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Perspective

Analysis of oral health complications in diabetic patients – A diagnostic perspective.

Susant Mohanty,[1] Neeta Mohanty[2] & Shakti Rath.[3]

Affiliations: [1]Department of Pedodontics and Preventive dentistry, Institute of Dental Sciences, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar, Odisha, India. [2]Department of Oral Maxillofacial Pathology and Microbiology, Institute of Dental Sciences, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar, Odisha, India. [3]Central Research Laboratory, Institute of Dental Sciences, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar, Odisha, India.

Corresponding author: Neeta Mohanty. Department of Oral Maxillofacial Pathology and Microbiology, Institute of Dental Sciences, Siksha 'O' Anusandhan Deemed to be University, Kalinga Nagar, Bhubaneswar, Odisha India; Email: dr.neetamohanty@gmail.com

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Diabetes mellitus is a metabolic disorder affecting multiple organ systems in the human body. It is considered to be one of the leading cause of mortality and morbidity, worldwide. Onset of diabetes becomes the cause for several other health complications that may affect the entire body. The oral cavity also gets critically affected by the diabetic condition along with complications arising from oral infections. Periodontitis, reduced saliva secretion, oral lesions, infections and cancer are a few of the complications found in such patients. These manifestations are more prevalent in individuals with uncontrolled diabetes. This article gives an insight on oral health complication in diabetic patients as well as the necessity for routine oral health examination to prevent such complications.

Diabetes mellitus is a clinical condition, wherein a person is either incapable of producing insulin or the body is not able to utilize the available insulin.[1] While many consider diabetes as a genetic disorder, today it has become one of the leading lifestyle disease.[1] Diabetes is characterized by prolonged elevated blood sugar levels known as hyperglycemia, which further exposes a person to the risk of developing a wide range of health issues. Hyperglycemia affects the metabolism of the entire body, from eyes to feet, including cardiovascular disease, obesity and infections. Therefore, diabetes becomes the foremost and leading cause of morbidity and mortality throughout the world, particularly in urban populations.[1]

Diabetes in India

According to World Health Organization (WHO) data, India leads the diabetic population in the world, followed by China, the United States of America, Indonesia, Japan, Pakistan, Russia, Brazil, Italy and Bangladesh.[2] As reported in a survey data, at end of 2015, the total number of people with diabetes in India was 69.2 million, which accounted for 8.7% of the total world diabetic population, and it is expected to double by the year 2030.[3] The prevalence of pre-diabetes, also known as *"impaired glucose tolerance"* or *"precursor to diabetes"*, is 1.4 times higher than the prevalence of diabetes, which is 7.3% according to a survey report from Indian Council of Medical Research that included data on 57,117 adults over 20 years from 14 states and the Union Territory (UT) of Chandigarh.[3] Several permanent health complications, such as retinopathy, nephropathy

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and cardiac dysfunction and slow-healing wounds are seen in Indian patients with diabetes as a result of late diagnosis.[3] Currently, India has an estimated population of 36 million undiagnosed diabetes patients.[2]

Oral complications in diabetic patients

Patients with diabetes mellitus often have several soft tissue disorders in the oral cavity such as periodontitis and gingivitis. These patients also suffer from salivary dysfunction resulting in a decrease in salivary flow, and changes in saliva composition along with a loss of taste buds.[4] A decrease in salivary flow rate is a common symptom in diabetics, which is also accompanied by inflammation or swelling of the parotid glands and a burning sensation in the mouth.[6] Microbial infections have also been reported in the oral cavity of diabetic patients. Oral mucosal lesions like stomatitis, geographic tongue, benign migratory glossitis, fissured tongue, traumatic ulcer, lichen planus and angular chelitis have also been reported.[4] Moreover, complications such as mucosal-neuro-sensory disorders, delayed mucosal wound healing, dental caries and tooth-loss are common in diabetic patients.[5,6] These patients have a higher chance of developing oral mucosal lesions and infections, compared to healthy people. Since most patients believe that diabetes is only related to kidney dysfunction, oral health care gets overlooked or it is not considered in the regular treatment regimen, creating multiple complications in the oral cavity, which sometimes become untreatable.[5,6] Some of the common oral health complications are described below.

Oral Bacterial Infections

Bacterial infections of the oral cavity are frequently observed in diabetic patients due to increased glucose level and poor metabolism. In fact, these patients are more susceptible to deep neck bacterial infection than non diabetics.[6] *Streptococcus* is one of the major bacterial genus responsible for oral bacterial infection in diabetic patients. Since it becomes difficult to control the blood glucose level in such patients, they have longer hospitalization periods and other pre- and post-surgical complications. Increased concentrations of glucose in saliva helps the harmful bacteria to proliferate.

These bacteria combine with food to form plaque, leading to bad breath, dental caries and gingivitis. Further, complicated bacterial infections of the oral cavity can also lead to mouth sores.[5] *Streptococcus mutans*, a common oral pathogen is also known to cause bacterial endocarditis, originating from mild oral infections.[6] Diabetics are frequently treated with antibiotics to treat these infections, especially in the mouth and tongue. The bacteria flourishes because of the increased glucose levels in the saliva of the diabetics. *Propionibacterium acnes, Peptostreptococcus prevotii, Fusobacterium nuclea-tum, Prevotella intermedia, Saccharomyces cerevisiae, Porphoromynas gingivalis, Actinomyces israelii, Streptococcus intermedius* and *Streptococcus sanguis* are a few of the common bacteria isolated from oral infections of diabetics.[4-6]

Periodontitis and other complications

Periodontitis is the most widespread oral disease in diabetics. Periodontitis is the inflammation of the gums and supporting structures of the teeth and is mainly caused by periodontal bacteria.[7] A high prevalence of periodontitis has been reported in populations of diabetic patients and the severity increases with increased severity of diabetes. The exact initiating mechanism of periodontal infections in diabetes patients is not clear; however, according to some reports, conditions such as advanced glycation end products, alterations in collagen structure and defective immune responses leads to impaired polymorphonuclear leukocyte function, aiding bacterial intrusion into these tissues.[8] As reported, the accumulation of advanced glycation end products due to sustained and established hyperglycemia with hypersecretion of pro-inflammatory cytokines such as tumour necrosis factor-α and prostaglandin E-2, increases in collagenase enzyme activity together with a decrease in collagen synthesis.[7] Together these mechanisms adversely influence collagen metabolism, resulting in delayed wound healing and periodontal tissue destruction. A few reports suggest that periodontitis controls glycaemic conditions in patients with diabetes by two different mechanisms.[8]

There are several other studies that show a significant increase in periodontal complications, like dental

caries, in diabetic patients.[11] Numerous predisposing factors such as smoking and other tobacco habits, poor oral hygiene with poor metabolic control also make the diabetic patients more prone to periodontitis. The cleaning and buffering capacity of the saliva is also reduced, leading to a condition called as xerostomia. Such patients frequently suffer from dental caries which leads to decaying and loss of teeth.[7,8]

Oral Fungal Infections

Oral candidiasis is an opportunistic infection, primarily caused by *Candida albicans.* It has frequently been reported, especially in patients with diabetes. This infection is more prevalent in patients with smoking habits, dentures, with poor glycemic control and patients under treatment with steroids and broad spectrum antibiotics.[9] Moreover, decreased saliva secretion in diabetics also contributes to a higher load of fungi in these patients. Both local and systemic predisposing factors increase the occurrences of oral candidosis in the diabetic population. Other factors like, xerostomia, endocrine and metabolic diseases, old age, medications, Cushing's syndrome and malignancies also facilitate oral candidiasis.[10] Oral candidiasis has a primary and secondary stage of infection. Primary oral candidosis is further classified into acute pseudomembranous-erythematous candidiasis, chronic pseudomembranous-erythematous-hyper-plastic candidiasis and *Candida* associated lesions.[9,10] These lesions mostly have a mixed bacterial and fungal etiology. They are generally denture induced stomatitis, angular chelitis and median rhomboid glossitis. Diabetic patients with poor glycaemic control are frequently diagnosed with such lesions. A few opportunistic fungal pathogens oral like *Aspergillus, Mucor* and *Cryptococcus* frequently cause infections in diabetics, whereas species like *Penicillium, Saccharomyces, Rhodotorula, Geotrichum* and *Fusarium* are uncommon pathogens in the oral cavity.[10]

Oral Cancer

The complications associated with oral cancer are increasing, despite exhaustive research. Some reports suggest that impaired glucose tolerance is a risk factor or a predisposing factor for oral cancer. Several studies have reported on the inflammatory lesions of the periodontal tissues and oral mucosa in patients with diabetes, which becomes complicated in undiagnosed or inadequately treated diabetic patients.[11] However, the clear association between oral cancer and diabetes is yet to be established.

Reports suggest faulty metabolism in diabetic conditions leads to a breakdown in the oxidation equilibrium resulting in an increased glucose concentration and excessive formation of free radicals. As a result, there is a significant reduction in antioxidant scavenging activity, causing molecular level damages in biological structures.[12]

Other predisposal factors such as tobacco and alcohol increases the risk of cancer in diabetic patients. Associations between colon, breast, pancreas and endometrium cancers and chronically increased levels of insulin have been established. This condition is also known as hyperinsulinemia. Insulin receptors in the pre-neoplastic target cells can directly mediate the tumourogenic effects of insulin. Tumourogenic effects can also be a result of changes in endogenous hormone metabolism. It is reported that insulin promotes the synthesis and biological activity of insulin like growth factors-1 (IGF-1), which act as a growth factor that promotes cell proliferation and inhibits apoptosis. There is enough evidence of the relation between IGF-1 and p53 mutations, which are quite common in head and neck malignancies.[11,12]

CONCLUSIONS

A regular oral health check up can easily decrease the complications and risk factors associated with diabetes. Since the frequent changes in the oral cavity due to diabetes further complicates the metabolism of the patients, focus should increase on the relationship between oral health and systemic health in diabetic patients. Similar to the routine eye, foot, and kidney investigations, equal importance should be paid to the regular assessment of oral health, and it should become an essential part of the diabetes treatment regimen and preventive diabetic therapies. A dentist should be familiar with ongoing medical treatment regimens and the implications of diabetes on oral health, which can help the diabetic patients in having a healthy oral cavity as well as a healthy lifestyle.

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