

Early childhood caries update: A review of causes, diagnoses, and treatments

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Abstract

Dental caries (decay) is an international public health challenge, especially amongst young children. Early childhood caries (ECC) is a serious public health problem in both developing and industrialized countries. ECC can begin early in life, progresses rapidly in those who are at high risk, and often goes untreated. Its consequences can affect the immediate and long-term quality of life of the child's family and can have significant social and economic consequences beyond the immediate family as well. ECC can be a particularly virulent form of caries, beginning soon after dental eruption, developing on smooth surfaces, progressing rapidly, and having a lasting detrimental impact on the dentition. Children experiencing caries as infants or toddlers have a much greater probability of subsequent caries in both the primary and permanent dentitions. The relationship between breastfeeding and ECC is likely to be complex and confounded by many biological variables, such as mutans streptococci, enamel hypoplasia, intake of sugars, as well as social variables, such as parental education and socioeconomic status, which may affect oral health. Unlike other infectious diseases, tooth decay is not self-limiting. Decayed teeth require professional treatment to remove infection and restore tooth function. In this review, we give detailed information about ECC, from its diagnosis to management.

Key words: Early childhood caries, etiology, feeding, fluoride

INTRODUCTION

Dental caries is the most common chronic *infectious disease* of childhood, caused by the interaction of bacteria, mainly *Streptococcus mutans*, and sugary foods on tooth enamel. *S. mutans* can spread from mother to baby during infancy and can inoculate even pre-dentate infants. These bacteria break down sugars for energy, causing an acidic environment in the mouth and result in demineralization of the enamel of the teeth and dental caries.^[1] Early childhood caries (ECC) is a serious public health problem in both developing and industrialized countries.^[2] ECC can begin early in life, progresses rapidly in those who are at high risk, and often goes untreated.^[3,4] Its consequences can affect the immediate and long-term quality of life of the child

and family, and can have significant social and economic consequences beyond the immediate family as well.^[5]

DESCRIPTION

Dental caries in toddlers and infants has a distinctive pattern. Different names and terminology have been used to refer to the presence of dental caries among very young children.^[6] The definitions first used to describe this condition were related to etiology, with the focus on inappropriate use of nursing practices. The following terms are used interchangeably: Early childhood tooth decay, early childhood caries, baby bottle-fed tooth decay, early childhood dental decay, comforter caries, nursing caries, maxillary anterior caries, rampant caries, and many more.^[7,8] Some of these terms indicate the causes of dental caries in pre-school children.^[8] *Baby bottle-fed tooth decay* refers to decay in an infant's teeth, associated with what the baby drinks.^[9] However, some authors use the term "nursing caries" because it designates inappropriate bottle use and nursing practices as the causal factors.^[7,10] However, the term "early childhood caries" is becoming increasingly popular with dentists and dental researchers alike.^[8,11]

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The term “early childhood caries” was suggested at a 1994 workshop sponsored by the Centers 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.^[12] ECC is defined as “the presence of one or more decayed (non-cavitated or cavitated lesions), missing teeth (due to caries), or filled tooth surfaces in any primary tooth in a child 72 of months age or younger. 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, one or more cavitated, missing teeth (due to caries), or filled smooth surfaces in primary maxillary anterior teeth, or decayed, missing, or filled score of ≥ 4 (age 3), ≥ 5 (age 4), or ≥ 6 (age 5) surfaces constitutes S-ECC.^[13]

In the initial phase, ECC is recognized as a dull, white demineralized enamel that quickly advances to obvious decay along the gingival margin.^[14] Primary maxillary incisors are generally affected earlier than the four maxillary anterior teeth which are often involved concurrently.^[15] Carious lesions may be found on either the labial or lingual surfaces of the teeth and, in some cases, on both.^[16] The decayed hard tissue is clinically evident as a yellow or brown cavitated area. In older children, whose entire primary dentition is fully erupted, it is not unusual to see considerable advancement of the dental damage.

EPIDEMIOLOGY

Despite the decline in the prevalence of dental caries in children in the western countries, caries in pre-school children remains a problem in both developed and developing countries. ECC has been considered to be at epidemic proportions in the developing countries.^[4,17]

A comprehensive review of the occurrence of the caries on maxillary anterior teeth in children, including numerous studies from Europe, Africa, Asia, the Middle East, and North America, found the highest caries prevalence in Africa and South-East Asia.^[18] The prevalence of ECC is estimated to range from 1 to 12% in infants from developed countries.^[19]

Prevalence of ECC is a not a common finding relative to some European countries (England, Sweden, and Finland), with the available prevalence data ranging from below 1% to 32%.^[20,21] However, this figure is rising by as much as 56% in some eastern European countries.^[22] In US, pre-school children data from a more recent study indicate that the prevalence of dental caries of children

2–5 years of age had increased from 24% in 1988–1994 to 28% in 1999–2004. Overall, considering all 2–5-year olds, the 1999–2004 survey indicates that 72% of decayed or filled tooth surfaces remain untreated.^[14,23,24] The prevalence of ECC children in the general population of Canada is less than 5%; but in high-risk population, 50–80% are affected.^[25–27] Studies reveal that the prevalence percentage of ECC in 25- to 36-month olds^[28] is 46% and the reported prevalence in Native Canadian 3-year-olds^[29] has been as high as 65%.

Published studies show higher prevalence figures for 3-year-olds, which ranges from 36 to 85%^[30–32] in Far East Asia region, whereas this figure is 44% for 8- to 48-month olds^[33] reported in Indian studies. ECC has been considered at epidemic proportions in the developing countries.^[34] Studies conducted in the Middle East have shown that the prevalence of dental caries in 3-year-olds is between 22% and 61%^[35–37] and in Africa it is between 38% and 45%.^[38,39]

ETIOLOGY

The etiology of ECC is multifactorial and has been well established. ECC is frequently associated with a poor diet^[40] and bad oral health^[14] habits.

Microbiological risk factors

S. mutans and *Streptococcus sobrinus* are the main cariogenic micro-organisms.^[41,42] These acid-producing pathogens inhabiting the mouth cause damage by dissolving tooth structures in the presence of fermentable carbohydrates such as sucrose, fructose, and glucose.^[43,44] Most of the investigations^[15,45,46] have shown that in children with ECC, *S. mutans* has regularly exceeded 30% of the cultivable plaque flora. These bacterial masses are often associated with carious lesions, white spot lesions, and sound tooth surfaces near the lesions. Conversely, *S. mutans* typically constitutes less than 0.1% of the plaque flora in children with negligible to no caries activity.^[47] It is well known that initial acquisition of mutans streptococci (MS) by infants occurs during a well-delineated age range that is being designated as the window of infectivity.^[48] Most of the long-term studies also demonstrated that the individuals with low infection levels in this period are less likely to be infected with MS, and subsequently have the lowest level of risk of developing caries.^[49,50] This may be explained by the competition between the oral bacteria, resulting in the invasion of the niches, where MS can easily colonize, by less pathogenic species.^[51]

Vertical transmission, also known as mother-to-child transmission, is the transmission of an infection or other disease from caregiver to child. The major reservoir from

which infants acquire MS is their mothers. The early evidence for this concept comes from bacteriocin typing studies^[52-54] where MS isolated from mothers and their infants demonstrated identical bacteriocin typing patterns. More advanced technology that utilized chromosomal DNA patterns or identical plasmids provided more compelling evidence to substantiate the concept of vertical transmission.^[55-58]

Feeding practices

Inappropriate use of baby bottle has a central role in the etiology and severity of ECC. The rationale is the prolonged bedtime use of bottles with sweet content, especially lactose. Most of the studies have shown significant correlation between ECC and bottle-feeding and sleeping with a bottle.^[59-61] Breastfeeding provides the perfect nutrition for infant, and there are a number of health benefits to the breastfed child, including a reduced risk of gastrointestinal and respiratory infections.^[62] However, frequent and prolonged contact of enamel with human milk has been shown to result in acidogenic conditions and softening of enamel. Increasing the time per day that fermentable carbohydrates are available is the most significant factor in shifting the re-mineralization equilibrium toward de-mineralization.^[63] There appears to be a clinical consensus amongst dental practitioners that prolonged and nocturnal breastfeeding is associated with an increased risk of ECC, especially after the age of 12 months. These conditions explained by less saliva production at night result in higher levels of lactose in the resting saliva and dental plaque for longer than would be expected during the day. Thereby, balance is shifted toward de-mineralization rather than re-mineralization during the night because of the insufficient protection caused by reduced nocturnal salivary flow.^[64,65]

Sugars

In general, perspective dental caries is accepted as primarily a microbial disease, but few would disagree that dietary features play a crucial and a secondary role. Numerous worldwide epidemiologic studies, laboratory and animal experiments, as well as human investigations after the World War II have contributed to much of the knowledge on the etiology and natural history of caries.^[66]

Fermentable carbohydrates are a factor in the development of caries. The small size of sugar molecules allows salivary amylase to split the molecules into components that can be easily metabolized by plaque bacteria.^[67] This process leads to bacteria producing acidic end products with subsequent de-mineralization of teeth^[68,69] and increased risk for caries on susceptible teeth. Some authors^[70,71] found a positive relationship between sugar intake and the incidence of dental caries where fluoridation was minimal and dental

hygiene was poor. The length of time of exposure of the teeth to sugar is the principal factor in the etiology of dental caries; it is known that acids produced by bacteria after sugar intake persist for 20–40 min. Some authors^[72] studied the clearance of glucose, fructose, sucrose, maltose, and sorbitol rinses, as well as chocolate bars, white bread, and bananas, from the oral cavity. Sucrose is removed the quickest, while sorbitol and food residues stay in the mouth longer. Retentiveness of the food and the presence of protective factors in foods (calcium, phosphates, fluoride) are considered as other factors that contribute to de-mineralization.

The best available evidence indicates that the level of dental caries is low in countries where the consumption of free sugars is below 40–55 g per person per day.^[73] Caries risk is greatest if sugars are consumed at high frequency and are in a form that is retained in the mouth for long periods.^[74] Non-milk extrinsic sugars (NMES) have also been widely implicated as the cause of caries, while milk sugars are not.^[75] However, consumption of milk-based formulas for infant feeding, even without sucrose in their formulation, proved to be cariogenic.^[76] The relationship between diet and dental caries has become weaker in contemporary society and this has been attributed to the widespread use of fluoride.^[77] There is evidence to show that many groups of people with habitually high consumption of sugars also have levels of caries higher than the population averages.

Socioeconomic factors

Association between ECC and the socioeconomic status (SES) has been well documented. Studies suggested that ECC is more commonly found in children who live in poverty or in poor economic conditions,^[35,40,44,78,79] who belong to ethnic and racial minorities,^[80] who are born to single mothers,^[81] whose parents have low educational level, especially those of illiterate mothers.^[35,82,83] In these populations, due to the prenatal and perinatal malnutrition or undernourishment, these children have an *increased risk* for enamel hypoplasia and exposure to fluorine is probably insufficient,^[80] and there is a greater preference for sugary foods.^[84]

The possible influence of SES on dental health may also be a consequence of differences in dietary habits and the role of sugar in the diet.^[85] In their review on inequalities in oral health, Sheiham and Watt indicated that the main causes of inequalities in oral health are differences in patterns of consumption of non-milk sugars and fluoride toothpaste.^[86] Weinstein^[4] emphasizes the discrepancy in ECC prevalence rate: 1–12% in developed countries, whereas it is as high as 70% in developing countries or within select immigrant or ethnic minority populations. Authors in Ref.^[23] confirm that children with parents in the lowest

income group had mean Decayed, Missing, and Filled Teeth (dmft) scores four times as high as children with parents in the highest income group.

DIAGNOSIS

ECC is initially recognized as a dull, white band of de-mineralized enamel that quickly advances to obvious decay along the gingival margin.^[31] The decay is generally first seen on the primary maxillary incisors, and the four maxillary anterior teeth are often involved concurrently.^[87] Carious lesions may be found on either the labial or lingual surfaces of the teeth and, in some cases, on both.^[40] The decayed hard tissue is clinically evident as a yellow or brown cavitated area. In the older child whose entire primary dentition is fully erupted, it is not unusual to see considerable advancement of the dental damage.

Furthermore, the expression S-ECC was adopted in lieu of rampant caries in the presence of at least one of the following criteria:

- Any sign of caries on a smooth surface in children younger than 3 years.
- Any smooth surface of an antero-posterior deciduous tooth that is decayed, missing (due to caries), or filled in children between 3 and 5 years old.
- The dmft index equal to or greater than 4 at the age of 3 years, 5 at the age of 4 years, and 6 at the age of 5 years.^[88]

CONSEQUENCES OF UNTREATED DENTAL CARIES IN CHILDREN

Although largely preventable by early examination, identification of individual risk factors, parental counseling and education, and initiation of preventive care procedures such as topical fluoride application, the progressive nature of dental disease can quickly diminish the general health and quality of life for the affected infants, toddlers, and children.^[89] Failure to identify and prevent dental disease has consequential and costly long-term adverse effects [Table 1]. As treatment for ECC is delayed, the child's condition worsens and becomes more difficult to treat, the cost of treatment increases, and the number of clinicians who can perform the more complicated procedures diminishes.

Oral health means more than just healthy teeth. Oral health affects people physically and psychologically, and influences how they grow, look, speak, chew, taste food, and socialize, as well as their feelings of social well-being.^[90] Children's quality of life can be seriously affected by severe caries because of pain and discomfort which could lead

Table 1: A summary of the consequences of leaving untreated carious primary teeth

Short term
Pain
Infection, e.g., abscess, cellulitis
Poor appetite
Disturbed sleep
Emergency visits and possibly hospitalizations
Loss of school days with restricted activity
Reduced ability to learn and concentrate
Need for extractions
Need for treatment under general anesthesia
Premature loss of primary molars predisposing to malocclusion
Long term
Poor oral health and dental disease often continue into adulthood
Higher risk of new carious lesions in the other primary teeth and the succeeding permanent dentition
Affect child's general health, resulting in insufficient physical development especially in height and weight
Increased treatment costs and time for parents
Potential to affect speech, nutrition, and quality of life
Rare sequelae
Sub-orbital cellulites
Brain abscesses
Unexplained recurrent fevers
Acute otitis media

to disfigurement, acute and chronic infections, and altered eating and sleeping habits, as well as risk of hospitalization, high treatment costs, and loss of school days with the consequent diminished ability to learn.^[91] In most small children, ECC is associated with reduced growth and reduced weight gain due to insufficient food consumption to meet the metabolic and growth needs of children less than 2 years old.^[91] Children of 3 years of age with nursing caries weighed about 1 kg less than control children^[92] because toothache and infection alter eating and sleeping habits, dietary intake, and metabolic processes. Disturbed sleep affects glucocorticoid production. In addition, there is suppression of hemoglobin from depressed erythrocyte production. Early tooth loss caused by dental decay has been associated with the failure to thrive, impaired speech development, absence from and inability to concentrate in school, and reduced self-esteem.^[92-94]

At the level of family consequences, there is a troubling association between ECC and child maltreatment. Sheller and colleagues^[95,96] concluded that a dysfunctional family or social situation can lead to a recurrence of ECC, often with emotional outbursts and the threat of or actual violence. The relationship between ECC and neglect is well established, but only recently have child maltreatment experts included dental caries in their list of health conditions that predispose children to maltreatment.^[97,98]

Untreated oral disease can exacerbate the already fragile conditions of many children with special health care

needs^[99] because of the prevalence of chronic medical conditions such as seizure disorders or severe emotional disturbances. For example, it can complicate the treatment of organ and bone marrow transplants (sometimes resulting in death); it can result in severe complications (e.g., pneumonia, urinary tract infections, fever, and generalized infections of the entire body); and it can cause infection of a defective heart valve (resulting in death 50% of the time).^[99]

A third possible mechanism of how untreated severe caries with pulpitis affects growth is that pulpitis and chronic dental abscesses affect growth by causing chronic inflammation that affects metabolic pathways where cytokines affect erythropoiesis.^[100] For example, interleukin-1 (IL-1), which has a wide variety of actions in inflammation, can induce inhibition of erythropoiesis. This suppression of hemoglobin can lead to anemia of chronic disease, as a result of depressed erythrocyte production in the bone marrow.^[101,102] One of the best predictors of future caries is previous caries experience.^[103,104] Children under the age of 5 with a history of dental caries should automatically be classified as being at high risk for future decay. However, the absence of caries is not a useful caries risk predictor for infants and toddlers because even if these children are at high risk, there may not have been enough time for carious lesion development.^[105] Since white spot lesions are the precursors to cavitated lesions, they will be apparent before cavitations. These white spot lesions are most often found on enamel smooth surfaces close to the gingiva. Although only a few studies have examined staining of pits and fissures^[106] or white spot lesions^[107] as a caries risk variable, such lesions should be considered equivalent to caries when determining caries risk in young children.

Tooth extraction is a common and necessary treatment for advanced caries. Premature loss of molars is likely to result in future orthodontic problems.^[96] Therefore, children affected by ECC are likely to continue having oral health problems for which treatment is often financially out of reach for their parents. Furthermore, caries in the early years has been associated with caries in late childhood.^[108,109]

PREVENTION OF EARLY CHILDHOOD CARIES

There are three general approaches that have been used to prevent ECC [Figure 1]. All three approaches include training of mothers or caregivers to follow healthy dietary and feeding habits in order to prevent the development of ECC.

Prevention of maternal bacterial transmission to the child

The strategy to combat the early transmission of cariogenic bacteria from parents to their offsprings is often named

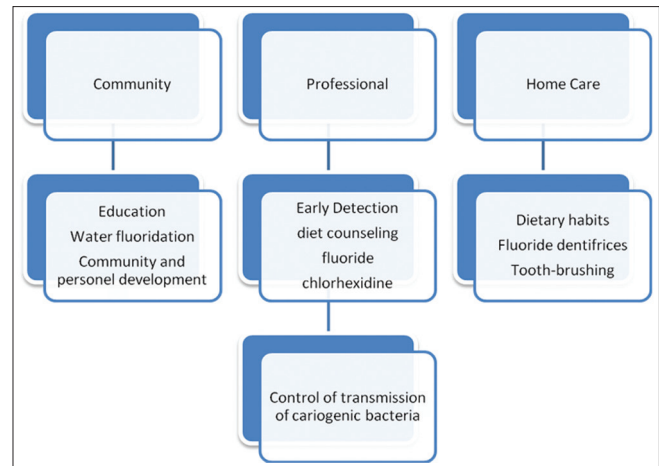


Figure 1: Strategies for the prevention of ECC^[113]

primary-primary prevention. The preventive intervention is most often directed to pregnant women and/or mothers of newborn babies. This includes the following.

A. Reduce the bacteria in the mouth of the mother or primary caregiver. Earlier studies suggest that infants acquire MS from their mothers and only after the eruption of primary teeth.^[49,50] Preventive interventions for the purpose of reducing the transmission of bacteria from mothers to children improve the likelihood of better oral health for the child.^[110] Effective approach in the prevention of dental caries is the suppression of *S. mutans* in the mouth of the child's primary caregiver (usually the mother). Chemical suppression by use of chlorhexidine gluconate in the form of mouth rinses, gels, and dentifrices has been shown to reduce oral microorganisms.^[111,112]

B. Minimize the transmission of bacteria that cause tooth decay. Minimizing saliva-sharing activities between children and parents/caregivers limits bacterial transmission. Examples include avoiding the sharing of utensils, food, and drinks, discouraging a child from putting his/her hand in the caregiver's mouth, not licking a pacifier before giving it to the child, and not sharing toothbrushes. The goal is to prevent or delay children as long as possible from acquiring the bacteria that cause tooth decay.

Oral health education

Dental caries cannot occur without the substrate component of sugar. Therefore, much of the professional advice and practical research has focused on modification of the infant diet and feeding habits through education of the parents.^[113,114] Child health professionals, including but not limited to physicians, physician assistants, nurse practitioners, and nurses, can play a significant role in reducing the burden of this disease. While most children do not visit a dentist until the age of 3 years, children have visited a child health professional up to 11 times for

well-child visits by this age.^[113] Oral health education is a designed package of information, learning activities, or experiences that are intended to produce improved oral health.^[115] With the primary goal of disease prevention, its purpose is to facilitate decision-making for oral health practices and to encourage appropriate choices for these behaviors.

Effective health education may thus^[116]

- produce changes in knowledge;
- induce or clarify values;
- bring about some shift in belief or attitudes;
- facilitate the achievement of skills; and
- bring about change in behaviors or lifestyles.

Health promotion programs to stimulate tooth brushing have been among the most successful educational programs.^[117,118] Cross-sectional surveys, clinical trials, and experiments for tooth brushing research studies involving populations of 1450–1545 children have found that tooth brushing with flossing twice a day resulted in increased tooth retention.^[117]

The American Academy of Pediatric Dentistry (AAPD) has given recommendations on anticipatory guidance, bottle-feeding habits to prevent ECC, and infant/toddler oral hygiene care.^[88]

Avoiding caries-promoting feeding behaviors

- I. Infants should not be put to sleep with a bottle containing fermentable carbohydrates.
- II. *Ad libitum* breastfeeding should be avoided after the first primary tooth begins to erupt and other dietary carbohydrates are introduced.
- III. 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 12–14 months of age.
- IV. Repetitive consumption of any liquid containing fermentable carbohydrates from a bottle or no-spill training cup should be avoided.
- V. Between-meal snacks and prolonged exposures to foods and juice or other beverages containing fermentable carbohydrates should be avoided.

Fluoride

The use of fluorides for dental purposes began in the 19th century. Fluorides are found naturally throughout the world.^[119] They are present to some extent in all foods and water, so that all humans ingest some fluoride on a daily basis. In addition, fluorides are used by communities as a public health measure to adjust the concentration of fluoride in drinking water to an optimum level (water fluoridation); by individuals in the form of toothpastes,

rinses, lozenges, chewable tablets, drops; and by the dental professionals in the professional application of gels, foams, and varnishes.

Fluoride varnish is a concentrated topical fluoride with a resin or synthetic base. At least 19 fluoride varnish reviews,^[120] including a systematic review^[121] and three meta-analyses,^[122–124] have been published in English. In the last three decade, a great deal of research published that evaluated fluoride varnish efficacy in the permanent teeth of school-aged children,^[125] regarding fluoride varnish differed for permanent and primary teeth. All of these studies stated, “The evidence for the benefit of applying fluoride varnish to permanent teeth is generally positive.” Fluoride varnish works by increasing the concentration of fluoride in the outer surface of teeth, thereby enhancing fluoride uptake during early stages of de-mineralization. The varnish hardens on the tooth as soon as it contacts saliva, allowing the high concentration of fluoride to be in contact with tooth enamel for an extended period of time (about 1–7 days). This is a much longer exposure compared to that of other high-dose topical fluorides such as gels or foams, which is typically 10–15 minutes. The amount of fluoride deposited in the tooth surface is considerably greater in de-mineralized versus sound tooth surfaces.^[126,127] Thus, the benefits of fluoride varnish are greatest for individuals at moderate risk or high risk for de-mineralization or tooth decay.^[128]

There is a global consensus that regular use of fluoride (F) toothpaste constitutes a cornerstone in child dental health. In fact, a global survey revealed that most experts addressed F toothpaste as the main reason for the dramatic decline in caries during the last decade of the 20th century.^[129] Moreover, toothpaste is probably the most readily available form of F and tooth brushing is a convenient and approved habit in most cultures.^[130] Working groups within national Health Technology Agencies have independently and in parallel presented strong scientific evidence that daily tooth brushing with F toothpaste is the most cost-effective, self-applied method to prevent caries at practically all ages.^[131–134] Because small children usually swallow 30% of the paste, it is important to limit the amount of toothpaste to a pea size or less.^[135] According to Douglass *et al.*^[11] the amount of toothpaste should not exceed the size of a rice grain or the tip of a pencil eraser for children as young as 6–12 months of age. Fluoride products such as toothpaste, mouth rinse, and dental office topicals have been shown to reduce caries between 30% and 70% compared with no fluoride therapy.^[136,137] Because young children tend to swallow toothpaste when they are brushing, which may increase their exposure to fluoride, guidelines [Table 2] have been established to moderate their risk of developing dental

Table 2: Recommended dosages for fluoride supplementation chart

American Dental Association recommendation dosages for fluoride supplementation			
Age of child	Water fluoride concentration (ppm)*		
	Less than 0.3	0.3-0.6	Greater than 0.6
Birth to 6 months	0	0	0
6 months to 3 years	0.25 mg	0**	0**
3 years to 6 years	0.5 mg	0.25 mg	0
6 years to 16 years	1 mg	0.5 mg	0

*1.0 ppm = 1 mg/L and 2.2 mg sodium fluoride contains 1 mg fluoride ion,

**Infants whose nourishment comes exclusively from breast milk need a 0.25 mg supplement

fluorosis while optimizing the benefits of fluoride, by the American Dental Association (ADA) (2008)^[138]

The most common method for systematically applied fluoride is fluoridated drinking water shown to be effective in reducing the severity of dental decay in entire populations. Fluoridation of community drinking water is the precise adjustment of the existing natural fluoride concentration in drinking water to a safe level that is recommended for caries prevention. The United States Public Health Service has established the optimum concentration for fluoride in the water in the range of 0.7–1.2 mg/L.^[139] Reductions in childhood dental caries attributable to fluoridation were approximately from 40 to 60% from 1949 to 1979, but in the next decade, the estimates were lower: from 18% to 40%.^[113,134,139] This is likely caused by the increasing use of fluoride from other sources, with the widespread use of fluoride toothpaste probably being the most important factor.^[113,133]

TREATMENT

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. Examining a child by his or her first birthday is ideal in the prevention and intervention of ECC.^[88] During this initial visit, conducting a risk assessment can provide baseline data necessary to counsel the parent on the prevention of dental decay. 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.^[140]

The current standard of care for treatment of S-ECC usually necessitates general anesthesia with all of its potential complications because the level of co-operative behavior of babies and pre-school children is less than ideal.

Stainless steel (preformed) crowns are pre-fabricated crown forms which can be adapted to individual primary molars and cemented in place to provide a definitive restoration.^[141] They have been indicated for the restoration of primary and permanent teeth with caries, cervical decalcification, and/or developmental defects (e.g., hypoplasia, hypocalcification), when failure of other available restorative materials is likely (e.g., interproxima caries extending beyond line angles, patients with bruxism), following pulpotomy or pulpectomy, for restoring a primary tooth that is to be used as an abutment for a space maintainer, or for the intermediate restoration of fractured teeth.

Another approach of treating dental caries in young children is Atraumatic Restorative Treatment (ART). The ART is a procedure based on removing carious tooth tissues using hand instruments alone and restoring the cavity with an adhesive restorative material.^[142-144] At present, the restorative material is glass ionomer. ART is a simple technique with many advantages, such as it reduces pain and fear during dental treatment,^[145] it does not require electricity,^[146] and it is more cost-effective than the traditional approach using amalgam.^[147] It is an alternative treatment available to a large part of the world's population.^[148] In addition, it is mostly indicated for use in children, as it is reportedly atraumatic because no rotary instruments are used and in most cases no local anesthesia is needed.^[149]

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