Review Article

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Dental Management and Diet Counselling for Early Childhood Caries- A Review of Literature

Pitambra Sahu[1]* Ashish Saxena[2] Ajay Parihar[3] Neha Verma[4]

[1]PG Student, Department of Pedodontics and Preventive Dentistry, Government College of Dentistry, Indore, MP, India.
[2]Professor and Head, Department of Pedodontics and Preventive Dentistry, Government College of Dentistry, Indore, MP, India.
[3]Professor and Head, Department of Oral Medicine and Radiology, Government College of Dentistry, Indore, MP, India.
[4]Lecturer, Department of Prosthodontics, Government College of Dentistry, Indore, MP, India.

ABSTRACT

Background: Dental caries is a public health problem with biological, social and behavioural determinants. It the most common dental disease occurring all around the globe. It affects children of all age groups. Early childhood caries in primary teeth is growing tremendously and becoming a significant health problem in low and middle income. Improper feeding habits, feeding time and beverages, presence of bacterial plaque, improper oral hygiene practices cause dental caries, affects everyday living leading to overall diminished growth both physically and mentally. This increased pattern is due to a parallel transition towards a modern diet and changing lifestyles. The unattended treatment leads to its deterioration, causing pain, enamel defects, orthodontic complications and further difficulties. This situation causes an enormous impact on oral health, general health, growth and development, sleep disturbances, concentration issues and the quality of life of the children's families and communities. Proper awareness, knowledge, counselling and keeping a watch on dietary practices of a child can be a boon to help restrict and properly manage caries. This article aims to focus on dental management and diet counselling for early childhood caries.

Keywords: Dental management, diet counselling, early childhood.

INTRODUCTION

Early childhood caries is the most common chronic illness among children and adolescent, which can lead to pain and reduced ability to chew and eat, which may also lead to iron deficiency due to malnutrition. , thus leading to reduced quality of life, disturbed sleep and concentration problems. [1]

The American Academy of Pediatric Dentistry defines Early childhood Caries (ECC) as the presence of one or more decayed (non-cavitated, cavitated), missing (as a result of caries), or filled tooth surfaces in any primary tooth in a child 71 month of age or younger.[2]

Dental caries in preschool children has been described by numerous terms and attributed to various aetiologies over the years. Prior to 1997, NIH sponsored 'Early Childhood Caries Conference' dental caries in preschool children was first described as "Comforter Caries" in 1911, and in 1962 as "Milk Bottle Mouth". Over the years, it also has been referred to as "Baby Bottle Syndrome", "Nursing Bottle Caries", "Nursing Caries", and "Baby Bottle Tooth Decay". These references to dental caries in preschool children generally assumed causality to inappropriate feeding with a baby bottle. The current term early childhood caries (ECC) connotes a more complex disease, related to frequent sugar consumption in an environment of enamel adherent bacteria that is not necessarily related to bottle feeding[3]

Etiology

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***Correspondence Dr. Pitambra Sahu.**
Department of Pedodontics and Preventive Dentistry, Government College of Dentistry, Indore, MP, India.
Email: pitambrashu15@gmail.com

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ECC involves the interaction between pathogenic organisms, fermentable carbohydrate substrate, host susceptibility, and time.[4][5]

Acidogenic bacteria ferment carbohydrates from the diet, leading to a rapid fall of pH in tooth adherent biofilms to 5.0 or below. The lower pH leads to a so-called dysbiotic microbiome that is characterized by an increase in the proportion of acidic biofilm species, changes in the composition of the biofilm matrix and demineralization of tooth structure.

Consumption of free sugars (i.e. sugars added to food and beverages and sugars naturally present in honey, syrups, fruit juices, and fruit juice concentrates) is of critical importance to the development of dental caries[6] ***Chaffee BW and Feldens CA, Rodrigues et al.*** showed that two key characteristics are critical in ECC dietary practices: the age at which sugar is introduced to a child and the frequency of its consumption.[7][8] Regarding sugar introduction, dietary patterns in infancy, characterized by a greater number of highly sweetened foods and drinks in the first year of age, baby bottle and breastfeeding beyond 12 months especially frequent and/or nocturnal are strongly associated with the incidence of childhood caries in subsequent years.[9]

The loss of surface integrity and deficiencies in mineralization, socioeconomic factors at the community and family level are also associated with a higher risk of ECC prevalence. [10] [11]

The cariogenic microorganisms play an important part in caries development and Streptococcus mutant, veillonella and lactobacilli are important pathogenic organism in its development. S. mutant constitutes about 60% of the cultivable flora of dental plaque obtained from preschool children with ECC and less than 1% of the flora in children with few or no caries [12]. A study done by ***Tanner AC et al.*** reported an association between the amount of S. mutans and the prevalence of dental caries in children. [13] The major reservoir from which infants acquire cariogenic bacteria, such as mutans streptococci (MS), is the mother's saliva. Infants whose mothers have high levels of MS, as a result of untreated caries, are at greater risk of acquiring the organism earlier than children whose mothers have low levels of MS. [14]

Clinical Features

ECC follows a special pattern. The caries attack usually starts on the labial surface of the upper anterior incisors with a whitish area of decalcification along the gingival margin. Then soon become pigmented and spread laterally and coronally. Caries on molars may start simultaneously in the pit and fissure area and the gingival area of the buccal surface. The four upper incisors are among the first teeth to erupt and are usually the most severely affected, having the longest exposure to cariogenic substances. Also, the nursing liquid always pools around these four teeth, whereas mandibular incisors are more resistant to decay.

Infant Dietary Practices

Two bottle-related behaviours have attracted most interesting ECC research–the use of bottles at night/naptime and the use of the bottle beyond 12months. The critical period maybe soon after the eruption of teeth into the mouth and that early use of the bottle containing sweet fluids supports the early establishment and dominance of cariogenic microflora. This may be more important than bottle use after 12months. ***Litt et al*** found that the use of the bottle at night-time was associated with sugar intake. The mothers who reported night-time bottle use were also more likely to have children with a higher sugar intake.[15]

Caretakers should restrict the frequency of juices, drinks and sweets. According to AAP recommendation, fruit juice should not be given to children younger than 1 year of age and be limited to 120ml for 1 to 3 year old and 120 to 140 for 4 to 6 year old.[16]

CARIES RISK ASSESSMENT

Caries risk assessment (CRA) is the process of establishing the probability of an individual patient, or groups of children, developing carious lesions over a certain time period or the likelihood that there will be a change in size or activity of lesions already present.[17] The most common CRA tools available are the manual AAPD CRA form[16] and CAMBRA[18] checklists, comprising of 13 and 14 items, respectively, the algorithm-based software programs Cariogram[19] and NUSCRA.[20] In general, three levels of caries risk are applied: "low risk",

"moderate risk", and "high risk". There is consensus that "low risk" means the absence of disease (risk) factors and presence of protective factors, but there are no accepted definitions on the moderate and high-risk categories.

Clinical Management of ECC

There are three levels of prevention of ECC in children.

Primary prevention

Primary prevention begins before the initiation of disease and is the key to reducing the worldwide prevalence of ECC. It is essential for parents/caregivers to be aware of caries risk and protective factors. Information includes;

- limiting free sugar intake in foods and drink for children under two years
- avoiding night-time bottle feeding with milk or drinks containing free sugars; and avoiding baby bottle and breastfeeding beyond 12 months, especially if frequent and/or nocturnal.
- Optimal exposure to dietary fluoride is important to all dentate infants and children and can be delivered by fluoridated water, fluoridated salt, and fluoridated milk.
- Topical fluoride can be delivered at home by having the child's teeth brushed twice daily with fluoridated toothpaste, containing at least 1000 ppm fluoride and using an age-appropriate amount of toothpaste on the brush—a "smear" (approximately 0.1 mg F) for children under age 3, and a "pea size" (approximately 0.25 mg F) for children age 3-6. [21]
- According to a WHO meeting in 2016: Fluoride concentration in toothpaste for anti-caries efficacy ranges from 1000 to 1500 Part per million (ppm) with a minimum of 800 ppm fluoride ion bioavailable. Brushing frequency should be at least two times per day.
- The amount of F toothpaste recommended by the consultation was:

for children from 6 months to 2 years – a thin smear, half a pea (0.05-0.1 g);

for children aged 2–6 years, a small pea size or width of the toothbrush (0.25 g);

for children aged six years and older, the full length of a child's toothbrush (1–1.5 g). Brushing time should be a minimum of two minutes. Spitting out the toothpaste and rinsing minimum times with minimal water were recommended. The ideal time for brushing is after meals in the morning and immediately before going to bed. If used as recommended, fluoride toothpaste is safe to use irrespective of low, normal or high fluoride exposure from other sources.

Ideally, a child should have a dental visit for comprehensive care in the first year of life, and any child at caries risk should have regular 5% fluoride varnish applications.[16]

Secondary prevention

It is preventing the progression of or stimulating the regression (remineralization) of, caries, prior to the cavitation stage of lesions. Early detection of incipient, more frequent fluoride varnish applications, such as four times per year, applying pit and fissure sealants to susceptible molars are effective non-invasive measures to arrest caries progression. Glass ionomer cement used for dental sealants is favourable in preschool children, because of fluoride release, chemical bonding to enamel and dentine and reduced moisture sensitivity.

Xylitol, Other Polyols, Caries Vaccine and chemical-mechanical means :

Xylitol, a 5-carbon sugar alcohol antibacterial effects specific for S mutans by compromising its metabolism and colonization . In the Turku Sugar Studies, Scheinin and Ma¨ kinen, other studies ***Kiet A Ly, Peter Milgrom*** substituted the non-fermentable polyol xylitol for virtually the entire sugar content of the dietary components of dental students and faculty at a dental school in Finland during a 3-year period. This substitution resulted in a remarkable caries incidence reduction, by comparison with similarly fructose-substituted and conventional sucrose-containing foods.

A protective layer on the top of enamel was found when using CPP-ACP. This calcium phosphate is also able to remineralize initial enamel lesions

equivalent to fluorides.[22] Different studies done by ***D. L. Bailey et al.*** showed that early lesions could also be remineralized and regressed using CPP-ACP [23] and regarding remineralization identified CPP-ACP to even be superior to a high fluoride containing the product (5000ppm fluoride).[24]

Vaccines are an immunobiological substance designed to produce specific protection against a given disease by the production of a protective antibody and other immune mechanisms. Four routes of immunization have been used with S. mutans: 1. Oral 2. Systemic (subcutaneous) 3. Active gingival-salivary 4. Passive dental immunization. The antibodies find their way into the oral cavity through gingival crevicular fluid and are protective against dental caries.

Chemical- mechanical means of caries removal are very effective in alteration with traditional caries removal and is efficient in removing infected dentine without altering the healthy dental tissue or harming the adjacent oral mucosa, decreases patient discomfort and provides a pleasant dental experience. Various chemicals used are GK-101E, Caridex, Carisolv, Papacarie, Chloramine, Toluidine blue.

Tertiary prevention

This involves both non-invasive and invasive preventive management when there are cavitated dentine lesions. Conservative caries removal and tooth restoration are necessary to prevent further tooth breakdown, pain, and prevent unnecessary pulp exposures.[25] The use of atraumatic caries removal and tooth restoration with glass ionomer cement (ART) for cavitated dentine lesions is supported by studies in developing countries.[26] For multi-surface restorations in primary teeth, resin-based composite is superior to glass ionomer restorations.[27] Conservative tertiary prevention approaches are supported by the WHO global consultation on prevention of ECC.[28] In preschool children, glass ionomer cement and resin-modified glass ionomer cement may be considered for occlusal, proximal and cervical restorations since these materials bond to tooth structure and release fluoride which inhibits secondary caries.[27] As Resin-based composite have stronger bond strength and compressive strength than glass ionomer cement, so it is considered for occlusal, proximal and cervical restorations. Full coverage crowns may be necessary when restoring ECC in patients with high caries risk and extensive loss tooth structure due to caries.[29]

COMMUNITY MANAGEMENT OF ECC

It helps in managing ECC in high-risk, low socioeconomic, deprived communities using established caries prevention methods. Early dental visit strategy at 1-year of age is a key ECC management method. The preventive dental examinations should include CRA, tooth brushing instruction, dietary counselling, anticipatory guidance, and establishment of a dental home. Forming partnerships with non-dental primary care providers, for example, general doctors, paediatricians, and midwives to integrate oral health promotion into general health care may help to increase infants' access for early preventive examinations and referral for dental care.[30] Also, partnerships with nursery school staff to perform school-based oral examinations and tooth brushing are successful in reducing ECC in many socially underprivileged communities worldwide.[31] Primary, secondary, tertiary prevention methods, multiple prevention methods and culturally competent, flexible community-based participatory approaches to managing ECC in community programmes. The conservative disease management approach for ECC using interim restorations and preventive techniques is cost-effective and may be appropriate for communities that do not have resources for traditional dental care.

In a meeting in Bangkok, Thailand, 26–28 January 2016 WHO Global Consultation on Early Childhood Caries brought together staff from WHO headquarters and regional offices with representatives of WHO collaborating centres for oral health, international experts and rapporteurs

The meeting was summarised as [32] :

- ECC is a public health problem, with more severity in communities of low socioeconomic status where mostly untreated caries have a major impact on the general health and quality of life of infants and toddlers. Nevertheless, ECC is preventable through correct management of common risk factors, and by

following WHO's recommendations for infant feeding and reduced intake of free sugars – especially in complementary foods for young children. Strategies for management of ECC include all levels of prevention as early as possible, starting with tooth brushing with fluoride toothpaste and modification of socio-behavioural factors.

- Primary prevention – covering the promotion of healthy behaviours and appropriate fluoride use – will be the key to ECC management. Prevention of ECC should be integrated into existing primary health care programmes, especially those for maternal and child health. Health promotion aimed at pregnant women, new mothers and primary caregivers should raise concerns at the common risk factors of ECC by emphasizing WHO's recommendations on breastfeeding until six months of age, no added sugars for complementary feeding up to two years, and after that limited free sugars intake in accordance with the WHO guideline. Primary caregivers should be trained to provide a proper tooth brushing with the right amount of fluoride toothpaste from the first primary tooth eruption, followed by early detection of early lesions of caries during the vaccination period within primary care. Management of ECC should be part of the curriculum for all health professionals who promote the health of infants and toddlers in society. Moreover, a health policy should be developed to include affordable and effective fluoride toothpaste, a non-sugar complementary diet, a healthy environment and community fluoride administration.

- Secondary prevention of ECC should focus on the early detection of carious lesions. Therefore, ECC – as well as severe ECC – should be clearly defined. Not only dental personnel but also other health professionals and even mothers should be trained to detect the early signs of carious lesions. Oral health check-up records should be integrated into the child's health profile at the child health clinic during the vaccination period and when the child has general health examinations. Diet counselling, proper bottle-feeding, and especially limited free sugars intake should be regularly emphasized during the periodic visits to the child health clinic. Application of fluoride varnish on early carious lesions, such as white spot lesions, by trained personnel, is recommended, as are sealants with glass ionomer cement on non-cavitated lesions. Parents and caregivers should be actively and routinely involved in the dietary and oral hygiene practices of their children.

- Tertiary prevention of ECC aims to reduce the negative impact of the untreated frank, open cavity and improve the quality of life of children by avoiding unnecessary extraction and restoration functions. Silver diamine fluoride or fluoride varnish can stop carious dentine lesions. However, atraumatic restorative treatment/simplified modified ART/interim therapeutic restoration (ART/SMART/ITR) is an alternative option, with glass ionomer cement as the material of choice for tertiary prevention. If ECC is left untreated, extensive treatment will soon be required. Depending on the child's behaviour and cooperation, in serious cases, the child's rehabilitation may need to be done under general anaesthesia by skilled professionals in appropriate facilities. For this, more resources are needed, and the cost of such treatment would be higher than primary and secondary prevention.

CONCLUSION

ECC is a chronic, infectious disease, serious public health problem affecting young children. It is one of the most common preventable diseases which prevails worldwide. It is a multifactorial disease consequent to the interaction of cariogenic microorganisms, exposure to carbohydrates, inappropriate feeding practices, and a range of social variables. It is affecting a child's well-being, learning ability, and quality of life. The associated pain affects children's emotional states, sleep patterns, and the ability to learn or perform their usual activities. Oral health has been recognized as an essential component of general health and quality of life. Hence both oral disease prevention and oral health promotion should be included as an integral part of chronic disease prevention and general health promotion programs.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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