



Change of Oral Mucus in Patients with Diabetes

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ABSTRACT	This article talks about changes in the mucous membrane of the oral cavity in patients with diabetes. Diabetes mellitus is associated with a greater likelihood of developing certain oral mucosal disorders.
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Diabetes mellitus (DM) is a group of metabolic diseases characterised by hyperglycemia resulting from defects in insulin secretion, insulin action or both (1). The World Health Organization (WHO) recognises 2 major clinical forms: insulin-dependent diabetes mellitus (IDDM) or type 1 diabetes and non-insulin-dependent diabetes mellitus (NIDDM) or type 2 diabetes (DM2).

Diabetes mellitus currently affects 246 million people worldwide, and it is expected to affect a staggering 380 million people by 2025 (2). An estimated 3-fold rise in the prevalence of the disease is expected in Asia—especially in China and India. Similarly, other rapidly developing Asian countries including Malaysia, Singapore and Thailand will also see a dramatic increase in the number of DM cases (3).

Diabetic complications account for most of the socio-economic burden of the disease (4). DM is considered the leading cause of blindness, renal failure, lower-limb amputation

and deaths due to cardiovascular disease (5). Chronic hyperglycemia induces structural changes in tissues (6) and is associated with impaired wound healing, higher susceptibility to infections (7) and microvascular and macrovascular dysfunctions (8).

Diabetes mellitus (DM) is a chronic metabolic disease characterized by hyperglycemia due to either a deficiency of insulin secretion or resistance to the action of insulin or both [1-3]. Chronic hyperglycemia leads to different complications in various regions of the body including the oral cavity, so blood glucose control is very critical [4]. Possible mechanisms that may be related to oral complications of diabetes include impaired neutrophil function, increased collagenase activity and a reduction in collagen synthesis, microangiopathy and neuropathy [4].

The oral manifestations and complications related to DM include dry mouth (xerostomia), tooth decay (including root

caries), periapical lesions, gingivitis, periodontal disease, oral candidiasis, burning mouth (especially glossodynia), altered taste, geographic tongue, coated and fissured tongue, oral lichen planus (OLP), recurrent aphthous stomatitis, increased tendency to infections, and defective wound healing[1-8]. The intensity of diabetic complications is usually proportional to the degree and duration of hyperglycemia[5]. In this study, we briefly reviewed DM and its oral manifestations and complications in recent reliable scientific papers.

People with diabetes experience salivary dysfunction, which can lead to decreased salivary flow and change in saliva composition. The estimated universal prevalence of xerostomia among diabetic patients ranges between 34% and 51%[1,2]. Xerostomia can lead to numerous problems such as difficulty in eating, swallowing, and speaking. It can actually have a negative effect on patients' quality of life. Many studies have detected impaired salivary function in adults with diabetes. The etiology is unknown, but may be related to polyuria, autonomic neuropathies, and microvascular changes and alterations in the basement membranes of salivary glands[2,4,5,7,8]. There is a significant relationship between the degree of xerostomia and glucose levels in saliva. Notably, the highest level of salivary dysfunction is observed in diabetics with poor glycemic control[4,5].

Diabetic patients are susceptible to the development of new and recurrent dental caries. Reduced cleansing and buffering capacity of the saliva, increase of carbohydrate in the saliva, and increased level of oral yeasts, mutans streptococci and lactobacilli can lead to an increase in the incidence of tooth decay. In addition, chronic hyperglycemia may cause irreversible pulpitis leading to pulp necrosis[1,2,5,7,8]. Some studies have shown that apical periodontitis and radiolucent periapical lesions are more common in diabetic compared to nondiabetic individuals[1,5,9].

Poor glycemic control can be associated with the outbreak and progression of gingivitis, periodontitis, and alveolar bone loss.

Periodontal disease has been reported with increased incidence and prevalence in patients with type 1 and 2 diabetes. Prevalence of severe periodontitis in diabetic patients compared to nondiabetics has been found to be 59.6%:39%[3,7,8,10].

Possible mechanisms for explanation of increased susceptibility to periodontal diseases include alterations in host defense response (such as neutrophil dysfunction), subgingival microflora, structure and metabolism of collagen, vascularity and gingival crevicular fluid and also, inheritance patterns. Furthermore, several risk factors have been reported, which make these patients more susceptible to the development of periodontal disease including poor oral hygiene, poor metabolic control, longer duration of diabetes and smoking[3,6-8].

It is noteworthy that numerous studies have shown that periodontal disease has a negative impact on diabetes, and the treatment of periodontal disease has a desirable effect on blood glucose control. The elimination of pathogens by treatment leads to a decrease of inflammation, which in turn reduces insulin resistance; this in turn decreases glucose levels. Therefore, there is a two-way relationship between periodontal disease and diabetes[1,3,5,10]. In adults, periodontal disease is the main reason for tooth mobility and consequently, loss of it. Therefore, treatment of periodontitis, in addition to lowering blood glucose levels, can prevent tooth loss[11].

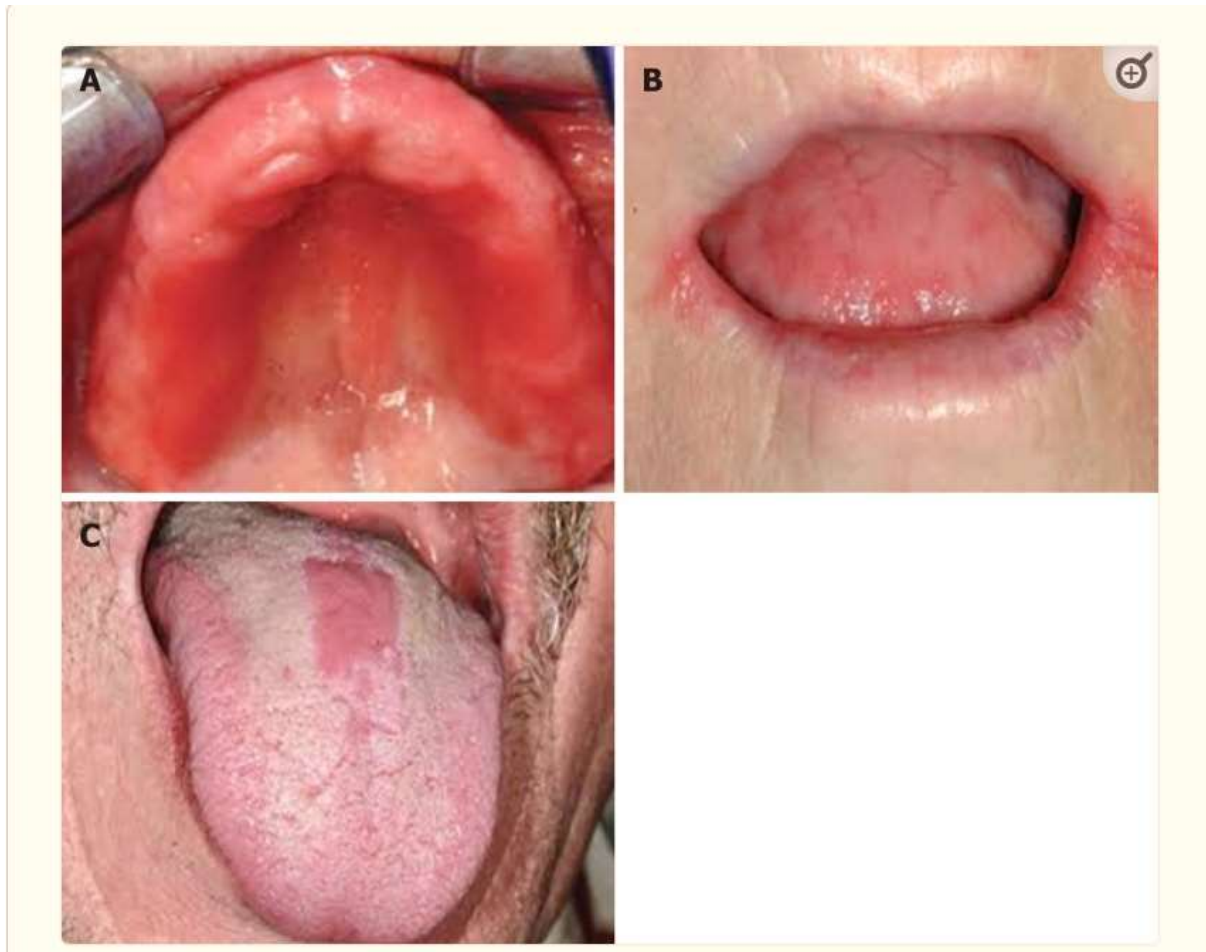
Patients with diabetes are more susceptible to the development of various oral infections including fungal and bacterial infections. Decreased salivary flow rate and the absence of its antimicrobial effects can cause these infections. In addition, an impaired defense mechanism and poor metabolic control may play an important role in developing infection[2,7,8].

Oral candidiasis is an opportunistic fungal infection. The prevalence of that is increasing, as it is one of the most common fungal infections. Higher candida colonization rates were reported in patients with diabetes type 1 when compared to type 2 (84% vs 68%,

respectively), while the percentage in nondiabetic subjects was about 27%[2,12].

Oral candidiasis can be developed by numerous predisposing factors including xerostomia. Salivary dysfunction in these patients can contribute to higher carriage of fungi. Candida-related lesions include denture

stomatitis, angular cheilitis, and median rhomboid glossitis[2] (Figure (Figure1).1). Candida infection is more prevalent in diabetic patients who smoke, wear dentures, have poor glycemic control, and use steroids and broad spectrum antibiotics[2,7,8].



Burning sensation or dysesthesia in the oral cavity of diabetic patients is attributed to poor glycemic control, metabolic alterations in oral mucosa, angiopathy, candida infection, and neuropathy[1]. Neuropathic pain in these patients can be manifested as burning, tingling, or even as electric shock or stabbing sensation that these symptoms may be very debilitating. These pain sensations have a considerable effect on the physical and psychological functions, and are associated with the level of sleep disturbance, anxiety, and depression[1,4].

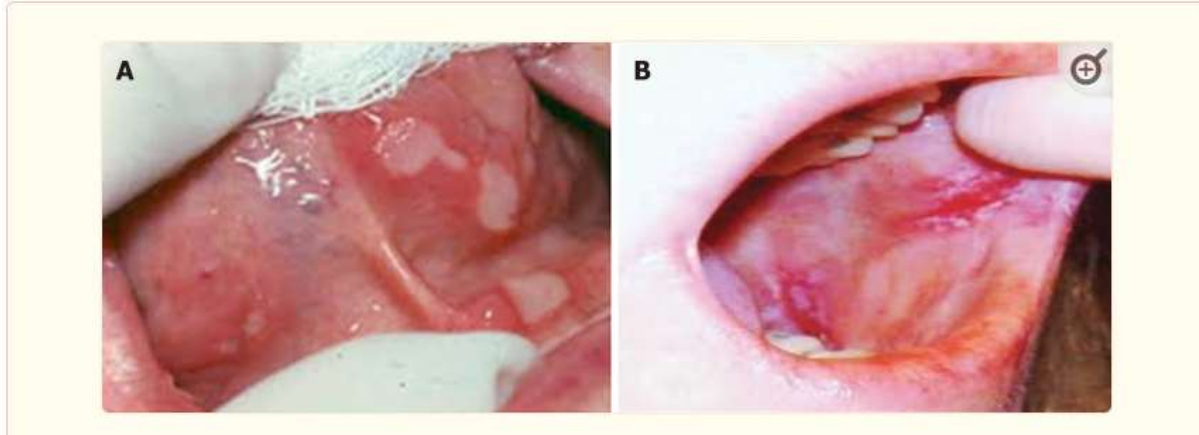
Taste dysfunction can occur in patients with poorly controlled diabetes. In a cross-

sectional study, among diabetic or prediabetic patients, 5.7% had a sweet taste disorder and 8.6% had a salt taste disorder[8,13]. Salivary dysfunction can cause altered taste sensation or raise of detection thresholds. Neuropathy also increases the threshold of taste. This sensory dysfunction can inhibit the ability to maintain a good diet and can lead to poor glucose regulation[1,2,4,7,8].

Some oral mucosa alterations such as coated and fissured tongue, geographic tongue, recurrent aphthous stomatitis, and some premalignant lesions including lichen planus can be associated with diabetes[1,2,5,7,8]

(Figure (Figure2).2). Susceptibility of these patients to oral cavity changes is still controversial, but insufficient control of diabetes, immuno-logical alteration, microcirculatory changes with decline of blood supply, xerostomia and alteration in salivary flow and composition, and smoking have been

mentioned[1]. OLP occurs more frequently in patients with type 1 diabetes compared to type 2, because type 1 diabetes is considered an autoimmune disease and OLP has an underlying autoimmune mechanism[2,8]. Acute hyperglycemia causes changes in the immune responsiveness in diabetic patients[2].



Delayed healing of soft and hard tissues in diabetic patients is a well-known complication during oral surgeries [2,8]. Based on some studies, effective factors in the prolonged wound healing of these patients include delayed vascularization, diminished blood flow and hypoxia, a reduction in innate immunity, decreased growth factor production, and psychological stress [2,14].

Oral complications in patients with DM are considered major complications of the disease and can impress the patients' quality of life. There is evidence that chronic and persistent oral complications in these patients adversely affect blood glucose control. Thus, prevention and management of oral complications due to diabetes are considerable.

Similarly, a number of oral health complications are frequently associated with DM (9). These include various inflammatory diseases, reduced saliva secretion, and oral mucosal pathologies. Further, inflammatory diseases such as gingivitis, periodontitis, candidiasis, stomatitis, benign migratory glossitis or geographic tongue (GT), median rhomboid glossitis, and angular cheilitis have been reported frequently in various studies (10–13). DM predisposes an individual to bacterial and fungal infections as well, including those caused by *Candida* species (14).

DM is believed to promote periodontitis through an exaggerated inflammatory response to the periodontal microflora and hyperglycemia-induced vascular changes. Oral soft tissue abnormalities that are associated with DM include fissured tongue, irritation fibroma, traumatic ulcers and parotid gland enlargement.

Certain studies have reported a possible association between DM and potentially malignant disorders such as leukoplakia (8), erythroplakia (9) and lichen planus (6). However, other studies neither demonstrated this association nor found any influence of DM on the duration, distribution or type of lesion (14). These conflicting results stem from several variations in the sample populations with regard to age, type of diabetes, time of diabetes onset, level of metabolic control and daily consumption of drugs. Additionally, comparing the sample population with an appropriate control group is fundamental when investigating the prevalence of oral mucosal alterations in patients with DM.

In this study, DM2 patients had a higher prevalence of oral mucosal alterations than control subjects. Higher occurrence of OMLs was significantly associated with poor metabolic control of DM. These findings highlight the necessity of regular clinical

examinations to ensure early diagnosis and prompt management of OMLs in DM patients.

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