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DENTAL CARIES INCIDENCE, PREVALENCE, DIAGNOSIS AND TREATMENT

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Abstract:

Dental caries is one the most common dental health diseases encountered in dentists' outpatient clinics, and it is estimated to be one of the main causes of oral pain and teeth loss. Dental caries constitutes a major obstacle against maintenance of oral health and is thought to be the main cause of progressively increasing burden of the global dental disorders despite the improvement in dental care. Poor dental health can negatively affect the general health and subsequently the quality of life. Dental caries can be prevented and can be effectively treated if early diagnosed. Thus, appropriate knowledge about dental caries epidemiology, diagnostic features, and treatment is fundamental for caries control. Dental caries is prevalent among 9% of children, 36% of adult population, and 29-59% of geriatric population. It is characterized clinically by localized teeth pain that is exacerbated by thermal changes or sugary foods. Clinical examination reveals tooth discoloration, change in texture, and localized tenderness. Plain X ray or laser fluorescence may be required to diagnose early cases of dental caries. Management of caries can be preventive (e.g. dietary modification, oral hygiene practices, fluoride application, sealants for pits and fissures, and vaccines), restorative measures (e.g. filling, crowns, or root canals), and tooth extraction. The choice of treatment measure depends on the dental state and the extent and severity if dental caries. In this article, the incidence, prevalence, diagnosis, and treatment will be reviewed.

Keywords: *Caries, dental caries, diagnosis, incidence, prevalence, treatment.*

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INTRODUCTION:

Dental caries is one the most common dental health diseases encountered in dentists' outpatient clinics, and it is estimated to be one of the main causes of oral pain and teeth loss. Dental caries can be prevented and can be effectively treated if early diagnosed [1]. Thus, appropriate knowledge about dental caries epidemiology, diagnostic features, and treatment is fundamental for caries control. Dental caries constitutes a major obstacle against maintenance of oral health and is thought to be the main cause of progressively increasing burden of the global dental disorders despite the improvement in dental care [2,3]. Poor dental health can negatively affect the general health and subsequently the quality of life [4].

. Dental caries is a chronic progressive disease that implies local destruction of teeth and dental tissue by accumulating acids produced by the bacterial action on dietary sugars. Residual dietary carbohydrates at teeth results in activation of bacterial fermentation and production of acidic by-products that are destructive to the dental tissue. On chronic basis, the imbalance between the microbial-secreted biofilm and the dental minerals results in changes in oral Ph and de-mineralization of dentine and enamel [5,6]. Dental caries may be primary, secondary, or arrested. Primary caries implies affection of a location that has not been previously affected with caries, and it usually involves both approximal and occlusal surfaces of teeth and can occur beneath the teeth contact areas or on a localized area resulting in fissures or pit. Secondary caries, on the other hand, occur at a location that was previously involved and is usually localized to teeth margins. Arrested caries implied demineralization followed by remineralization of a portion of the teeth without causing cavitation [1,7]. In this article, the incidence, prevalence, diagnosis, and treatment will be reviewed.

EPIDEMIOLOGY OF DENTAL CARIES:

Dental caries is one of the most common dental disorders worldwide. It is estimated to affect about 36% of adult population (i.e. 2.4 billion individuals) worldwide [8]. Among children, about 620 million children were reported to have caries affecting their primitive teeth[8]. Dental caries is the most common pathological etiology for teeth loss among pediatric population, and it affects about 29-59% of the geriatric population [9,10]. Data from the United States shows that dental caries is considered the most common childhood disorder, that was reported to be five times more prevalent than bronchial asthma during the period between 1990 and 2010 [8].

Dental caries severity varies significantly among different countries. It is of the highest prevalence in the Middle East countries, Asia, and Latin America [10]. Among these countries, more than 60% of the school students are affected [11]. Several factors also affect the prevalence of disease particularly sex, age, race, socio-economic status, oral hygiene, and food practices [12,13].

A systemic review conducted in 2010 in more than 74 countries with reported children having dental carried and 67 countries with adult caries stated that the mean incidence of dental caries over the period 1990 to 2010 was 15 to 27 new cases per 100 people per year in primitive and permanent teeth, respectively [11]. The peak age of dental caries prevalence was shown to be around the age of 25 years, which is thought to represent dental neglect after the school age. [11]

DIAGNOSIS OF DENTAL CARIES:

Classically, dental caries presents clinically with teeth pain that is often localized to the affected tooth. However, diffuse pain may also occur over several teeth. Even though, it does not cross midline [14]. The pain characteristically increases by thermal changes in the oral cavity. Cold temperature aggravates the pain if the dental pulp remains vital, whilst heat aggravates pain in teeth with necrotic pulp [15]. Pain with sweet food, hot, or cold drinks is characteristic. Dental caries pain results in difficulty during eating, chewing, smiling, and speaking which negatively affect the patient's quality of life [15]. As the disease progresses, foul breath and bad taste are experiences, and fever, trismus, and chills may be encountered in advanced cases [1]. Though pain is the classical presentation of dental care, its site and characteristics vary according to the age of the patient, the microbiota involved, and the duration and activity of caries [1].

In young children and infants, dental caries is most likely to affect maxillary anterior teeth [16]. The predilection of caries to these teeth is proposed to be attributed to leaving the children fall asleep with sweetened liquid bottles [16]. The mandibular teeth are protected by the tongue position during feeding. Because the maxillary incisors are the first teeth to emerge, they are the most commonly affected teeth by dental caries in young children. If the caries became chronic, the upper first molar teeth, the upper

second molar teeth, and the upper canines will be affected, respectively [17-19]. This type of caries is referred to as 'early childhood caries' and is known to be more prevalent among children with hypoplasia or malnutrition [20].

On examination, the change in dental colour, texture, or dental pain on exploration are the key features for diagnosis of dental caries. The dental caries appears initially as chalky area that develops over time to a large cavitation in affected teeth [2]. Examining for dental caries should be performed under ambient light using a dental mirror and a dental explorer. Small early cavitation at teeth may be visible on clinical examination prior to any clinical manifestation. With caries progression, visible holes or pits start to appear, white, brown, or black staining is visualized on any of the teeth surfaces, and foul breath may be smelled. Inn advanced cases, pulpitis, tooth death, and permanent teeth discoloration occur [14]. Ludwig angina and cavernous sinus thrombosis are potentially fatal complications of dental caries [20,21].

The main investigations of dental caries are dental plain X ray and laser (without ionizing radiation). These investigations are essential for visualizing less visible areas between teeth and to confirm the diagnosis of pits and fissures. Laser fluorescence is used to quantify the microbial load in dental caries and is sensitive even during the early stages of caries. Digital imaging fiber-optic trans-illumination (DIFOTI) is the technology developed to early detect cracks, fissures, demineralization, and fractures [22].

TREATMENT OF DENTAL CARIES:

The main objectives of dental caries management are to preserve the structure and function of the patient's affected teeth and to prevent further involvement of the healthy adjacent teeth. Exploration and control of patients' risk factors is fundamental during caries management to prevent disease progression [14]. Dietary habits (e.g. snacking habits, sugar consumption, ...etc), oral hygiene practices (e.g. mouse rinse, use of fluoride toothpaste, frequency of teeth brushing, …etc), the presence or absence of pits and/or fissures, calculus deposition, and salivary flow are the main predictors for caries progression [23].

Management of dental caries includes preventive measures, restorative measures, or tooth extraction in advanced cases. One of the initial steps to decide which type of management of dental caries to be decided is to assess whether the caries is cavitated or non-cavitated. Basically, remineralization can occur if the non-cavitated lesions were arrested [24]. The process of remineralization implies reconstruction of the molecular structure of the teeth via tight restriction to dietary modifications, reduction of refined sugars, and optimal oral hygiene [24]. Remineralization cannot occur, however, in teeth with cavitated lesions (particularly if this cavitation involve the dentin) or excessively destroyed teeth [25].

The main preventive measures of dental caries are dietary modification, oral hygiene, fluoride application, Sealants for fissures and/or pits, or vaccination. Restorative measures include filling, the use of crowns, root canals, or tooth extraction in advanced cases.

PREVENTIVE MEASURES:

a) Dietary modification:

Residual carbohydrates at oral cavity are acted upon by bacteria, and the by-products of fermentation destroy the dental tissue. Thus, one of the main preventive measures for dental caries is reduction of frequency of sugary food, particularly sucrose-containing carbohydrates. Because of the difficulty of complete elimination of the sucrose from the modern diet, less injurious sugar substitutes, such as Xylitol, can be used. Xylitol has several disadvantages. It has a sweeter flavour than conventional sugar, it is not cariogenic, and has also anti-cariogenic action[2,13,26].

Other dietary recommendations include reducing the frequency of snacks, minimizing sticky foods (e.g. candies and dried fruits), minimizing sugary drinks, and avoid leaving feeding bottles in babies' mouths during sleep. Additionally, adequate intake of calcium is essential for protection against dental caries. Calcium strengthens the enamels and makes them more resistant to demineralization. Calcium-rich foods include milk, diary products, and green vegetables[27].

b) Oral hygiene practices:

Adequate regular oral hygiene reduces oral bacteria, dental biofilms, and dental plaques. Daily proper teeth brushing, and flossing are keys to prevention of dental caries. All patients should be educated about the appropriate brushing and flossing

methods during healthcare visits and on regular follow-ups to optimize their dental health[28].

c) Fluoride Application:

Fluoride acts by inhibition of dental demineralization and enhancing remineralization. It binds to the hydroxyapatite crystals in dental enamels reducing demineralization. When teeth surfaces are re-mineralized, they become more resistant to the destructive effect of acidic by-products of bacterial-induced fermentation of residual dietary carbohydrates. Moreover, fluoride inhibits the action of bacterial enzymes. Thus, fluoride is essential for restoration of teeth enamels and reverse the early cavitary lesions[17,29].

Fluoride can be applied via variable methods. It can be applied through fluoridation of tape water, using tooth pastes with fluoride, fluoride-containing mouth rinse, fluoride-rich dietary supplements, and professional fluoride compounds (e.g. varnishes and gels). Professional fluoride compounds are generally preferred to fluorinated water, mouth rinses, and tooth pastes due to their high fluoride content. After application of fluoride, rinsing should be avoided[30–32].

d) Sealants for pits and fissures:

Dental pits and fissures are the most common sites affected by dental caries because their anatomy makes them susceptible to plaque deposition and bacterial flourish. Moreover, oral hygiene measures cannot reach these narrow spaces. Therefore, filling these highly susceptible spaces is essential in prevention of dental caries. Dental sealants are thin coatings, made mostly of plastic, specifically designated to be applied to the teeth chewing surface. Sealants application prevents dietary residual trapping inside the existing fissures and gums, and subsequently reducing the incidence of caries formation[33].

e) Vaccination:

Development of vaccination against the bacterial diseases that interact with food residuals forming bacterial biofilms in the oral cavity has long been considered. Many recombinant and synthetic proteins, peptide, and protein-carbohydrate vaccines were experimentally tried and have shown promising results. However, an effective vaccine has not yet been approved[34,35].

RESTORATIVE MEASURES:

a) Dental filling:

Dental filling is the most common and most conventional restorative technique used to prevent dental caries. They are made of porcelain, resins, dental amalgam, or a combination of these materials. Filling with teeth-coloured materials is usually preferred for aesthetic reasons[36–38].

b) Dental crowns:

Dental crowns are custom-fitted dental appliances that provide a covering that substitute the natural damaged teeth crowns. Artificial dental crowns are usually indicated in cases with severe caries destroying their natural crowns. Before crown application, dentists remove and cleanse the existing dental caries. Dental crowns are made of resin, porcelain, fused metal porcelain compounds, or gold[38].

c) Root canals:

In more advanced cases of dental caries, the teeth pulp may get destroyed. In these cases, the diseased teeth pulp is removed and replaced with an artificial one. The root canals are sometimes filled with antibiotics to treat any residual infection. After resolution of infection, the pulp can be replaced with a filling[1].

TOOTH EXTRACTION:

Tooth extraction is the last measure used in excessively damaged teeth by dental caries. If the tooth become so destroyed that none of the aforementioned restorative techniques can be performed, tooth extraction should be performed. Following extraction, a dental bridge, denture, or a dental implant should be placed to avoid teeth malposition and movement[20].

CONCLUSION:

Dental caries is a common public health problem that affects individuals at different age groups. Dental caries is prevalent among 9% of children, 36% of adult population, and 29-59% of geriatric population. Dental caries is characterized clinically by localized teeth pain that is exacerbated by thermal changes or sugary foods. Clinical examination reveals tooth discoloration, change in

texture, and localized tenderness. Plain X ray or laser fluorescence may be required to diagnose early cases of dental caries. Management of caries can be preventive (e.g. dietary modification, oral hygiene practices, fluoride application, sealants for pits and fissures, and vaccines), restorative measures (e.g. filling, crowns, or root canals), and tooth extraction. The choice of treatment measure depends on the dental state and the extent and severity if dental caries.

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