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More Milk, Stronger Teeth? (Part I)

Early childhood caries (ECC) starts with a primary streptococcal infection, followed by the accumulation of streptococci in the biofilm at pathogenic concentrations secondary to the frequent and prolonged exposure to a cariogenic diet. Fermentation of sugars by *Streptococci mutans* inside the dental plaque causes enamel demineralization, resulting in cavitation of dental structures. Inappropriate nursing habits, especially related to a nursing bottle at night and adding sugar to milk, are the principal risk factors that can lead to ECC. Breastfeeding should be encouraged; however, due to conflicting findings from less rigorous research studies, no definitive time at which an infant should be weaned can be recommended.

Children's eating habits have dramatically changed in the last years. Milk consumption has decreased whereas the consumption of soft drinks, juices, non-citric beverages and carbohydrates has increased. Unfortunately, these habits have been correlated with a rise in the prevalence of dental caries.[1] Milk, in its various forms, is well known to be beneficial for the development of teeth and bone. More importantly, milk is the major nutritional source in the first years of life. However, different health care workers such as dentists, dietitians and nursing professionals have been known to give contradictory recommendations to the public, especially on the practice of night-time feeding and weaning.[2] Therefore, the presumed cariogenicity or not of milk is an issue of paramount importance. In this article, the authors will present a commentary review of the literature on the topic, and investigated the possible relationship among the various kinds of milk, nursing habits and caries.

Early Childhood Caries

Dental caries is a disease that is induced by dietary factors and, despite its decline in all age groups worldwide, its prevalence remains relatively constant in the primary dentition. In developed countries the prevalence is reported to be between 1% and 12%. However, in developing countries and within disadvantaged populations in developed countries, the prevalence has been reported to be as high as 70% in preschool children.[3] Early childhood caries (ECC), which is the currently accepted term used to describe dental caries occurring in infants and young children,[4] has recently received great attention from various publications in the literature. This term embraces many other terms, such as nursing bottle caries, nursing caries, baby bottle tooth decay, baby bottle caries and baby bottle syndrome.

The literature does not provide a universally-accepted definition for ECC, but the American Academy of Pediatric Dentistry (AAPD) considers ECC to be the presence of any carious surface of a primary tooth, missing (due to caries) or filled, in children younger than six years.[5] Based on this definition, the expression severe ECC (S-ECC) was adopted in lieu of rampant caries, in the presence of at least one of the following criteria: (i) any sign of caries on a smooth surface in children younger than three years old; (ii) any smooth surface of an anteroposterior primary tooth that is carious, missing (due to caries) or filled, in children between three and five years old; and (iii) decayed, missing, and filled teeth index (dmft) 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.[5]

ECC is a multifactorial, transmissible and infectious disease. The microflora, substrate, host and saliva are key factors involved in the pathogenesis, together with the immature host defense system and developing bacterial flora. These factors interact in a certain period of time, causing an imbalance in

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the demineralization and remineralization of the tooth surface and the adjacent plaque layer (biofilm).[6]

The main cariogenic microorganisms are the so-called mutans streptococci, especially *Streptococcus mutans* and *Streptococcus sobrinus*. These pathogens can colonize the tooth surface and produce acids at a faster speed than the capacity of neutralization of the biofilm in an environment below the critical pH value (less than 5.5); this results in the destruction of the tooth enamel. The major factor responsible for an infant becoming infected with *S. mutans* is the level of maternal infection or on the person in closest contact with the infant.[6] The severity of ECC is directly related to the early establishment of *S. mutans* in the infant.[7] In the period known as the window of infectivity, which corresponds to the eruption of lower incisors (6 months) and upper molars (24 months), the acquisition of *Streptococci* increases and these bacteria increase with the number of erupted teeth and with age.[8]

Sucrose is the most important cariogenic food. It can also turn non-cariogenic and anticariogenic foods into cariogenic ones. Other sugars involved in cariogenesis are glucose and fructose, which are found in honey and fruit. A single simple exposure to cariogenic food is not a risk factor for dental caries, but frequent and prolonged contact of these substances with the teeth is a problem.[9]

Host risk factors for the development of caries include immature post-eruptive enamel, the presence of developmental defects of enamel (mainly hypoplasia), and morphologic characteristics of the tooth, such as size, surface, depth of fossae and fissures;[10] while saliva is the major defense system of the host against caries. Saliva removes food debris and bacteria, and provides buffering against the acids produced. It also functions as a mineral reservoir for calcium and phosphate, which are necessary for enamel remineralization. Individual situations that decrease salivary flow and, consequently, its buffering capacity, as occurs while infants are sleeping, increase the susceptibility of the teeth to caries.[6]

ECC is more commonly found in children who live in poverty or in poor economic conditions, who belong to ethnic and racial minorities, are born to single mothers, and parents with low educational level, especially illiterate mothers.[10] In these populations the oral hygiene of the children is usually poor, exposure to fluoride is probably insufficient, and there is a greater preference for sugary foods.[10] Several specific situations are associated with ECC, such as malnutrition, low birth weight, diabetes mellitus, iron deficiency anemia, recurrent infections, and chronic diseases. They may lead to reduced salivary flow, low salivary buffering capacity, or enamel hypoplasia.[6] The severity of ECC increases with the severity of bronchial asthma, which is commonly treated with beta 2 agonists, which reduce salivary secretion. In addition, powder inhalers and oral medications contain sugar in their

formulation.[11]

ECC is a serious public health problem and its control should be a priority, since it may lead to a malocclusion in the permanent dentition, cause phonetic problems and lower self-esteem. ECC can also gradually reduce a child's weight gain, which may be reversed after complete oral rehabilitation.[12] However, ECC can be painful and debilitating, and it is well accepted that its treatment is difficult, expensive, demanding, and time consuming.

Efforts to prevent ECC should logically begin prior to the onset of the disease. Hence, primary prevention of ECC should start in the ante-natal period. Oral health education and dietary instruction should be provided to the caregivers, who influence the dietary habits of children and serve as promoters of oral hygiene practices, and should even be provided to pregnant women.

Nursing Habits

• Bottle Feeding

Dietary habits are the main factors in the aetiology of dental caries in any age group, but principally in preschoolers.[13] For instance, sweetened milk in a nursing bottle for a long time has, been considered to be a significant risk factor for ECC.[14] The use of a nursing bottle at bedtime appears to be a widespread practice to help the infant to go to sleep.[15] However, during sleep, salivation decreases and its buffering capacity is also reduced. Hence, the oral clearance rate of carbohydrates is reduced and the length of contact time between plaque and the substrates is increased.[16] Furthermore, when in the mouth, the nipple on the nursing bottle causes restricted salivary flow around the palatal surfaces of the maxillary teeth and labial surfaces of the incisors. There is evidence to show that glucose clearance was slowest on the labial surfaces of the maxillary incisors and the buccal surfaces of the mandibular molars.[17] This may explain why carious maxillary incisors (**Figure 1**) and first molars are the characteristics of ECC, whereas lower incisors, which are close to the main salivary glands, are also protected from liquid contact by the nipple and the tongue.[18]

Night-time use of a nursing bottle has been shown to be prevalent in children with and without caries yet this nocturnal feeding habit has for a long time been known to contribute to EEC. [15,19] Thus, the contents of the nursing bottle and the length of time that the bottle is in the mouth especially at night time are properly more important and appear to be positively related to ECC.[15] In addition, it has been demonstrated that infants with ECC sleep less at night, they tend to wake up more frequently, and to receive more frequent bottle feedings as a way to manage their sleep problems.[20]

Figure 1 Carious primary maxillary incisors - one of the characteristics of ECC

A nursing bottle at night may be used as a form of comforter thus creating a habit that is subsequently difficult to break. Therefore, the importance and significance of feeding habits need to be emphasized prior to the establishment of a deleterious habit. The practice of adding sugar to milk should be totally avoided. Moreover, parents are encouraged to offer their infants beverages in drinking cups before their first year of life and to stop bottle feeding between 12 and 14 months of life.[21]

• Breast Feeding

The health and economic benefits of breast feeding in both developing and developed countries have been extensively documented.[22] Breast feeding is practiced longer by women from upper social classes, who are better educated and older mothers, and by those with a steady relationship, and better dental hygiene is also practiced by mothers in these groups compared to the under privileged classes, in which ECC is more common.[10] Abbey[23] suggested that it is unlikely that milk accumulates in the infant's mouth during breast feeding because the breast and nipple occupy a greater volume of the oral cavity during breast feeding than does an artificial nipple used on a nursing bottle. This mechanism should theoretically mean that breast feeding does not cause ECC. Moreover, results from many studies have shown that there is no correlation between ECC and breast feeding or with its duration.[24-27]

However, there is quasi-consensus that breastfeeding on demand, especially at night and if prolonged, produces caries; because of the accumulation of milk in the mouth, which, combined with reduced salivary flow and lack of oral hygiene, may result in caries.[28] Therefore, some dental professionals have the perception that weaning from the breast should have commenced by the first birthday.[29] In this context, it is interesting to note that the World Health Organization (WHO) recommends to maintain breast feeding up to the second year

of life or even longer.[30] The opinions about breast feeding at night are also controversial. The AAPD recommends that ad libitum breastfeeding at night should be avoided after the eruption of the first tooth.[5] However, others believe that breastfeeding at night should not be discouraged because this can be detrimental to the normal development of an infant because the infant who wakes up crying at night in order to be breastfed is simply expressing a need that should be met by the mother.[10]

The various studies that have investigated the association between breastfeeding and ECC are contradictory and the findings have not always been reproducible. It may be due to the different definitions of terms such as ECC, breastfeeding, frequent and prolonged feedings, or it may due to the fact that breast milk expressed directly onto the soft palate does not stagnate during sucking[31] and the volume ingested by the infant is difficult to quantify. In a systematic review of 151 articles, the authors found a moderate correlation between breastfeeding and ECC in only three studies. They verified that the quality of the studies is relatively poor and that the stated variables were difficult to compare. Finally, the authors concluded that, there is no strong and consistent evidence between breastfeeding and the development of ECC, and thus there is no justifiable reason to stop breast feeding.[2] In another review article, the authors argued that studies, which correlated ECC with breastfeeding invariably, observed the factors related to caries development, whilst ignoring those factors related to breastfeeding. They claimed that there is no scientific evidence to confirm the association between breastfeeding and ECC. Therefore, breastfeeding at night should not be discouraged and exclusive breastfeeding should be encouraged up to the sixth month of life and can be maintained at least up to the second year of life. There should be flexibility in the feeding schedules and the breast milk should be complemented with appropriate weaning foods.[10]

Clearly, EEC is avoidable, if effective preventive strategies are practiced. Dental professionals are well-positioned to inform parents and caregivers regarding age-appropriate healthy feeding practices for young children entrusted to their care. Parents and all personnel involved in child health and welfare should be educated on how to recognize early signs of ECC, as well as to promote early intervention and appropriate referral. In Part II it is proposed to consider the cariogenicity of different types of milk. DA

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