

An Update On Early Childhood Caries – A Review

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Abstract. Early Childhood Caries (ECC) is one of the rapidly progressing dental carious lesions found to be affecting innumerable children around the globe in an endemic manner. Bacterial plaque retention, inadequate oral hygiene and increased frequency of sugar consumption are considered as the primary risk factors causing this lesion. Recent evidences have shown that ECC has undeniable influence on child's growth and development which can result in early loss of deciduous dentition, insufficient space for erupting succedaneous teeth, poorly developed speech and mastication which can finally affect the child's growth physically and in psychological constraints. Hence it is highly essential that these carious lesions have to be maintained and prevented in a therapeutically systematic manner which can benefit the child. This paper presents a review which enhances an update on Early childhood caries and details the various contributing factors and adds up the recent treatment and risk assessment strategies in ascertaining the carious lesions prior its advancement.

Keywords: Early Childhood Caries, oral hygiene, feeding habits.

Introduction

Nursing bottle caries, is a recently introduced synonym that is used for detailing carious lesions in young children as consequence of bottle feeding especially during night [1]. One of the most challenging scenario a pediatric dentist confronts in managing a child with ECC is the need for cooperation and rehabilitation of the affected carious lesions.

There are considerably numerous contributing factors and etiologies leading to initiation of ECC. The undeniable contributors leading to ECC include are fermentable carbohydrates (substrate); cariogenic microorganisms, frequent intake of sugar and the socioeconomic status [2]. *Streptococcus mutans* and *wiggisiae* metabolizes the residual carbohydrates thereby producing destructive acids which causes considerable decrease in pH of oral cavity. This subsequently leads to demineralization finally progressing to dental caries [3]. Unattended forms of ECC is now considered to be a part of generalized child neglect thereby affecting child's speech and overall growth and development [3].

Clinical Features of Early Childhood Caries

In the initial stage the lesion appears as white opaque spots or as a white band in the cervical third of the maxillary incisors. The initial lesion can also appear around the gingival margin between the interproximal surfaces of teeth or on the palatal surfaces of teeth and in extreme cases at the incisal edge [4]. As the condition progresses the enamel surface breaks down and a cavity is created which can turn yellow, brown or black and gradually encircles the neck of the teeth with extensive loss of hard tissue. The thickness of enamel in primary incisors is less (<0.5 mm) and the immature enamel of primary teeth is porous and hence more easily dissolved by acids [5]. These two factors contribute to the rapid progression of caries in primary teeth. In advanced cases there may be complete loss of crown structure of maxillary incisors whereas the mandibular incisors remain caries free.

Classification

Early childhood caries have been classified earlier by several authors according varying criteria and standards.

The first system of classification was given by Wyne in 1999 [6]. It was based on the severity and the associated aetiology of ECC. According to this system ECC was classified into three categories (Table 1).

Veerkamp and Weerheijm in 1995 modified this classification based on the development of dentition and dental caries. According to this classification dental caries occurs in successive ages beginning at 10 months and subsiding at 48 months of age. The extent of dental caries varies from demineralization to cavitated lesions [6].

Rate of ECC Prevalence

The rate of ECC prevalence between 2 and 5 years old children in the United States was found to be 27.9% between 1999 and 2004. In countries with developing financial strategies the rate of ECC have been estimated to an increase of 85% among infants in an advertent manner. Recent studies conducted shows that Palestine has a prevalence rate of 76% and the United Arab Emirates depicts considerably high rate of 83%. India is reported to have prevalence of 51.9%, Israel of about 64.7% and Brazil about 45.8% respectively. Recent studies conducted and evidences define that the children of 3–4 year old predominantly boys exhibit the highest prevalence rate of ECC [7].

Table 1. Classification of Early childhood caries by Wyne.

Types	Location of Lesion	Etiology
Type I Mild to moderate	Caries on incisors and molars	Semisolid/solid diet rich in carbohydrates and sugary substrates and lacking poor oral hygiene
Type II Moderate to severe	The lesions are present on the labial or lingual surface of maxillary central incisors. Molar caries may be present depending on the child's age and disease. The mandibular incisors remain unaffected	Prolonged utilization feeding bottle and/at-will breast feeding with poor oral hygiene maintenance
Type III Severe or extreme	Every teeth are affected.	Cariogenic food and lack of adequate oral hygiene

Risk Factors

Microbiologic Risk Factors

The prime microorganisms responsible for causing early childhood caries are *Streptococcus mutans* (SM) and *Streptococcus sobrinus*. SM transmission occurs through two different modes of transmission namely vertical and horizontal transmission. Vertical transmission occurs between child and caregiver. Poor maternal oral hygiene frequent sugar intake increases the transmission rate to the child. Horizontal transmission occurs when neonates have increased chance of acquiring these bacteria especially in children born via cesarean sections [8].

Dietary Risk Factors

Improper bottle feeding constitutes an important etiological factor of severe ECC. Several studies have shown a direct relationship between ECC and extended periods of bottle feeding. Children consuming frequent sugar rich diets also is found to be highly susceptible in developing ECC. These sugars will be converted to demineralizing acids by cariogenic microorganisms resulting in tooth surface demineralization. Recent studies have elaborated that cow's milk is considered to be least cariogenic compared to other commercially available milk varieties [8].

Environmental Risk Factors

Dental plaque is one of the identified primary causative agent of caries. The effective removal of dental plaque is necessary for caries prevention. Therefore, children should receive oral hygiene instructions soon after the eruption of first primary tooth. Salivary factors including salivary flow rates, antimicrobial properties, salivary buffering play a major role in decreasing the prevalence of cavitated lesions in the oral cavity. Socioeconomic status of caregivers, fluoridation levels, ethnicity, educational status and dental insurance inclusion are other subsidiary factors contributing to caries progression [8].

Prevention of Early Childhood Caries

Reducing transmission of cariogenic bacteria from mother to child is the most ideal and initial preventive measure. The transmission of cariogenic bacteria from mother to child can be reduced by avoiding saliva sharing activities like sharing of utensils, food and drinks. The involvement of multidisciplinary professionals including pediatricians, physicians and nurses can act as an adjunct in creating awareness among parents regarding early childhood caries.

Risk Assessment

Apart from the traditional and conventional methods, which provides treatment only after the lesion has established, this current risk assessment strategies prevents and manages before extensive destruction to the dental hard tissues [9].

Caries Risk Assessment Tool (CAT)

American Academy of Paediatric Dentistry (AAPD) in 2006 introduced this depending on the child's age and incorporating biological factors, protective factors and absolute clinical findings which aids in identifying caries incidence in the child [10].

The biological factors include (a) The presence of caries in mother (b) Patients of low financial background (c) Patients consuming frequent sugary snacks and beverages. (d) Patients who require special health care needs and treatment. (d) Patients who are recent immigrants [10].

The protective factors of the patients include (a) Patient has >1 increased incidence of inter proximal lesions. (b) Presence of lesion activity. (c) Patient having comparatively low salivary flow and rate. (d) Patients possessing numerous defective restorations. (e) Patients who are continuously wearing any sort of intraoral appliance [10]. Subsequent progression or caries remineralization is identified by the altered balance existing between disease indicators along with risk factors on one side and the protective factors on the other side of the statistically balancing beam (Figure 1) [10].

Caries Management by Risk Assessment (CAMBRA)

Western CAMBRA Coalition comprising of multidisciplinary industrial analysts including government bodies and private practitioners of the United States introduced CAMBRA nearly a [10]. CAMBRA management is mainly

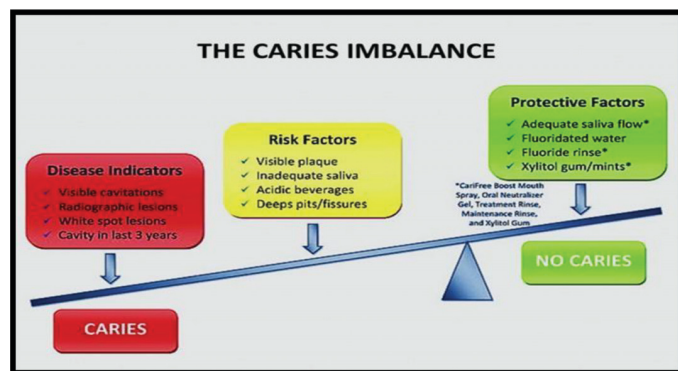


Figure 1. Caries Imbalance Diagram [10].

dependent on disease stage and the resultant severity it has on tooth surfaces [10]. CAMBRA incorporates several therapeutic methods strategies that prevents the progression of cariogenic microorganisms within the oral cavity, indicators that possess the remineralizing potential for management of the early carious lesions thereby preventing demineralization [10]. CAMBRA enhances the utilization of sufficient agents remineralization for early white lesions along with minimally invasive restorative treatment modalities (Figure 2).

Cariogram

Cariogram is a recently developed strategical tool by Prof. D. Bratthall which demonstrates the close relation between caries and causative risk factors. This was instituted into a PC format by Dr. L. Allander and K.O. Lybegård. Peterson G et al. in 2003 in his detailed experimental studies determined the fact that findings that the Cariogram accurately determined the caries incremental rate and accurate rate of incidence [11]. Previous history of dental caries, the probable increase in Streptococcus mutans count, persistence of community fluoridation or other programmes and the influence of salivary buffer capacity are the factors incorporated in the Cariogram model that showed considerable correlation with associated risk factors among the studied population. The Cariogram is divided into five coloured sectors in pie circle diagram [11]. These colors signifies 1. The green sector (chances to avoid new cavity), the dark blue sector (diet), the red sector (bacteria), the light blue sector (susceptibility) and the yellow sector (circumstances). "0" is noted as the most acceptable best value and "3" signifies that the individual has high risk of caries. The program facilitates the entry of maximum of ten values however seven scores would be sufficient enough for cariogram to appear (Figure 3) [11].

Fluorides

Fluoride therapy forms an integral part of the caries preventive strategy. Fluoride is obtained from various sources like fluoridated community water, food processed from fluoridated water and fluoride supplements like fluoridated milk, salt etc. Fluoride is also available in the form of toothpastes, mouth rinses, lozenges, chewable tablets, gels, foams and varnishes. The most easily available and widely used form of fluoride is the fluoridated toothpaste. There is strong scientific evidence which suggests that daily tooth brushing with fluoridated toothpaste is the most effective method of caries prevention.

The AAPD has described the following recommendations that should be strictly carried out while prescribing fluoride toothpaste or supplements to patients (Figure 4).

Factors	High Risk	Moderate Risk	Low Risk
Biological			
Patient is of low socioeconomic status	Yes		
Patient has >3 between meal sugar-containing snacks or beverages per day	Yes		
Patient has special health care needs		Yes	
Patient is a recent immigrant		Yes	
Protective			
Patient receives optimally-fluoridated drinking water			Yes
Patient brushes teeth daily with fluoridated toothpaste			Yes
Patient receives topical fluoride from health professional			Yes
Additional home measures (e.g., xylitol, MI paste, antimicrobial)			Yes
Patient has dental home/regular dental care			Yes
Clinical Findings			
Patient has ≥1 interproximal lesions	Yes		
Patient has active white spot lesions or enamel defects	Yes		
Patient has low salivary flow	Yes		
Patient has defective restorations		Yes	
Patient wearing an intraoral appliance		Yes	

Circling those conditions that apply to a specific patient helps the practitioner and patient/parent understand the factors that contribute to or protect from caries. Risk assessment categorization of low, moderate, or high is based on preponderance of factors for the individual. However, clinical judgment may justify the use of one factor (e.g., ≥1 interproximal lesions, low salivary flow) in determining overall risk.

Overall assessment of the dental caries risk: High Moderate Low

Figure 2. Caries Risk Assessment for 0–3 years [12].

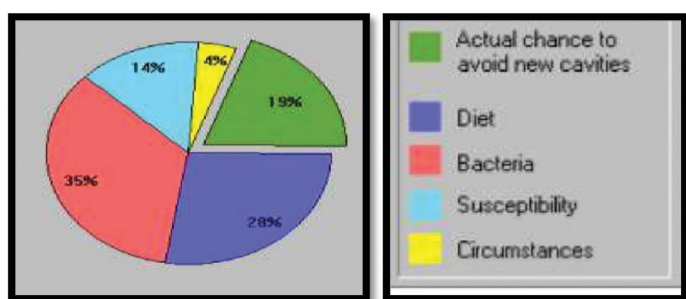


Figure 3. Cariogram [11].

Age	Fluoride Ion Level Present in Drinking Water		
	<0.3 ppm*	0.3-0.6 ppm	>0.6 ppm
≤6 months	None	None	None
6 months–3 years	0.25 mg/day†	None	None
3-6 years	0.50 mg/day	0.25 mg/day	None
6-16 years	1 mg/day	0.50 mg/day	None

* 1 ppm = 1 mg/L.
 † 2.2 mg sodium fluoride contains 1.0 mg fluoride ion.
 ppm: part per million.
 Source: Reference 13.

Figure 4. Recommendations for Fluoride Supplementation [12].

Management of Early Childhood Caries

Restorative treatment is based on removal of caries and the choice of restorative material depends on the site and extent of decay, child’s ability to cooperate and longevity of restoration. The commonly used restorative materials are amalgam, composite, GIC and Resin Modified GIC. If extensive dental treatment is required in a non-cooperative child, then the procedure has to be carried out under GA. In teeth affected by severe ECC pulpotomy followed by

placement of preformed stainless- steel crowns in posterior teeth and strip crowns in anterior teeth is preferred. Atraumatic restorative treatment (ART) is a pain free restorative procedure in which hand instruments are used for removing caries and Glass Ionomer Cement is used as the restorative material. The major advantage of GIC is fluoride release, chemical adhesion to tooth structure and biocompatibility [13].

Case Report

A 5-year old girl reported with decayed upper front teeth. It happened to be the child’s first dental visit. Intraoral examination revealed severely decayed and carious 51, 52, 61, 62, 74 and 75. (Figure 5). Radiographs were advised for 51, 52, 61, 62, 74 and 75 which detailed that there was pulpal involvement of 51, 52, 61, 62, 74 and 75. Taking into consideration of the child’s age a treatment plan was formulated. After detailing the various available treatment options a written consent which explained the selected treatment protocol was obtained from the parents. Pulpotomy with Metapex was carried out for 51, 52, 61 and 62 followed by strip crown placement with Filtek Z350 XT WD composite resin (3M ESPE) in color (A1). A probe was used to remove the excess material in the cervical region. Occlusal adjustment and polishing was then carried out. Pulpotomy was carried out in 74 and 75 followed by stain-



Figure 5. Preoperative.



Figure 6. Postoperative.

less steel crown placement. Fluoride application was done following the completion of the treatment and the parents were advised regular recall visits every six months (Figure 6).

Discussion

Ideal esthetic rehabilitation in children is always considered as an uprising challenge among the Pediatric dentists as it should be one which can aid the child in reestablishing the child's esthetics and phonetics thereby facilitating in achieving the normal developmental milestones of the child [13].

Loss of deciduous anterior teeth at an early age will lead to development of detrimental oral habits and deleterious malocclusion. These associated problems will lead to severely reduced self-esteem in the child [14]. In the present case report the child presented with multiple carious lesions which were rehabilitated with pulpectomy procedure followed by strip crown and stainless steel crown preserving the child's esthetic demands and functional ability up to a great extent.

Stainless steel crowns are the most preferred crowns in deciduous dentition following root canal therapies and are also indicated in cases developmental anomalies of teeth [14]. Harboring with the only disadvantage of its unesthetic appearance stainless steel crowns can be easily finished with the adequate fit due to its ease of manipulation in a single visit thereby resulting in successful restorative treatments. The stainless steel crowns possess the ideal and acceptable features of extended durability, financially acceptable and subsequent ease of chairside manipulation offering an ideal full coverage restoration. In primary teeth, the stainless steel crowns are indicated following pulpotomy/pulpectomy and are also applicable for teeth with developmental defects, large carious lesions involving multiple surfaces where amalgam is likely to fail and fracture teeth [14].

The increasing aesthetic needs thereby ascertain strip crowns as the material of choice by majority of the Pediatric dentists today. The main advantage of it being the material of choice include highly superior esthetics and ease of repair and use when compared to traditional crowns. However early and prompt management along with adequate behavior modification is therefore a necessity in treating such carious lesions [15].

Conclusion

Early Childhood Caries is a rapidly progressing lesion of concern which should be managed adequately prior its advancement. In today's clinical scenario where esthetics is determined to be the prime concern strip crowns proves to be the acceptable solution to aesthetic restoration which provides adequate results to patient needs and demands. The advent of newer materials like Zirconium is also gaining popularity considering its esthetically superior nature. The routine practice of compulsory and definitive oral hygiene strategies along with the advent of new restorative materials will aid in creating esthetically acceptable smiles and provide a newer path in the process of rehabilitation in a cost effective.

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