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Chapter 7

Infant Oral Health

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1. Introduction

Infancy is the first year of life after birth and a newborn child is called an infant from birth till the completion of the first year of life. In the initial half of infancy, the oral cavity has gum pads alone and towards the later half there is the eruption of primary teeth in the oral cavity. Preventive oral care in infancy is the basis of future oral health. The primary aim of a dentist or pediatric dentist at this stage is to educate and motivate the new parents to maintain good oral hygiene of the infant. An infant is completely dependent on the parents/caregivers to fulfil his basic needs. Thus, the entire responsibility of preventive care for optimal oral health lies in the hands of the infant's parents/ caregivers.

1.1. Importance of infant oral health care

Infant oral health is the foundation upon which education and motivation regarding dental hygiene and other preventive dental care must be built on, to augment the prospect of a lifetime free of preventable dental diseases. Infant oral health is an integral part of general well being of an infant, as he or she increases in age. It encompasses the care of the oral cavity and monitoring of the development of the teeth. Unfortunately, pregnant women, parents and caregivers of infants often do not receive timely and accurate education about preventive oral and dental health care [1].

1.2. Role of infant oral health care in preventive dentistry

Prevention is the primary focus of infant oral health care and prevention of dental diseases should be initiated in infancy itself. For diseases that occur early in life such as early childhood caries (ECC) prevention of diseases and the promotion of healthy behavior among parents/ caregivers must be given importance [2]. Preventive oral healthcare must be initiated in infancy because of the following reasons:

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1. Poor oral hygiene and improper infant feeding practices create an environment that promotes the colonization of cariogenic bacteria such as *Streptococcus mutans* in the infant's mouth. Thus, when a tooth erupts in an infant's mouth, it is in an undesirable oral environment that promotes demineralization.
2. Risk factors such as improper feeding practices and poor oral hygiene that may lead to early childhood caries (ECC) may be identified at an early age and appropriate intervention may be planned.
3. Parents/caregivers may be educated regarding good oral health care practices to maintain the infant's mouth in a state of good dental health.
4. Undesirable consequences of poor dental health such as ECC may be avoided and the infant may escape its complications such as dental pain and poor nutrition.
5. Psychologic health of the child can be maintained as unesthetic appearance of teeth negatively impacts the psychology of a child.

1.3. Causes and risk factors leading to poor infant oral health

Evidence suggests that early-in-life risk factors play a significant role as predictors of future dental caries in children [3-6]. These risk factors include the extent of parental knowledge, attitude and practices (KAP) and an infant's oral hygiene status, medical history, oral medications and feeding habits. Thus it is important to understand the causes and risk factors of poor infant oral health to avoid the risk of early childhood caries later in life. A major factor contributing to poor infant oral health is insufficient or improper knowledge, attitudes and practices (KAP) related to infant feeding practices and oral care. Evidence gathered from both global and Indian studies shows that both pregnant mothers and parents/caregivers of infants have inadequate KAP regarding infant feeding, weaning, and bottle feeding practices and cleaning of the mouth [7-10]. Lower socio economic status has also been correlated to a low dental KAP [11, 12]. The age group of parents does not show a consistent correlation with lack of dental KAP, with different studies reporting varying results [7, 13]. In addition to the lack of KAP regarding infant oral health, pregnant women seldom attain regular dental care and have dental care needs that are not satisfactorily dealt with [14].

Infants with medically compromised health such as congenital heart disease (CHD) may also be prone to poor oral health. Despite good dental care and intensive prevention, poorer dental health has been seen in children with CHD than in healthy children [15]. Medically compromised children may also have poor oral hygiene since in the presence of life threatening conditions, oral hygiene takes on low priority.

Medical illness and long term medication for it, is another risk factor for poor infant oral health [16-7]. Medically compromised infants are often on long term medication that may have side effects of xerostomia or alteration of salivary properties such as flow, buffering capacity or rate. For example, diuretics are used in congenital heart disease since they increase the excretion of water from the circulatory system. Reduced saliva and altered salivary flow are known side effects of diuretics [18]. Disturbed mineralization in teeth has also been reported

[19]. Additionally, medications in syrup form for infants are often sweetened and this may result in a caries promoting oral environment. Sucrose is still used as a sweetener in some drugs, to enhance flavor [20-1].

Inappropriate infant feeding practices related to bottle feeding, breastfeeding and sweetened pacifiers/ liquids may be another cause of early childhood caries (ECC) as the teeth in the infant [22]. Nighttime bottle feeding with sweetened or sweet liquids is a risk factor for ECC due to salivary reduction and prolonged exposure of the teeth to fermentable carbohydrates [22]. The American Academy of Pediatrics (AAP) recommends breastfeeding as the ideal method of feeding and nurturing infants and recognizes the role of breastfeeding as primary in achieving optimal infant growth and development [23]. Further, the AAP recommends exclusive breastfeeding for the first 6 months followed by the addition of iron-enriched solid foods between 6 to 12 months of age [23]. Though breastfeeding serves several health and immunologic advantages to the infant, certain breastfeeding practices may result in ECC. The factors associated with breastfeeding that may result in ECC are ad libitum or at-will feeding, prolonged breastfeeding and frequent breastfeeding during the night, resulting in accumulation of milk in the teeth, which, combined with reduced salivary flow and lack of oral hygiene, may produce tooth decay [24-5].

1.4. Consequences of poor infant oral health

Dental caries remains the most widespread chronic disease of childhood and can have damaging effects on growth and development when it progresses to severe forms [26]. Early childhood caries is a public health problem with its etiologic factors playing a role from infancy itself. Low-income and minority children experience disproportionately more dental caries than other groups because of their added barriers, such as limited access to dental services [27].

Poor infant oral health may lead to early childhood caries which is an infectious disease, and *S. mutans* is the most likely causative agent. Early acquisition, i.e., in infancy, of *S. mutans* is a crucial event in the natural history of ECC [28].

2. The infant's mouth

Oral microbial colonization of an infant's mouth begins shortly after birth [29]. The infants mouth consists only of gum pads in the pre-dentate stage, i.e., till about 6-7 months of age. As the teeth begin to erupt into the oral cavity (as the infant enters dentate stage), the colonization changes as the teeth present additional hard tissue surfaces for colonization. Influences from the mother/caregiver and siblings also play a role in the type of colonization of an infant's mouth.

2.1. Infant Oral Microbiology

The initial microbial microorganisms that colonize an infant's mouth are *Streptococcus salivarius*, *Streptococcus mitis* and *Streptococcus oralis* which belong to the group Mutans streptococcus

[30-3]. Of interest to the dentist is the acquisition of another species of the group Mutans streptococcus – *Streptococcus mutans* (*S. mutans*), which is strongly implicated in the etiology of dental caries [34]. Early-in-life or infant colonization by *S. mutans* is a chief risk factor for early childhood caries and future dental caries [28]. *Streptococcus mutans* was believed to show feeble adhesion to epithelial surfaces found in the pre-dentate infant's mouth [35-6]. The infants' mouth in the pre-dentate stage was thus considered unlikely to harbor *S. mutans* colonization. However, more recent evidence has shown that *S. mutans* colonization does occur in pre-dentate infants and the tongue may serve as an ecological niche in such cases [37-9]. Recently, a new microorganism *Scardovia wiggasiae* has been isolated from the plaque of ECC affected children using polymerase chain reaction (PCR) technology and research in this area is in progress [40].

2.2. Clinical aspects: Acquisition and transmission of *Streptococcus mutans*

Early-in-life acquisition of *Streptococcus mutans* has an impact on the future oral health of infants [28]. Infants may develop oral colonization with *S. mutans* colonization from their colonized parents [41]. The mother is the main source of transmission of S. mutans to a child as seen from clinical and microbiologic studies [42]. Mother-to-child or maternal transmission of *S. mutans* is one of the primary sources of transmission of *S. mutans* to an infant's mouth. This type of transmission of *S. mutans* is also known as *vertical transmission* [43]. In support of this route of transmission, several studies have reported identical bacteriocin profiles [44-5] and plasmid or chromosomal DNA patterns [46-7] of *S. mutans* strains in mother-child pairs. One study reported that when maternal salivary reservoirs exceed 10^5 colony forming units (CFU) the frequency of transmission of *S. mutans* to the infant was 9 times greater than when the maternal salivary levels of *S. mutans* were less than or equal to 10^3 CFU [48].

Horizontal transmission is the other major mode of transmission of *S. mutans* which occurs thorough sharing of spoons, glasses and interpersonal contact between the infant and other members of his/her environment such as siblings, daycare supervisors etc. Evidence for this mode of microbial transmission comes from several studies which have shown that infants and children in the same environment shared *S. mutans* isolates [49, 50]. Accordingly, vertical and horizontal transmission of *S. mutans* needs to be evaluated when taking into account risk factors for dental caries in an infant.

3. Dental home: Concept and advantages

The first step towards promotion of good infant oral health is the creation and maintenance of a dental home. This concept is derived from the concept of medical home that was proposed by the American Academy of Pediatrics in 1992 [51]. The premise behind the medical home was that the best care may be offered to a child when the child in focus and his/her family has a good relationship with the doctor.

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The American Academy Pediatric Dentistry (AAPD) recommends that a dental home may be designed for the infant on the same lines as the medical home concept. The characteristics of an ideal dental home are the following [52]:

1. **Accessible:** This implies that dental care should be reachable to the infant and family
2. **Family Centered:** The importance of the family is recognized and behavior management techniques acceptable to the family are utilized.
3. **Continuous:** A dental home should be designed to look after the needs of a child from infancy through adolescence so that continuous care may be provided to the infant at all stages of childhood and adolescence.
4. **Comprehensive:** A dental home provides round-the-clock dental care for a child and includes primary, secondary and tertiary care for the infant.
5. **Coordinated:** An ideal dental home setup works in coordination with school and family of a child so that information may be shared for the benefit of the child in focus.
6. **Compassionate:** In a dental home, good relationships are established with a child's family a community with a concerned and compassionate approach for the child receiving dental care and his/her family.
7. **Culturally Competent:** Since children at a dental home come from varying backgrounds and cultures, an ideal dental home recognizes, values and respects the varied cultures and ethnic backgrounds of children.

There are several advantages of developing a dental home for an infant. Most importantly, the timing of the first dental visit of an infant may be planned within 1 year of age of an infant. This is in accordance with AAPD recommendations for the first dental visit of the child. Early-in-life risk factors can thus be identified at an early stage and appropriate intervention through increase in KAP related to infant feeding and oral hygiene suggested to the parents/caregivers [52]. Moreover, a dental home personalized or tailored preventive program may be designed to suit the specific oral health needs of a child at every stage.

4. Anticipatory guidance

The dental home provides scope for anticipatory guidance at every stage of a child's development. Anticipatory guidance is the process of providing practical, developmentally appropriate information about children's health to prepare parents for the significant physical, emotional and psychological milestones [43, 53]. Anticipatory guidance encompasses 3 types of responsibilities: (1) gathering information, (2) establishing a therapeutic alliance, and (3) providing education and guidance [43, 54].

5. Prenatal oral health counseling

Prenatal oral health counseling for parents is the first step to infant oral healthcare. The rationale of prenatal oral health counseling is to generate awareness among expectant mothers about dental disease, its prevention and the means to promote good oral health in the infant [54]. A mother's DMFS scores, education, and feeding habits are strong risk indicators for the colonization of caries-related micro-organisms and ECC [55].

5.1. Importance of prenatal oral health care (during pregnancy)

Ideally, optimization of infant oral health begins prenatally and continues with the monitoring and counseling of the mother and child, beginning when the infant is approximately 6 months of age, with the eruption of the first tooth [56]. Infants with low birth weight and malnourished infants are at risk for development of enamel hypoplasia [22, 57-8]. Enamel hypoplasia may result in a rough enamel surface which can result in areas more prone to plaque accumulation and resultant caries [57, 59]. Thus, expecting mothers should be advised to optimize nutrition during the third trimester and the infant's first year, when the enamel is undergoing maturation [54]. Recent literature also reports an association between periodontitis in the mother and preterm birth [60] and between *S. mutans* levels in mothers and caries experience in their children [42].

Evaluation of the oral status of expectant mothers followed by pre-and perinatal counseling regarding the expectant mothers' nutrition, oral hygiene, caries experience and KAP regarding infant feeding practices can have a significant impact on the child's caries rate in the future [54]. A dental home can address these needs, if developed at the prenatal stage itself. Pediatric dentists, pediatricians and nutritionists have a combined role in relation to prenatal counseling with a goal to providing the best oral and overall health for the newborn and infant. Future parents should be monitored on a regular basis to ensure effective oral hygiene and dietary habits have been established through regular pre-and perinatal parent counseling.

5.2. Anticipatory guidance for the pregnant mother

Anticipatory guidance has been recommended for the pregnant mother to avoid caries and gingival problems and promote later oral health for the child. These include the following [43, 61-2]:

a. Education concerning development and prevention of dental disease and also demonstration of oral hygiene procedures.

b. Counseling to instill preventive attitudes and motivation among mothers.

c. Providing information to pregnant women about pregnancy gingivitis.

d. Visiting a dentist for an examination and restoration of all active decay as soon as feasible and to decrease chances of developing pregnancy gingivitis.

e. Eating healthy foods such as fruits, vegetables, grain products (especially whole grain), and dairy products (milk, cheese) during meals and snacks. Limit eating between meals.

f. Eating foods containing only sugar at mealtimes, and limiting the amount.

g. Brushing teeth thoroughly twice a day (after breakfast and before bed) with fluoridated toothpaste and flossing daily.

h. Rinsing every night with an alcohol-free, over-the-counter fluoridated mouth rinse.

i. Not smoking cigarettes or chewing tobacco.

6. Infant oral health care: Strategies and methods

An effective approach toward primary prevention of early childhood caries is to develop an approach that targets its infectious element, for example by preventing or delaying primary acquisition of *S. mutans* at an early age or infancy, through suppression of maternal reservoirs of *S. mutans* [63]. Mothers with dense salivary or plaque reservoirs of *S. mutans* are at high risk for transmitting the microorganism to their infants early-in-life [54].

6.1. Parent oral health counseling and education

Parent education and increase in knowledge, attitude and practices (KAP) regarding infant oral health care may provide long lasting benefits on an infant's oral health. Maternal/ Caregiver KAP [7-9] is an area where several lacunae exist regarding infant nutrition, feeding practices and first dental visit. Emphasis must be placed on behavioral approaches to conditions such as ECC that begin early in life the prevention of diseases and the promotion of healthy behavior among mothers and their children [2]. Low-cost health education combined with external motivation proved to be a valuable tool for promoting health behavior in mothers and their children [64].

6.2. Infant feeding related behavior

Infant feeding practices related to breastfeeding, bottle feeding and their timing of cessation must be given importance. Infant formulas are acidogenic and possess cariogenic potential [65-6]. Prenatal and postnatal counseling is essential to generate awareness about the unfavorable consequences of inappropriate infant feeding practices on infant oral health. Recommendations for appropriate infant feeding practices behaviors include [54, 67-8]:

- Infants should not be put to sleep with a bottle containing fermentable carbohydrates.
- At-will breast-feeding should be avoided after the first primary tooth begins to erupt and other dietary carbohydrates are introduced.
- Parents should be encouraged to have infants drink from a cup as they approach their first birthday.
- Infants should be weaned from the bottle at 12 to 14 months of age.
- Repetitive consumption of any liquid containing fermentable carbohydrates from a bottle or training cup should be avoided.

- Between-meal snacks and prolonged exposures to foods and juice or other beverages containing fermentable carbohydrates should be avoided.

6.3. Oral hygiene for the infant

Oral hygiene measures must be implemented no later than the time of eruption of the first primary tooth. These measures include the following [25, 68]:

- If an infant falls asleep while feeding, the teeth should be cleaned before placing the child in bed.
- Tooth brushing of all dentate children should be performed twice daily with a fluoridated toothpaste and a soft, age-appropriate sized toothbrush.
- Parents should use a 'smear' of toothpaste to brush the teeth of a child less than 2 years of age and perform or assist with their child's tooth brushing.

6.4. Fluoride supplementation

Fluoride is a well documented agent in caries control and it may be used for infants also. As per the AAPD, daily fluoride exposure for all children is recommended as a primary preventive procedure [69]. An infant's exposure to drinking water fluoride should be determined based on access to fluoridated water in community water supplies or through water analysis for those drinking well water [69]. A comprehensive knowledge of high fluoride belts and regions with endemic fluorosis is also important especially in countries like India with several geographic high fluoride belts. For infants older than 6 months of age who are exposed to water with less than 0.3 ppm fluoride, dietary fluoride supplements of 0.25 mg fluoride per day should be prescribed [69]. Irrespective of fluoride exposure in water, dietary supplements should not be prescribed for infants under the age of 6 months [69].

7. First dental visit: timing and its relevance

To promote early detection of dental caries and the establishment of a dental home, both the American Academy of Pediatrics (AAP) and American Academy of Pediatric Dentistry recommend the first dental visit by 1 year old. The AAPD recommends that the first oral evaluation visit should occur within 6 months of the eruption of the first primary tooth and no later than 12 months of age [70]. Since *S. mutans* begins to colonize an infant's mouth even prior to tooth eruption, a good dental care regime complemented by a dental home that is established at an initial stage of infancy may lead to long term oral health benefits for the infant.

8. Conclusion

Infant oral health forms the basis of a lifetime of good oral health. The primary focus of infant oral health is prevention and every effort must be made to prevent and promote oral health at

this crucial stage of infancy. A dental home must be developed for each child, which provides anticipatory guidance from infancy through adolescence. Maternal education and emphasis on good maternal oral health should also be encouraged at pre-and perinatal stages to further prevent early colonization of cariogenic microorganisms.

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