

# Save Your Precious ones From Baby Bottle Syndrome

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## Abstract

**D**ental caries (decay) is localized dissolution of tooth surface by metabolic events taking place in biofilm (dental plaque). ECC is a serious public health problem in both developing and industrialized countries affecting children of age range of 12-30 months. Today the new name for Early Childhood Caries is Maternally Derived Streptococcus Mutans Disease (MDSMD). The causative factors are such as mutans streptococci, enamel hypoplasia, intake of sugars, as well as social variables, such as parental education and socioeconomic status. Iron deficiency play role in development of the disease. 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. Modification of feeding habits, Fluorides, topical antimicrobial therapy, ACP and oral health education helps preventing this disease. As regarding treatment, decayed teeth require professional care to remove infection and restore tooth function. Caries management by risk assessment (CAMBRA) is an easy approach to disease prevention management that integrates risk assessment of childhood caries as an integral component of a comprehensive oral health visit. In this article, we review information about MDSMD in detail w.r.t its cause, diagnosis, prevention, management and its effects on quality of life.

## Introduction

The term "dental caries" is used to describe the results, signs, and symptoms of a localized chemical dissolution of the tooth surface caused by metabolic events taking place in the biofilms (dental plaque) that cover the affected area.<sup>1</sup> Children in the age range of 12-30 months have a special caries pattern that differs from that in older children.<sup>2</sup> 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 and family, and can have significant social and economic consequences beyond the immediate family as well.<sup>3</sup>

ECC begins with white-spot lesions in the upper primary incisors along the margin of the gingiva. If the disease continues, caries can progress, leading to complete destruction of the crown.<sup>4</sup> Not only does ECC affect teeth, but the consequences of this disease may also lead to more widespread health issues. Infants with ECC grow at a slower pace than caries-free infants. Some young children with ECC may be severely underweight because of associated pain and their disinclination to

eat.<sup>4</sup>

## Epidemiology

Despite the decline in the prevalence of dental caries in children in the western countries, ECC has been considered to be at epidemic proportions in the developing countries.<sup>5</sup>

In developing countries, the prevalence of ECC differs according to the group examined, and a prevalence of up to 85% has been reported for disadvantaged groups.<sup>6</sup>

Studies show higher prevalence figures for 3-year-olds, which ranges from 36 to 85%<sup>7</sup> in Far East Asia region, whereas this figure is 44% for 8- to 48-month olds<sup>8</sup> reported in Indian studies and in Africa it is between 38% and 45%.<sup>9</sup> 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%.<sup>10</sup> However, this figure is rising by as much as 56% in some eastern European countries. In the Western world, the prevalence at 3 years of age was 19.9%, and strong associations were found with socioeconomic status and ethnicity.<sup>11</sup> (Fig. Pre-Operative & Post-Operative).

## Process

The presence of a fermentable carbohydrate (e.g., sucrose, glucose, fructose, cooked starch) and biofilms on the teeth support the metabolism of acidogenic microorganisms, resulting in acidic substances, the hydrogen ions of which dissolve the carbonated hydroxyapatite crystal lattice of enamel, cementum and dentin. Continued demineralization results in cavitation of the tooth enamel surface. In the primary dentition, when demineralization passes from the outer enamel tooth layer to the more highly organic dentin layer, caries progression is rapid, and restorative dentistry is often required.<sup>12</sup>

## Etiology

The etiology of ECC is multifactorial and has been well established.

## Microbiological factors

ECC is an infectious disease and mutans streptococci (MS), including the species *Streptococcus mutans* and *Streptococcus sobrinus*, are the most common causative agents. Lactobacilli also participate in the development of caries lesions and play an important role in lesion progression, but not its initiation.<sup>13</sup> 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.<sup>14</sup> 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.<sup>15</sup>

Vertical transmission of MS from caregiver to child has been reported. The major reservoir of MS is the mother, from whom the child acquires it during a window period of around 2 years of age. At this time, the child is probably most susceptible to acquiring MS.<sup>16</sup>

## Diet

Children with ECC typically experience frequent and prolonged consumption of sugared beverages.<sup>17</sup> Sugared beverages are readily metabolized by MS and lactobacilli to organic acids that can demineralize enamel and dentin. The use of nursing bottles enhances exposure to lactose. 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.<sup>18</sup> 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 remineralization equilibrium toward demineralization.<sup>19</sup> 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.<sup>20</sup>

## Sugars

Some authors 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 2040 min.<sup>21</sup>

The best available evidence indicates that the level of dental caries is low in countries where the consumption of free sugars is below 4055 g per person per day.<sup>22</sup> 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.<sup>23</sup> Non-milk extrinsic sugars (NMES) have also been widely implicated as the cause of caries, while milk sugars are not.<sup>24</sup> However, consumption of milk-based formulas for infant feeding, even without sucrose in their formulation, proved to be cariogenic.<sup>25</sup>

## 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,<sup>25</sup> who belong to ethnic and racial minorities,<sup>26</sup> whose parents have low educational level, especially those of illiterate mothers.<sup>27</sup> 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.<sup>26</sup>

#### Enamel Developmental Defects

Lack of enamel maturation or the presence of developmental structural defects in enamel may increase the caries risk in preschool children. Such defects enhance plaque retention, increase MS colonization, and in severe cases, the loss of enamel enables greater susceptibility to tooth demineralization. A strong correlation is found between presence of enamel hypoplasia and high counts of MS.<sup>28</sup> Enamel defects in the primary dentition are most associated with pre-, peri- or post-natal conditions such as low birth weight, and child's or mother's malnutrition or illness.<sup>29</sup>

#### Deficiency of Iron

The purpose of this case-control study was to contrast ferritin and haemoglobin levels between preschoolers with S-ECC and caries-free controls.

The study was approved by the University's Health Research Ethics Board. Statistics included descriptive, bivariate and logistic regression analyses. A p value  $\leq .05$  was significant. A total of 266 children were recruited; 144 with S-ECC and 122 caries-free.

The study concluded the following-

1. Children with S-ECC appear to be at significantly greater odds of having low ferritin status compared with caries-free children.
2. Children with S-ECC appear to have significantly lower haemoglobin levels when compared with caries-free controls.
3. Children with S-ECC appear to be at significantly greater odds for iron deficiency and iron deficiency anaemia than cavity-free children.

The analyses revealed that children with S-ECC were nearly twice as likely to have low ferritin levels and were over six times more likely to have iron deficiency anaemia than caries-free controls.<sup>47</sup>

#### Diagnosis

ECC is initially recognized as a dull, white band of de-mineralized enamel that quickly advances to obvious decay along the gingival margin.<sup>30</sup> The decay is generally first seen on the primary maxillary incisors, and the four maxillary anterior teeth are often involved concurrently.<sup>31</sup> Carious lesions may be found on either the labial or lingual surfaces of the teeth and, in some cases, on both. The decayed hard tissue is clinically evident as a yellow or brown cavitated area.

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.<sup>32</sup>

#### Prevention of Early Childhood Caries

##### 1. 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 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. Chemical suppression by use of chlorhexidine gluconate in the form of mouth rinses, gels, and dentifrices has been shown to reduce oral microorganisms.

B. 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.<sup>33</sup>

##### 2. Target Cariogenic Feeding behavior

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.

##### 3. Topical Antimicrobial Therapy

. Topical application of a 10% povidone-iodine solution to the dentition of infants every 2 months in a double-blind, placebo-controlled clinical trial for 1 year increased the number of caries-free infants.<sup>34</sup> These infants were at high risk for ECC as they were all colonized by MS and had decay-promoting feeding behaviors. This study suggested that povidone-iodine had suppressive effects on the oral colonization of MS and prevented dental caries. However, povidone-iodine has strong bactericidal/

virucidal effects and demolishes normal flora in the pharynx and the oral cavity, which interfere with pathogenic viral invasion.<sup>35</sup> Therefore, povidone-iodine should not be routinely used.

#### 4. Flourides

**Tooth Brushing with Fluoridated Toothpaste :** The convincing evidence exists for the decay-preventing benefit of tooth brushing with fluoride-containing toothpaste. Three clinical trials have shown that daily tooth brushing with fluoride toothpaste in 3-6 year olds significantly reduces caries incidence.<sup>36</sup>

**Systemic Fluoride Supplements :** If the fluoride content of water is sub-optimal or unknown, the drinking water can be analyzed for fluoride content, and systemic fluoride supplementation can be recommended based on the fluoride content of the water, the child's age, as well as the child's caries risk. Data from over 20 clinical trials show caries' reduction in primary teeth of 30-80% from fluoride supplements, provided that they are started close to birth and continued for five or more years.<sup>37</sup>

**Fluoride Varnish:** Fluoride varnish is ideally suited for topical applications to the teeth of preschool children because of ease of use, acceptability to young children and reduced risk of over ingestion of fluoride. Commercially, these varnishes generally come in single use dispensers that limit the quantity of fluoride application to either 5.6, 9.0, 13.6 mg F, corresponding to 0.25, 0.4 and 0.6 ml varnish in the dispenser. Their efficacy to reduce caries in primary teeth has been shown in several studies.<sup>38</sup>

#### 5. Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP)

CPP-ACP nanocomplexes are casein-derived peptides in which ACP is stabilized by CPP. These nanocomplexes act as a calcium and phosphate reservoir when incorporated into the dental plaque and on the tooth surface [CPP-ACP has been shown to reduce demineralization and promote remineralization of carious lesions. CPP-ACP is better used as a self-applied topical coating after the teeth have been brushed with a fluoridated toothpaste by children who have a high risk of dental caries.<sup>39</sup>

#### 6. Dental Referral

For those children that are at caries risk, MS colonization and the carious process often begin before the first birthday. Therefore a dental referral consisting of examination of the teeth, anticipatory guidance counseling, performing preventive procedures and establishing a "dental home" has recommended for all infants at 12 months.<sup>40</sup>

#### 7. Oral health education

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.<sup>41</sup>

**Treatment**

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.<sup>42</sup>

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. 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, it does not require electricity and in most cases no local anesthesia is needed.<sup>43</sup>

**Caries Management by Risk Assessment (CAMBRA)**

CAMBRA assists providers to systematically-

- Assess each child and his caregiver’s caries risk in an individualized manner;
- Tailor a specific preventive therapeutic management plan or “care path;”
- Customize a restorative plan in conjunction with preventive care;
- Plan a timely, specific, and appropriate periodicity schedule based on the child’s caries risk

Caries risk assessment provides information pertaining to three specific overarching domains-

- **Risk and/or biological factors** such as continual bottle use, sleeping with a bottle, frequency and types of snacks, child taking any medications as well as other risk factors;
- **Protective factors** such as the use of fluoridated tap water, use of fluoridated toothpaste or the use of xylitol on a continuous basis; and
- **Clinical findings** such as presence of early demineralized enamel surface, cavitated lesions, plaque, lack of salivary flow, etc. (information to be obtained from Step 4)

Through a short and brief interview with the caregiver, information is gathered to assess the child’s risk of caries development and disease progression as low, moderate, or high. For example, a child may be at high risk if the child goes to bed or has a constant exposure with a bottle containing liquids with natural or artificial sugar, or snacks throughout the day, etc. Protective factors include brushing with a smear of fluoridated toothpaste at least once daily, especially before bed at night or drinking tap fluoridated water regularly.

Three findings are always associated with a high caries-risk. These are: 1) new carious lesions in the primary caregiver within the past 12 months; 2) prior caries and/or restorations in the child; and 3) white spot lesions, decalcification enamel defects or other obvious decay in the child. The information obtained from a caries risk assessment allows the care provider to formulate a caries risk profile for the child, an essential first step to determining the prevention and treatment plan, as well as the periodicity of patient follow-up/recall (one month, three months, six months or one year). Caries risk assessment can be easily and efficiently, performed by dental and medical providers.<sup>44</sup>

**Consequences of Untreated Dental Caries In Children**

Children’s quality of life can be seriously affected by severe caries because of pain and discomfort which could lead 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. 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.<sup>45</sup> 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.

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

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.<sup>46</sup>

**Conclusion**

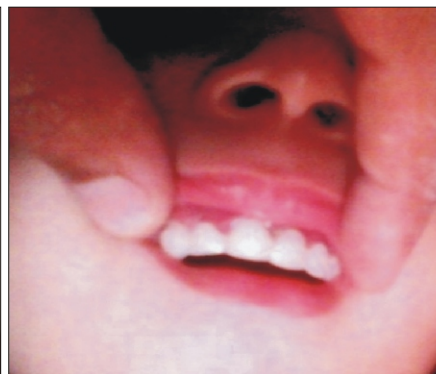
A review of the literature with regard to ECC identifies some risk factors, consequences, prevention strategies, and nursing interventions needed to assist children and their families to remain caries-free. Management of ECC is done according to progression of disease and should be done as early as possible. The measures undertaken to prevent ECC including prevention of transmission from mothers, improving feeding practices, fluoride use proves to be very useful to the children. Dental health education also plays an important as per providing knowledge about the disease and its control at initial stages. Towards the end, it is very apt to say about ECC that prevention is better than cure.

**References**

References are available on request at [editor@healtalkht.com](mailto:editor@healtalkht.com)



Pre-Operative



Post-Operative

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