

Diabetes & Dental Health – A Review

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Abstract

Diabetes Mellitus is a metabolic disorder characterized by the presence of chronic hyperglycemia accompanied by alterations in the carbohydrate, protein, and lipid metabolisms. It has become a global epidemic, the complications of which have a significant bearing on the quality of life and longevity of an individual. Long standing hyperglycemia which is unattended can result in widespread multisystem damage in the form of retinopathy, neuropathy, nephropathy, macrovascular disease, and delayed wound healing. This article intends to put forth a complete review on the oral manifestations as a sequel of diabetes mellitus.

Keywords: Diabetes Mellitus, disorder, hyperglycemia, macrovascular.

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INTRODUCTION

Diabetes mellitus represents a group of metabolic diseases that are characterised by hyperglycaemia due to a total or relative lack of insulin secretion and insulin resistance or both [1]. It is associated with long-term damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels [2]. It is considered a leading cause of death due to its microvascular and macrovascular complications [3]. Various inflammatory diseases and soft tissue pathologies in oral cavities are associated with diabetes mellitus [4]. Epidemiological studies indicate that the severity of diabetic complications is generally proportional to the degree and duration of hyperglycemia. The prevalence of type 2 diabetes is increasing rapidly. According to World Health Organization estimates, the number of adults with diabetes worldwide will increase from 171 million in 2000 to 366 million by 2030 [5]. India has been called “the diabetes capital of the world” because of its high diabetes rates. Nearly 41 million Indians have diabetes, accounting for one-fifth of all diabetes cases worldwide [6].

Diabetes Mellitus

Diabetes Mellitus results when either there is impairment in insulin released from the pancreas or insulin action at peripheral tissues is impaired [7]. This

results in hyperglycemia which leads to an increase in the urinary volume of glucose and fluid loss, which then produces dehydration and electrolyte imbalance [8]. The stress of the disease also results in an increase in cortisol secretion. It is the inability of the diabetic patient to metabolize and use glucose, the subsequent metabolism of body fat, and the fluid loss and electrolyte imbalance that causes metabolic acidosis. It is the hyperglycemia and ketoacidosis coupled with vascular wall disease (that alters the body's ability to manage infection and heal [8]). Based on the pathogenic processes, four types of diabetes are identified. Type 1 diabetes, Type 2 diabetes, Gestational diabetes and diabetes caused by various metabolic disorders, drugs or surgery [9]. Type 1 diabetes is caused by insulin deficiency, due to autoimmune destruction of pancreatic β -cells mediated by T cells and humoral mediators. The pathophysiology of Type 2 diabetes is characterized by β -cell dysfunction, with relative insulin deficiency and peripheral insulin resistance [10]. Gestational diabetes appears during pregnancy in a previously non-diabetic patient and disappears after the end of gestation. However, this type of diabetes should not be underestimated since almost half of pregnant women with diabetes will later become people with type 2 diabetes if preventive measures are not considered [11]. Fasting plasma glucose, two-hour plasma glucose during an Oral Glucose Tolerance test (OGTT), random

plasma glucose levels, and glycosylated hemoglobin (HbA1c) levels are the diagnostic methods used for diabetes [12].

Oral Manifestations

Several soft tissue abnormalities have been reported to be associated with diabetes mellitus in the oral cavity. The prevalence and the chance of developing oral mucosal lesions were found to be higher in patients with diabetes compared to healthy individuals [13]. Patients with diabetes present impaired function of polymorphonuclear leukocytes, impaired bactericidal activity, altered response to exposure to antigens, and alteration to the function of T lymphocytes [14]. Literature research reveals a clear link between chronic inflammation and the development of Type 2 Diabetes Mellitus. Both Diabetes Mellitus type 1 and type 2 present numerous possible long-term complications. The oral manifestations related to DM described include dry mouth, tooth decay, periodontal disease and gingivitis, oral candidiasis, burning mouth syndrome, taste disorders, mucormycosis, aspergillosis, oral lichen planus, geographic tongue and fissured tongue, delayed wound healing, and increased incidence of infection, salivary dysfunction, altered taste and other neurosensory disorders, impaired tooth eruption, and benign parotid hypertrophy [15]. Periodontal diseases been reported as a more frequent oral complication of diabetes.

Periodontitis

Periodontitis is one of the most widespread diseases in the world affecting the oral cavity, and is highly prevalent in both developed and developing countries [16]. Type 2 diabetes is considered a risk factor for periodontitis [17]. Diabetic patients tend to have vascular damage in the periodontium, leading to poor transport of nutrients and oxygen and less rapid elimination of metabolites. In addition, collagen metabolism is also affected, reducing the regenerative capacity of the periodontium. Finally, hyperglycemia leads to the formation of proteins called advanced glycolization end products, molecules associated with increased oxidative stress and an amplified inflammatory response [18]. In addition, any existing periodontal infection may adversely affect the glycemic control of diabetes. Periodontal therapy has shown reasonable improvement in glycemic control in diabetic patients with periodontitis [19]. The risk of developing periodontitis in patients with diabetes has been reported to be three times higher than the general population [20]. Numerous risk factors have been reported that make patients with diabetes more susceptible to periodontal disease, especially those with poor oral hygiene, poor metabolic control, longer duration of diabetes and who are smokers [21].

Salivary Dysfunction

Saliva has a major role in maintaining a healthy oral cavity. It is observed that reduced salivary flow rate and xerostomia were more frequently reported by patients with diabetes than normal individuals [1]. Patients with diabetes have a lower stimulated parotid gland flow rate and increase in salivary pathogens. The constant dryness of the mouth would irritate the oral soft tissues, which in turn will cause inflammation and pain [1, 15]. In patients suffering from diabetes, a reduction in the protective function of saliva increases the susceptibility to dental caries, oral mucosal soreness, and altered taste [12]. In patients using removable prostheses, these problems are of even greater importance, considering that the lower salivary flow implies a much lower retention of the prosthesis [22].

Taste Disturbances

Literature reveals that some patients suffering from diabetes may encounter taste disturbances. One study reported that more than one-third of adults with diabetes had hypogeusia or diminished taste perception, which could result in hyperphagia and obesity [23]. This sensory dysfunction can inhibit the ability to maintain a proper diet and can lead to poor glycemic regulation [1].

Dental Caries

Considering the fact that glucose levels in the saliva of diabetics are higher than normal salivary pH changes are expected [11]. This reduction of pH will lead to a highly cariogenic environment, and consequently a higher activity of cariogenic bacteria [24]. The proliferation of these species will lead to an even lower pH, and this vicious cycle continues and also affects the growth of protective microflora of the oral cavity [25].

Delayed Wound Healing & Infections

In diabetes, changes in the collagen metabolism and host defense contribute to alterations in wound healing. Increased degradation of newly formed collagen, due to excessive production of collagenase and decreased solubility of the existing collagen, due to modification by the advanced glycation end products (AGEs), causes a shift in collagen turnover, thereby altering the healing response [12]. Patients with diabetes have impaired leukocyte function, and the metabolic abnormalities of diabetes lead to inadequate migration of neutrophils and macrophages to the wound, along with reduced chemotaxis [26]. Such cellular changes would predispose individuals to an increased risk of wound infection. It was reported that delayed vascularisation, reduced blood flow, a decline in innate immunity, decreased growth factor production, and psychological stress may be involved in the protracted wound healing of the oral cavity mucosa in patients with diabetes [27].

Burning Mouth Syndrome

Oral dysesthesia or burning mouth syndrome is a painful condition that affects the oral cavity in diabetic patients. Diabetic neuropathy could be the underlying cause of burning mouth syndrome in patients with diabetes. The nerve damage in diabetic neuropathy has been reported to show an increase in the Langerhans cells that are associated with immune disturbance.²⁸ Therefore, it is crucial to screen patients who have symptoms of BMS for diabetes mellitus.

Oral Lesions

In diabetic patients, the most common oral lesions are of the ulcerative type [29]. These lesions may lead to symptomatology such as glossodynia, discomfort and burning. In severe cases, it may affect everyday tasks, such as dysgeusia, oral paraesthesia, increased susceptibility to dental abscesses and reduced tissue regenerative capacity [30]. Other conditions found in diabetics such as angular cheilitis and hairy tongue may increase the propensity to manifest infections such as oral candidiasis [29]. Oral Candidiasis is the most common opportunistic fungal infection in diabetes, followed by zygomycosis and aspergillosis [31]. Studies have shown increased oral Candida carriage in diabetics compared to non-diabetics. This could be attributed to increased salivary glucose levels, decreased salivary flow rate, or decreased candidacidal activity of the neutrophils [31].

Oral Cancer

Studies reveal that there is a greater possibility of development of pre-malignant lesions and tumors in the oral cavity in diabetic patients particularly in whom the condition is poorly controlled [32]. Diabetic patients with smoking habits surely have a greater predisposition to the appearance of pre-malignant lesions [32]. It is postulated that an increased production of reactive oxygen species and peroxides in diabetics, especially those with decompensated pathology and with excessive levels of triglycerides. In turn, this will lead to a higher free radical presence, which may alter the DNA structure of the cells of the oral cavity, ultimately resulting in an increased risk of developing malignant lesions [32].

CONCLUSION

Diabetes mellitus is a chronic, non-communicable and endemic disease. There is increasing evidence that chronic oral complications in patients with diabetes adversely affect blood glucose control. Prevention and management of oral complications, in patients with diabetes is important due to their possible adverse effect on glycaemic control. Early identification and/or management of these oral manifestations may help in the early diagnosis of diabetes and in attaining better glycaemic control. Therefore, diabetic oral complications need to be identified and included in the ultimate care of diabetes in order to fight this chronic metabolic disease effectively.

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