Common Pediatric Dental Dilemmas

Linda S. Nield, James P. Stenger and Deepak Kamat

Clin Pediatr (Phila) 2008; 47; 99 originally published online Aug 31, 2007;
DOI: 10.1177/0009922807305810

Clinical Pediatrics
Volume 47 Number 2
March 2008 99-105

10.1177/0009922807305810
http://clp.sagepub.com
hosted at
http://online.sagepub.com

Common Pediatric Dental Dilemmas

Linda S. Nield MD[1], James P. Stenger, DDS, MSD,[2,3] and Deepak Kamat MD[3]

Keywords: oral health; dentist; teething; caries; malocclusion; delayed dentition

The American Academy of Pediatric Dentistry (AAPD)[1] recommends that all children have an oral evaluation within 6 months of the eruption of the first tooth and have an established dental home by 1 year of age. The pediatrician has a crucial role in the establishment of a dental home as advocated by the American Academy of Pediatrics.[2] A systematic literature review by Bader et al[3] found that children referred to a dentist by a primary care provider were more likely to visit a dentist than children who were not referred.

Although a pediatric dentist is the ideal resource for a parent who has a concern about their child's teeth, the pediatrician is often the first medical professional contacted for dental advice. The pediatrician should have a basic knowledge about dental health because many general dentists are uncomfortable with caring for children in the first few years of life, and there are only about 4000 pediatric dentists in the United States.[4] The appreciation of oral health as an integral part of the overall health of the child and the need for physicians to promote good oral health were core principles discussed at an international forum of dental experts in 2005.[5]

In addition to causing pain and cosmetic concerns, untreated dental abnormalities can lead to lifelong oral health problems. Dental issues that are often initially recognized or addressed in the general pediatric clinic are teething, delayed and ectopic dentition, caries, and malocclusion. The basics of these common pediatric dental dilemmas are reviewed here for the primary care pediatrician.

From [1]West Virginia University School of Medicine, Morgantown, West Virginia; [2]Children's Hospital of Michigan; and [3]Wayne State University, Detroit, Michigan.

Address correspondence to: Deepak Kamat MD, The Carman and Ann Adams Department of Pediatrics, Children's Hospital of Michigan, 3901 Beaubien Blvd, Detroit, MI; e-mail: dkamat@dmc.org.

Normal Tooth Development

Tooth development begins as early as the sixth week of fetal life when a tooth bud forms from the primitive ectodermal-lined oral cavity.[6] At about the fifth fetal month, dentinogenesis or the production of dentin begins. This lays the foundation for enamel formation, then calcification or hardening of the tooth occurs. Primary tooth formation, therefore, is an ongoing process from about the sixth week in utero through early childhood, until the root formation of the particular tooth is completed 2 to 3 years after the tooth erupts. Throughout this time frame, any oral or systemic health crises (ie, nutritional deficiencies, underlying syndromes, or systemic illness) in the fetus or the child may adversely affect tooth development.

The first primary tooth typically erupts between 5 and 8 months postnatally.[7] The mandibular central incisors usually erupt first, and by 30 months of age, the average child will have all 20 primary teeth in place. Eruption cysts, characterized as a bluish fluid-filled lesion around an erupting tooth, may appear a few weeks before the new tooth actually emerges. Usually asymptomatic, these cysts concern parents because of their appearance and the subsequent bleeding that occurs when the tooth breaks through the gingiva. The last primary teeth to erupt, between age 20 and 30 months, are the second maxillary and mandibular molars. Although almost all healthy children will experience the eruption of all of

their primary teeth from approximately age 5 months to 3 years, some children are born with teeth (natal teeth), and the rare child may not have the first tooth erupt until the beginning of the second year of life.

Natal teeth are an interesting finding, and Leung[8] reported an incidence rate of approximately 1 in 3000. Term newborns are most commonly affected, but premature newborns can also have natal teeth. Sureshkumar and McAulay[9] describe the finding in a neonate born at 24 weeks' estimated gestational age.

Some genetic syndromes that are frequently associated with natal teeth include Sotos syndrome, chondroectodermal dysplasia, and Hallermann-Streiff syndrome. To determine the appropriate management, all natal teeth should be examined by a dentist, who will likely order a dental radiograph to determine if the tooth is supernumerary. Although nearly all natal teeth are due to the premature eruption of normal teeth, a small percentage of them are supernumerary.[8]

As Leung and Robson[10] emphasize in their review, natal teeth may have a normal appearance but may be abnormal in structure and function, with poor root formation and excessive mobility. Teeth that are highly mobile or supernumerary require extraction.[9,10] Although the exact risk of an infant aspirating a loose natal tooth is unknown, it is a distinct possibility. The tooth may also cause ulceration of the child's tongue and oral mucosa or the mother's nipple during nursing.

At age 6 to 7 years, the first primary teeth will exfoliate and the permanent adult teeth will start to erupt. By age 7, most children will have a mix of primary and permanent teeth (mixed dentition). The last primary teeth exfoliate and the last permanent teeth, with the exception of the third molars, typically erupt by age 13 to 14. The third molars may erupt during the second or third decade of life.

Teething

"Teething" is a term that refers to the process of tooth eruption. Parents and a substantial minority of health care professionals (pharmacists, general practitioners, pediatricians, dentists and nurses) often believe that teething is associated with several symptoms and predisposes the child to other medical conditions such as upper respiratory tract infection and otitis media.[11] Studies are available that support and refute the association of certain symptoms with teething. Although temporal associations between teething and some symptoms have been reported, it must be kept in mind that this does not prove a cause-and-effect phenomenon.

A prospective cohort study of 125 well children with 475 tooth eruptions by Macknin et al[12] found that increased biting, drooling, gum rubbing, sucking, irritability, wakefulness, ear-rubbing, facial rash, decreased appetite for solid foods, and mild temperature elevations (less than 102°F) were all statistically associated with teething. The teething period consisted of an 8-day window that included 4 days before tooth emergence, 1 day of emergence, and 3 days after emergence. The symptoms not significantly associated with teething included congestion, sleep disturbance, vomiting, diarrhea, decreased appetite for liquids, cough, nonfacial rashes, and temperature greater than 102°F.

In contrast, a prospective cohort study by Wake et al[13] of 21 children with 90 erupted teeth found no statistical association between fever and tooth eruption when comparing tooth-days (the 5 days leading up to and including the eruption day) with non-tooth-days (those days which were more than 28 days clear of any tooth eruption). Other symptoms not statistically associated with teething included mood disturbance, drooling, "strong" urine, and rashes. Parents, but not the study's child care staff, reported looser stools on surrounding days of teeth emerging. Wake et al[13] suggest that teething undeservedly serves as the "scapegoat" explanation for many unwelcome physical discomforts and symptoms often experienced by children aged 6 to 24 months. Although there is some discrepancy of which symptoms accompany teething, the general consensus is that teething should not be the sole diagnosis in a child who appears toxic or who has a significant fever.

To diagnose teething, the gingiva should be examined and palpated for evidence of tooth eruption, while excluding other potential underlying causes for the child's symptoms. Discomfort of varying degrees is a likely adverse effect of teething and can be combated by the administration of over-the-counter topical or oral analgesics. Oral ibuprofen or acetaminophen and topical anesthetics (ie, benzocaine gel) are generally safe if not misused but are of questionable efficacy in relieving teething symptoms. The short-lived numbing effect of benzocaine may soothe some children, but it can also decrease

the gag reflex and produce an irritating oral sensation in other children.

Parents must be warned that over-the-counter teething products have active ingredients and overzealous use of benzocaine-containing teething gel has been associated with the development of methemoglobinemia in children.[14,15] Wilson and Mason[16] describe the case of a 10-month-old child in the United Kingdom with a severe oral chemical burn due to misuse of a topical salicylate-containing teething gel. As long as they are not a choking hazard, allowing the child to chew or suck on cold teething rings or foods that apply pressure to the affected area can soothe or distract the child from the pain. Parents should also be warned against putting frozen items in the child's mouth owing to the risk of cold injury.

Table 1. Some Conditions Associated With Delayed Dentition

Aarskog syndrome
Apert syndrome
Albright osteodystrophy
Cleidocranial dysostosis
Dubowitz syndrome
Ectodermal dysplasia
Human immunodeficiency virus infection
Hypoparathyroidism
Hypopituitarism
Hypothyroidism
Incontinentia pigmenti
Increasing birth order
Osteogenesis imperfecta type I
Prematurity
Progeria
Rickets
Trisomy 21

Delayed Tooth Eruption

Eruption of a particular tooth is considered delayed if the age at eruption is greater than 2 standard deviations from the mean expected eruption time for that particular tooth, according to 1 definition.[17] Lack of any primary teeth erupting by age 12 months infrequently will occur in the otherwise healthy child; however, it is reasonable to consider this child as having delayed dentition. It is particularly important for the child with no teeth by age 1 year to have an established dental home so the dentist will be involved with the subsequent evaluation and monitoring of this condition.

Both local and systemic factors can lead to delayed dental eruption.[17,18] A local factor usually affects only 1 tooth, whereas a systemic condition affects many if not all of the teeth. Local conditions in the mouth that obstruct the emergence of a tooth include oral scars from trauma, supernumerary teeth, gingival hyperplasia, and tumors.[17] Oral clefts are another local entity associated with delayed tooth eruption. The main categories of systemic conditions (Table 1) associated with late eruption of the primary teeth include genetic syndromes or a familial trait, endocrine disorders (ie, hypothyroidism, hypoparathyroidism, hypopituitarism), complications of medical interventions (chemotherapy, radiation), and nutritional deficiencies (ie, rickets). At least 50 genetic disorders have been reportedly associated with delayed tooth eruption, as listed in the review by Suri et al.[17]

Prematurity, increasing birth number, and infection with human immunodeficiency virus have also been reportedly associated with delayed tooth eruption.[18] Viscardi et al[19] reported that most of their study patients born at less than 36 weeks' gestation with a birth weight of less than 2.5 kg had their first tooth erupt when they were older than age 10 months.

Ethnicity may also be a factor in timing of tooth eruption; for example, Al-Jasser and Bello's study[20] suggests that Saudi children experience primary tooth eruption slightly delayed compared with the norms stated earlier for Caucasian children, but the order in which the particular teeth erupt is the same. The mandibular central incisors were the first to erupt in Saudi children at a mean age of 8.5 months.

Congenital absence of 1 or more primary teeth is quite rare (<0.9% prevalence rate) compared with the prevalence of congenitally missing permanent teeth (about 3%-6%), which is often a familial trait.[21] Fekonja[22] reported a prevalence of 11.3% of 1 to 6 missing teeth in a sample of orthodontically treated children, excluding third molars. Congenital absence of all or most of the teeth is extremely rare, but can occur in syndromes such as ectodermal dysplasia.[22]

The child with delayed dentition deserves a careful evaluation and referral to the pediatric dentist. The medical history and physical examination will provide clues to the underlying diagnosis. Family history of variations in tooth eruption patterns

should be documented, along with inherited conditions. History of prematurity, poor nutrition, and any systemic symptoms should be noted. The physical examination should focus on the presence of oral pathology, dysmorphic features, bony abnormalities, growth disturbances, and other findings indicative of an endocrinopathy or genetic disorder. The mouth should be inspected for any soft tissue pathology and the alveolar ridges carefully palpated to ensure normal dental arch form. Laboratory studies should be obtained on a case-by-case basis and guided by the suspected underlying systemic illness (ie, thyroid-stimulating hormone and thyroxine level in suspected hypothyroidism). If not already done so, children with oral clefts should be followed up by a multidisciplinary team to address the dental disturbances and other complications associated with these defects.

The work-up for delayed dentition will include an oral examination for evaluation of any oral pathology and assessment of tooth development, and may include localized radiography.[17] A panoramic image may be delayed until a cooperative age. If there is generalized delayed tooth eruption, treatment consists of observation and diagnosis and management of any underlying systemic illness. Children with severe abnormal tooth development, as occurs with ectodermal dysplasia, will require consultation with other oral medicine and dental experts, such as an orthodontist, to determine appropriate management, which may even include the use of dental implants.[23]

Caries

The dental dilemma of childhood caries is a very large topic unto itself, and a brief overview is presented here. Recent surveillance in the United States revealed that 41% of children aged 2 to 11 years had dental caries in their primary teeth.[24] About one fifth of that same age group had untreated tooth decay, and 14% of children aged 6 to 19 years had untreated tooth decay in their permanent teeth. By the age 20 years or older, 8% of the population had lost all of their natural teeth. There are disparities in the distribution of dental disease in the United States: early childhood caries are more prevalent in low-income and minority children.[25]

Caries develop as a result of the interplay of several factors, including diet, the composition of oral microflora, an underlying increased host susceptibility,

Figure 1. Initial flat surface cavitation from progressive penetrating demineralization.

and social, cultural, and behavioral circumstances. Lower maternal education level, low socioeconomic status, and consuming a diet high in sugar have all been associated with the development of caries.[26]

The bacteria *Streptococcus mutans* plays a primary role in the development of early childhood caries.[26] The acidic metabolites produced by the bacterial breakdown of sucrose and other carbohydrates in plaque, the sticky biofilm-like substance, adhere to the tooth leading to demineralization (Figure 1). Demineralization is further propagated by further influx of more bacteria to the affected area. Calcium, phosphate, and carbonate are leached from the tooth in the process of demineralization.

Vertical colonization of *S mutans* from mother to child in the first 2 years of life is considered an important factor in the caries-forming process.[27] Factors reportedly associated with *S mutans* colonization by Wan et al[27] include consumption of sweetened fluids during bedtime, a high-sugar diet and frequent snacking, the practice of sharing foods with adults, and high maternal *S mutans* levels. Nursing bottle caries result when a sugary beverage is consumed throughout the night, allowing the continued adherence of the sugar byproduct to the teeth surfaces. Sohn et al[28] found that high consumption of carbonated soft drinks by young children is a risk indicator for dental caries.

The definitive diagnosis of caries requires the expertise of the dentist; however, Bader and colleagues report that, after 4 to 5 hours of training, physicians were able to identify caries as well as dentists were.[3] At well child visits, the pediatrician should inspect the teeth during the oral examination. Areas of tooth demineralization appear as

Figure 2. Demineralized enamel surface with progressively deepening lesion. Full cavitated exposure of underlying dentin.

white, chalky spots ("white spot lesions") and are highly susceptible to further decay.[4] White spot lesions or other discolorations should be noted (Figure 2). Treatment of caries includes restorative procedures at the discretion of the dentist.

Along with the dentist, the pediatrician has a very important role in the prevention of dental decay. Good dental hygiene measures (Table 2) can be touted from the newborn visit onward.

Fluoride use is considered the most important tool in preventing and controlling caries[24] and is supported by many major US dental and health associations,[2,24,29,30] either through the use of fluoridated community water supplies or prescribed oral preparations. Fluoride prevents caries by reducing tooth enamel solubility, reducing the effects of plaque-forming pathogens, and promoting remineralization of demineralized areas.[31] The child's level of fluoride exposure should be assessed, and if inadequate, fluoride supplements should be prescribed by the dentist or the pediatrician. All possible sources of fluoride (foods, toothpastes, rinses, other water supplies, or ingested products) should be taken into consideration for each particular child.

In general, fluoride should not be prescribed to children who live in fluoridated areas and generally is not recommended for breastfed infants in fluoridated areas, especially if supplemented with powdered formula reconstituted with tap water.[30] The US Centers for Disease Control and Prevention recommends fluoride supplementation for children at high risk of caries who live in an area with low fluoride content in the drinking water. The AAPD Guideline on Fluoride Therapy[29] recommends that fluoride supplements should be considered for all children older than 6 months living in areas with a fluoride content of less than 0.6 parts per million (ppm). The basics of the fluoride supplementation schedule provided by the AAPD are described in Table 3.[29]

Table 2. Pediatrician's Role in Promoting Good Oral Health

Encourage the establishment of a dental home by age 12 months
Inquire about caries risk factors (diet, maternal history, fluoride exposure)
Include inspection of teeth as part of physical examination
Encourage meticulous dental hygiene:
• Wipe infant's teeth with brush or washcloth at first sign of tooth eruption
• Stop bedtime bottles with sweet liquids
• Discourage the practice of adults sharing food or eating utensils with infants
• Emphasize the importance of daily tooth brushing and flossing
• Encourage parent's supervision of brushing and flossing until child has mastered these tasks
• Limit sugar consumption and frequent snacking
If determined that fluoride exposure is inadequate, prescribe fluoride supplements
Suggest daily maternal chewing of xylitol gum
Recommend orthodontic evaluation at age 7 years

Despite the approval of the many professional medical and dental associations, fluoride supplementation of community water supplies and individual patients is not advocated by all due to potential serious side effects. Long-term ingestion of too much fluoride can cause dental fluorosis, which is staining and disruption of the tooth enamel. Skeletal fluorosis is also a potential complication in which excess fluoride is stored in bones and joints, leading to musculoskeletal abnormalities and pain.[31] An acute ingestion of a large amount of fluoride can cause nausea and vomiting, and if the ingestion is great enough, seizures and arrhythmias can occur. In any case, to ensure the patient's safety, fluoride supplementation should not be prescribed until a thorough fluoride-exposure history is obtained.

Other caries prevention measures are also available. Maternal consumption of xylitol-containing mints or chewing gum several times per day has been associated with decreased caries in the offspring.[32,33] Xylitol is a sugar substitute that inhibits the growth of *S mutans*.[34] Dental sealants or fluoride varnish (applied by the dentist), aggressive dental hygiene practices, and a diet low in sugar and snacking should also be encouraged.

Table 3. Fluoride Supplementation

Age	Fluoride Dose
<6 months	Not recommended in this age group for any FWC
6 months to 3 years	0.25 mg of fluoride only if FWC < 0.3 ppm Do not supplement if FWC ≥ 0.3 ppm
3 years to 6 years	0.50 mg if FWC <0.3 ppm 0.25 mg if FWC = 0.3-0.6 ppm Do not supplement if FWC > 0.6 ppm
6 years to ≥16 years	1.00 mg if FWC <0.3 ppm 0.50 mg if FWC = 0.3-0.6 ppm Do not supplement if FWC > 0.6 ppm

Note: FWC = fluoride water content; ppm = parts per million.
Source: Adapted from American Academy of Pediatric Dentistry Guideline on Fluoride Therapy.[29]

Malocclusion

Malocclusion refers to any teeth and jaw malalignment that leads to cosmetic concerns or oral dysfunction. Anterior and posterior crossbites, open bites, dental crowding or protrusions, ectopic tooth eruptions, supernumerary or missing teeth, protrusive or retrusive jaws, and narrow maxillae are some of the manifestations of malocclusions.[35,36] Malocclusion is either inherited or acquired. Genetic syndromes such as Down syndrome may be associated with irregular placement of teeth and dental crowding. Acquired malocclusions may result from thumb, finger and pacifier sucking, obligate mouth breathing, dental disease or trauma, dysfunctional swallowing, and malnutrition.

Children with the habit of nonnutritive sucking of digits or pacifiers that continued for 48 months or more produced the greatest changes in dental arches and occlusal characteristics in the primary teeth.[37] Those children with sucking habits ceasing at 24 to 26 months also displayed significant dental changes in comparison with children whose habit ceased at 12 months. It is unknown if the changes that occur in primary dentition persist, but it is thought that some do persist to some extent.[37]

Definitive diagnosis of malocclusion requires the expertise of a dentist or an orthodontist. Obvious malalignments or displaced teeth can be discovered on inspection of the teeth in the pediatrician's office, but more subtle abnormalities may not be appreciated by the nondental health professional. Photographs of various types of malocclusions are available at the American Association of Orthodontics (AAO) Web site (www.braces.org).[38] Treatment of the particular malocclusion will be decided by the orthodontist on a case-by-case basis. The trend has been to promote earlier evaluation and treatment, which my decrease the length and difficulty of definitive orthodontic correction.

The AAO[35] recommends that all children should be examined by an orthodontist at age 7 years. The AAO recommends this age because by 7 years old, the first permanent molars have erupted and the posterior occlusion is established, incisors have begun to erupt, and dental crowding and bite and jaw disturbances can be detected. The structural consequences of past or continued sucking habits can also be assessed and addressed at this time. It would be reasonable to refer any aged child to an orthodontist if the pediatrician suspects tooth or jaw malalignment and is unsure of its significance

Conclusion

The pediatrician has an obligation to have a basic knowledge of common dental dilemmas. Good dental health contributes to the overall good health of the child. Establishment of a dental home, promotion of meticulous oral hygiene, and early referral and treatment of potential dental abnormalities may prevent lifelong painful or disfiguring conditions.

References

1. American Academy of Pediatric Dentistry. Council on Clinical Affairs. *Policy on the Dental Home. Oral Health Policies. Reference Manual 2005-2006*. Adopted 2001, Revised 2004. Available at: http://www.aapd.org/media/Policies_Guidelines/P_DentalHome.pdf. Accessed on January 27, 2007.
2. American Academy of Pediatrics. Section of Pediatric Dentistry Policy Statement. Oral health risk assessment and establishment of a dental home. *Pediatrics.* 2003;111:1113-1116.
3. Bader JD, Rozier RG, Lohr KN, Frame PS. Physicians' roles in preventing dental caries in preschool children—a summary of the evidence for the US Preventive Services Task Force. *Am J Prev Med.* 2004;26;315-325.
4. Brunk D. Assess need for fluoride varnish before age 1. *Pediatr News.* 2006;40:41.
5. Brown A, Lowe E, Zimmerman B, Crall J, Foley M, Nehring M. Preventing early childhood caries: lessons from the field. *Pediatr Dent.* 2006;26:553-560.

6. Larsen PE. Odontogenesis and odontogenic cysts and tumors. In: Cummings CW, Flint PW, Haughey BH, et al, eds. *Otolaryngology: Head and Neck Surgery.* 4th ed. Philadelphia, Pa: Mosby, Inc; 2005:1511-1515.
7. American Dental Association. *Tooth Eruption Charts*. Available at: http://www.ada.org/public/topics/tooth_eruption.asp#additional. Accessed January 21, 2007.
8. Leung AK. Natal teeth. *J Am Dent Assoc*. 1986;140:249-251.
9. Sureshkumar R, McAulay AH. Natal and neonatal teeth. *Arch Dis Child Fetal Neonatal Ed*. 2002;87:F227.
10. Leung AK, Robson WL. Natal teeth: a review. *J Natl Med Assoc*. 2006;98:226-228.
11. Wake M, Hesketh K. Teething symptoms: cross-sectional survey of five groups of child health professionals. *BMJ*. 2002;325:814.
12. Macknin ML, Piedmonte M, Jacobs J, Skibinski C. Symptoms associated with infant teething: a prospective study. *Pediatrics*. 2000;105;747-752.
13. Wake M, Hesketh K, Lucas J. Teething and tooth eruption in infants: a cohort study. *Pediatrics*. 2000;106:1374-1379.
14. Townes PL, Geertsma MA, White MR. Benzocaine-induced methemoglobinemia. *Am J Dis Child*. 1977;131:697-698.
15. Balicer RD, Kitai E. Methemoglobinemia caused by topical teething preparation: a case report. *ScientificWorld Journal*. 2004;15:517-520.
16. Wilson PHR, Mason C. The trouble with teething—misdiagnosis and misuse of a topical medicament. *Int J Paediatr Dent*. 2002;12:215-218.
17. Suri L, Gagari E, Vastardis H. Delayed tooth eruption: pathogenesis, diagnosis, and treatment. A literature review. *Am J Orthod Dentofacial Orthop*. 2004;126:432-445.
18. Noffke CE, Chabikuli NJ, Nzima N. Impaired tooth eruption: a review. *SADJ*. 2005;60:422-425.
19. Viscardi RM, Romberg E, Abrams RG. Delayed primary tooth eruption in premature infants: Relationship to neonatal factors. *Pediatr Dent*. 1994;16:23-28.
20. Al Jasser NM, Bello LL. Time of eruption of primary teeth in Saudi children. *J Contemp Dent Pract*. 2003;4:1-7.
21. American Academy of Pediatric Dentistry. Guideline on management of the developing dentition and occlusion in pediatric dentistry. *Reference Manual 2005-2006*. Available at: http://www.aapd.org/media/Policies_Guidelines/G_DevelopDentition.pdf. Accessed January 27, 2007.
22. Fekonja A. Hypodontia in orthodontically treated children. *Eur J Orthod*. 2005;27:457-460.
23. Kramer FJ, Baethge C, Tschernitschek H. Implants in children with ectodermal dysplasia: a case report and literature review. *Clin Oral Impl Res*. 2007;18:140-146.
24. Beltran-Aguilar ED, Barker LK, Canto MT, et al. Surveillance for dental caries, dental sealants, retention, edentulism, and enamel fluorosis United States, 1998—1994 and 1999—2002. *MMWR Surveill Summ*. 2005;54:1-44.
25. Vargas CM, Crall JJ, Schneider DA. Sociodemographic distribution of pediatric dental caries: NHANES III, 1988-1994. *J Am Dent Assoc*. 1998;129:1229-1238.
26. American Academy of Pediatric Dentistry. Guideline on infant oral health. *Reference Manual 2005-2006*. Available at: http://aapd.org. Accessed January 27, 2007.
27. Wan AK, Seow WK, Purdie DM, Bird PS, Walsh LJ, Tudehope DI. A longitudinal study of *Streptococcus mutans* colonization in children after tooth eruption. *J Dent Res*. 2003;82:504-508.
28. Sohn W, Burt BA, Sowers MR. Carbonated soft drinks and dental caries in the primary dentition. *J Dent Res*. 2006;85:262-266.
29. American Academy of Pediatric Dentistry. Guideline on fluoride therapy. *Reference Manual 2005-2006*. Available at: http://aapd.org/media/policies_guidelines/g_fluoridetherapy.pdf. Accessed January 27, 2007.
30. American Dietetic Association. Position of the American Dietetic Association: the impact of fluoride on health. *J Am Dent Assoc*. 2005;105:1620-1628.
31. Ananian A, Solomowitz BH, Dowrich IA. Fluoride. A controversy revisited. *N Y State Dent J*. 2006;72:14-18.
32. Thorild I, Lindau B, Twetman S. Caries in 4-year-old children after maternal chewing of gums containing combinations of xylitol, sorbitol, chlorhexidine, and fluoride. *Eur Arch Paediatr Dent*. 2006;7:241-245.
33. Gomez SS, Weber AA. Effectiveness of a caries preventive program in pregnant women and new mothers on their offspring. *Int J Paediatr Dent*. 2001;11:117-122.
34. Miyasawa-Hori H, Aizawa S, Takahashi N, et al. Difference in the xylitol sensitivity of acid production among *Streptococcus mutans* strains and the biochemical mechanism. *Oral Microbiol Immunol*. 2006;21:201-205.
35. American Association of Orthodontists. *American Association of Orthodontists Recommendation for Orthodontic Check-Ups No Later than Age 7*. Available at: http://www.braces.org/healthcareprofessionals/dentists/upload/Prolems_to_Watch_for_in_7YrOlds_FINAL.pdf. Accessed January 21, 2007.
36. Nelson G. Orthodontic treatment in the mixed dentition. *Orthod Dialogue*. 1997;9:1-3.
37. Warren JJ, Bishara SE, Steinbock KL, et al. Effects of oral habits' duration on dental characteristics in the primary dentition. *J Am Dental Assoc*. 2001;132:1685-1693.
38. American Association of Orthodontists. *Problems to Watch for in Seven Year Olds*. Available at: http://www.braces.org/healthcareprofessionals/dentists/upload/Prolems_to_Watch_for_in_7YrOlds_FINAL.pdf. Accessed on January 21, 2007.