Early Childhood Caries- *the malefactor incapaciating innocence*

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Abstract

Aim: To review, update and convey a global perspective of the present understanding definitions, aetiology, risk factors, prevalence, management, and prevention strategies, associated with early childhood caries (ECC)

Background: Early childhood caries (ECC), formerly referred to as nursing bottle caries and baby bottle tooth decay, it one of the most popular and prevalent diseases in young children all over the world. Early childhood caries (ECC) is a significant public health complication in both low and middle-income country and modern countries as well. ECC is caused by a dysbiotic state of oral microorganisms mainly caused by a sugar-rich diet. Additionally, poor oral hygiene or insufficient dental plaque removal leads to the rapid progression of ECC. ECC results in dental destruction and pain with children, along with it, it affects the life quality of the caregivers. The ECC starts affect in children only after eruption of primary teeth upto age of about 5 years.

Review Results: Children with extensive ECC are at high risk to develop caries with the permanent dentition or will have other problems with speaking and/or eating. The ECC involves all parts of the tooth it affects smooth surface. Usually it affects upper anterior teeth and primary molars. Likeliness of affecting the lower anterior teeth are less. The additional factors, such as feeding practices and presence of enamel defect also contribute to the initiation and progression of ECC. Approaches to reduce the prevalence include interventions that start in the first year of a child's life, evidence-based and risk-based management, and compensation systems that stimulate preventive care to prevent ECC, should be considered. Children should brush their teeth with toothpastes containing gentle ingredients, such as mild surfactants and agents showing anti adherent properties regarding oral microorganisms. Parents/caregivers have to help their children with brushing the teeth. Furthermore, remineralizing and nontoxic agents should be included into the toothpaste formulation.

Conclusion: managing the disease of dental caries among children remains a formidable task. Steps should be directed towards strategies of preventive caries control among children also managing preexisting carious lesion.

Clinical Significance: Oral health take part in an important role in children to maintain the oral functions and is required for food intake, development of speech, and instills a positive self-image about oneself. So, it is important to make improvement in awareness of oral health among parents, to setup a dental home at the early stage of childhood, and construct an individualized plan for management of caries, in order to prevent the harmful effects of ECC.

Keywords: dental caries, early childhood caries, dietary habits, oral health, pediatric oral health, sociodemographic factors, infant feeding.

Introduction:

Dental caries in pre-school children and toddlers was described by several terms like baby bottle decay or nursing bottle caries. Oral diseases are a major global public health problem, having both high prevalence and major negative impacts on individuals, communities, and society[(1)]. The prevalence and incidence of untreated caries remained unchanged in all regions of the world over the 20years studied[(2)]. ECC has been spreading in many countries all over the world and has become a notable health issue. The consequences of ECC often include a higher risk of new carious lesions in both the primary and permanent dentitions, hospitalizations and emergency room visits, high treatment costs, loss of school days, decreased ability to learn, and declination in oral health-related life quality[(3)]. Prior to the 1997, NIH sponsored 'Early Childhood Caries Conference' dental caries occurring in pre-school children were first described as “Comforter Caries” in 1911[(4)] and in 1962 as “Milk Bottle Mouth”.[(5)] For many years, it also has been referred to as “Baby Bottle Syndrome”, “Nursing Bottle Caries”, “Nursing Caries”, and “Baby Bottle Tooth Decay”. These all references to dental caries in pre-school children generally indicated causality to incorrect feeding with a baby bottle. The contemporary term early childhood caries (ECC) connotes a more complex disease, which is related to frequent sugar consumption in environment of enamel with adherent bacteria that may not be related to bottle feeding. ECC can begin in early stages of life, with rapid progression in those children who are at high risk, and frequently goes untreated[(6)].

Definition:

ECC is defined as the presence of one or more decayed (non-cavitated or cavitated), missing (as a result of caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger.

The American Academy of Pediatric Dentistry (AAPD) also specifies that, in children younger than 3 years of age, any sign of smooth surface caries or a dmfs (decayed, missing, or filled surfaces) score of greater than or equal to four (age 3), greater than or equal to five (age 4), or greater than or equal to six (age 5) is indicative of severe early childhood caries (S-ECC)[7].

Prevalence: - ECC is one of the most widespread diseases worldwide. ECC is one of the most prevalent diseases in India and all over the world. Its global prevalence as reported by Uribe *et al*. was 48%, in India overall prevalence of ECC was estimated 46.9% %[8]. Incidence of ECC among children with deciduous teeth is 1.76 billion (95% CI: 1.26 billion; 2.39billion)[9]. Assessment of 193 United Nations published data between 2007 and 2017 showed that the mean ECC prevalence was 23.8 and 57.3% in children younger than 3 years and children aged 3 to 6 years, respectively with no significant change observed from 1990 to 2019[10].

Secondly, although ECC is prevalent around the world, it is, growing rapidly in developing countries[11]. Thirdly, the untreated initial caries remains high. Medically, socially, and economically ECC is still a global public health burden[12]. Worldwide, approximately 532 million cases (95% UI, 443 to 622 million) had untreated caries in primary teeth in 2017, and between 1990 and 2017, the percentage change in the number of prevalent cases decreased in advanced countries and increased in underdeveloped countries[13].

ECC is not at all limited to children with a low socioeconomic status (SES)[14]. Milsom et al. described that children with an already existing caries lesion have a 5–6 times higher incidence of developing new caries lesions compared to previously caries-free children[15]. Issues and inadequate sleep can also be identified as risk factor for ECC, as sleeping issues lead to a more recurrent use of nighttime bottle use with sugar-sweetened beverages[16]. Sociocultural and socioeconomic backgrounds of the parents can also be found as risk factors for ECC. The parents along with their children should be motivated to take care of the primary dentition to prevent ECC and as a consequence prevent further caries development in the secondary dentition[17].

Etiology

The cause of origin of ECC is multifactorial and has been well established. Research has confirmed that ECC is a multifactorial disease. ECC is frequently associated with a poor diet and bad oral health. Child oral health-care behaviour, feeding and cleaning behaviour are associated with ECC among children; night time bottle feeding and frequent consumption of cariogenic food; late commencement of child tooth brushing and irregular brushing habits.

Ecc Core Microbiome: -

The community of micoorganisms also known as caries microbiome plays a pivotal role and is the primary cause in dental caries development. Endogenous bacteria act on fermentable carbohydrates within the biofilm and produce by product in form of acids, which results in fall of local pH values leading to demineralization of tooth hard tissues. Therefore, the etiological study of ECC is mainly points on disruption of oral microecological equilibrium , caries core microbiome, and their relationships with host genetic factors, which contributes to the aetiology study of ECC and provides the theoretical foundation for prevention and treatment of ECC. It refers to microorganisms in dental plaque or saliva connected to the event of caries. It is well known that not only Streptococcus spp., and Actinomycete spp., Lactobacillus spp., but also previously unidentified species are involved in the advancement of ECC. The significant difference in microbial community structure between caries and caries-free children has been revealed, including Veillonella spp., Granulicatella spp., Fusobacterium spp., Neisseria spp., Selenomonas spp., and Campylobacter spp.In a recent study Teng et al. detected that Veillonella spp. And Prevotella spp. were the pioneer of ECC instead of S.mutans in a 3-year cohort study[18-20]. Scardovia wiggsiae, secluded from ECC, has been correlated with initial carious lesions with high acid tolerance and acid production[21]. In a recent study found that the addition of the arginine deiminase system protects Saccharibacteria and their host bacteria from the acidic microenvironment which is present in the plaque biofilm[22]. Along with bacteria fungi have been related to ECC with interkingdom interactivity it has also been seen that the abundance of Candida albicans is markedly higher in children with ECC than in children without ECC[23]. Although S. mutans is a very important bacterium which is associated with caries and takes part in the initiation and progress of caries, its presence or absence is not always associated with the caries severity . A study on correlation of S. mutans and other microorganism levels on caries-consistent and non caries populations. The results showed that salivary microbial communities formed clusters based on S. mutans levels and they were not dependent on their caries experience. In groups with high S. mutans levels, Veillonella spp., Streptococcus spp., and Prevotella spp. were significantly increased[24].

Diet:-

Diet plays a significant role in the development of ECC especially if it contains high levels of carbohydrates that are fermentable; the child has a higher risk for dental caries. Unsuitable feeding practice can lengthen the time of exposure of teeth to fermentable carbohydrates which in turn may provoke the chances of ECC. Bottle feeding during bedtime or sleeping has been related to initiation and later development of caries in children[25]. SM produces acids from fermentable carbohydrates, which can cause demineralization of enamel and dentin[26]. Studies have shown that cow milk has minimal cariogenicity due to its mineral content and low lactose level. Iida et al. showed that breast feeding and its duration were independently associated with an increased risk for ECC among 2- to 5-year-old children. A systematic review revealed the relation of breast feeding for more than a year and at night to increase in cause of dental caries Infant inappropriate feeding practices such as frequent sugar exposure, snacking, intake of sweetened drinks to bed, sharing common foods with adults, as well as maternal caries condition, oral hygiene status and diet increases susceptibility to early SM colonization and its establishment of high MS counts[27].

Environmental Factors: -

Absence of good oral hygiene practices encourages the event of ECC. Soon after the eruption of the first primary tooth Children should be provided with oral hygiene care Children from low socioeconomic status are two times more prone to have dental caries than children from higher income strata.The social status of caregivers, deprivation, poverty, number of years of education, and dental insurance coverage along with few other factors influence the oral hygiene habits of children and the severity associated with ECC[28]. Saliva has a protective role against dental caries development by providing the main defence system. Saliva flow rate, antimicrobial properties, the buffering capacity, and clearance of foods from the oral cavity are factors that are important in reducing the development of caries[29]. Feeding of high sugar containing food at night may increase the caries risk for infants and toddlers due to the low salivary flow rate[30]. Studies have shown the presence of hypoplastic enamel defects with prenatal conditions such as low birth and premature birth weight, as well as with malnutrition and illness. Although enamel hypoplasia has been confirmed as an independent risk factor for caries, the proof that it is actually a cause of dental caries has not been established. Low socioeconomic status, poor parental education, and life style factors have significant influence on ECC[31]. Leroy et al[32-35]. reported a significant relationship between parental smoking habit and caries experience children.

Characteristics Of Deciduous Enamel And Enamel Of Permanent Teeth: -

Enamel is the hardest tissue in the human body. It mainly consists of hydroxyapatite (97%) (HAP), Ca5(PO4)3(OH), which is a calcium phosphate mineral[36]. Enamel is highly mineralized and has extraordinary mechanical properties interior of a tooth consists of dentin (about 70% HAP and 20% proteins mainly collagen and 10% water), produced by odontoblasts, and the enamel, that is built by ameloblasts. Ameloblasts are restricted to produce enamel one time: ameloblasts produce several proteins and attract calcium and phosphate ions to crystallize.Enamel of deciduous teeth is built within a significantly shorter period (24 months) than permanent teeth (up to 16 years)[37]. Consequence of the shorter time for enamel development is the formation of a very thin enamel (half the thickness than that of the permanent teeth) and a less organized microstructure[38]. As a result, acids demineralize deciduous enamel faster than permanent enamel[39-42]. The cervical portion of primary tooth is constricted, which causes difficulty in cleaning. The calcium content and mineralization degree of primary tooth also is lower than the permanent tooth. These factors add on to the causes of susceptibility primary tooth to dental caries[43].

Clinical Presentation

ECC is a dental disease consisting of stages of early, moderate and late dental decay that affects the primary teeth of infants and toddlers. Surfaces with low risk for caries, such as the labial surfaces of maxillary incisors and lingual and buccal surfaces of maxillary and mandibular molars are mostly affected. ECC initially appears as dull white or brown spots on maxillary incisors along the gingival margin, which later spreads and results in complete destruction of the crown, leaving isolated root stumps . In moderate stage, the caries starts spreading to the maxillary molars. In the severe stage, the caries process causes complete destruction of the maxillary teeth and later spreads to the mandibular molars. Based on the clinical appearance, ECC can be classified as Severe early childhood caries (S-ECC) refers to children with 'atypical,' 'progressive,' 'acute,' or 'rampant' pattern of dental caries. A child with ECC may suffer from extreme pain, leading to difficulty in food intake and speaking. If the extent of the damage results in early extraction of the anterior teeth within age 2 or 3 years may result in delay in physical development due to poor nutrition and the pain and discomfort may reduce their desire to eat. The oral health quality of life of the child is affected from the pain and suffering associated with the caries[44].

Management Clinical Management Of Early Childhood Caries

Primary Prevention

Preventing ECC primarily needs to begin before the beginning of disease and is the key to lower the worldwide prevalence of ECC. Proper delivery of educational information and preventive therapies to the parents/caregivers has been shown to be effective in reducing the prevalence of ECC. Physicians, nurses, and other healthcare workers have more opportunities to educate the caregivers than dental professionals because they are frequently in contact with the family in the child's first few year therefore, it is essential that these providers are well trained regarding of caries risk and protective factors and promote primary care preventive messages that must include limitation free sugar intake in foods and drink for children under 2 years; avoiding baby bottle and breastfeeding beyond 12 months; avoidance night-time bottle feeding with milk or drinks containing free sugars. Along with it, optimal exposure to dietary fluoride is of prime importance to all dentate infants and children and can be delivered via fluoridated water, fluoridated milk and fluoridated salt,. Topical fluoride can be provided at home by having the child's teeth brushed twice daily with fluoridated toothpaste, which contais at least 1000 ppm fluoride and using an appropriate amount of toothpaste on the brush according to age—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, Ideally, a child should have a dental visit for complete care in the first year of life, and any child at caries risk should be given regular 5% fluoride varnish applications. children need to be based on biomimetic strategies as alternatives to prevent caries and especially ECC. Several products based on different calcium phosphates are already on the market and wellstudied. Besides others, hydroxyapatite (HAP) [Ca5(PO4)3(OH)] and amorphous calcium phosphates [Cax(PO4)y·n H2O] stabilized by casein proteins (CPP-ACP) show the most promising results[45].

Secondary Prevention

Secondary prevention for ECC is preventing the spread of, or stimulating the remineralization of, caries, before progressing to the cavitation stage of lesions. Early detection of incipient caries is clue to the cavitation prevention. Besides the primary prevention approaches listed above, prevention of applying pit and fissure sealants to susceptible molars and applying fluoride varnishes such as four times per year are effective non-invasive measures that arrest. Progression of caries. Glass ionomer cements used for dental sealants have several properties, such as reduced moisture sensitivity, fluoride release, chemical bonding to enamel and dentine, that makes them favourable for use in pre-school children[46].

Tertiary Prevention

Tertiary prevention for ECC can involve both non-invasive and invasive preventive management when there are cavitated dentine lesions already appeared. Besides all of the primary and secondary prevention applications, silver diamine fluoride recently has gained popularity for the arrestment of cavitated lesions. The exposed dentine due to the infiltration of silver products results in black staining of the lesion, however, in certain populations its acceptability limited[4]. Caries removal and[9] conservative tooth restoration prevent further tooth breakdown, pain, and also prevent unnecessary pulp exposures In developing countries the use of atraumatic caries removal and tooth restoration with glass ionomer cement (ART) for dentine lesions that are cavitated is supported from studies. Resin-based composite is superior to glass ionomer restorations in case of more than one surface restorations in primary teeth[47]. Conservative tertiary prevention approaches are supported by the WHO global consultation that are required to prevent ECC The restoration of cavitated carious lesions with restorative material should be made along with the caries risk assessment. In pre-school children, glass ionomer cement and resin-modified glass ionomer cement may be considered for occlusal, Class II, Class III, and Class V restorations as these materials bond to tooth structure and result in release fluoride which acts on caries and inhibits secondary caries Additionally, glass ionomer cements can be placed with minimum clinical tooth isolation. This material, glass ionomer cement however, is not recommended because of its compressive strength and fracture issues, for Class II restorations or for the restorations of the incisal section of incisors. For occlusal, Class II, Class III, and Class V restorations Resin-based composite also may be considered, they have stronger bond strength and compressive strength than glass ionomer cement. Resin-based materials can be used for minimally invasive restorative dentistry, but isolation of the tooth to prevent saliva contamination is very much needed. When restoring ECC in patients with high caries risk and extensive loss tooth structure due to caries full coverage crowns may be necessary. Resin-based strip crowns have been successfully used, but excellent tooth isolation is necessary to obtain an proper bond to acid-etched tooth structure[48-51].

Community Programmes

These programs are organized for managing ECC generally selecting target high-risk, low socioeconomic, backward, disadvantaged communities of people using established caries prevention methods. Programmes that are culturally suitable and acceptable with community-based participation and at par with community cultures have been organized and they prove to be successful in reducing ECC in indigenous,

low-income, and migrant communities globally[52-54]. Similarly, personal approaches such as visiting individual home and over the phone can reduce ECC by increasing caregivers' proper oral health knowledge and self-efficiency to change perspective and behaviours to improve their infants' oral health[55-56]. Early dental visit strategy at 1-year of age is a clue to ECC management method and which adapted in many community programmes[57].

Conclusion: -

ECC is a chronic, infectious disease which affects young children around 5 years of age, and account for a serious public health problem. It is one of the most common diseases which can be prevented and is spreading globally. ECC is a multifactorial disease resulting from the interaction of cariogenic microorganisms, exposure to carbohydrates, different feeding practices, and a range of social reasons. It can affect a child's well-being, and quality of life. This form of dental caries is virulent rapidly spreading and begins soon after dental eruption mainly on the smooth surfaces of the teeth. It has a continuing harmful impact on the dentition. Early childhood caries has high costs to society and has a major impact of parents' and children's quality of life. Approaches to reduce its prevalence include:

Management of the disease process that start in the first year of a child's life, and depending on the needs of the child includes primary, secondary, and tertiary prevention 3.Evidence-based education and risk-based reimbursement systems that foster a shift from surgical to preventive care.

Preventive steps taken for all pre-school children should consist: (a) avoiding sugar intake for children under agetwo; (b) limitation of sugar intake in children who are above age two; and (c) encouraging them to brush their teeth twice daily with fluoridated toothpaste (at least 1000 ppm), using an appropriate amoun tof paste according to age.

More research on ECC prevention followed by management, establishing proper oral health-related quality of life, and health economics to support the global benefits of reducing its prevalence. Establishment of a dental home at an early stage of childhood and an personalized caries management plan should be provided according to the caries-risk assessment done . Active and effective measurements related to the concept of minimum intervention should be taken to treat dental caries.

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