This draft does not constitute an official AAPD health oral policy or clinical guideline until approval by the General Assembly. Circulation is limited to AAPD members.

Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies

Originating Group
A collaborative effort of the American Academy of Pediatric Dentistry and the American Academy of Pediatrics

Review Council
Council on Clinical Affairs

Adopted
1978

Revised
1993, 1996, 2001, 2003, 2007, 2008

Purpose

The American Academy of Pediatric Dentistry (AAPD) recognizes early childhood caries (ECC; formerly termed "nursing bottle caries", "baby bottle tooth decay") as a significant public health problem.[1] The AAPD encourages oral health care providers and caregivers to implement ~~simple~~ preventive practices that can decrease a child's risks of developing this devastating disease.

Methods

This policy revision is based on a review of the current pediatric dental, medical, and public health literature related to ECC, including ~~the~~ proceedings of the 2005 Symposium on the Prevention of Oral Disease in Children and Adolescents, Chicago, Illinois~~1997 Conference on Early Childhood Caries, Bethesda, Md~~.[1] A MEDLINE search was conducted using the terms "early childhood caries", "nursing caries", and "baby bottle caries". ~~The literature includes studies that used sound scientific methodology, were reported in refereed journals, and are accepted by the dental profession as state of the art in caries causes and prevention. The literature on the consequences of ECC is based on both prospective and retrospective clinical studies that followed accepted clinical protocols.~~ Preventive recommendations were based primarily upon review of published studies and proceedings. In cases where the data did not appear sufficient or were inconclusive, recommendations were based upon expert and consensus opinion.

Background

In 1978, the AAPD released "Nursing Bottle Caries", a joint statement with the American Academy of Pediatrics, to address a severe form of caries associated with bottle usage.[2] Initial policy recommendations were limited to feeding habits, concluding that nursing bottle caries could be avoided if bottle feedings were discontinued soon after the first birthday. An early policy revision added ad libitum breastfeeding as a causative factor. Over the next 2 decades, however, recognizing that this distinctive clinical presentation was not consistently associated with poor feeding practices and that caries was an infectious disease, AAPD adopted the term "early childhood caries" to reflect better its multifactoral etiology.

Caries is a common, complex, chronic disease resulting from an imbalance of multiple risk factors and protective factors over time.[3] Fundamentally, ~~C~~caries is biofilm (plaque)-mediated acid demineralization of enamel or dentin. Given time, the interaction of cariogenic

microorganisms and fermentable carbohydrates (sucrose) may induce demineralization, which can progress to loss of tooth structure/cavitation.[4] The disease of ECC ~~is~~ has been defined as "the presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces" in any primary tooth in a child 71 months of age or younger. [2,3,5,6] In children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC). From ages 3 through 5, 1 or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of ≥4 (age 3), ≥5 (age 4), or ≥6 (age 5) surfaces constitutes S-ECC.[4,7]

~~Carious lesions are produced from the interaction of 3 variables: cariogenic microorganisms (mutans streptococci), fermentable carbohydrates (sucrose), and teeth (nonshedding tooth surfaces).[5] Given the proper time, these variables induce incipient carious lesions that continue to progress.[5]~~ Caries is a transmissible infectious disease; understanding the acquisition of cariogenic microbes is necessary to improving preventive strategies. Vertical transmission is the passing of microbes from caregiver to child, and the major reservoir from which infants acquire cariogenic bacteria [eg, mutans streptococci (MS)] is their mother's saliva.[4,8] The success of the transmission and resultant colonization of maternal MS may be related to several factors, including magnitude of the inoculum,[9] frequency of small dose inoculations,[10] and a minimum infective dose.[11] Infants whose mothers have high levels of MS, a result of untreated caries, are at greater risk of acquiring the organism earlier than children whose mothers have low levels.[9] Suppressing maternal reservoirs of MS via dental rehabilitation and antimicrobial treatments can prevent or delay infant inoculation.[12,13] Ideally, these interventions would be initiated in the prenatal period.[14] Horizontal transmission (ie, between members of a family or group such as daycare) of MS also occurs.[8] Eliminating saliva-sharing activities (eg, sharing utensils, orally cleansing a pacifier) may help decrease an infant or toddler's acquisition of cariogenic microbes.

Recent studies have shown that MS can colonize the mouths of predentate infants.[8] Oral cleanings following feedings, if not previously implemented, need to begin with eruption of the first primary tooth.[14] Newly-erupted teeth, because of immature enamel, and teeth with enamel hypoplasia may be at higher risk of developing caries. Current best practice includes recommending twice-daily use of a fluoridated toothpaste for dentate children in optimally fluoridated and fluoride-deficient communities.[15] Therapeutic use of fluoride for children needs to focus on regimens that maximize topical contact, preferably in lower-dose, higher-frequency approaches.[15] Twice-daily use has benefits greater than once-daily brushing.[15] A 'smear' of fluoridated toothpaste (see figure 1) for children less than 2 years of age may decrease risk of fluorosis.[16] A 'pea-size' amount of toothpaste is appropriate for children aged 2 through 5 years.[16-18] Parents should dispense the toothpaste onto a soft, age-appropriate sized toothbrush and perform or assist with toothbrushing of preschool-aged children. To maximize the beneficial effect of fluoride in the toothpaste, rinsing after brushing should be kept to a minimum or eliminated altogether.[16,19]

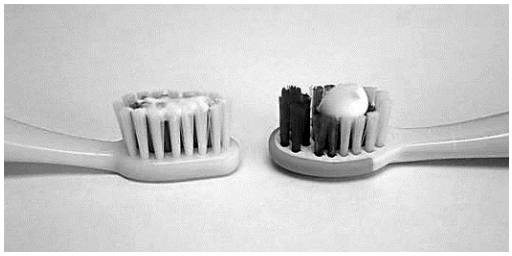

Figure 1

In addition to the establishment of oral flora, infants and young children have other unique caries-risk factors including development of dietary habits and childhood food preferences. High-risk dietary practices appear to be established early, probably by 12 months of age, and are maintained throughout early childhood.[20,21] The role of carbohydrates in caries initiation is unequivocal. Frequent bottle feeding at night, breast-feeding ad libitum, and extended and repetitive use of a no-spill training cup are associated with, but not consistently implicated in, ECC.[22] While ECC may not arise from breast milk alone, breast feeding in combination with other carbohydrates has been found in vitro to be highly cariogenic.[23] Frequent consumption of between-meal snacks and beverages~~liquids~~ containing fermentable carbohydrates (eg, juice, milk, formula, soda) increases the risk of caries due to prolonged contact between sugars in the consumed food or liquid and cariogenic bacteria on the susceptible teeth.[6~~24~~] The American Academy of Pediatrics has recommended children 1-6 years of age consume no more than 4-6 ounces of fruit juice per day, from a cup (ie, not a bottle or covered cup) and as part of a meal or snack.[25] ~~Frequent bottle feeding at night, breast-feeding on demand, and extended and repetitive use of a no-spill training cup are associated with, but not consistently implicated in, ECC.[7]~~

~~The major reservoir from which infants acquire mutans streptococci (MS) is their mother's saliva.[5,8] The success of the transmission and resultant colonization of maternal MS depends largely on the magnitude of the innoculum.[9] Infants and toddlers whose mothers have high levels of MS, a result of untreated caries, are at greater risk of acquiring the organism than children whose mothers have low levels. Consequently, it has been shown that suppressing maternal reservoirs of MS via dental rehabilitation and antimicrobial treatments can prevent or delay infant inoculation.[10,11]~~

Children are at varying levels of risk for developing caries throughout life. Evidence increasingly suggests that to be successful at preventing dental disease, dentists must begin preventive interventions within the first year of life.[26] Consequences of ECC include a higher risk of new carious lesions in both the primary and permanent dentitons,~~[12-17]~~[27-32] hospitalizations and emergency room visits,~~[18-21]~~[33-36] increased treatment costs and time,~~[22,23]~~[37,38] insufficient physical development (especially in height/weight),~~[24,25]~~[39,40] loss of school days and increased days with restricted activity,~~[26-28,]~~[41-43]diminished ability to learn,~~[26,29-32]~~[41,44-47] and diminished oral health-related quality of life.~~[33-36]~~[48-51]

Policy statement

The AAPD recognizes ~~a distinctive pattern of caries, known as ECC~~caries as a common, complex, chronic disease resulting from an imbalance of multiple risk factors and protective factors over time~~, associated with frequent or prolonged consumption of liquids containing fermentable carbohydrates~~. To decrease the risk~~s~~ of developing ECC, a~~this~~ potentially devastating ~~pattern of caries~~infectious disease, the AAPD ~~discourages inappropriate feeding practices of infants and toddlers and~~ encourages ~~appropriate~~ professional and at-home preventive measures including age-appropriate feeding practices that do not contribute to a child's caries risk. These include:

1. Reducing the mother's/primary caregiver's/sibling(s) MS levels (ideally during the prenatal period) to decrease transmission of cariogenic bacteria.
2. Minimizing saliva-sharing activities (eg, sharing utensils) between an infant or toddler and his family/cohorts.
3. Implementing oral hygiene measures no later than the time of eruption of the first

primary tooth.

- If an infant falls asleep while feeding, the teeth should be cleaned before placing the child in bed.
- Toothbrushing of all dentate children should be performed twice daily with a fluoridated toothpaste and a soft, age-appropriate sized toothbrush. Parents should use a 'smear' of toothpaste to brush the teeth of a child less than 2 years of age. For the 2-5 year old, parents should dispense a 'pea-size' amount of toothpaste and perform or assist with their child's toothbrushing.
- Flossing should be initiated when adjacent tooth surfaces can not be cleansed by a toothbrush.

4. Establishing a dental home within 6 months of eruption of the first tooth and no later than 12 months of age to conduct a caries risk assessment and provide parental education including anticipatory guidance for prevention of oral diseases.

5. Avoiding caries-promoting feeding behaviors. In particular:

- Infants should not be put to sleep with a bottle containing fermentable carbohydrates.
- Ad libitum ~~nocturnal~~ breast-feeding should be avoided after the first primary tooth begins to erupt and other dietary carbohydrates are introduced.
- ~~If the infant falls asleep while feeding, the teeth should be cleaned before placing the child in bed.~~
- ~~2.~~ Parents should be encouraged to have infants drink from a cup as they approach their first birthday. Infants should be weaned from the bottle at 12 to 14 months of age.
- ~~3.~~ Repetitive consumption of any liquid containing fermentable carbohydrates from a bottle or no-spill training cup should be avoided.
- Between-meal snacks and prolonged exposures to foods and juice or other beverages containing fermentable carbohydrates should be avoided.

~~4. Oral hygiene measures should be implemented by the time of eruption of the first primary tooth.~~

~~5. A dental home should be established within 6 months of eruption of the first tooth and no later than 12 months of age to conduct a caries risk assessment, educate parents, and provide anticipatory guidance for prevention of dental disease.~~

~~6. An attempt should be made to assess and decrease the mother's/primary caregiver's MS levels to decrease the transmission of cariogenic bacteria and lessen the infant's or child's risk of developing ECC.~~

References

1. ~~Proceedings. Conference on early childhood caries, Bethesda, Md, October 1997. Comm Dent Oral Epidemiol 1998;26(suppl).~~American Academy of Pediatric Dentistry. Symposium of the Prevention of Oral Disease in Children and Adolescents, Chicago, IL, November 11-12, 2005: Conference Papers. Pediatr Dent 2006;28(2):96-198.2. American Academy of Pedodontics and American Academy of Pediatrics. Nursing bottle caries. January, 1978. Chicago, IL.

3. Crall JJ. Rethinking Prevention. Pediatr Dent 2006;28(2):96-101.

4. Loesche WJ. Dental caries: A treatable infection. Grand Haven, Mich: Automated Diagnostic Documentation, Inc; 1993.

5. Kaste LM, Drury TF, Horowitz AM, Beltran E. An evaluation of NHANES III estimates of early childhood caries. J Public Health Dent 1999;59(3):198-200.
~~3~~6. Drury TF, Horowitz AM, Ismail AI, et al. Diagnosing and reporting early childhood caries for research purposes. J Public Health Dent 1999;59(3):192-7.
~~4~~7. Ismail AI, Sohn W. A systematic review of clinical diagnostic criteria of early childhood caries. J Public Health Dent 1999;59(3):171-91.
8. Berkowitz RJ. Mutans streptococci: Acquisition and transmission. Pediatr Dent 2006;28(2): 106-9.
9. Berkowitz RJ, Turner J, Green P. Maternal salivary levels of Streptococcus mutans and primary oral infection in infants. Arch Oral Biol 1981;26(2):147-9.
10. Loesche WJ. Role of Streptococcus mutans in human dental decay. Microbiol Rev 1986;50(4):353-80.
11. Van Houte J, Green DB. Relationship between the concentration of bacteria in saliva and colonization of teeth in humans. Infect Immun 1974;9(4):624-30.
12. Köhler B, Bratthall D, Krasse B. Preventive measures in mothers influence the establishment of the bacterium *Streptococcus mutans* in their infants. Arch Oral Biol 1983;28(3):225-31.
13. Isokangas P, Söderling E, Pienihäkkinen K, Alanen P. Occurrence of dental decay in children after maternal consumption of xylitol chewing gum, a follow-up from 0 to 5 years of age. J Dent Res. 2000;79(11):1885-9.
14. American Academy of Pediatric Dentistry. Guideline on infant oral health care. Pediatr Dent 2008;30(suppl):XX.
15. Adair SM. Evidence-based Use of Fluoride in Contemporary Pediatric Dental Practice. Pediatr Dent 2006;28(2):133-142.
16. Scottish Intercollegiate Guideline Network. Prevention and Management of Dental Decay in the Pre-school Child. A National Guideline #83. November 2005;1-44. http://www.sign.ac.uk/pdf/qrg83.pdf (accessed March 30, 2008)
17. Pang DT, Vann WF Jr. The use of fluoride-containing toothpastes in young children: The scientific evidence for recommending a small quantity. Pediatr Dent 1992;14:384-387.
18. Ramos-Gomez FJ, Crall JJ, Gansky SA, Slayton RL, Featherstone JDB. Caries risk assessment appropriate for the age 1 visit (infants and toddlers). J Calif Dent Assoc 2007;35(10)687-702.
19. Sjögren K, Birkhed D: Factors related to fluoride retention after toothbrushing and possible connection to caries activity. Caries Res 1993;27(6):474-7.
20. Douglass JM. Response to Tinanoff and Palmer: Dietary determinants of dental caries and dietary recommendations for preschool children. J Public Health Dent 2000;60(3):207-9.
21. Kranz S, Smiciklas-Wright H, Francis LA. Diet quality, added sugar, and dietary fiber intake in American preschoolers. Pediatr Dent 2006;28(2)164-71.
22. Reisine S, Douglass JM. Psychosocial and behavioral issues in early childhood caries. Comm Dent Oral Epidem 1998;26(suppl 1):32-44.
23. Erickson PR, Mazhari E. Investigation of the role of human breast milk in caries development. Pediatr Dent 1999;21(2):86-90.
24. Marino R, Bonze K, Scholl T, Anhalt H. Nursing bottle caries: Characteristics of children at risk. Clin Pediatr 1989;28(3):129-31.
25. American Academy of Pediatrics Committee on Nutrition. Policy statement: The use and misuse of fruit juices in pediatrics. Pediatrics 2001;107(5):1210-3. Reaffirmed October, 2006.
26. Lee JY, Bouwens TJ, Savage MF, Vann WF, Examining the Cost-effectiveness of Early Dental Visits. Pediatr Dent 2006;28(2):102-105, discussion 192-8.~~5. Loesche WJ. Dental caries: A~~

~~treatable infection. Grand Haven, Mich: Automated Diagnostic Documentation, Inc; 1993.~~
~~6. Marino R, Bonze K, Scholl T, Anhalt H. Nursing bottle caries: Characteristics of children at risk. Clin Pediatr 1989;28:129-31.~~
~~7. Reisine S, Douglass JM. Psychosocial and behavioral issues in early childhood caries. Comm Dent Oral Epidem 1998;26(suppl 1):32-44.~~
~~8. Berkowitz RJ. Etiology of nursing caries: A microbiologic perspective. J Public Health Dent 1996;56:51-4~~
9. ~~Berkowitz RJ, Turner J, Green P. Maternal salivary levels of Streptococcus mutans and primary oral infection in infants. Arch Oral Biol 1981;26:147-9.~~
~~10. Kohler B, Brathall D, Krasse B. Preventive measures in mothers influence the establishment of Streptococcus mutans in their infants. Arch Oral Biol 1983;28: 225-31.~~
~~11. Isokangas P, Soderling E, Pienihakkinen K, Occurrence of dental decay in children after maternal consumption of xylitol chewing gum, a follow-up from 0 to 5 years of age. J Dent Res. 2000;79:1885-9.~~
~~12~~27. Grindefjord M, Dahllöf G, Modéer T. Caries development in children from 2.5 to 3.5 years of age: A longitudinal study. Caries Res 1995;29(6):449-54.
~~13~~28. O'Sullivan DM, Tinanoff N. The association of early childhood caries patterns with caries incidence in preschool children. J Public Health Dent 1996;56(2):81-3.
~~14~~29. Johnsen DC, Gerstenmaier JH, DiSantis TA, Berkowitz RJ. Susceptibility of nursing-caries children to future approximal molar decay. Pediatr Dent 1986;8(3):168-70.
~~15~~30. Al-Shalan TA, Erickson PR, Hardie NA. Primary incisor decay before age 4 as a risk factor for future dental caries. Pediatr Dent 1997;19(1):37-41.
~~16~~31. Gray MM, Marchment MD, Anderson RJ. The relationship between caries experience in deciduous molars at 5 years and in first permanent molars of the same child at 7 years. Community Dent Health 1991;8(1):3-7.
~~17~~32. Heller KE, Eklund SA, Pittman J, Ismail AA. Associations between dental treatment in the primary and permanent dentitions using insurance claims data. Pediatr Dent 2000;22(6):469-74.
~~18~~33. Sheller B, Williams BJ, Lombardi SM. Diagnosis and treatment of dental caries-related emergencies in a children's hospital. Pediatr Dent 1997;19(8):470-5.
~~19~~34. Majewski RF, Snyder CW, Bernat JE. Dental emergencies presenting to a children's hospital. J Dent Child 1988:55(5):339-42.
~~20~~35. Fleming P, Gregg TA, Saunders ID. Analysis of an emergency dental service provided at a children's hospital. Int J Paediatr Dent 1991;1(1):25-30.
~~21~~36. Schwartz S. A one-year statistical analysis of dental emergencies in a pediatric hospital. J Can Dent Assoc 1994;60(11):959-62, 966-8.
~~22~~37. Griffin SO, Gooch BF, Beltran E, Sutherland JN, Barsley R. Dental services, costs, and factors associated with hospitalization for Medicaid-eligible children, Louisiana 1996-97. J Public Health Dent 2000;60(2):21-7.
~~23~~38. Ramos-Gomez FJ, Huang GF, Masouredis CM, Braham RL. Prevalence and treatment costs of infant caries in Northern California. J Dent Child 1996;63(2):108-12.
~~24~~39. Acs G, Lodolini G, Kaminsky S, Cisneros GJ. Effect of nursing caries on body weight in a pediatric population. Pediatr Dent 1992;14(5):302-5.
~~25~~40. Ayhan H, Suskan E, Yildirim S. The effect of nursing or rampant caries on height, body weight, and head circumference. J Clin Pediatr Dent 1996;20(3):209-12.
~~26~~41. Reisine ST. Dental health and public policy: The social impact of disease. Am J Public Health 1985;75(1):27-30.

~~27~~42. Gift HC, Reisine ST, Larach DC. The social impact of dental problems and visits. Am J Public Health 1992;82(12):1663-8.

~~28~~43. Hollister MC, Weintraub JA. The association of oral status with systemic health, quality of life, and economic productivity. J Dent Educ 1993;57(12):901-12.

~~29~~44. Peterson J, Niessen L, Nana Lopez GM. Texas public school nurses' assessment of children's oral health status. J Sch Health 1999;69(2):69-72.

~~30~~45. Schechter N. The impact of acute and chronic dental pain on child development. J Southeast Soc Pediatr Dent 2000;6:16.

~~31~~46. Ramage S. The impact of dental disease on school performance. J Southeast Soc Pediatr Dent 2000;6:26.

~~32~~47. National Center for Education in Maternal and Child Health. Oral health and learning. Bethesda, Md. National Center for Education in Maternal and Child Health and Georgetown University; 2001.

~~33~~48. Low W, Tan S, Schwartz S. The effect of severe caries on the quality of life in young children. Pediatr Dent 1999;21(6):325-6.

~~34~~49. Acs G, Pretzer S, Foley M, Ng MW. Perceived outcomes and parental satisfaction following dental rehabilitation under general anesthesia. Pediatr Dent 2001;23(5):419-23.

~~35~~50. Thomas CW, Primosch RE. Changes in incremental weight and well-being of children with rampant caries following complete dental rehabilitation. Pediatr Dent 2002;24(2):109-13.

~~36~~51. Filstrup SL, Inglehart MR, Briskie D, daFonseca M, Lawrence L, Wandera A. The effects on early childhood caries (ECC) and restorative treatment of children's oral health-related quality of life (OHRQOL)–The parents'/guardians' and the child's perspective [master's thesis]. Ann Arbor, Mich: The University of Michigan; 2001.