidates for more aggressive fluoride therapy utilization. Caries susceptibility and sources of dietary fluoride (eg, water supplies, beverages, prepared food, toothpaste) should be considered before recommending fluoride therapies.^{45–48} Enamel fluorosis develops before tooth maturation and emergence, typically in children younger than 8 years.⁴⁹ The risk of enamel fluorosis is an aesthetic concern, with very mild or mild forms most commonly observed in the general population.^{2,50}

ANTICIPATORY GUIDANCE

Anticipatory guidance is the process of providing practical, developmentally appropriate information about children's health to prepare parents for significant physical, emotional, and psychological milestones.⁵¹ Anticipatory guidance during well-child visits is an effective tool to educate parents about maintaining children's health. Mirroring the pediatric model, the American Academy of Pediatric Dentistry advocates oral health anticipatory guidance.^{52–55} Anticipatory guidance focused on oral health disease should be an integral part of

preventive pediatrics. Information concerning the impact of diet on dental health and counseling in regards to oral hygiene, nonnutritive oral habits, and dental safety should be shared with parents. Therefore, in addition to dietary counseling and optimizing fluoride exposure, anticipatory guidance for oral health includes:

1. Infant oral hygiene instruction: Teeth should be brushed at least twice daily with caregiver supervision and assistance for children. For children with elevated dental caries risk, consider using a pea-sized amount of toothpaste or an amount equivalent to the child's fifth-digit fingernail. Flossing should begin as soon as adjacent teeth are in contact and for surfaces at which 2 teeth touch and they can no longer be cleansed with a toothbrush.
2. Counseling regarding nonnutritive oral habits: Use of pacifiers in the first year of life may prevent sudden infant death syndrome.⁵⁶ Sucking habits (eg, pacifiers or digits) of sufficient frequency, duration, and intensity may be associated with dentoalveolar deformations. Some changes persist past cessation of the habit. Professional evaluation is indicated for nonnutritive sucking habits that continue beyond 3 years of age.⁵³
3. Age-appropriate information regarding dental injury prevention: Parents should cover sharp corners of household furnishings at the level of walking toddlers, ensure use of car safety seats, and be aware of electrical cord risk for mouth injury. Properly fitted mouth guards are indicated for youths involved in sporting activities that carry a risk of orofacial injury.

Anticipatory guidance is valuable, because it emphasizes prevention of dental problems rather than surgical or restorative care. Anticipatory guidance and well-child visits during the first 2 years of life decrease the number of hospitalizations among poor and near-poor children irrespective of race and health status.⁵⁷ Oral health anticipatory guidance can reduce dental expenditures.⁵⁸ In light of this evidence, oral health anticipatory guidance should be integrated as a part of comprehensive counseling during well-child visits.⁵⁹

INTERPROFESSIONAL COLLABORATION AND ESTABLISHMENT OF A DENTAL HOME

To be successful in preventing dental disease, interventions must begin within the first year of life. Pediatricians are well positioned to initiate preventive oral health care by providing early assessment of risk, anticipatory guidance, and timely referral to establish a dental home. The American Academy of Pediatric Dentistry, the American Dental Association, and the American Association of Public Health Dentistry recommend that infants be scheduled for an initial oral examination within 6 months of the eruption of the first primary tooth but by no later than 12 months of age.

The pediatric community promotes the concept of a medical home to improve families' care utilization, seeking appropriate and preventive services with optimal compliance to recommendations. The concept of the

dental home is based on this model and is intended to improve access to oral care. A dental home is the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way.^{52,60,61} A dental home should be able to provide the following:

1. an accurate risk assessment for oral diseases and conditions;
2. an individualized preventive dental health program based on risk assessment;
3. anticipatory guidance about growth and development issues (eg, maxillofacial and dentoalveolar development);
4. a plan for emergency dental trauma management;
5. information regarding care of teeth and oral soft tissues;
6. nutrition and dietary counseling;
7. comprehensive oral health care in accordance with accepted guidelines and periodicity schedules for pediatric oral health; and
8. referrals to dental specialists such as endodontists, oral surgeons, orthodontists, and periodontists when care cannot be provided directly within the dental home.

Lack of access to dental care can be a barrier to establishment of a dental home. Because of the specialized training and expertise, the dentist provides an ideal dental home; however, when a dentist is not available, the pediatric medical provider should fulfill the dictates of preventive oral health care until a dentist can be accessed and a dental home can be established. Therefore, primary care pediatric practitioners are an integral community component in the overall effort to address oral health issues (eg, access to care, preventive intervention). With the continuing challenges of access to dentistry coupled with preschool-aged children making many more visits to medical offices than to dental offices, primary care practitioners with oral health training have reported that they have provided preventive oral health services for their pediatric patients.^{51,52} North Carolina primary care practitioners were able to integrate preventive dental services into their practices, increasing preventive services for young children who receive Medicaid benefits and whose access to dentists is restricted (eg, geographically or because of nonparticipation of dentists).⁶² Often, the first step of timely establishment of a dental home is a referral from the physician. Although a report from the US Preventive Services Task Force on physicians' roles in preventing dental caries in preschool-aged children found referral by a primary care practitioner only partially effective in increasing dental visits,⁴⁰ another study⁶³ reported that dentists were more likely to see young children referred by primary care practitioners.

Primary care practitioners are able to identify children in need of a referral to a dentist.⁶⁴ After 2 hours of

training in infant oral health, primary care pediatric practitioners accurately identified children with cavities with good specificity (92%–100%) and sensitivity (87%–99%).^{40,63} These results suggest that dental screening can be incorporated into a busy pediatrics practice and that primary care pediatric practitioners can contribute significantly to the overall oral health of young children by encouraging parents to enroll their children in a dental home as early as possible.

In summary, the ideal setting for administration of oral health care is the dental home. When there is no access to a dentist, the pediatric medical provider should consider administering risk-based preventive oral health measures until a dental home can be made available. With preparation, primary care practitioners are routinely able to screen accurately and provide oral health anticipatory guidance for children. Furthermore, they are ideally positioned to refer children to a dental home in a timely manner. Establishing collaborative relationships between physicians and dentists at the community level is essential for increasing access to dental care for all children and improving their oral and overall health.

RECOMMENDATIONS FOR PRIMARY CARE PEDIATRIC PRACTITIONERS

1. An oral health risk assessment should be administered periodically to all children.
2. Oral health risk-assessment training should be recommended for medical practitioners who are in training programs and those who currently administer care to children.
3. Dietary counseling for optimal oral health should be an intrinsic component of general health counseling.
4. Anticipatory guidance for oral health should be an integral part of comprehensive patient counseling.
5. Administration of all fluoride modalities should be based on an individual's caries risk. Patients who have a high risk of caries are candidates for consideration of more intensive fluoride exposure after dietary counseling and oral hygiene instruction as compared with patients with a lower risk of caries (see Figs 1 and 2).
6. Supervised use of fluoride toothpaste is recommended for all children with teeth.
7. The application of fluoride varnish by the medical practitioner is appropriate for patients with significant risk of dental caries who are unable to establish a dental home.
8. Every child should have a dental home established by 1 year of age.
9. Collaborative relationships with local dentists should be established to optimize the availability of a dental home.

CONCLUSIONS

Oral health is an integral part of the overall health and well-being of children. A pediatrician who is familiar

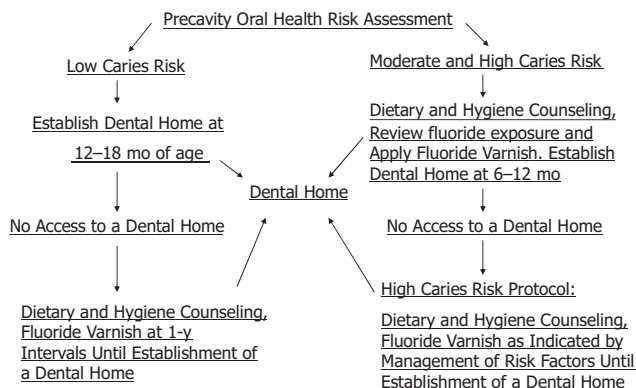


FIGURE 1
Pediatric medicine: oral health intervention algorithm.

- Appoint patient at 1-mo intervals \times 3.
- Review dietary intake of sugars sources (juices, etc) at each appointment.
- Assess oral hygiene at each appointment, (plaque/inflammation).
- Review fluoride exposure and apply fluoride varnish at each appointment if risk factors persist.
- At the third 1-mo visit, if all risk factors are well managed: Reappoint at 3 mo, review diet, hygiene, fluoride exposure, and apply fluoride varnish. If risk factors are not controlled: Continue with 1-mo recalls until risk factors are managed.
- At 3-mo recall interval, if all risk factors are well managed: Reappoint every 6 mo, review diet, hygiene, fluoride exposure, and apply fluoride varnish.

FIGURE 2
High caries risk protocol.

with the science of dental caries, capable of assessing caries risk, comfortable with applying various strategies of prevention and intervention, and connected to dental resources can contribute considerably to the health of his or her patients. This policy statement, in conjunction with the oral health recommendations of the American Academy of Pediatrics *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*, 3rd edition,⁶⁵ serves as a resource for pediatricians and other clinicians to be knowledgeable about addressing dental caries. With dental caries being such a common and consequential disease process in the pediatric population, it is essential that pediatricians include oral health in their daily practice of pediatrics.

SECTION ON PEDIATRIC DENTISTRY AND ORAL HEALTH EXECUTIVE COMMITTEE, 2006–2007

Martha Ann Keels, DDS, PhD, Chairperson
*Kevin J. Hale, DDS
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Paul A. Weiss, DDS, Immediate Past Chairperson

LIAISON

Jack W. Morrow, DDS, MSD
American Academy of Pediatric Dentistry

CONTRIBUTORS

James Crall, DDS, ScD
David Krol, MD, MPH
Jessica Lee, DDS, MPH, PhD
Man Wai Ng, DDS, MPH
Rocio Quinonez, DDS
Jenny Stigers, DMD

STAFF

Aleksandra Stolic, MPH

*Lead author

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Oral Health Risk Assessment Tool

The American Academy of Pediatrics (AAP) has developed this tool to aid in the implementation of oral health risk assessment during health supervision visits.

Instructions for Use

This tool is intended for documenting caries risk of the child, however, two risk factors are based on the mother or primary caregiver's oral health. All other factors and findings should be documented based on the child.

The child is at an absolute high risk for caries if any risk factors or clinical findings, marked with a  sign, are documented yes. In the absence of  risk factors or clinical findings, the clinician may determine the child is at high risk of caries based on one or more positive responses to other risk factors or clinical findings. Answering yes to protective factors should be taken into account with risk factors/clinical findings in determining low versus high risk.

Visit: <input type="checkbox"/> 6 month, <input type="checkbox"/> 9 month, <input type="checkbox"/> 12 month, <input type="checkbox"/> 15 month, <input type="checkbox"/> 18 month, <input type="checkbox"/> 24 month, <input type="checkbox"/> 30 month, <input type="checkbox"/> 3 years, <input type="checkbox"/> 4 years, <input type="checkbox"/> 5 years, <input type="checkbox"/> 6 years, <input type="checkbox"/> other _____		
RISK FACTORS	PROTECTIVE FACTORS	CLINICAL FINDINGS
<ul style="list-style-type: none">  Mother or primary caregiver had active decay in the past 12 months Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Mother or primary caregiver does not have a dentist Yes <input type="checkbox"/> No <input type="checkbox"/> 	<ul style="list-style-type: none"> <input type="checkbox"/> Existing dental home Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Drinks fluoridated water or takes fluoride supplements Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Fluoride varnish in the last 6 months Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Has teeth brushed daily Yes <input type="checkbox"/> No <input type="checkbox"/> 	<ul style="list-style-type: none">  White spots or visible decalcifications in the past 12 months Yes <input type="checkbox"/> No <input type="checkbox"/>  Obvious decay Yes <input type="checkbox"/> No <input type="checkbox"/>  Restorations (fillings) present Yes <input type="checkbox"/> No <input type="checkbox"/>
<ul style="list-style-type: none"> <input type="checkbox"/> Continual bottle/sippy cup use with fluid other than water Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Frequent snacking Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Special health care needs Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Medicaid eligible Yes <input type="checkbox"/> No <input type="checkbox"/> 		<ul style="list-style-type: none"> <input type="checkbox"/> Visible plaque accumulation Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Gingivitis (swollen/bleeding gums) Yes <input type="checkbox"/> No <input type="checkbox"/>
<ul style="list-style-type: none"> <input type="checkbox"/> Teeth present Yes <input type="checkbox"/> No <input type="checkbox"/> <input type="checkbox"/> Healthy teeth Yes <input type="checkbox"/> No <input type="checkbox"/> 		
<p>Caries Risk: <input type="checkbox"/> Low <input type="checkbox"/> High</p> <p>Completed: <input type="checkbox"/> Anticipatory Guidance <input type="checkbox"/> Fluoride Varnish <input type="checkbox"/> Dental Referral</p>		

Treatment of High Risk Children

If appropriate, high-risk children should receive professionally applied fluoride varnish and have their teeth brushed daily with an age-appropriate amount of fluoridated toothpaste. Referral to a pediatric dentist or a dentist comfortable caring for children should be made with follow-up to ensure that the child is being cared for in the dental home.

Supported in part by



Adapted from Ramos-Gomez FJ, Crystal YO, Ng MW, Crall JJ, Featherstone JD. Pediatric dental care: prevention and management protocols based on caries risk assessment. *J Calif Dent Assoc.* 2010;38(10):746-761; American Academy of Pediatrics Section on Pediatric Dentistry and Oral Health. Preventive oral health intervention for pediatricians. *Pediatrics.* 2003; 122(6):1387-1394; and American Academy of Pediatrics Section of Pediatric Dentistry. Oral health risk assessment timing and establishment of the dental home. *Pediatrics.* 2003;111(5):1113-1116.

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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

*Assistant Professor of Pediatrics, Associate Director, Child Protection Team, University of Michigan, Ann Arbor, Mich.

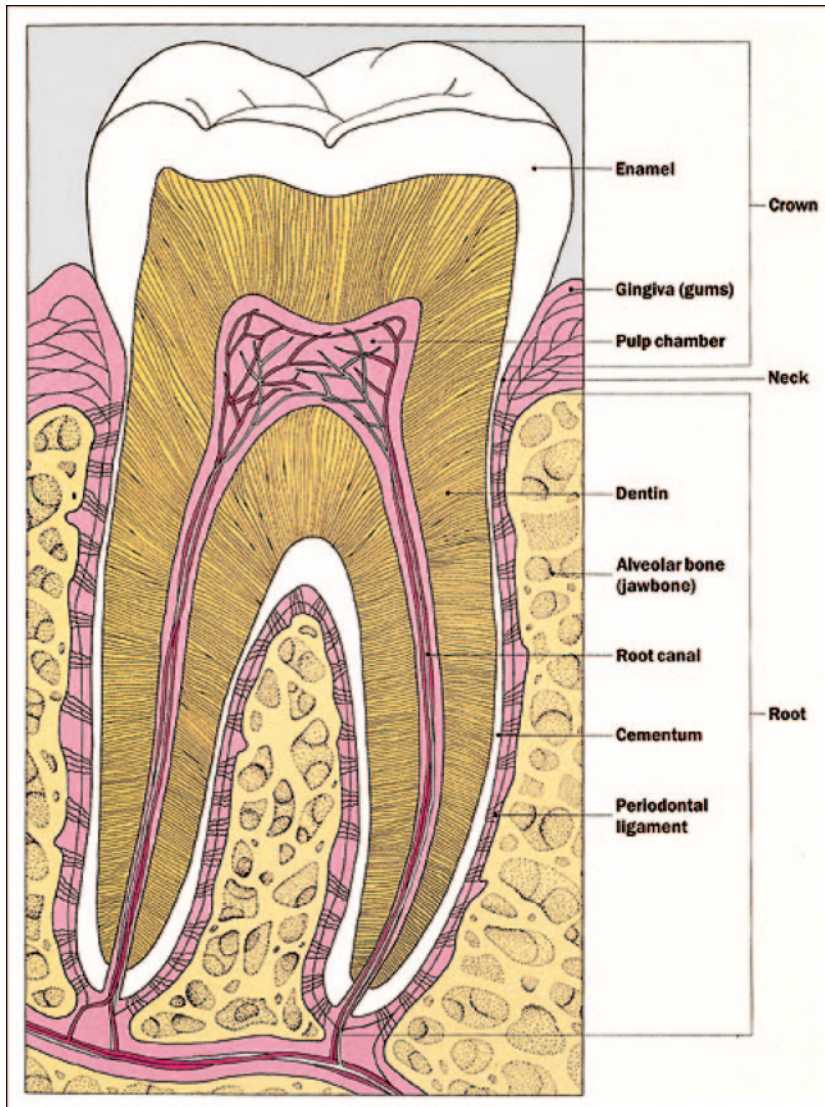


Figure 1. Tooth anatomy. © American Dental Association. Used with permission.

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.

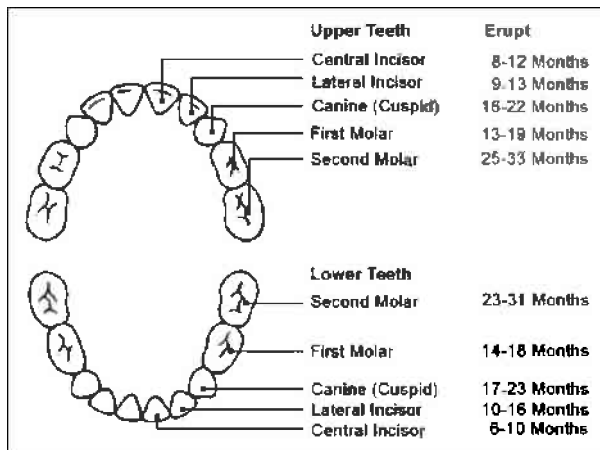


Figure 3. Primary teeth eruption chart. © American Dental Association. Used with permission.

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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Pediatric Dental Health Coverage

A Logistic “How To” Guide

www.tricare.mil

The screenshot shows the TRICARE website interface. At the top, the URL **www.tricare.mil** is displayed. Below the navigation bar, the main content area features the TRICARE logo and a section titled "Answer Three Questions to get health care information just for you". This section contains a form with three numbered questions:

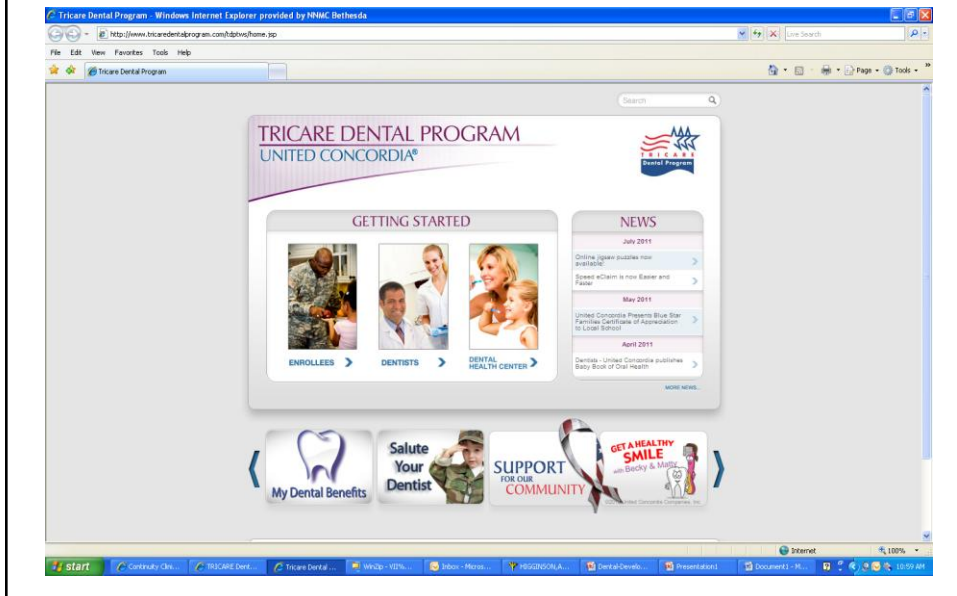
- 1 Who are you? (highlighted with a red box and the text "Complete this section")
- 2 Where do you live?
- 3 What plan are you using?

A "SUBMIT" button is located below the form. To the right of the form is a "PLAN FINDER" button. Below the form, there are sections for "New to TRICARE", "Quick Links", "Crisis Center", and "News". The "New to TRICARE" section includes a list of steps: "1. Confirm Your Eligibility", "2. Explore Your Health Plan Options", and "3. Decide and Enroll". The "News" section lists several articles, including "Hurricane/Storm Info", "Mental Health Resource Center", and "TRICARE Pharmacy Home Delivery Is Available!".

Click on Dental, "Tricare Dental Program"

Click on Concordia link

From here, patients can enroll and search for a local pediatric dentist



- Or, simply—if you can remember—go directly to www.tricaredentalprogram.com

Can patients be seen at WRNMMC?

- Yes....but....
 - Very limited access due to selection process*
 - “The requirement needs of the [dental] residents determines who is selected for treatment.”
 - Consider for complex medical patients
 - Consider for acute dental issues or need for operative repair
 - NOT a “dental home”
 - Pediatric dentists here recommend that all children enroll in Concordia

*\\nnmc-fs-02\shares\$\Pediatrics\Higginson,A\clinic resources, education, etc\dental →“peds dental policy NMMC” to view power point on official pediatric dental clinic policy

How do I refer to the pediatric dental clinic?

- “Peds dentistry” consult in AHLTA/CHCS I **AND** call the clinic directly! (Or have the patient call the clinic)
- Mr. Wynne 295-1364 is the clinic manager
- CDR Haluska and LT Colosi are the two pediatric dentists at WRNMMC

Oral Health Quiz

1. The AAP, ADA, and AAPD recommend that infants be scheduled for an initial dental visit within **6** months of the eruption of the first primary tooth OR no later than **12** months of age.
2. Federal Fluoridation guidelines established in 1962 state that community drinking water should contain **0.7** to **1.2** ppm fluoride.
3. The teeth most commonly involved in dental trauma are the **central maxillary incisors**.
4. Please complete the following chart for fluoride supplementation:

Hint: Review MMWR Link or Harriet Lane

Fluoride Concentration in Community Drinking Water

Age	<0.3 ppm*	0.3-0.6 ppm	>0.6 ppm
0-6 months	NONE	NONE	NONE
6 months-3 years	0.25 mg/day	NONE	NONE
3-6 years	0.5 mg/day	0.25mg/day	NONE
6-16 years	1 mg/day	0.5 mg/day	NONE

*1 parts per million (ppm) = 1mg/L

5. Most children develop their first tooth around **6 months** of age. Total # of deciduous/ “baby” teeth = **20** and most children have all by **30 months** of age.
-List a differential diagnosis of delay in tooth eruption: *(taken from the PIR article)*

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

6. List the 7 types of tooth injury:

- Concussion
- Subluxation
- Lateral Luxation
- Intrusion
- Extrusion
- Avulsion
- Fracture

Oral Health Cases

Case 1

You are seeing siblings in clinic for well checks. Mom is concerned because her 12 month old doesn't have any teeth. She asks you, "How many teeth should she have?" Since she doesn't have any teeth, mom asks if she still needs to be doing any kind of dental hygiene.

Mom doesn't have any specific concerns about her healthy 2.5 year old. However, you notice that she has a pacifier in her mouth. Mom tried to schedule an initial visit with her own dentist, but was told that their clinic didn't see kids "less than age 3 years." When asked about teeth brushing, mom laughs and states "Ha! She won't let me brush her teeth. She has to do it herself and just chews on the brush."

What other historical questions would you ask regarding the girls' dental health?

- **See AAP Risk Assessment Tool**
- For the 12 month old:
 - Prematurity? Any other significant medical issues? Infants born prematurely may have tooth eruption at a delayed chronologic age compared to term infants (however, eruption occurs at the same post-conceptual age)
 - Feeding habits? (Bottle or breast, feeding throughout the night? Sippy cup introduction?)
 - Diet?
 - Any oral care?
 - Fluoride exposure?
- For the 2.5 year old:
 - Feeding/Diet habits? (Sippy/straw cup or regular? What is she drinking? Sugary food intake?)
 - Oral care? Is mom using toothpaste?
 - Fluoride exposure?
- Mom's oral health status?
 - *Streptococcus mutans* is strongly associated with dental caries → adheres to enamel by creating plaque and produces an acidic environment in which it can thrive
 - Plaque concentrates dietary sugar which *s.mutans* can ferment, creating lactic acid. This decreases local pH and causes demineralization of enamel. *S. mutans* thrives in the acidic environment, causing a shift from benign to aciduric flora.
 - Maternal oral flora is very closely associated with infant oral flora. Primary prevention (optimizing maternal oral health; avoiding sharing utensils, cleaning pacifiers in mom's mouth, etc) can decrease or delay infant colonization with aciduric oral flora.

Mom mentions that the family lives in the District, and that she would "never let [her] children drink the tap water." She tells you that the family "only drinks Evian."

What guidance would you provide for the 2.5 year-old child? For the 12 month-old?

- Discuss that bottled water does not contain adequate amounts of fluoride. Recommend switch to tap water, or if mom insists on bottled water, nursery water that is fluoridated.

- Consider all sources of fluoride—water, diet, toothpaste (smear until kids can reliably spit, then pea sized amount. There is controversy about when to start fluoridated toothpaste. Some advocate not until kids can spit it out, others would start a smear as soon as tooth brushing started)
- Discuss fluoride supplementation recommendations—would you start fluoride liquid/tabs on these girls (if mom tells you that she will only drink Evian)? **This is controversial in the <6 year old population. Some would advocate only if kids are “high risk.” The quality of the evidence to recommend supplementation in kids <6 years is only II-3 and the strength of the recommendation is class C.**
- Risk vs. benefit discussion: balancing prevention of caries with fluorosis→ hypomineralization that results in a range of visually detectable enamel opacity.
 - Risk of fluorosis limited to kids <8 years, as enamel is not susceptible after preeruptive maturation is complete.
 - Most sensitive periods for maxillary central incisors are 15-24 months for boys and 21-30 months for girls (transition and early maturation stages of enamel development)
- No bottles in bed, if still frequently nursing, attempt to clean gums after each feed. Limit sugary food/juice intake.
- Start routine oral care on the 12 month old, and schedule initial dental visits for both kids.

Mom understands your guidance but wonders where she can find a pediatric dentist. **What do you tell her?**

- Refer to power point on “Pediatric Dental Health Coverage”

Mom notes during the interview that the 2.5 year old “really likes juice”. Although she reassures you that it’s “100% juice”, she is unsure about how much juice is healthy for her daughter.

What would you recommend?

- No more than 4-6 oz per day. Review the role of sugary foods in the pathogenesis of dental caries

Case 2

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 (ie, how long ago did it occur)
- Any other injuries, particularly head injuries
- Primary versus permanent teeth

What should your physical examination focus on?

- Thorough neurologic exam
- Thorough dental exam → checking for missing, loose, and/or displaced teeth, fractures of teeth, pain, ability to open/close and laterally deviate jaw

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 do you do now?

- Likely lateral luxation injury of the tooth → risk for pulpal necrosis and root resorption
- Jaw tenderness and difficulty opening his mouth is very concerning for a possible fracture. Would send him to the ER for films/dental consult.

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

- This is a dental emergency!
- First try to locate the tooth—if unable to do so, do NOT assume that it was lost on the field (could be swallowed, aspirated, intruded into the alveolar bone)
- If you have the tooth, carefully rinse it off with saline or milk → gently re-implant, the sooner the better (at least within 20 minutes, best if within 5)
- If unable to re-implant, transport the tooth in tooth storage solution, warm milk, saline or saliva NOT water

If this was a baby tooth—do NOT re-implant

Oral Health Board Review

1. A 20-month old boy is seen for routine well child care. Physical exam reveals caries involving the maxillary incisors. Which one of the following is most likely to have contributed to this condition?

- (A) The use of both fluoride drops and fluoride toothpaste simultaneously, which has caused fluorosis.
- (B) Falling asleep with a water-filled bottle in the mouth
- (C) Falling asleep while breastfeeding**
- (D) Oral colonization with *Staphylococcus aureus*
- (E) Living in an area in which tap water contains <0.2 ppm fluoride

Because of the patient's age and involvement of the maxillary incisors, this patient likely has nursing or bottle caries. Nursing or bottle caries are found in 3-6% of children and are associated with falling asleep with a bottle or nipple in the mouth. Any liquid other than water can serve as a substrate for infection including breast milk. *Streptococcus mutans* is the most common bacterial agent. Those who live in areas of low fluoride (<0.3ppm) are at higher risk for caries. Excess fluoride may cause cosmetic abnormalities to the enamel, but the risk of caries is not increased.

2. 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 of the following 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 the 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.

3. A 7-month-old boy who is formula-fed presents to your clinic. The parents ask you how much fluoride should be in the water he drinks. Which of the following would be your reply?

- (A) None
- (B) At least 0.3 ppm**
- (C) At least 0.6 ppm
- (D) At least 1 ppm
- (E) At least 2 ppm

Fluoride plays a major role in the prevention of dental caries. The combination of the fluoride ion with tooth enamel increases resistance of the tooth to *Streptococcus mutans*. Fluoride supplementation is indicated in this age group if the water supply contains less than 0.3 ppm of fluoride. Some household water purification systems filter out fluoride; therefore, a history regarding these systems should be elicited. Fluoride is best administered at bedtime because taking the supplementation with food decreases its absorption.