

Early Childhood Caries: A Comprehensive Review of Literature

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Abstract: Early childhood caries (ECC) is a virulent form of caries occurring in children under 71 months of age, develops on smooth surfaces, and progresses rapidly. It is a serious public health issue in both the developing and industrialized countries, especially where malnutrition is common in the communities. In extreme cases, ECC can result into a complete loss of the crown/tooth structure. It affects the dentition immediately after the eruption of teeth within the oral cavity. It causes early tooth loss, loss of vertical dimension, tongue thrusting, reduced masticatory efficiency, malocclusion, space loss, speech problems, and psychological problems in a child. This review of literature focuses on the etiology, risk factors, preventive strategies and management of ECC.

Keywords: ECC, Early Childhood Caries, Risk factors, Nursing caries

Introduction: Dental caries is a multifactorial disease that is ubiquitous and is as old as mankind.¹ It is an international public health challenge, especially among infants and toddlers, and is known as early childhood caries. The disease of ECC is the presence of 1 or more decayed (cavitated or non-cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child who is 71 months of age or younger.²

ECC has several unique characteristics in clinical appearance such as rapid development of caries, which affects a number of teeth soon after they emerge in oral cavity. These lesions involve tooth surfaces that are less prone to caries development. Several terminologies were used to describe the condition such as, nursing bottle caries, nursing caries, rampant caries, baby bottle caries, baby bottle tooth decay, milk bottle syndrome, and prolonged nursing habit caries. ECC is a multifactorial disease that results from the interaction of factors that include cariogenic microorganisms, exposure to fermentable carbohydrates through inappropriate feeding practices, and a range of social variables. ECC is a severe health condition found among children living in socially disadvantaged communities in which malnutrition is a social and health disparity.^{3,4} ECC is associated with other health problems, ranging from local pain, infections, abscesses, leading to difficulty in chewing, malnutrition, gastrointestinal disorders, and difficulty in sleeping.⁵

The term “Early childhood caries” was suggested at a 1994 workshop sponsored by the Center for Disease Control and Prevention in an attempt to focus attention on the multiple factors (i.e. socioeconomic, behavioral, and psycho-social) that contribute to caries at such early ages, rather than ascribing sole causation to inappropriate feeding methods.^{6,7}

The risk factors related to ECC can be biological, behavioral or socioeconomic contributors to the caries process. The most significant factors contributing to the risk of developing the disease include feeding and oral hygiene practices, levels of *Streptococcus mutans*, various dental problems in parents or caregivers, the socioeconomic status, and the time of the first dental visit.⁸ The objective of this review of literature focuses on the etiology, risk factors, preventive strategies and management of ECC.

Etiology of ECC: Dental caries results from the interaction of various etiological factors, which might be concurrently present to initiate and progress the disease. The factors are:

1. Cariogenic microorganisms
2. Fermentable carbohydrates (substrate)
3. Susceptible tooth surface/host.

Cariogenic Microorganism: Streptococcus mutans (SM) and Streptococcus sobrinus are the most common microorganisms associated with ECC. Lactobacilli also participate in the development of caries lesions and play an important role in lesion progression, but not its initiation.⁹ These pathogens can produce acids in the presence of carbohydrates like sucrose, glucose or fructose and these acids can dissolve the tooth structures. On average oral bacteria can divide 2-4 times per day and in infants swallowing occur very frequently, so in order to survive the bacteria must become attached to an oral surface. Previous studies have also demonstrated that the ability of S. mutans to become attached to epithelial surfaces is very weak. Therefore it can be presumed that these organisms are not able to colonize the mouth of a normal infant before the eruption of teeth.^{10,11}

Nowadays, it is well known that not only bacteria, but also fungi, such as Candida albicans and the interkingdom interactions, can enhance the progression of caries.¹²

Fermentable Carbohydrates: Dietary practices also play a significant role in the development of ECC especially if it contains high levels of fermentable carbohydrates; the child is at higher risk for dental caries.¹³ Increasing the availability of fermentable carbohydrates determine the shift in equilibrium from remineralization to demineralization. Improper bottle feeding constitutes an important etiological factor of severe ECC. Studies have also shown that long periods of night-time breast feeding especially after the age of twelve months of age is associated with an increased risk of ECC because saliva production decreases at night which in turn increases the level of lactose in the resting saliva. These factors result in a shift in the balance from remineralization to demineralization.^{14,15}

Susceptible Tooth Surface/Host: Poor oral hygiene practices promotes the development of ECC. Major risk factor for ECC is the loss of tooth surface integrity resulting from developmental disturbances of the enamel.¹⁶ These defects enhance the plaque retention, enhances colonization of micro-organisms and increases the susceptibility to enamel demineralization. The major causes of defects are congenital medical conditions, birth prematurity, childhood metabolic and infectious illnesses, and the intake of certain medications, like, cytotoxic drugs.¹⁷

Risk Factor Associated to ECC

Table no 1: Risk Factor Associated to ECC (Kirthiga M et al.) ¹⁸		
Sociodemographic Factors Gender (male) Residence (urban) Low socioeconomic status Low education of the caregiver Low parental education No schooling of mother Low maternal education Greater household size Low household income	Dietary Factors Daily sweet snacks High sugar foods >1x/day Added sugar beverage intake Sweet food index >24 Pre sweetened cereal High density of sugar at 12 months Very frequent sugar consumption Cariogenic food consumption Sweet drinks Night time consumption of sweet beverages after 24 months Low levels of Vitamin D, Calcium during pregnancy	Oral hygiene Visible plaque Parental indulgence while tooth brushing Lack of fluoride toothpaste Feeding Nocturnal breastfeeding No breastfeeding Prolonged breastfeeding Bottle feeding Slept at night with bottle containing sweet drink Other factors Presence of enamel defects Low birth weight Parent's negative attitude

Classification of ECC:

Table no 2: Classification of ECC According to Wyne (1999) ¹⁹	
Characteristics of Carious Lesion	Associated etiological factors
Type I (Mild to Moderate): Isolated carious lesions involving incisors and/or molars.	The most common causes are usually a combination of semisolid/solid diet and lack of oral hygiene.
Type II (Moderate to Severe): The lesions are present on the labial or lingual surface of maxillary central incisors.	The main cause is usually an improper use of a feeding bottle or at-will breast feeding. or a

Molar caries may or may not be present depending on the age of the child and stage of the disease. The mandibular incisors remain unaffected	combination of both, with or without poor oral hygiene.
Type III (Severe/Extreme): In this type the carious lesions affect almost all teeth including the mandibular incisors.	The causative factors are a combination of cariogenic food substance and poor oral hygiene.

Severe ECC: 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 to 5, the severity of ECC can be classified according to dmf scores²⁰

Table no 3: S-ECC Status by Age	
Age (years)	S-ECC status
<3	Any sign of smooth surface caries
3	dmf \geq 4
4	dmf \geq 5
5	dmf \geq 6

Prevention of ECC: The Center for Disease Control and Prevention defines the three levels of prevention as follows.²¹

Primary Prevention of ECC: Refers to prevention that occurs before the presence of a disease or condition. This is done through avoiding substances and behaviors known to increase risk and taking precautionary steps to prevent the onset of disease.

Stop caries from happening in the first place through anticipatory guidance, the early establishment of a dental home, frequent oral health visits starting from an early age, and good oral health habits with the application of fluoride varnish at the age one visit.

Secondary Prevention of ECC: Includes identifying the disease before symptoms begin to show through regular exams and/or testing. Detect, track, and treat non-cavitated, carious lesions early on when they are still reversible. Prevent and treat them from progressing further through fluoride application, combination therapy approach, self management goals, etc.

Tertiary Prevention of ECC: Refers to how a disease is managed after diagnosis and the steps that are taken to hinder or stop disease progression. Repair and restore cavitated, carious lesions with SDF, glass ionomers, and other pertinent restorative dental materials.

Measures for Prevention of ECC

Oral health and hygiene: As soon as a child's teeth begin to erupt, parents should brush the teeth twice a day. Parents should begin flossing their child's teeth once the child's teeth are touching.²²

Reducing transmission of cariogenic bacteria from mother to child: This can be accomplished by improving maternal oral health. Maternal stock of cariogenic bacteria can be reduced by application of chlorhexidine (0.12%) or fluoride mouth rinses or by using sugar free chewing gums. The mother should be advised to avoid frequent consumption of sugar and sweetened beverages.

The transmission of cariogenic bacteria from mother to child can be reduced by avoiding saliva sharing activities like sharing of utensils, food and drinks. The mother or caregiver should avoid the habit of licking a pacifier before giving it to the child.²³

Good dietary practice guidelines should be given to new mothers to prevent ECC: Revised guidelines of the American Academy of Pediatric Dentistry (AAPD)²²

- Infants should not be put to sleep with a bottle and nocturnal breast feeding should be avoided after the eruption of first primary tooth.
- Infants should be weaned from the bottle at 12-14 months of age
- Frequent consumption of any liquid containing fermentable carbohydrates from a bottle or no-spill training cup should be avoided.
- Oral hygiene measures should be initiated from the time of eruption of the first primary tooth.
- An oral health check-up is recommended at 12 months of age to educate parents and provide anticipating guidance for prevention of dental disease

Fluoride: Optimal exposure to dietary fluoride is important to all dentate infants and children and can be delivered by fluoridated water, fluoridated salt, and fluoridated milk. Topical fluoride can be delivered at home by having the child's teeth brushed twice daily with fluoridated toothpaste, containing at least 1000 ppm fluoride and using an age-appropriate amount of toothpaste on the brush—a “smear” (approximately 0.1 mg F) for children under age 3, and a “pea size” (approximately 0.25 mg F) for children age 3-6.²⁴ Ideally, a child should have a dental visit for comprehensive care in the first year of life, and any child at caries risk should have regular 5% fluoride varnish applications.²⁵

Management of ECC: Treatment of ECC can be accomplished through different types of intervention, depending on the progression of the disease, the child's age, as well as the social, behavioral and medical history of the child.

The first step in the management of ECC involves conducting a caries risk assessment for each individual child patient. Caries risk as the probability that an individual will develop a certain number of carious lesions (cavitated or noncavitated) or reach a given level of disease progression, over a specific period of time, provided his or her exposure status remains the same during this period.²⁶ Assessing a patient's caries risk status is an essential component in the modern day management of dental caries, where the emphasis is on a non-operative/preventive approach, rather than just the surgical/restorative intervention to the disease process.²⁷ Incorporation of caries risk assessment (CRA) into regular clinical practice can assist the dental professional in making standardized preventive and treatment recommendations (e.g., frequency of recall visits, number of diagnostic radiographs needed, fluoride treatment modalities, anticipatory guidance protocols, etc.) according to each patient's caries risk status. Risk assessment can thus also contribute to a more efficient allocation of time and resources for oral health programs by eliminating many unnecessary interventions (e.g., professional topical fluoride application in a low caries risk child).²⁸

Children at low risk may not need any restorative therapy. Children at moderate risk may require restoration of progressing and cavitated lesions, while white spot and enamel proximal lesions should be treated by preventive techniques and monitored for progression. Children at high risk, however, may require earlier restorative intervention of enamel proximal lesions, as well as intervention of progressing and cavitated lesions to minimize continual caries development.²⁹

The commonly used restorative materials are amalgam, composite, GIC and Resin Modified GIC. If extensive dental treatment is required in a non-cooperative child, then use of GA may be considered. In teeth affected by severe ECC pulpotomy followed by placement of preformed stainless-steel crown is the treatment of choice.³⁰

For teeth that are pulpally involved, the clinician may decide to conduct endodontic treatment or extraction. Extraction of primary teeth is one of the treatment options in managing children with S-ECC although the clinician should try to avoid dental extractions during the child's first visit. The decision to extract should only be made after considering both general and local factors below factors³¹:

General factor

- Patient's cooperation
- Medical condition
- Dental infection - may increase patient's morbidity

Local factors

- Restorability
- Extent of caries which may involve the pulp and roots
- Potential for malocclusion of disturbances in development of the dentition - balancing and compensating extractions may be considered

Children with S-ECC must be reviewed to detect any changes. Recall intervals are based on the outcome of their caries risk assessment: Children with obvious signs of active oral disease or its predisposing factors should be reviewed at 3 monthly intervals until well controlled. Recall visit of high caries risk children should be based on the clinician's assessment of the child's caries risk status using the caries risk assessment checklist, and should not exceed 12 months.

Conclusion: Early childhood caries (ECC) is major oral health problem, mainly in socially disadvantaged populations. ECC affects infants and preschool children worldwide. ECC is a multifactorial disease consequent to the interaction of cariogenic microorganisms, exposure to carbohydrates, inappropriate feeding practices, and a range of social variables. It can affect a child's well-being, learning ability, and quality of life. This virulent form of dental caries begins soon after dental eruption mainly on the smooth surfaces of the teeth, which progress at a rapid state. Dentists must focus on utilizing existing techniques to distinguish indications of right on time and propelled caries and give guidance on the best way to counteract and control caries in children. Approaches should be directed to preventive caries control strategies among children.

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