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ASSOCIATION OF DENTAL CARIES AND DIABETES.

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Abstract

Diabetic patients are recognized to be more prone to dental caries due to various risk factors. Despite the existing understanding, the exact impact of factors like blood glucose levels, salivary glucose concentration, and glycemic control on the development of dental caries in individuals with type 2 diabetes (T2D) remains unclear. It is crucial in caries management to evaluate a patient's susceptibility to caries. High blood sugar levels leading to hyperglycemia can reduce salivary flow rate, a common occurrence during periods of inadequate metabolic control in diabetes, creating an environment conducive for aciduric bacteria to flourish and caries to initiate formation. Because diabetes causes long-term glucose leakage into saliva, which indirectly raises oral microflora metabolic activity, modifies dental biofilm, and ultimately promotes the development of dental decay and periodontal diseases, diabetes may be linked to a higher prevalence of dental caries. Diabetes is a metabolic disorder characterized by improper lipid, carbohydrate, and protein metabolism. Hyperglycemia causes a decrease in salivary flow rate, which is common during periods of poor diabetes metabolic control, allowing aciduric bacteria to thrive and caries to form.

Keywords

Glucose, Diabetes, Salivary, Metabolism, Dental caries, Periodontitis.

Introduction

Dental caries remains one of the most predominant and progressive aspect of dentistry. Historically their treatment is by removal of the cavitated tissue and replace them with suitable restorative material[1]. Dental caries are reported to be more common in diabetic people. Diabetes is marked by abnormal metabolism of carbohydrate, protein and lipids. Hyperglycemic stage can alter the function of saliva by reducing the flow rate and production[2]. The possible risk variables including blood and salivary glucose management play in development of dental caries in T2DM. Diabetes is associated with the development of periodontal disease and an increased number of other consequences including neuropathy, retinopathy and nephropathy [2].

Assessment of dental caries

Caries risk assessment evaluates the likelihood of developing new cavities or incipient lesions over a specific period. It also predicts potential changes in the size or activity of existing lesions[3]. Nearly half of the dentists did not incorporate caries risk assessment into their treatment planning[1]. Documenting the results of caries detection, diagnosis, and risk assessment, and informing patients about the findings and their implications for treatment and prognosis, is as essential for effective care and caries disease management as recording the proposed treatment plan and its outcome [4].

Caries is a multifactorial disease, and a comprehensive risk assessment should consider all the factors contributing to its development. When individual risk factors are assessed in isolation, they are generally poor predictors of caries onset[3]. By evaluating all risk factors together, a more accurate risk assessment can be made, identifying the specific etiologic factors responsible for the disease in each patient. This holistic approach enables the creation of personalized management strategies[5].

Metabolic control

Caries risk can be evaluated on the basis of nine biological variables. The development of dental caries was assessed according to a predefined scale and incorporated into the program poor general health, fluoride use, unfavorable food intake, oral hygiene level, flow of saliva, micro-organism, salivary lactobacilli, buffering capacity of saliva and past experience of dental caries[6]. A statistically significant relationship between caries risk and HbA1c was demonstrated in a group of adolescents with type 1 diabetes. Increased caries risk at the time of diagnosis provided prognostic information regarding the level of metabolic control[7]. Type 1 includes cases where destruction of beta pancreatic cells occurs due to an autoimmune process (type 1A), and where the etiology and pathogenesis of the destruction is idiopathic (type 1B), which is less common. Type 2 is characterized by insulin resistance and a relative lack of insulin secretion, and is often associated with obesity and metabolic syndrome[8]. The mean DMFS index of children with poorly controlled type 1 diabetes was significantly higher than that of well-controlled children[9].To resolve sugar-induced hypoglycemic symptoms, diabetic patients should be well informed about proper oral hygiene procedures, especially when these symptoms occur at night. Reduced saliva secretion, especially at night, is very common in diabetic patients[7]. This reduction reduces the rate of matrix excretion and sugar dissolution, which in turn reduces the effectiveness of pH regulation and antibacterial mechanisms, promoting bacterial proliferation and sugar metabolism by cariogenic bacteria[10]. All this can lead to demineralization of tooth structure. Since dental caries is a multifactorial disease, a thorough and careful evaluation of all etiological factors is required to assess the risk profile of an individual diabetic patient[7]. Evaluation of primary factors (carbohydrate intake and the presence of cariogenic microorganisms) and secondary factors (oral hygiene habits) is necessary. Patients with diabetes mellitus who have hyperglycemia have higher salivary glucose levels[11]. This could be significant because the cariogenic bacteria in the dental biofilm may use glucose as a food source [6].

Relationship between dental caries and diabetes mellitus

The link between tooth caries and diabetes is conflicting. Diabetes alters the structure of the salivary glands, leading to dry mouth and xerostomia, which impair oral health and accelerate the development of dental cavities.

The development and progression of caries are influenced by a number of variables, such as salivary flow, buffering action, and salivary glucose level. Caries prevalence is also influenced by other contributing variables, including poor educational attainment, plaque deposits, dental hygiene knowledge, and cariogenic diet. Age-

related physiological changes in patients include gingival recession, which promotes senile caries and is more prevalent in people with type II diabetes[12]. In addition to diabetes patients who have poor oral hygiene, those who are physically impaired are more likely to get dental caries than diabetic patients who are physically active and maintain proper oral hygiene. Those with diabetes had a higher chance of developing candidiasis, erosion, and coronal/root caries. White spot lesions in the enamel, which manifest as tiny regions of underlying demineralization, are the initial signs of smooth surface caries. It starts as demineralization in the root surfaces, which softens the area and makes it easier for microorganism to enter [13].

Dental caries can be found in two different places: on the tooth's crown, which is covered in tooth enamel and visible in the oral cavity, and on the root, which is embedded in the alveolar (jaw) bone and not visible in periodontal health because it is covered by gums [13]. Acidic byproducts from bacterial fermentation of dietary carbohydrates that cause localized destruction of vulnerable dental hard tissues (enamel, dentine, and root cementum) and seen as cavitated tooth surface [2]. Equilibrium between the tooth minerals and the bacterial biofilm. Bacteria in the dental biofilm, such as *Streptococcus mutans*, other closely related *Streptococci,* and some *Lactobacilli,* produce a sticky polysaccharide matrix and acids that demineralize the hard dental tissues if this balance is upset (often referred to as the ecological shift) [3]. It has been discovered that diabetes raises the risk of mental illness, especially depression [14]. Cavitation is the end result of this. The aciduric bacteria can continue this activity as long as they stay on the surface and have enough food, especially sucrose, because human teeth are made of non-shedding tissue. Poor dental hygiene and frequent consumption of foods, snacks, and soft drinks can that contain sucrose or other fermentable carbohydrates—some of which may be acidic[12].

Diabetes frequently causes long-term glucose leakage into saliva, which may change the dental biofilm and thereby increase the risk of dental caries and other oral diseases. In fact, the saliva plays a significant part in maintaining the integrity of oral tissues by stabilizing pH, regulating the local demineralization-remineralization equilibrium, and shielding these tissues from different pathogens. It is noted that xerostomia, or dry mouth, is highly prevalent in people with diabetes and may increase the risk of dental caries [15].

Genetic association between glycemic trait and caries

One of the most common and serious progressing diseases is type 1 diabetes. The disorder is brought on by autoimmune inflammation that damages the pancreatic islet's beta cells of Langerhans, which generate the insulin hormone. Numerous pathogenic genes have been shown to be shared by this disease, which affects children and adolescents more often than adults, with other conditions such as hypothyroidism and nonalcoholic fatty liver disease [16]. Because of the intricacy of the illness and the peculiarity of its predisposing age, better care of T1DM patients has become crucial. Consequently, investigating illnesses that could be connected to type 1 diabetes helps with its treatment and early interdisciplinary intervention[17].

Dental caries is a prevalent long-term infectious condition that damages teeth's hard structures. It is the eleventh most prevalent symptom of all disorders, globally in terms of prevalence, according a recent analysis published in Lancet. Uncertain genetic and environmental factors contribute to the development and emergence of dental caries. Additionally, systemic illnesses that significantly lower human quality of life can be caused by or made worse by tooth caries and its related problems [18]. These measures are critical for controlling the anticipated diabetes epidemic.

Upon further analysis of the study, it can be concluded that dental caries is more prevalent in diabetic individuals, with higher age, elevated blood sugar levels, and increased DMFT (Decayed, Missing, and Filled Teeth) values compared to the control group [19]. Therefore, diabetic patients should prioritize maintaining good dental hygiene, including proper brushing techniques, and promptly address any signs of decay or carious lesions. Most

importantly, they should adhere to the recommendations of their physician or dietitian for a noncariogenic diet to help minimize the risk of dental issues [20]. A thorough caries assessment should encompass a range of considerations including the patient's history with caries, dietary habits, exposure to fluoride, presence of bacteria known to cause caries, salivary health, overall medical background, and behavioral and environmental aspects. In addition, various demographic and medical characteristics should also be taken into account as they could potentially influence the development of caries. It is important to conduct a caries risk assessment that also examines factors that could pose challenges to the patient's ability to maintain proper oral hygiene [18].

Conclusion

To alleviate the disease burden of diabetes in India, effective government interventions and collective efforts from all sectors of society are essential. Clinicians should be actively involved in implementing screening and early detection programs, diabetes prevention strategies, self-management counselling, and appropriate therapeutic management, following local guidelines.

Furthermore, the potential oral complications faced by individuals with diabetes such as dental caries, dry mouth, and oral mucosal lesions have become increasingly common in recent times. It is therefore essential to consider these complications when assessing and managing oral health in diabetic patients to ensure comprehensive care and timely intervention.

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