

Protecting All Children's Teeth

Caries



American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



<http://www.aap.org/oralhealth/pact>

Introduction



used with permission from Ian Van Dinther

Caries is an infectious transmissible disease resulting from tooth adherent bacteria that metabolize sugars to produce acid which ultimately demineralize tooth structure and, if left untreated, can progress to a cavity.

Dental caries is the most common chronic disease of childhood and disproportionately affects poor and minority populations.

Early Childhood Caries, or ECC, is the presence of 1 or more decayed, missing (due to caries), or filled tooth surfaces in any primary tooth in a child under the age of 6.

Learner Objectives



used with permission from Ian Van Dinther

Upon completion of this presentation, participants will be able to:

- Define caries and Early Childhood Caries (ECC).
- Name the primary bacteria involved in the caries process.
- Discuss the contribution of carbohydrate metabolism in caries development.
- State the important protective benefits of saliva.
- List risk factors and describe the oral manifestations of ECC.
- Describe the 5 stages of ECC and identify early lesions on physical exam.
- Discuss the impact of ECC on overall health and well-being.
- Recall the 5 major methods of preventing ECC.

Etiology and Pathophysiology

There are 3 requirements for the formation of dental caries:

1. Cariogenic bacteria
2. Sugar
3. Teeth

Because dental caries has a microbial etiology, caries cannot form in the absence of cariogenic bacteria, regardless of sugar intake.



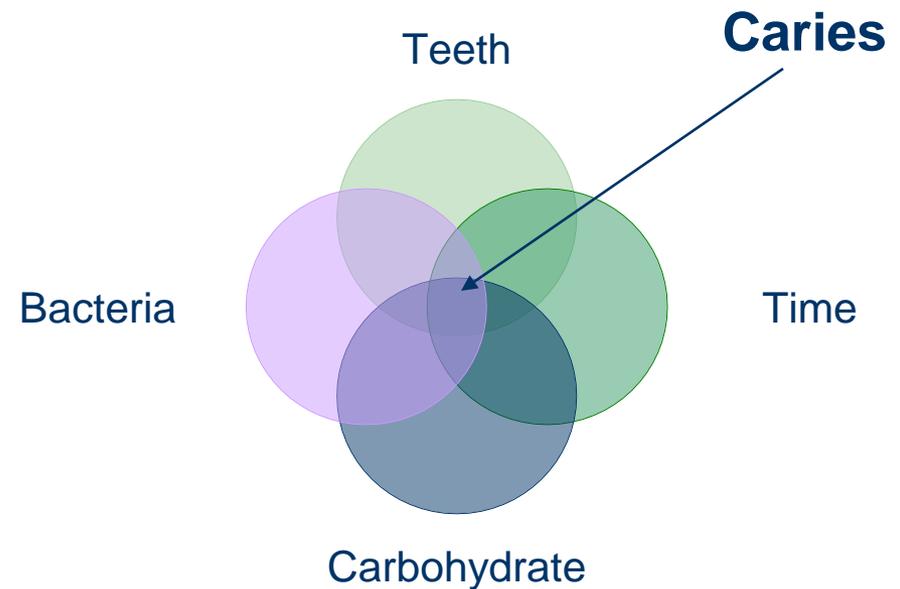
Used with permission from Miller Medical
Illustration & Design

Etiology and Pathophysiology

Bacteria adhere to the tooth surface in a biofilm called dental plaque.

When carbohydrates are consumed, they are metabolized by bacteria and produce acid as a byproduct.

The acid causes demineralization of the tooth enamel over time.



created by AAP Oral Health Staff

Etiology and Pathophysiology, continued

The following factors contribute to demineralization:

- High cariogenic bacterial load
- Frequent feedings
- Poor oral hygiene
- Decreased saliva production

Etiology and Pathophysiology, continued

These factors aid in the remineralization process:

- Saliva
- Good oral hygiene
- A non-cariogenic diet

However, it is possible to reverse the demineralization process before cavitation occurs.



Used with permission from Giusy Romano-Clarke, MD

Bacteria

The primary bacterial species involved in the pathogenesis of caries is *Streptococcus mutans*, but many other bacteria have also been implicated, including *S. sobrinus*, *Actinomyces* sp, and *Lactobacillus* sp.

High levels of cariogenic bacteria are indicative of active caries process and are associated with increased risk of new caries development



Used with permission from Rocio B. Quinonez, DMD, MS, MPH; Associate Professor Department of Pediatric Dentistry, School of Dentistry University of North Carolina

Bacteria, continued

Plaque is composed of salivary proteins that adhere to teeth, as well as bacteria and their byproducts.

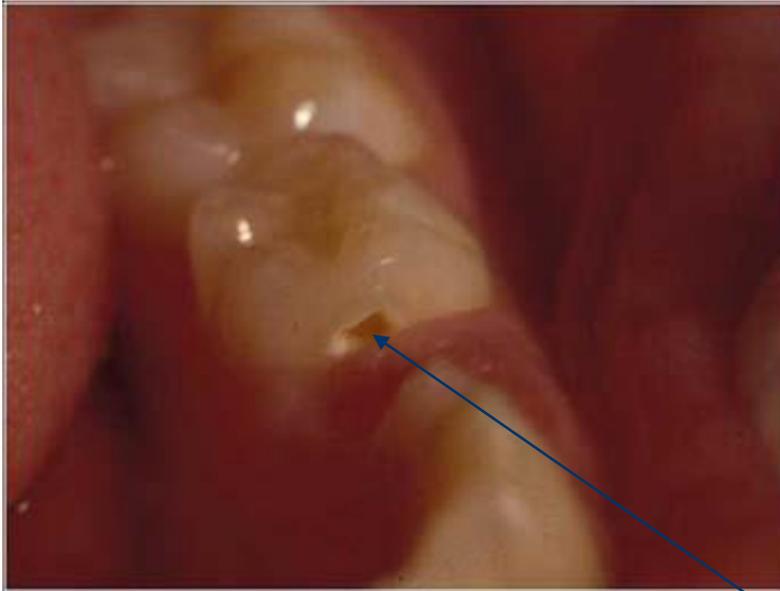
Plaque harbors the bacteria that initiate the demineralization process.

Adequate plaque control can reduce the likelihood of developing dental caries.



Used with permission from Sunnah Kim

S Mutans



Used with permission from Martha Ann Keels, DDS, PhD; Division Head of Duke Pediatric Dentistry, Duke Children's Hospital

S. mutans is concentrated in the pits and fissures of teeth, so the grooved surfaces of the molars are the most common site for caries lesions.

Cavity

S. Mutans, continued

The virulence of *S. mutans* varies by strain. The type of *S. mutans* cannot be modified, but the amount of bacteria can be altered.

These methods can be used to decrease bacteria and minimize caries:

- Brushing with fluoride toothpaste
- Professional dental cleanings
- Exposure to topical fluoride
- Chlorhexidine mouthrinses and *Xylitol* use
- Flossing



Used with permission from Valerie Abbott

S Mutans, continued

S mutans is transmitted from the primary caregiver to infant by saliva.

Transmission rates increase when parents:

- Share utensils or toothbrushes.
- Taste food or drink before serving it.
- “Clean” a dropped pacifier with saliva.
- Allow a child to place fingers into an adult's mouth.



Used with permission from Jamie Zaleski

Sugar



Used with permission from Content Visionary

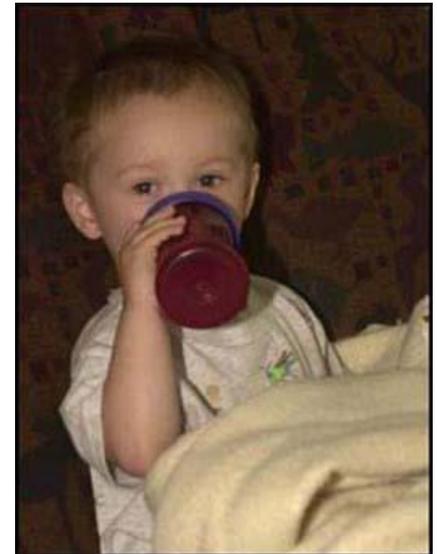
The metabolism of carbohydrates by oral bacteria creates acid that demineralizes enamel.

The risk of demineralization and caries development is directly related to the frequency with which the teeth are exposed to sugar.

Sugar, continued

Caries development is positively associated with the following activities:

- Frequent or prolonged contact of the teeth with sugary substances.
- Consumption of sticky foods.
- Dipping a pacifier in sweeteners like honey or corn syrup.
- Regular use of medications that contain sucrose, including some multi-vitamins.



Used with permission from ANZ Photography

Sugar, continued

Caries risk is reduced when:

Teeth are brushed immediately after eating to remove sticky foods.

Fresh fruit, vegetables, and whole grain snacks are chosen instead of candy or juice.



Enamel

Enamel is a physical barrier to bacterial invasion of the tooth.

Acid produced by bacteria on the teeth demineralizes the enamel.

When the enamel is weakened or less able to remineralize, the risk for caries is increased.

The health and strength of the enamel can be modified by changing health behaviors.



Used with permission from Monica Wind

Dental Sealants

Outside the Early Childhood Caries (ECC) age range, the majority of caries develop on grooved surfaces of teeth—the pits and fissures of the molars.

This is why dental sealants are an effective method of caries prevention.



Used with permission from David A. Clark, MD; Chairman and Professor of Pediatrics at Albany Medical Center

Saliva

Saliva has several important properties that help to protect against the majority of carious lesions:

- Saliva buffers acid.
- Saliva is bacteriostatic.
- Saliva aids in remineralizing the teeth.

Saliva, continued

Decreased saliva production promotes development of caries.

Possible causes of limited saliva production include:

- Systemic diseases
- Salivary gland damage from surgery or radiation therapy
- Medication effects

Saliva, continued

Medications are the most common cause of decreased saliva production in children.

Pediatricians need to be aware of this risk and choose medications carefully.



Used with permission from Joe Martinez

Early Childhood Caries (ECC)



Used with permission from Noel Childers, DDS, MS, PhD; Department of Pediatric Dentistry, University of Alabama at Birmingham

ECC is defined as the presence of 1 or more decayed, missing (due to caries), or filled tooth surfaces in any primary tooth in a child under the age of 6.

ECC typically results in severe tooth morbidity and extensive restorative treatment needs.

Early Childhood Caries, continued

ECC affects 24.7% of children in the United States.

ECC is concentrated among poor and minority children, with 80% of total tooth decay occurring in 25% of the nation's children.

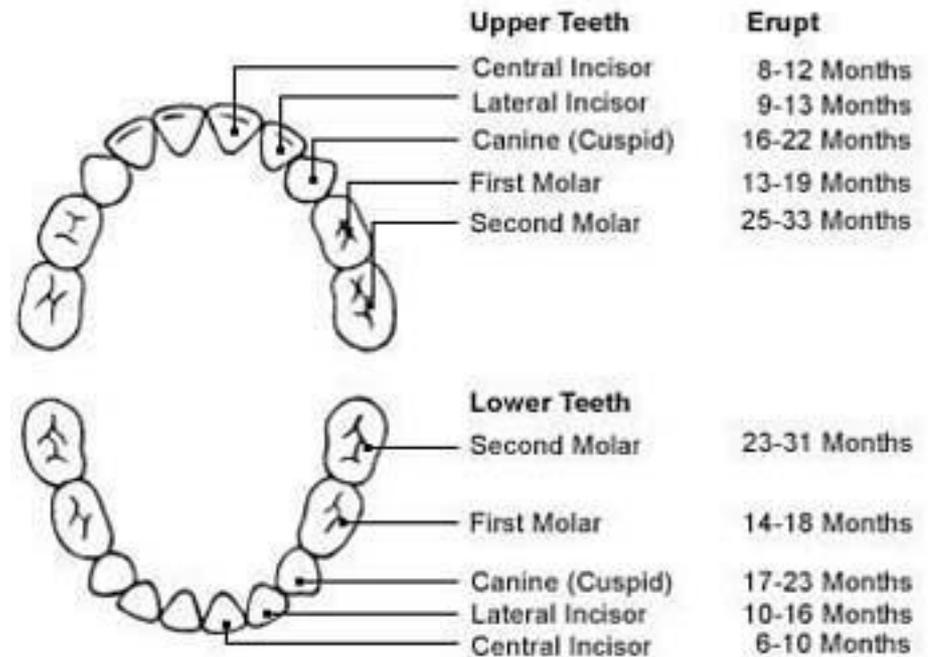


Used with permission from iStock

Pattern of primary tooth eruption

The typical pattern of primary tooth eruption is:

1. Lower central incisors
2. Upper central incisors
3. Lateral incisors
4. First molars
5. Canines (cuspids)
6. Second molars



Used with permission from the American Dental Association

Affected Teeth

ECC tends to affect the upper (maxillary) incisors first because they erupt earliest and are less protected by saliva.

The primary molars are affected next because of their grooved surfaces.

Plaque stagnates in the molar's pits and fissures, which are difficult areas to clean with a toothbrush.



Used with permission from Rocio B. Quinonez, DMD, MS, MPH; Associate Professor Department of Pediatric Dentistry, School of Dentistry University of North Carolina

Affected Teeth, continued



Used with permission from Martha Ann Keels, DDS, PhD; Division Head of Duke Pediatric Dentistry, Duke Children's Hospital

The canines tend to be spared because they are smooth teeth that erupt later.

The lower teeth are better protected by saliva and the tongue.

Diagnosis and Stages

The stages of ECC are as follows:

1. **Plaque:** This biofilm contains cariogenic bacteria.
2. **Incipient lesions or white spots:** Usually begin along the gum line, which is the most important place to examine for ECC. With intervention at this stage, the caries process is entirely reversible.
3. **Enamel caries:** A defect in the enamel surface is visible.
4. **Dentine caries:** ECC has extended into the dentine layer, where the nerve and pain fibers are located.
5. **Pulpitis:** The caries lesion has progressed so that it now affects the pulp.

Impact and Effects on Health

ECC increases the risk of caries lesions developing in permanent teeth.

Other health effects include:

- Pain
- Difficulty chewing, which may lead to poor weight gain
- Difficulty speaking
- Oral infections
- Loss of sleep, difficulty concentrating, and interrupted learning
- Destruction and loss of teeth
- Damage to permanent teeth

Impact and Effects on Health, continued



Paper Permission on file from Mayra Patino

ECC results in increased office, dental, and ER visits.

These costs far exceed those of preventive dental care.

It is 10 times more expensive to provide inpatient care for caries-related symptoms than to provide that same patient the recommended periodic preventive care.

Risk Factors for ECC

Social/Environmental Characteristics

- Ethnicity, minority or low socioeconomic status
- Parents with less than a high school education
- Limited or no dental insurance
- Limited or no access to dental care
- Inadequate fluoride exposure
- Caries in a parent or sibling (especially in the past 12 months)
- High levels of S mutans in parents

Risk Factors for ECC, continued

Physical Characteristics

- Children with special health care conditions
- Low birth weight (less than 2500 grams)
- Gingivitis
- Chronic conditions that weaken enamel, promote gingivitis, or cause decreased saliva production
- Visible plaque on the teeth

Risk Factors for ECC, continued



Used with permission from Rocio B. Quinonez, DMD, MS, MPH; Associate Professor Department of Pediatric Dentistry, School of Dentistry University of North Carolina

Behavioral Risk Factors

- Poor nutritional/feeding habits
- Poor oral hygiene

Preventing ECC

Physicians who care for children
Should teach the following methods
to prevent or delay caries:

1. Improve oral hygiene
2. Alter feeding/eating practices
3. Delay colonization of the teeth
4. Ensure adequate fluoride
5. Establish dental care, such as a dental home



Used with permission from Melinda Clark, MD, Associate Professor of Pediatrics,
Albany Medical Center

In older high-risk children, encourage dental sealants

Question #1

Through which of the following mechanisms does saliva inhibit caries formation?

- A. Supplying fluoride to aid in tooth remineralization
- B. Removal of dietary carbohydrates from tooth surfaces
- C. Buffering of acid
- D. Providing calcium and phosphate to aid in remineralizing the teeth
- E. All of the above

Answer

Through which of the following mechanisms does saliva inhibit caries formation?

- A. Supplying fluoride to aid in tooth remineralization
- B. Removal of dietary carbohydrates from tooth surfaces
- C. Buffering of acid
- D. Providing calcium and phosphate to aid in remineralizing the teeth
- E. All of the above

Question #2

True or False? The risk of caries development is directly related to the frequency with which the teeth are exposed to sugar.

- A. True
- B. False

Answer

True or False? The risk of caries development is directly related to the frequency with which the teeth are exposed to sugar.

- A. True
- B. False

Question #3

Which of the following helps to prevent or delay dental caries?

- A. Limiting snacks between meals
- B. Ensuring adequate fluoride
- C. Improving oral hygiene
- D. Establishing a dental home
- E. All of the above

Answer

Which of the following helps to prevent or delay dental caries?

- A. Limiting snacks between meals
- B. Ensuring adequate fluoride
- C. Improving oral hygiene
- D. Establishing a dental home
- E. All of the above**

Question #4

Which teeth does Early Childhood Caries tend to affect first?

- A. Mandibular molars
- B. Maxillary incisors
- C. Mandibular incisors
- D. Maxillary molars
- E. All teeth are equally affected

Answer

Which teeth does Early Childhood Caries tend to affect first?

- A. Mandibular molars
- B. Maxillary incisors**
- C. Mandibular incisors
- D. Maxillary molars
- E. All teeth are equally affected

Question #5

Which of the following bacterial species is the primary pathogen implicated in the development of dental caries?

- A. Streptococcus salivarius
- B. Streptococcus mutans
- C. Bacteroides sp.
- D. Streptococcus viridans
- E. Actinomyces sp.

Answer

Which of the following bacterial species is the primary pathogen implicated in the development of dental caries?

- A. Streptococcus salivarius
- B. Streptococcus mutans**
- C. Bacteroides sp.
- D. Streptococcus viridans
- E. Actinomyces sp.

References

1. American Academy of Pediatrics Policy Statement. Oral health Risk Assessment Timing and Establishment of the Dental Home. *Pediatrics*. 2003; 111(5): 1113-1116. Available online at <http://aappolicy.aappublications.org/cgi/content/full/pediatrics;111/5/1113>. Accessed November 20, 2006.
2. Anderson M. Risk assessment and epidemiology of dental caries: review of the literature. *Pediatr Dent*. 2002; 24(5): 377-385.
3. Berkowitz RJ. Causes, Treatment and Prevention of Early Childhood Caries: A Microbiologic Perspective. *J Can Dent Assoc*. 2003; 69(5): 304-7.
4. Berkowitz RJ. Mutans Streptococci: Acquisition and Treatment. *Pediatr Dent*. 2006; 28(2): 106-9.
5. Gift HC, Reisine ST, Larach DC. The Social Impact of Dental Problems and Visits. *Am Journal of Public Health*. 1992; 82(12): 1663-8.
6. Holt K and Barzel R. Open Wide: Oral Health Training for Health Professionals. Available online at <http://www.mchoralhealth.org/openwide>. Accessed November 20, 2006.

References, continued

7. Isokangas P et al. Occurrence of dental decay in children after maternal consumption of xylitol chewing gum, a follow-up from 0-5 years of age. *J Dental Res.* 2000; 79(11):1885-9.
8. Kaste LM et al. Coronal caries in the primary and permanent dentition of children and adolescents 1-17 years of age: United States, 1988-1991. *J Dental Res.* 1996; 75: 631-41.
9. Keyes PH. Research in Dental Caries. *JADA.* 1968; 76: 1357-1373.
10. Lai PY et al. Enamel hypoplasia and dental caries in VLBW children: a case-controlled, longitudinal study. *Pediatr Dent.* 1997; 19(1): 42-9.
11. Lee JY et al. Examining the cost-effectiveness of early dental visits. *Pediatr Dent.* 2006; 28(2):102-5.
12. Li Y, Caufield PW. The fidelity of initial acquisition of mutans streptococi by infants from their mothers. *J Dent Res.* 1995, 74(2): 681-5.
13. Linnett V et al. Oral health of children with gastroesophageal reflux disease: a controlled study. *Aust Dent J.* 2002; 47(2): 156-62.

References, continued

14. Oral health in America: A Report of the Surgeon General. Rockville MD: US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; 2000. Available online at <http://www.nidcr.nih.gov/DataStatistics/SurgeonGeneral>. Accessed November 20, 2006.
15. Pettinato ES, Webb MD, Seale NS. A comparison of Medicaid reimbursement for non-definitive pediatric dental treatment in the emergency room versus periodic preventative care. *Pediatr Dent*. 2000; 22(6): 463-8.
16. Savage MF et al. Early preventative dental visits: effects on subsequent utilization and costs. *Pediatrics*. 2004; 114(4): 418-23.
17. Seow WK. Enamel hypoplasia in the primary dentition: a review. *ASDC J Dent Child*. 1991; 58(6): 441-52.
18. Soderling E et al. Influence of maternal xylitol consumption on mother-child transmission of mutans streptococci: 6-year follow-up. *Caries Res*. 2001; 35(3):173-7.
19. Vargas CM et al. Sociodemographic Distribution of Pediatric Dental Caries: NHAANES III, 1988-1994. *JADA*. 1998; 129: 1229-1238.