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The Role of General Pediatrician in Children's Oral Health: A Review

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Abstract

Oral health is an essential part of overall health and, thus, pediatricians have a responsibility to factor in oral health as part of providing holistic general health services for children. Coordination of care for oral health requires a baseline level of knowledge to facilitate communication, referral, collaboration and ongoing follow up and care. Oral health issues are faced by a majority of children in the developed and developing world, therefore, pediatricians must be aware of these issues and be competent in addressing them. Dental disease is common in children with dental caries (tooth decay) being the most common chronic disease of childhood. Dental caries is highly prevalent and is 5 times more common than asthma and 7 times more common than hay fever. Many dental problems, especially early childhood caries (ECC), are either preventable or can be intercepted effectively by early recognition and management. Primary prevention can and should begin in the pediatrician's clinic, with subsequent coordination and collaboration with dental colleagues.

Keywords: Oral health; Pediatrician; Early Childhood Caries (ECC); Risk assessment; Prevention

Abbreviations

#: Percentage; AAPD: American Academy of Pediatric Dentistry; B/C: Benefit-Cost; C/E: Cost-Effectiveness; e.g.: For example; ECC: Early Childhood Caries; GA: General Anesthesia; LB: Lactobacilli; MS: Mutans Streptococci; UAE: United Arab Emirates

Introduction

Oral health has become a major global issue among children. Dental caries is considered to be the most common chronic childhood disease [1]. Dental caries among children is reported to occur between 5 to 8 times more frequently than asthma [2]. Dental caries in preschool children or Early Childhood Caries (ECC) is a chronic, transmissible infectious disease affecting the primary (milk) teeth. It is defined as the presence of one or more decayed, filled or missing tooth surfaces in any primary tooth in a child 71 months of age or younger [3,4]. It can result in considerable suffering, pain, reduction of quality of life of affected children and disfigurement and can frequently compromise their future dentition. The etiology of the condition is a combination of 1) frequent consumption of fermentable carbohydrates as liquids, especially at night, usually as a result of on-demand breast- or bottle-feeding, 2) oral colonization by cariogenic bacteria (especially mutans streptococci) and 3) poor oral hygiene [5].

In most cases, the etiology will be a combination of several of these factors. The prevalence has been reported to vary worldwide. Higher prevalence has occurred in children from lower socioeconomic backgrounds, migrants and those from ethnic minority populations [6].

The prevalence of ECC worldwide has been reported to vary

between 3% and 94%. In the United Arab Emirates (UAE), ECC is by far the most common childhood disease and its prevalence of ECC has been reported as 93.8% in 5-year-old children [7].

Prevention of ECC can be achieved by the education of prospective and new parents, as well as by the identification of 'high risk' children [8]. Strategies have focused on the individual mother and child by preventing transfer of cariogenic bacteria from mother to her infant, using preventive agents such as fluoride and teaching good oral hygiene practices [9]. Community-based approaches have been attempted. An example of a successful program was reported by Kowash et al [10] which investigated the effect of dental health education provided by trained, non professionals (not dentists) carrying out regular home visits in a low socioeconomic high-caries area in Leeds, UK. The study was able to demonstrate a significantly reduced occurrence of ECC after three years.

The treatment of ECC is very costly, time consuming and in most cases, requires full dental rehabilitation under general anesthesia by a pediatric dentist. Unfortunately, in many countries, even in the developed world, these carious teeth end up being extracted.

For pediatricians to competently address child oral health issues, they must have adequate knowledge of the disease process, its etiology and risk factors, clinical presentation, prevention and intervention strategies. Therefore, this paper aims to provide an up-to-date evidence-based review of ECC. The literature in regards to ECC definition and terminology, etiology, prevalence, clinical picture and preventive strategies is discussed. The role that a pediatrician can play in the risk assessment and management of ECC and the barriers preventing pediatricians fulfilling their role in this regard are also highlighted and discussed.

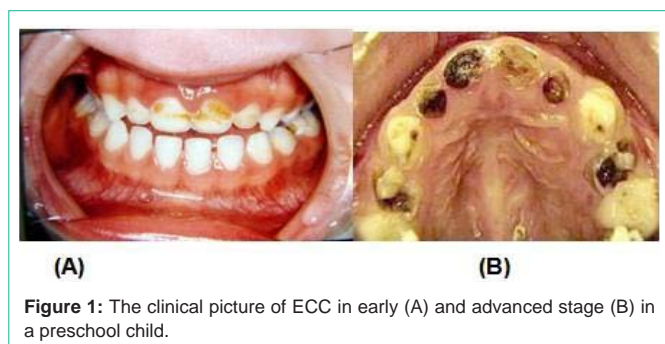


Figure 1: The clinical picture of ECC in early (A) and advanced stage (B) in a preschool child.

Definition and Terminology of ECC

ECC has been defined as “the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces” in any primary tooth in a child 71 months of age or younger [3,4]. In children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC). From ages three through five, one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled surfaces with a score of ≥ 4 (age three), ≥ 5 (age four), or ≥ 6 (age five) is indicative of S-ECC [11]. Dental decay in infants and young children goes by several names including: “nursing caries”, “nursing bottle caries”, “nursing bottle syndrome”, “baby bottle caries” and “baby bottle tooth decay” [5]. These terms are often used interchangeably in dental literature. They describe the condition and the possible etiological factors of the decay as understood by parents, the public and professionals. However, none include the concept of a sweetened pacifier, which may be a significant cause in infants. Tinanoff and O’Sullivan use the term “Early Childhood Caries” which has been introduced in the USA to describe caries in infants and young children. This term has now been widely accepted as the correct term by most dental clinicians and educators [12].

Clinical Picture of ECC

ECC has a specific pattern and clinical presentation. It is a specific form of rampant caries with the only feature differentiating it from generalized rampant caries being the usual absence of decay of the mandibular incisor teeth (Figure 1). The most commonly affected teeth are the maxillary incisors. Involvement of other teeth (the canines, first and second primary molars) depends on how long the carious process remains active but usually the severity of the lesions in these teeth is less than that in the maxillary incisors. The mandibular incisors are usually not affected because the teat of the bottle is usually held above the tongue during sucking, so the lower incisors are protected by the tongue and also by the flow of saliva from the submandibular ducts [5]. The role of the innate infantile physiological tongue thrust pattern during deglutition is thought to be important in protecting the lower incisors [5].

In most cases of ECC, the first clinical sign is a band of dull white demineralization along the gingival line of the maxillary incisor teeth. As the lesion progresses, the white bands develop into cavities. This results in a brown or black collar around the necks of the incisors. In advanced cases, the lesions may become so severe that the crowns of the teeth are amputated leaving only decayed brownish-black root

stumps (Figure 1). The commonly involved surfaces are the labial, palatal, mesial, distal of maxillary incisors and of the maxillary and mandibular canines. In the first and second primary molars, the occlusal surface is commonly affected [13]. According to Ripa [5], the reason for this unique distribution is related to three factors: 1) the chronology of tooth eruption; 2) the duration of the deleterious habit; and 3) the muscular pattern of infant sucking.

Prevalence of ECC

The prevalence of ECC varies greatly across different studies. The prevalence worldwide has been reported to vary between 3% and 94%. This wide range may be due to several factors such as: 1) children studied; their age and the accessibility for examination; 2) socio-economic status; 3) ethnic and cultural factors and 4) criteria used for diagnosis.

The prevalence of ECC in one country usually cannot be compared with another [14]. Richardson et al reported that even results from one ethnic group cannot be extrapolated beyond that specific group, even within the same country [14]. In western societies, approximately 80% of caries is present in 20% of the population, commonly in children from low socio-economic groups, certain immigrant populations, patients with learning difficulties and those with physical and medical disabilities. The dental survey of children aged one and half to four years in Great Britain [15] showed that the proportion of children affected increased with age: 4% of one and half to two and half year olds, 14% of two and half to three and half year olds and 30% of those aged three and half to four and half years had some experience of dental caries.

In the United States, the Center for Disease Control and Prevention (CDC) reported that more than one in four (28%) preschoolers experience tooth decay. This finding suggests that nationally, over 4 million children are affected by dental caries, which is an increase of over 600,000 additional preschoolers during the past decade [16]. Higher prevalence was reported in the city of Abu Dhabi in the UAE: ECC in 2, 4 and 5 year olds is 35.5%, 85.7% and 93.8% respectively [7]. Hashim et al. (2006) in Ajman, UAE studied caries prevalence and severity of ECC in 5–6-year-old children. They reported high caries prevalence (76.1%) and an average decayed, missing and filled surfaces (dmfs) score of 10.2 and also reported that Emirati (local) children had higher caries severity than children of other nationalities [17].

Etiology of ECC

The exact etiology of dental caries is still obscure. However, there is good scientific evidence to show that, for dental caries to occur, four main factors and some other minor or predisposing factors have to be present. Thus dental caries has a multi factorial etiology [18]. The four main factors are as follows: susceptible host (teeth and saliva), a substrate (fermentable carbohydrate), micro-organisms (mainly streptococci and lactobacilli) and time. Predisposing factors include: feeding habits, oral hygiene practices, general health and nutritional status. Socio-economic factors (parental education and occupation, family income, number of siblings, parental attitude and knowledge of dental health) and demographic factors such as race, age, gender, soil and mater (?) aspects are also contributing factors. These factors are often used as indicators to identify caries

risk in children. The etiology of ECC is indistinguishable from other coronal carious lesions in older children and adults. However, the lesion progresses rapidly and the cariogenic challenge overwhelms the protective mechanisms [19]. The etiology of the condition is a combination of frequent consumption of fermentable carbohydrates as drinks, especially at night time, with on-demand breast- or bottle-feeding because during sleep, salivary flow is greatly reduced. Other contributing factors include oral colonization by cariogenic bacteria (especially mutans streptococci) and poor oral hygiene [5]. In most cases of ECC, the etiology will be a combination of several of the aforementioned factors.

There is considerable debate in the literature regarding the effect of milk on teeth. Several studies consider it to be cariogenic under certain conditions [20,21,22]. Others have indicated an anti-cariogenic effect [23,24,25]. Storey [26] reported that the reasons for this controversy are due to a combination of factors that include: 1) the difficulty of studying the effect of one item of food on dental health in humans, 2) the difficulties of designing definitive nutrition experiments even in animals, 3) the different effects of food processing procedures on milk and 4) basic differences in the composition of milk of different species. The lactose (a disaccharide composed of glucose and galactose) content of human and bovine milk aids the implantation of cariogenic bacteria and produces enamel demineralization and caries when fed to animals [20]. The effects of milk on teeth depend upon the type of milk feeding, feeding practice and time of weaning.

It is difficult to identify which type of microorganisms is responsible for causing dental caries due to the complexity of plaque micro-organisms. However, mutans streptococci (MS) and lactobacilli (LB) are considered to be the most important cariogenic bacteria [27]. MS and LB can grow at an intracellular pH value lower than 6 (high aciduricity) and unlike most other bacteria, they can also produce lactic acid when exposed to high concentrations of sugars [28]. MS is responsible for initiation of the carious lesion, whilst LB is responsible for the progression of the lesion and is the predominant microorganism of the cavitated carious lesion. The major source from which infants acquire cariogenic bacteria, especially MS, is the mother's saliva (vertical transmission). MS can also be acquired from other family members including child minders and nannies (horizontal transmission) [6]. Teeth provide a non shedding surface for colonization of MS and its counts are related to the number of erupted primary teeth [29]. However, recent studies have also shown that MS can colonize the mouth of pre-dentate infants [30,31].

Consequences and Complications of ECC

Depending on the severity and the extent of dental decay, ECC may lead to a significant impact on the child's oral and general health. Deep untreated carious lesions lead to pain and discomfort and inability to properly chew food. As a result, the child may avoid eating in response to the pain which may lead to weight loss and failure to thrive [32]. In severe cases, pulpal necrosis in primary teeth may lead to dental abscess formation which can cause pain and damage the developing permanent tooth. If there is a necessity for premature extraction, primary tooth loss may result in various orthodontic complications (Figure 2). Premature extraction of primary maxillary incisors may also lead to problems in speech, normal development

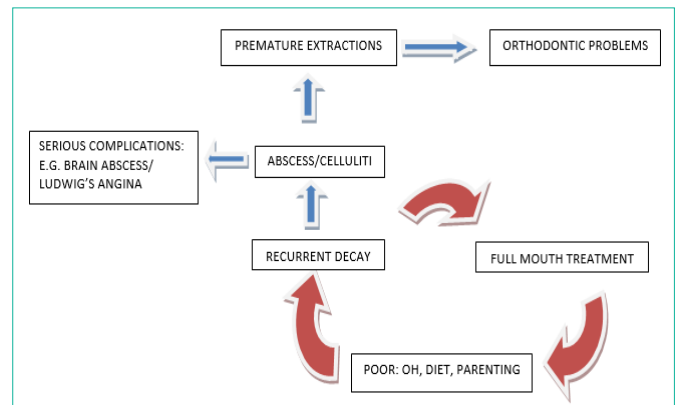


Figure 2: Vicious circle of treatment and re-treatment and its' complications in the absence of an effective preventive strategy.



Figure 3: General anesthesia full dental rehabilitation of a child with severe ECC: pre-treatment (A) and post- treatment (B).

of language and esthetic which may affect the personality and self-esteem of the child. Untreated ECC lesions may cause abscess, cellulitis and spread of infection, which may result in serious and fatal complications such as brain abscess and Ludwig's angina (Figure 2). Management of ECC complications requires increased emergency room visits and hospitalization. The socio-economic consequences of ECC manifest in increased treatment costs and missing school time as well as time off from employment for parents [33,34].

Management of ECC

Prevention is the solution for the continuing problem of ECC. Despite following high quality methods for proper restoration of decayed teeth (Figure 3), recurrence of decay and associated complications are very common in the absence of an adequate prevention program and follow up visits (Figure 2).

ECC is an infectious and transmissible disease but it is preventable. There are two main preventative program options that can be implemented: individual-based interventions and community-based interventions.

Individual-based Preventative Programs

This approach is used for high-risk populations because it is simple and does not require much effort from the parent or caregiver. The disadvantages of an individual-based approach are twofold. Firstly, it requires identification of at-risk children and secondly, it can be costly as it requires professional or auxiliary personnel. Studies have

used this approach by addressing the mother through counselling, providing information on importance of tooth brushing and the use of fluoride to reduce the number of maternal micro-organisms transmitted to her child. Restoration of the mother's open cavities and the use of anti-microbial agents can prevent or delay bacterial transmission to her infant [9].

The American Academy of Pediatric Dentistry (AAPD) [35] recommends dental health education programs for parents with young children to improve their dental awareness and attitude toward dental health. The AAPD recommendations for the infant's oral health include.

Establishment of a dental home

The dental home is the ongoing relationship between health professional staff and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way. A dental consultation visit no later than one year of age is recommended to educate parents and provide anticipatory guidance for prevention of dental diseases [35]. This initial visit should include thorough medical (infant) and dental (parent and infant) histories, a thorough oral examination, performance of an age-appropriate tooth brushing demonstration and prophylaxis and fluoride varnish treatment if indicated.

Oral hygiene

oral hygiene measures should be implemented no later than the time of eruption of the first primary tooth. Twice-daily use of fluoridated toothpaste using a soft toothbrush of age-appropriate size is advised. Toothpastes with more than 1000ppm (part per million) fluoride concentration should be used in children with an increased caries risk in addition to spitting excess toothpaste with no rinsing following brushing [36]. Parents should assess and supervise their preschool-aged child's tooth brushing. Infant's newly erupted teeth may be cleaned using a cloth. Flossing of child's teeth is recommended when adjacent tooth surfaces cannot be cleaned with a toothbrush.

Diet

Human breast milk has not been epidemiologically associated with caries. Frequent night time bottle feeding with milk is associated with but not consistently implicated in ECC. Breastfeeding greater than seven times daily after 12 months of age is associated with increased risk for ECC. Night time bottle feeding with juice, repeated use of a no-spill cup and frequent in between meal consumption of sugar-containing snacks or drinks (e.g. juice, formula, soda) has been shown to increase the risk of caries [37,38]. Therefore, it is recommended that infants should not be put to sleep with a bottle after the primary tooth begins to erupt. Parents should be encouraged to have infants drink from a cup after one year of age. Repetitive consumption of any liquid containing fermentable carbohydrates from a bottle should be avoided.

Fluoride

Optimal exposure to fluoride is important to all dentate infants and children [39]. Decisions concerning the administration of fluoride are based on the unique needs of each patient [40]. The use of fluoride for the prevention and control of caries is documented to be both safe and effective [41].

Community-based Preventive Programs

To solve the problem of ECC there should be a collaborative effort from caregivers, health professionals, and the community [42,43]. Weinstraub [43] believed that public health or community approaches are absolutely necessary and more effective than individualistic or behavioral approaches. Oral health professionals such as dentists and hygienists should be trained in the necessary skills in order to develop and successfully implement community-based initiatives and dental programs. These skills should include maintaining knowledge of social beliefs, culture and practices and establishing and implementing dental prevention programs [44]. A successful long-term dental health education program through regular home visits to mothers with infants, commencing at or soon after the time of the eruption of the first deciduous teeth, was shown to be effective in preventing the occurrence of caries, improving oral hygiene and dental attendance of young children. An added benefit was that the mothers of the children also significantly improved their oral hygiene in terms of debris, gingivitis and calculus scores [10]. Young children are dependent on their parents or caregivers for their daily dietary and oral hygiene practices. Therefore, it is important that the dental health messages should focus on educating and changing the behavior of parents or caregivers. Moreover, the dental health messages should be practical by giving alternatives, for example substituting milk with water in baby bottles at night for those who find it difficult to stop night-time bottle feeding. They should also consider the socioeconomic status of the parents and be culturally sensitive [10]. The benefit-cost (B/C) and cost-effectiveness (C/E) of a long-term dental health education program to mothers with young children through repeated home visits have been evaluated [45]. Comparisons were made for B/C and C/E with results from a clinical trial of a slow releasing fluoride device, community water fluoridation and a school based fissure sealant program. The results showed that dental health education programs for mothers of young children starting at 8 months of age gave better B/C and C/E ratios than other preventative programs.

The Role of Pediatricians in the Management of ECC

Pediatricians see children an average of 8 times in their first year of life and 13 times by age three [46]. This places them in a perfect position to start the process of risk assessment and prevention of ECC. The American Academy of Pediatrics (AAP) published a policy statement in May 2003 addressing the role that pediatricians can play in the oral health risk assessment of children [47]. The policy statement advocates that "pediatricians and pediatric health care professionals should develop the knowledge base to perform oral health risk assessments on all patients beginning at six months of age." The importance of oral health has also been highlighted by the Surgeon General in his report Oral Health in America [48] and the Centers for Disease Control and Prevention in Healthy People 2010 [49]. The knowledge base required of pediatricians to be competent and successfully perform their role in children's oral health should be built throughout the course of their medical education and reinforced through continued medical education courses. However, several studies [50,51,52,53] suggested that the oral health competency and practice of many pediatricians is less than adequate. In the United

States, Krol reviewed medical education guidelines, programs, surveys, and pediatrician experiences in oral health training at the undergraduate, graduate, and continuing medical education levels [54]. He concluded that the overall level of oral health education and training is inadequate to equip pediatricians with the required competencies for the provision of quality oral health care to children.

There are several barriers to educating pediatricians on child oral health; some are related to the topic of oral health and others are common barriers that affect medical education in general. These barriers include: 1) issues of professional boundaries, 2) time, 3) attitude and 4) the need for consistent topic reinforcement [54]. The first barrier is an important issue and both medicine and dentistry professions must agree on the role of pediatricians when it comes to dental care and its limitations. This will help in planning educational programs for pediatricians, the AAP policy on oral health risk assessment is an example and an important step in the right direction. Time is considered an important factor when trying to increase the number of classes to include the topic of oral health in the curriculum. Time limitation is also important in the practicing pediatrician's willingness to carry out oral health guidance and possible interventions even if she/he is adequately educated and competent because of tight office-visit limitations. The third challenging barrier is the attitude of the pediatrician regarding the importance of children's oral health and she/he should be encouraged to incorporate oral health in her/his daily practice. The fourth barrier is the need for consistent reinforcement of the importance of oral health through CME and refresher courses.

Conclusion

Early Childhood Caries (ECC) is a chronic, transmissible infectious disease affecting the primary teeth. It is the most common chronic disease amongst children and is still considered a continuing oral health problem in developing countries and also in most developed countries. It can result in considerable suffering, pain, disfigurement, reduction of quality of life of affected children and frequently compromises their future dentitions. The treatment of ECC is very costly, time consuming and in most cases, requires full dental rehabilitation under general anesthesia by a pediatric dentist. ECC, however, is a preventable disease and the solution for this continuing problem can be achieved by educating parents of young children and pregnant mothers.

Pediatricians see children from a young age and on a more frequent basis than general or pediatric dentists and therefore, they are in a perfect position to evaluate the risk of dental decay, start prevention and refer children who need dental treatment. However, their knowledge base of oral health should be adequate so that they are confident in their competency to successfully contribute to the role of managing and caring for children's oral health. As highlighted in this review, there are several barriers to educating pediatricians including issues related to professional boundaries between dentistry and medicine, time limitations and the pediatrician's attitude. These can be minimized by incorporating children oral health into medical teaching programs and through continued medical education courses and better, open communication between medical and dental professionals.

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