



IMPACT OF DIABETES MELLITUS ON DENTAL HEALTH; REVIEW

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Abstract:

Dental health is one of the direct metrics that may be used to determine the overall health of a community. Diabetes mellitus is linked to a variety of dental and oral difficulties, including xerostomia and periodontal issues, among others. The purpose of this narrative review is to identify oral problems that are associated with diabetes mellitus and to investigate the probable pathologies that are responsible for these issues. The Google search engine, Google Scholar, PubMed, and Science Direct were utilized in order to conduct the electronic database search. Diabetes is a significant complication in the field of medicine. According to the available research, oral health care professionals have the potential to have a large and beneficial impact on the oral and general health of patients who have diabetes mellitus.

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Introduction:

The chronic condition known as diabetes mellitus is defined by hyperglycemia, which is high blood glucose levels. Diabetes mellitus is caused by insulin malfunction and deficiency. Several various sections of the body, including the brain system, eyes, kidneys, and cardiovascular system, are affected by abnormalities and failures that are brought on by chronic hyperglycemia [1].

Moreover, hyperglycemia is the diagnostic tool for diabetes, which is a metabolic disorder that is chronic and associated to inflammation. These high blood glucose levels have a detrimental effect on the inflammatory response provoked by dental plaque, which ultimately results in gingivitis and periodontitis that are more severe. As a result, periodontitis and diabetes have a mutually detrimental impact on one another. When detecting and improving risk factors connected to one of these two diseases, it is possible that the other disease will also be present, and the severity of the other disease will be reduced. This is an important fact because the risk factors for these two diseases are virtually identical. Such enhancements may include giving up smoking, limiting the amount of added sugar consumed, minimizing any inflammation that may be present, and ensuring that adequate sleep is obtained at healthy times in accordance with the circadian cycle. Enhanced glycemic control in type 2 diabetes can be achieved by the utilization of routine, nonsurgical periodontal therapy, often known as "deep cleaning." This treatment can be carried out by dental health care professionals in regular dentistry practice or in periodontists' specialized offices. Additionally, adequate oral hygiene care at home can also contribute to this improvement [2].

It is also possible for hyperglycemia to have a role in the poor healing of lesions that are located at the apex (tip) of the teeth, which can be accompanied by persistent infection and inflammation in the jaw bone. Those who suffer from chronic periodontitis or periapical periodontitis and have their teeth extracted have a reduction in the levels of inflammatory biomarkers in their bodies. In addition, diabetes and the use of diabetic medication can cause dry mouth, which is a factor that leads to the development of periodontitis, caries, and thrush (candidiasis). In addition to being a potential contributor to trigeminal nerve pain and temporomandibular joint issues, diabetic neuropathy can also result in burning mouth syndrome (also known as glossodynia) and taste impairment (also known as dysgeusia). Periodontitis and diabetes both have the potential to

significantly reduce one's quality of life with serious consequences. On the other hand, those who have diabetes see the dentist less frequently than their comparable colleagues who do not have diabetes [2].

Due to the fact that both periodontitis and dysglycemia (hyperglycemia) have a deleterious impact on one another, it is essential for dental and medical professionals to be aware of the possibility that the two conditions might coexist. Both illnesses can be addressed if the knowledgeable providers engage in a patient-centered, interprofessional team approach in the purpose of providing the greatest possible oral and systemic health for their mutual patients [3]. Correct and mutual referral is vital since both diseases can be improved.

Review:

The metabolic problem known as diabetes mellitus is a chronic condition that is not communicable and is characterized by a disruption in either the action or secretion of insulin, or both. The metabolism of carbohydrates, proteins, and fats is disrupted when there is insufficient insulin in the body. The development of diabetes mellitus is influenced by both hereditary and environmental variables when it comes to the disease. It is eventually hyperglycemia and detrimental alterations in several organs that are the result of a decrease in insulin production, a loss in glucose consumption, or an increase in gluconeogenesis [4].

The following is a list of the general categories that diabetes may be classified into: There are three forms of diabetes: type 1 diabetes, type 2 diabetes, and diabetes of particular types that are caused by other factors, such as exocrine pancreatic disease, chemical or drug-induced diabetes, and monogenic diabetic syndrome-related diabetes. Gestational diabetes mellitus is the fourth condition. With diabetes mellitus, there are currently 422 million people throughout the world who are afflicted with the condition. Diabetes is directly responsible for the deaths of 1.6 million people over the course of each year. According to the findings of research conducted all over the globe, the International Diabetes Federation has developed an estimate that by the year 2045, there would be around 693 million cases of diabetes among people aged 18 to 99 years old [5,6]. This estimate is based on the data acquired from international studies.

As the incidence of diabetes continues to rise, it is anticipated that complications and complications associated to diabetes will have a substantial influence on both the economy and society.

Ketoacidosis and severe hypoglycemia are known to be among the acute consequences that can arise from diabetes. As an illustration, retina, neuropathy, cardiovascular disease, and nephropathy are all examples of problems that can arise from chronic diseases [7,8].

One of the areas of the body that might be impacted by persistent hyperglycemia is the oral cavity. Poor neutrophil function, microangiopathy, neuropathy, decreased collagen synthesis, and decreased collagenase activity are all factors that contribute to complications that arise in the oral cavity as a result of diabetes mellitus. According to the findings of a study, more than ninety percent of diabetes individuals experienced oral issues. According to the findings of yet another systematic review, the prevalence of oral mucosal disorders is significantly higher in patients with diabetes mellitus compared to the population that does not have diabetes. The prevalence ranges from 45–88% in patients with type 2 diabetes, whereas it ranges from 38.3–45% in non-diabetic subjects. Furthermore, the prevalence ranges from 44.7% in type 1 diabetic individuals to 25% in the non-diabetic population. Diabetes Mellitus can lead to a number of issues in the oral cavity, including but not limited to tooth decay, gingivitis, oral candidiasis, changed taste, geographic tongue, fissured tongue, dry mouth, the tendency to become infected, oral lichen planus, and poor wound healing [9,10,11].

Diabetes mellitus may lead to a number of dental issues, one of which is periodontal disease, which is made worse by extreme blood sugar levels. While this is happening, the systemic inflammation that is caused by periodontitis causes a decline in blood glucose levels in diabetic persons, demonstrating that there is a link that works in both directions. People who have diabetes mellitus are more likely to have periodontal disease and its prevalence is higher. Uncontrolled diabetes is characterized by the formation of deep pockets and the loss of attachment, and diabetic individuals have a high prevalence rate of periodontitis, which ranges from 34–68 percent. In persons with uncontrolled diabetes, the risk of losing alveolar bone is eleven times higher by comparison to individuals who are healthy [12].

Patients with diabetes have been seen to experience xerostomia, which is characterized by dryness of the mouth. In patients with diabetes, the prevalence of xerostomia was found to be 46.09 percent, according to a meta-analysis of 32 research. On the other hand, another study discovered that 92.5% of

diabetic patients suffered from the decreased salivary flow. This issue eventually leads to dysgeusia, dental caries, mouth discomfort, and dysphagia, all of which have the tendency to decrease the quality of life of diabetic patients [13].

People who have diabetes are more likely to suffer from mouth infections and wounds that take longer to heal. A high glucose level in the oral cavity and an immunocompromised condition are both factors that make oral bacterial infections more likely to occur in people with uncontrolled diabetes mellitus. One possible explanation for the delayed healing of wounds in diabetic patients is that the disease causes damage to the tiny blood vessels and reduces the body's ability to fight off infection and inflammation [14].

Patients who have diabetes are also more likely to get dental caries because of hyposalivation and high salivary glucose levels, both of which encourage the development of bacteria that are responsible for tooth caries. Burning Mouth Syndrome is a neuropathic orofacial syndrome that causes discomfort. These individuals may develop oral issues such as taste dysfunction, which is a condition in which diabetes patients have a reduction in their capacity to differentiate between different experiences of taste. Patients with diabetes are more likely to experience abnormalities of the tongue, including fissured tongue, atrophic glossitis, rhomboid glossitis, and benign migratory glossitis [15].

When a person has diabetes, the crevicular fluid may include higher quantities of glucose, which may encourage the growth of some types of microorganisms. As a result of extended osteoclast production and activity, it has been shown that diabetic individuals who suffer from periodontitis have a considerably elevated level of local mediators of inflammation, such as tumor necrosis factor-alpha (TNF α), interleukin-1 beta (IL-1 β), and prostaglandin E2. The upregulation of interleukin in diabetic patients leads to the promotion of osteoclast formation, which in turn prolongs the length of the inflammatory response. In addition, there is an overabundance of RANKL, which interacts with receptors on the surface of osteoclasts and causes osteoclasts to develop and become active [12,14].

Diabetes mellitus is characterized by an increased production of AGE, which functions in conjunction with RAGE. The subsequent rise in the production of RANKL receptor activator is what ultimately

leads to the promotion of osteoclast genesis. As a result of the interaction between AGE and RAGE, $\text{NF}\kappa\beta$ is activated, and the production of inflammatory cytokines is increased. When compared to normal persons, the neutrophils of diabetes patients emit a greater quantity of superoxides. An increase in reactive oxygen species (ROS) is a crucial factor in the oxidative stress that leads to the death of periodontal tissue. In diabetic patients, the production of ROS, $\text{TNF}\alpha$, and AGEs all contribute to the death of osteoblasts. Epithelial cells and fibroblasts undergo apoptosis as a result of periodontal infection, which is enhanced by a caspase-3-dependent pathway in diabetic patients. Diabetes mellitus is characterized by the presence of enhancement and apoptosis, both of which lead to the loss of epithelial barrier function and the suppression of repair [15,16]. People who have diabetes mellitus that is not under control are at risk for periodontal disease, often known as gum disease. Periodontal disease encompasses a variety of disorders that affect the gingiva, ligaments, and bones that support teeth. This local inflammation of the gingiva is caused by bacteria that are found in dental plaque. If the inflammation is not treated, it can proceed to chronic periodontitis, which is characterized by gingival, ligament, and bone loss that results in the formation of "pockets" in the deeper areas of the periodontium. This might result in the loss of teeth [17].

Hyperglycemia has an impact on the outcome of periodontal illnesses, while at the same time, periodontitis has a negative impact on the levels of glucose in the blood. This leads to a worsening of problems associated with diabetes. The periodontium is finally destroyed as a result of excessive inflammation, which is caused by an increase in cytokines in the crevicular fluid and saliva of gingival and periodontal tissue; oxidative stress, which is accompanied by the release of end products of advanced glycation in the hyperglycemic condition. Additionally, diabetes is associated with an increase in the expression of RANKL as well as an impairment in the creation of new bone in the periodontium [18].

On the other hand, persons with type 2 diabetes who have periodontal disease have a more difficult time maintaining control of their blood glucose levels. Through the production of pro-inflammatory cytokines, it produces insulin resistance and bacteremia, which in turn increases the likelihood of systemic inflammation. The periodontium, which is inflamed, serves as a persistent source for bacteria, the metabolites of

bacteria, and mediators of inflammation such as $\text{TNF}\alpha$, IL 1, and IL 6, which have various effects on glucose metabolism. Patients diagnosed with type 2 diabetes who had dental therapy for periodontal disease showed a considerable improvement in their ability to regulate their blood glucose levels, in comparison to diabetic patients who did not undergo dental treatment for periodontal disease. When compared to diabetic patients who did not undergo dental treatment for periodontal disease, patients with diabetes mellitus who received non-surgical treatment of periodontium showed an improvement in their ability to control their blood glucose levels, according to a meta-analysis that was carried out using nine randomized clinical trials [19].

Dental caries is an infectious illness that affects the teeth. It is characterized by the demineralization of the tooth structure, which is caused by bacteria, primarily *Streptococci mutans*, bacteria that cling to the tooth by creating acid from sugar. Dental caries can be caused by a number of different reasons, including microbial flora, cariogenic sugar, fermentable sugar, and environmental variables. The development of dental caries has been linked to diabetes mellitus, according to the findings of a number of research that were conducted in the past. A number of factors have been linked to the development of dental caries in people with type 1 diabetes mellitus. These factors include the presence of a high glucose level in saliva, a decrease in saliva flow, a change in the biochemical composition of saliva, a reduction in the salivary buffering effect, poor oral hygiene, a diet that is cariogenic, and the presence of orthodontic plaque. Individuals who consume sugar without any restrictions are more likely to acquire dental caries compared to those who have their blood glucose levels under control. Dental caries that arise in the cementum of teeth grow more common as people become older. Caries of the radicular region of the tooth have also been observed in individuals who are older and have type 2 diabetes mellitus. Hyposalivation was highlighted as a factor for poor oral hygiene in Type 1 diabetic patients in a research that compared the oral hygiene of patients with Type 1 diabetes to that of a control group [20].

Conclusion:

Within the context of the modern world, diabetes mellitus has developed into a huge epidemic. A number of issues, including those affecting the oral cavity, are brought on by this metabolic condition. The diabetic people is at a high risk of experiencing oral issues, which can have a negative impact on

their quality of life. As a consequence of these oral problems, the individual would experience difficulty in speaking, eating, and swallowing, as well as a painful sensation in the mouth. In addition, they are more likely to get oral infections, and taste anomalies cause them to consume more sugar and salt. This further deteriorates their ability to manage their blood sugar levels, which in turn leads to a decline in the oral cavity's overall health. Hyperglycemia is a factor that leads to a number of oral issues in diabetic patients, particularly in situations when there is poor control of the insulin level in the blood. At the same time, issues such as periodontitis cause a rise in blood glucose levels and contribute to the progression of other complications that occur inside the body. Periodontal health refers to a situation in which the periodontium is free of inflammation. This condition enables an individual to operate normally without experiencing any physical or mental ramifications as a result of a disease that has occurred in the past. When a person has diabetes mellitus, their periodontal health is impaired. This means that the inflammation of the periodontium increases with time and becomes more severe in diabetic patients who are suffering from periodontitis. The bidirectional association between Periodontitis and Diabetes Mellitus is a consequence of the production of inflammatory cytokines such as TNF α and interleukins, which lead to the deterioration of the periodontal disease status and the development of insulin resistance. Systemic inflammatory cytokines and bacterial endotoxins originating from contaminated periodontium are responsible for the development of insulin resistance by means of the loss of pancreatic β cells, which ultimately results in hyperglycemia. Because maintaining adequate dental hygiene can lower the frequency of oral problems as well as the severity of those difficulties, it is necessary to raise awareness about these oral complications.

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