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REVIEW ARTICLE

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Dental Caries: A Disease Which Needs Attention

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Abstract Dental caries is one of the most prevalent disease (about 50%) in children across the globe. If not treated in time, it can affect not only the mastication function but also the speech, smile and psychosocial environment and the quality of life of the child and the family. The treatment of dental diseases is very expensive in all countries and prevention is very simple and effective. The caries in children below 6 y is called early childhood caries (ECC). It is most commonly caused by milk bottle or mother's feed during night. The ECC spreads very fast and can cause severe pain, abscess, swelling, fever and psychological disturbances in children. The treatment of ECC requires multiple appointments and still the prognosis is not very promising in mutilated dentitions. A physician or pediatrician can easily identify early caries and habits of parents leading to caries and can counsel them for prevention and refer them to the specialist. Good oral hygiene, dietary modification with respect to use of sugar and sticky food and healthy diet can help in preventing this disease in children. The need of the time is to appraise all on the methods of dental caries prevention.

Keywords Dental caries · Oral health · Oral hygiene · Early childhood caries

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Introduction

Dental caries or decay is a disease of dental hard tissues and has been related to multi-factorial etiology. It is commonly caused by fermentation of simple carbohydrates like sucrose by the oral micro-organisms especially the streptococci and lactobacilli. It starts with small surface roughness or sub surface demineralization and then it progresses to cavitation followed by pulp involvement and swelling, abscess and systemic signs and symptoms. According to a recent multi-centric study in India, dental caries prevalence ranges from 27 to 64% in 12-y-old children and 26 to 83% in adults [1]. However in some of the developed countries, dental caries has been reported to be as high as 68% (Lithuania) and as low as 12% (Singapore) in different times [2]. The prevalence of early childhood caries has been reported in nearly 30–60% of pre school children across the globe. Benjamin RM reported that dental caries is one of the commonest chronic diseases in children being five times more common than asthma or hay fever [3].

It is very important for every pediatric physician to know about the signs and symptoms of dental caries; its sequelae, if untreated and its impact on general health. Sometimes an unexplained fever in a child may be related to an abscess associated with carious tooth with infection spreading into the jaw-bone. An otherwise asymptomatic, untreated carious lesion can lead to spread of infection into the bone *via* the root resulting in submandibular or deep cervical lymphadenopathy.

As stated earlier, sucrose is the main culprit in causation of dental caries due to its metabolism by bacteria to various types of acids which consecutively causes dental caries. There is no known estimate of dental caries burden due to long term use of sucrose containing medical syrups in children, but frequently it can be associated with severe dental caries affecting almost all teeth resulting in inadequate mastication, pain and poor

esthetics [4]. It is essential for health care professionals to know about possibility of dental caries in such individuals so that preventive instructions may be conveyed or alternate medication may be prescribed in chronic diseases. Some of the pharmacotheraputic agents like antihistaminics and anti hypertensives *etc.* also reduce the salivary production and secretion [5] leading to inadequate clearance of bacteria by salivary flow and increased risk for dental caries, thus exacerbating the disease.

Clinical Features and Types of Dental Caries

Dental caries in infants and children has been given several names in the past including baby bottle caries or baby bottle tooth decay but the broader term Early Childhood Caries (ECC) is now being followed [6]. American Academy of Pediatric Dentistry (2003) defines ECC as caries in one or more primary teeth in a child 71 mo of age or younger [7]. The early stage of ECC can be easily identified as chalky opaque surfaces or distinct whitish streak near the gum line of the maxillary primary incisors. In later stages the teeth start appearing yellow due to collapse of enamel and leading to dentin exposure. The child may complain of difficulty in eating or drinking cold foods due to sensitivity. At his time, many of the children complain of food getting stuck in the tooth. In advanced stages there is tooth destruction up to the level of root with pain on chewing and brushing teeth. Sometimes the infection may progress to have pus, sinus, fistula, large swellings, cellulitis, lymphadenopathy and fever *etc.*

ECC can have serious repercussions in the oral cavity as well as on general health. The sequelae of ECC range from mild discomfort or pain on eating, sleep deprivation due to spontaneous pain at night, refusal to eat due to avoidance of pain leading to malnutrition. The spread of infection can lead to cellulitis, lymphadenopathy, abscess formation and can even damage permanent tooth buds. Moreover it can also cause problems in speech development and poor esthetics; both of which might cause psychological impact on the child. Some of studies in scientific literature suggest an association between child's weight and ECC [8, 9].

The quality of life in such children is also poorer as compared to their counterparts [10]. Children with special health care needs generally fall under high risk group for development of caries.

Etiology of Dental Caries

Dental caries is a multifactorial disease, *i.e.*, it cannot be attributed to a single cause. The causation of dental caries can be related to three main factors *i.e.*, Oral bacteria in dental plaque, presence of fermentable carbohydrates and available tooth surface. Apart from this, several other contributing factors are responsible for increasing or decreasing the speed of decay of teeth like oral hygiene habits, shape of the tooth, surface characteristics, eating habits, quality and quantity of saliva *etc.* as shown in Fig. 1.

The tooth surface is covered with pellicle of protein which is a soft coating which is generally invisible to the naked eye, harbouring various microorganisms of oral flora. Two of the main organisms *viz. Streptococcus mutans* and *Lactobacillus acidophilus* are acid producing in nature. In the presence of fermentable carbohydrates, the acid produced by these bacteria starts eroding the superficial enamel or outermost tooth covering. However, due to constant presence of salivary calcium and phosphate ions, the surface is remineralized continually, *i.e.*, calcification occurs continuously. However, if the acid remains in contact with tooth for longer duration, it brings about subsurface demineralization or softening of the tooth in the initial stages. This subsurface loss of minerals from enamel is visible as white spot or a streak. On further progression, there is break in continuity of enamel which takes a shape of cavity.

The retention time of fermentable carbohydrates in oral cavity has proved to be main factor in initiation and progression of dental caries. Some of the items made up of refined wheat flour like bakery items stick on occlusal or chewing and interproximal surfaces of teeth and thereby retain for longer periods. This longer retention period provides enough time for oral bacteria to convert the complex carbohydrate molecule into simple carbohydrates (sucrose) and intiate/ progress dental caries.

Other Causative Factors

Other contributing factors in dental caries causation are salivary flow rate, buffering capacity, *i.e.*, ability of saliva to neutralize acids and maintain its pH and availability of some protective enzymes and molecules in saliva [11]. Moreover, composition, surface characteristics of enamel and location of the tooth in the

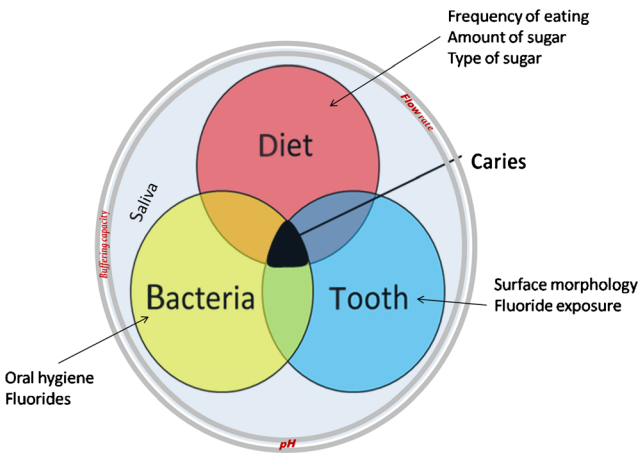

Fig. 1 Etiology of dental caries

dental arch can also be determinant for dental caries risk in an individual. Genetic preponderance to dental caries in some individuals and families have also been debated extensively but with no conclusive evidences. Some researchers have hypothesized that the dietary and hygiene habits in the family remains the major reason of preponderance of caries in some families. However some of the twin studies [12] have proved that differences in oral hygiene efficiency, tooth morphology, surface characteristics and location of tooth in the arch *etc.* were the reason for differences in dental caries experiences (specially in the twins separated after birth).

Medication Caries

The use of long term medicated syrup and suspensions for children has also been correlated with high caries. Menezes et al. has described role of medication in dental caries in children [13]. Some of the studies have proved cause and effect relationship between dental caries and long term use of sugar containing medication in children of various age groups.

Differential Diagnosis - Fluorosis, Enamel and Dentin Imperfectas, Hypoplasia

In the very initial stages, dental caries is visible as white spot on smooth surface near gingival margin or a blackish discoloration on the chewing surface. Most of the time, it is symptomatic. Initial lesion of dental caries may resemble an enamel hypoplastic spot or fluorosis. However, caries can be differentiated by wetting the surface with saliva or water. The hypoplastic or fluorosis spots in enamel are due to increase in opacity and it will remain the same after wetting the surface but in case of dental caries the spot is visible due to initial demineralization and porosity of enamel (loss of enamel translucency) and on wetting the surface the pores are filled with water causing disappearance of the white spot. The location of initial caries is normally near the gingival line (cervical) and hypoplasia and fluorosis is in the middle part of crown.

After cavitation, dental caries manifests as what we term as holes in common parlance or with associated food impaction between the teeth. At this time, the patient may have increased sensitivity to hot, cold, sweet or sour. On clinical examination a cavitation can be seen on tooth surface. Sometimes, the cavitated portion is in between the posterior teeth and is not visible clinically. In such cases, an intra oral radiograph can be helpful in diagnosis.

Prevention

It is aptly said that prevention is better than cure. Due to wide impact of ECC on children's health and quality of life it is better to institute a preventive protocol at an early stage. In order to have effective prevention of early childhood caries, preventive counselling should be done at various stages:

Prenatal: During pregnancy, the importance of maintaining oral hygiene should be stressed upon. It has been documented that children born to mothers with poor oral hygiene have a higher risk of developing dental caries [14].

At Birth: New mothers should be taught how to clean the oral cavity of a newborn after every feed. The appropriate way to clean the oral cavity is the use of a soft clean cloth which is wet and wrapped around finger. A single horizontal stroke is used to wipe the upper gum pad followed by the lower gum pad and tongue. Moreover the mother should be taught to feed the baby in an upright position. Mothers as well as other caretakers should be advised against use of honey, gripe water and ghutties as due to sweet content these contribute towards development of caries.

At 6 months: Usually the first deciduous tooth erupts at around six months of age. It is of utmost importance that parents understand the importance of the first dental visit at this age. They should be guided regarding use of "finger brush" which can be worn on the finger of the hand by mother/caretaker. It is made of silicone rubber and has multiple tufts placed in rows. It allows better manual dexterity as it is easier to control pressure and there is better tactile sensation. This allows the brush to easily reach all areas in the mouth and also protects the finger from being bitten due to its structural composition. The parents should be taught how to examine the teeth of the child by lifting the lip. This is the time when parents often introduce bottle feeding especially at night. The deleterious effects of sleeping with the bottle at night should be explained. Parents should be advised to switch to milk diluted with water during night as the child falls asleep. Cleaning of oral cavity should be emphasized. A quarter spoon of water inserted 3–4 times (at interval of 15–20 s) between the lips of sleeping child after feed can clean the milk remanants from teeth. Often parents introduce sweetened juices and milk at this time. Proper counselling should be done regarding these.

At 12 months: Sippy cup or glass should be introduced for intake of liquids. The child should be shown to a pediatric dentist soon after eruption of milk tooth. The brushing can be started with a baby brush and half pea size of non fluoride containing toothpaste. The parents should brush in such a way that it does not hurt the gums of the erupting teeth. In order to do so the parents should make the child stand in front of mirror and position themselves at the back of child in such a way that childs's occipital vertex is kept exactly in front of the left shoulder of the parent. The up and down strokes of brush with very light force will not trouble the child. The tongue cleaning

and gum massage should also be part of regular brushing. The frequency of brushing should be minimum twice daily.

At the age of about 2–3 y, the child often develops and start asking for autonomy and requests parents to let him/her brush for self. Such behavior should be promoted and supervised brushing should be started. The child may be asked to brush first under parental supervision and then parents should help in cleaning some areas where child's brush could not reach.

From 6 y onwards, child can use fluoride containing toothpaste twice daily. The correct method and frequency of brushing should be followed. The movement of brush should always be from gums to teeth. It means that for upper teeth we should move brush downwards in a swiping motion and reverse for lower teeth. The buccal (outer) and palatal/ lingual (inner) surface cleaning should be done by this method. The occlusal or chewing surfcae should be cleaned using small to and from movements. It is important to clean all the surfaces of teeth. Many a times people practice horizontal strokes (to and fro) with force for cleaning, it damages the tooth surface near gum line so it should be avoided. The brushing should be performed twice a day *i.e.*, in the morning and before going to bed. Wet toothbrush without toothpaste should be used preferably after every major meal. Tongue cleaning and gum massage are also important part of brushing and regular habit of the same will keep the oral cavity healthier.

These days some battery operated toothbrushes are available with several designs and types. Use of such toothbrush can be helpful in children with some motor disabilities.

Other Methods for Prevention of Dental Caries

1. *Use of fluoridated toothpaste and mouthwash*

   Fluoride ion (usually in form of some salt of fluoride in toothpaste) reacts with the outermost layer of enamel and makes it more resistant to dissolution by acids produced by oral bacteria. The fluoride containing tooth pastes and mouthwashes are easily available in market for use by the people. Whereas some high concentration gels and varnishes are available for topical application on teeth by the professionals. The amount of fluoride in toothpastes usually vary from 400 to 1500 parts per million (ppm). Most of the children's toothpastes have lower (500–800 ppm) concentration. After the age of 3 y, use of fluoride containing tooth paste for brushing twice daily is recommended. However the quantity of paste required for brushing is only equal to half pea size. From age 6 y onwards a pea size toothpaste is enough for brushing twice daily.
2. *Combat the microbial plaque by chemical methods*

   The commonly available mouthwashes for children contain fluoride for preventing dental caries. Normally the mouthwash should only be used with prescription. Some of the chlorhexidine, antibiotics like triclosan and povidine–iodine containing mouthwashes should only be used in specific conditions under the prescription of a specialist.
3. *Diet modification*

   The diet plays very important role in dental caries causation. The readily available sugars and sticky food make oral environment more conducive to dental caries. Therefore efforts should be made to reduce the intake and frequency of refined carbohydrates and sticky foods. Increase the intake of fibrous food to stimulate salivary flow, which is protective against caries. The use of healthy diet with adequate fibres and fresh fruits help in maintaining good oral health.
4. *Preventive interventions*

   Certain early interventions by dental professionals can help to prevent dental caries to a large extent.

   Use of pit and fissure sealants – The susceptible pits and fissure on occlusal surfaces of newly erupted posterior teeth are sealed with a fluoride releasing glass ionomer cement or composite resin.

   Application of fluoride varnish – It decreases the attachment of plaque on surface enamel and increases the abilty to resist demineralization due to acids produced by fermentation of carbohydrates and helps in remineralization by sustained release of fluoride.

Treatment of Dental Caries

Treatment of dental caries is mainly under the domain of a dental surgeon. The role of other medical professionals is mainly patient and parent education in order to prevent dental caries. Early identification of at-risk individuals and early referral to a dental surgeon form the key to successful management of such children.

Myths Regarding Dental Caries in Children

There are several misconceptions about the oral health in children and this needs to be addressed appropriately.

Myth 1: It is often assumed that there is no need to brush the child's teeth till 2–3 y of age. However this is a myth as this could lead to early onset of dental caries in children. It is important to start cleaning the oral cavity from the first day of birth itself and to start brushing without toothpaste as soon as the first tooth erupts in the oral cavity.

Myth 2: Another misconception is that deciduous or milk teeth will fall off and there is no need to treat caries in these teeth. This is a wrong notion as dental caries in deciduous teeth can lead to serious sequelae and also affect permanent teeth.

Myth 3: Another fallacy perceived by the general public is that only sugars and sweet foods can cause cavities. This myth especially needs to be debunked as sticky foods which may be salty can also lead to caries.

Conclusions

Dental caries in children is an important disease which can be very disturbing if it is not attended to. The physicians can play an important role in preventing its initiation, early identification and limiting the progressive sequelae of dental caries in children. Therefore the final recommendations are:

1. Each healthcare provider for children should be updated about causes, identification and prevention of dental caries.
2. All the healthcare providers must know the instructions to be given to the parents about mouth-rinse/ brushing after administration of sugar containing medicated syrups/ suspensions.
3. In case of identification of dental caries in a child's mouth, the healthcare providers must refer them to pediatric dentist in particular.

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Compliance with Ethical Standards

Conflict of Interest None.

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