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Review Article

Dentistry in Diabetes Mellitus

Oral Manifestations in Diabetes Mellitus and Management Considerations: A Review

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Abstract: Diabetes mellitus is a chronic metabolic disorder defined as an increase in sugar levels in the bloodstream brought on by either insufficient insulin secretion, resistance to insulin's effects, or both. All age groups are affected by the chronic condition known as diabetes mellitus. It is among the world's major causes of mortality and morbidity. Xerostomia, dental caries, periodontal disease, gingivitis, candidiasis, other oral infections, burning mouth syndrome, taste dysfunction, oral mucosal alterations, delayed wound healing, and localized osteitis are common oral manifestations of diabetes mellitus. Major complications impacting a patient's quality of life include oral complications in diabetic individuals. Long-term oral problems in these patients' harm blood glucose regulation, making oral complications care and prevention important. The dental professional should be familiar with DM's oral manifestations to identify this disease complication. This article not only discusses the oral manifestations but also discusses management considerations in diabetic patients which will help future dental professionals in dental practice. This article aims to spread knowledge and awareness about the potential oral manifestations of diabetes mellitus and treatment considerations.

Keywords: Diabetes mellitus, Oral manifestations, Diabetic patients, Periodontal disease, Xerostomia, Oral infections, Mucosal alterations

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1. INTRODUCTION

Hyperglycemia and glycosuria are two symptoms of diabetes mellitus, a carbohydrate metabolism resulting from an imbalance between the release of hormones from the pancreas, anterior pituitary, and adrenocortical glands, and glucose utilization by tissues[1]. Diabetes mellitus is a chronic metabolic disorder defined as an increase in sugar levels in the bloodstream brought on by either insufficient insulin secretion, resistance to insulin's effects, or both[2]. Hyperglycemia, glycosuria, polyuria, polyphagia, and polydipsia are symptoms of failure of the peripheral body to use the sugar in the cells, which causes sugar retention in the cells. The degree and duration of hyperglycemia are typically inversely correlated with the severity of diabetes complications[3,4]. Chronic hyperglycemia is accompanied, to varying degrees, by disturbances in the metabolism of lipids, proteins, and carbohydrates[5]. DM has spread worldwide, and its consequences negatively influence patients' life, longevity, and cost of care[5]. Regarding the global diabetes epidemic, the International Diabetes Federation reports that India is 2nd to China with 77 million patients with diabetes. IDF reports that the overall prevalence of cases in India in 2017 was 8.8% of the population[6]. Globally, diabetes is becoming more common. Diabetes now affects 422 million people worldwide. According to the World Health Organization, the incidence of diabetes among adults over 18 years of age has increased and is expected to reach 439 million, or about 10% of adults, by 2030[7]. Therefore, the prevalence of oral manifestations in diabetic patients is also increasing (Table 1). The degree and duration of hyperglycemia are often inversely correlated with the severity of diabetes complications. Xerostomia, dental caries, periodontal disease, gingivitis, candidiasis, other oral infections, burning mouth syndrome, taste dysfunction, oral mucosal alterations, delayed wound healing, and localized osteitis are common oral manifestations of DM[2,8]. The symptoms of diabetes and its consequences can only be addressed. As consequences in the early stages of the illness are less severe and easier to treat, the sooner the condition is diagnosed, the better the patient's prognosis. The dental professional should be familiar with DM's oral manifestations to identify early signs of the disease. The practitioner must also know how the controlled illness affects therapy while caring for DM patients. This review article focuses on common oral manifestations of diabetes and its management considerations (Table 2).

Table 1: Prevalence of oral manifestations in diabetic patients.

Oral Manifestations	Prevalence
Xerostomia	34% to 51% among diabetic patients[2].
Severe periodontitis	59.6%:39%; diabetic patients compared to nondiabetics[2].
Candidiasis	84% and 68%, respectively in type 1 and type 2 diabetes[2].
Taste dysfunction	Among diabetic patients, 5.7% had a sweet taste disorder, and 8.6% had a salt taste disorder[2].

Table 2: Oral manifestations or complications in diabetic patients

	Oral manifestations
1.	Xerostomia
2.	Dental caries
3.	Periodontitis and gingivitis
4.	Oral infections like Candidiasis
5.	Burning mouth Syndrome
6.	Taste disturbance or dysfunction
7.	Oral mucosal alterations
8.	Localized Osteitis/ Dry sockets
9.	Poor wound healing/ Delayed wound healing

Table 3: Symptoms of oral complications in diabetes

Oral manifestations/ Complications	Symptoms
1. Xerostomia	Decrease in salivary flow[9, 10].
2. Dental caries	New and recurrent dental caries with signs of irreversible pulpitis and periapical lessions[9-14].
3. Periodontitis and gingivitis	Gingivitis followed by periodontitis with alveolar bone loss present[13,14,20,21]. Mobility and enlargement are present in severe cases.
4. Oral infections like Candidiasis	Scrapable, painless lesion seen on mucosal surface with decreased salivary flow rate[10,13].
5. Burning mouth Syndrome.	Intense burning in the oral mucosa[2-7].
6. Taste disturbance or dysfunction	Salivary malfunction raises detection thresholds or altered taste perception [9-11,13,14].
7. Oral mucosal alterations	Signs and symptoms may vary according to the alterations. However, burning is the most common symptom seen in patients.
8. Localized Osteitis	Slower healing in extraction sockets[37]
9. Poor wound healing/ Delayed wound healing	Impaired healing of tissues[10,14].

2. XEROSTOMIA (Figure 1)

34% to 51% of diabetic patients are believed to have xerostomia on a global scale. Salivary dysfunction causes the salivary flow to decrease, which changes the content of saliva[9,10]. Its etiology is unknown but could be caused by several factors. It might also be related to polyuria, autonomic neuropathies, microvascular disturbances, and changes to the salivary glands[12-14]. In people with diabetes with inadequate glycemic control, the highest amount of salivary dysfunction is seen[11,12].

2.1. Management of Xerostomia

Every patient with xerostomia must adhere to preventative measures to stop the onset of oral infections linked to the condition. In particular, practicing strict oral hygiene and receiving regular dental treatment, including checkups every 4-6 months, is crucial. To reduce or discourage their consumption, patients must be informed about dietary sugars and refined carbohydrates' role in the emergence of caries. The topical fluorides can help in the treatment of hyposalivation-induced caries. Topical fluorides such as fluoridated toothpaste, daily fluoridated mouthwashes, and fluoridated gel can be used. Xerostomia-induced caries have been brought on by radiation therapy[15]. Salivary Stimulants: These stimulate saliva, topical treatments, saliva substitutes, and systemic sialogogues are currently available alternatives for treatment and symptom management[16]. Water consumption, drinking often, and staying hydrated are necessary treatments for symptoms of dry mouth. These actions help minimize symptoms and prevent oral problems[17]. Lifestyle modifications play an important role in the management of diabetes and xerostomia.

2.2. Systemic Sialogogues

Cevimeline is normally prescribed at a dose of 30 mg once a day for at least three months, and pilocarpine is typically given at a dose of 5 mg three times per day for at least three months. Topical intraoral agents such as chewing gum, saliva stimulants, and alternatives. Furthermore, sugar-free gel, mouthwash, toothpaste, and oral sprays, particularly those containing oxygenated glycerol triester, can be utilized in management. Additional topical treatments that comprise olive oil, betaine, and xylitol may be useful in treating secondary xerostomia caused by drug use[18].

Fig 1: Xerostomia

3. DENTAL CARIES (Figure 2:)

Diabetic patients have a higher prevalence of carious lesions than non-diabetic patients[19]. Those with diabetes are more likely to acquire both new and recurrent tooth decay. Caries may become more common due to decreased cleansing action of saliva and salivary buffering capacity, increasing carbohydrate content, and levels of oral micro-organisms. Persistent hyperglycemia may result in pulp necrosis. More chances to develop apical periodontitis and radiolucent periapical lesions in diabetic patients[12, 14, 19]. It is important to restrict or minimize the dietary intake of sugars. Thus, informing patients about how sweets and carbs contribute to dental caries is important. The management of caries is aided by the topical application of fluorides and proper brushing techniques[15].

Fig 2: Dental caries

4. PERIODONTITIS (Figure 3)

Studies have shown that the prevalence of severe periodontitis was higher in diabetes patients than in non-diabetics. The onset and advancement of gingivitis, periodontitis, and alveolar bone loss have been associated with poor glycemic management. Patients with type 1 and type 2 diabetes have a more incidence and prevalence of periodontal disease, according to reports[14,20,21]. Diabetes has been designated periodontal disease as its sixth major consequence[22]. Decreased metabolic regulation increases the severity of the disease[23]. Periodontitis and other gum diseases are more likely to develop and advance in the diabetic population. Periodontal infection is linked to a disturbance in glycemic control. Treatment for infections results in a reduction in inflammation, which then lowers insulin resistance, which lowers glucose levels. Hence, there is a reciprocal association between diabetes and periodontal disease[2]. In addition to lowering blood glucose levels, periodontal treatment can keep the patient's overall health and prevent tooth loss [24].

Fig 3: Localized Periodontitis

5. ORAL INFECTIONS

Different oral infections are more likely to develop in patients with diabetes. Many factors are responsible for the infection development, including decreased salivary flow rate, lack of anti-microbial properties, impaired defense mechanisms, and poor metabolic management[10,13,14].

6. ORAL CANDIDIASIS (Figure 4)

A common fungus infection known as oral candidiasis is opportunistic and caused by Candida albicans. The type-1 diabetic population had increased candida colonization rates (84%) than those with the type-2 diabetic population (68%), while non-diabetic patients had a colonization rate of roughly 27%[10,25]. Impairment of blood glucose levels and the immune system result in Candida infection. A dry mouth caused by poor glycemic control in diabetes individuals raises the density of candida species and results in oral candiasis[2,5]. Patients with diabetes who use tobacco and its products, denture wearer, patients with poor blood glucose control, patients on steroids, and patients on broad-spectrum antibiotics are more likely to have Candida infection[10,13,14].

Fig 4: Initial candida infection at the dorsal surface of the tongue posteriorly

6.1. Management

Hb1Ac and random blood glucose levels for the patient should be tracked and managed. Polyenes, including nystatin and amphotericin B, are antifungal medications frequently used in topical antifungal regimens. Clotrimazole, Miconazole, Ketoconazole, Fluconazole, and Itraconazole are different medications. Those who wear dentures should remove them before going to bed at night. The tissue-fitting surfaces of the dentures should be gently washed to eliminate any debris after being treated in disinfectants for an entire night. Systemic antifungal therapy can be necessary if topical antifungal therapy doesn't work after 10 days[18,26]. The medicine of preference for treating oral candidiasis systemically was found to be fluconazole[26].

6.2. Burning mouth syndrome

Intense burning in the oral mucosa and a lack of clinical symptoms are the hallmarks of burning mouth syndrome. Systemic, local, and psychological elements like stress, anxiety, and depression are involved in its aetiology[27]. Poor blood glucose levels, changes in intraoral mucosal metabolism, angiopathy, candidiasis infection, and neuropathy are all linked to burning sensations[9]. Neuropathic pain may feel searing, tingling, electric shock-like, or stabbing. The degree of sleep disruption, anxiety, and depression correlates with these pain sensations, which impact physical and psychological processes. Management of this syndrome includes topical therapies, systemic therapies, and therapeutic approaches. Topical therapy includes clonazepam, capsaicin, and low-level laser therapy found to be an effective treatment modality. Systemic therapy includes Clonazepam, Alpha Lipoic Acid, Gabapentin, and Amitriptyline. When used to treat burning mouth symptoms, topical bupivacaine may be an efficient topical anesthetic. Cognitive behavioral therapy may also help treat emotional and physical symptoms of depression and anxiety[28].

6.3. Taste disturbance or dysfunction

Although taste perception has an inherited tendency, neuropathies can impact it. Diabetes and the onset of obesity have both been linked to taste changes[29]. 5.7% of pre-diabetic or diabetic patients had impairment in sweet taste, and 8.6% had a salt taste impairment, according to a cross-sectional study[14,30]. Raised detection thresholds or altered taste perception can result from salivary malfunction. The threshold of taste also rises as a result of neuropathy. This sensory deficiency results in difficulty maintaining a healthy diet and can impair glucose levels[9-11] Management: Blood glucose levels in diabetic individuals should be maintained and kept stable because treatment is always based on the underlying cause of the taste impairment. Transcranial magnetic stimulation, the administration of zinc gluconate, and antidepressants are among the treatment options. The only well-studied medication for treating idiopathic taste abnormalities is likely zinc[31].

6.4. Oral mucosa alterations

Mucosal diseases may be more common in patients, and they may also recover more slowly, have impaired salivary function, or both[32]. These changes include fissured and coated tongue, irritant fibroma, traumatic ulcer (Figure 6), recurrent aphthous ulcerations (Figure 5), and lichen planus[33,34]. Because type I diabetes is considered an autoimmune disease and oral lichen planus has an underlying autoimmune mechanism, it affects patients with type I diabetes more commonly than patients with type 2 diabetes[10,14]. Diabetes patients' immunological response alters as a result of acute hyperglycemia[10]. Therefore, healthy lifestyle practices are important in managing oral mucosal alterations in diabetic patients. The cause of the infection should be treated, and if required, symptomatic treatment should be given to relieve pain and burning.

Fig 5: Oral mucosal alterations: Recurrent aphthous ulcerations on lower labial mucosa.

7. POOR ORAL WOUND HEALING (FIGURE 6)

One well-known concern with oral surgery in diabetic individuals is the slow or impaired healing of tissues[10,14]. Delay in vascularization, decreased flow of blood and hypoxia, a decrease in innate immunity, reduction in growth factor synthesis, and stress are all risk factors for delayed repair[10,35]. Drugs have demonstrated the capacity to enhance skin repair mechanisms. Inhibitors of dipeptidyl peptidase 4 are used systemically to treat poor wound healing. Drugs used topically include statins, phenytoin, and metformin[36].

Fig 6: Delayed healing of a traumatic ulcer

7.1. Localized Osteitis

Diabetes causes the development of dry sockets, which results in slower healing and a more compromised immune system[37]. Increased synthesis of matrix metalloproteinases (MMPs), such as collagenase, and lower osteocalcin levels, an anabolic bone hormone, are the main causes of localized osteitis[37-39]. Many methods of management may be considered the best for treating dry sockets. Chlorhexidine gluconate 0.2% rinses before surgery are recommended, as is the use of gel afterward. Using the right antibiotics can help in dry socket treatment. Alveolar osteitis can be treated with laser therapy and alvogyl, among other treatments. Platelet-rich plasma and platelet-rich fibrin are other management options. Also, zinc oxide eugenol and high growth factor plasma can be used. Tranexamic acid and other alternatives like ozone gas may be helpful[40].

Table 4: Association of oral manifestations of diabetes mellitus and diabetic status[42].

Oral Manifestations	Absent/ Present	Diabetic status		
		Nondiabetic	Prediabetic	Diabetic
Gingivitis	No	65.5 %	11.8 %	2.4 %
	Yes	34.4 %	88. %	97.6 %
Localized periodontitis	No	86.9 %	19.1 %	87.1 %
	Yes	13.1 %	80.9 %	12.9 %
Generalized periodontitis	No	91.8 %	82.4 %	14.1 %
	Yes	8.2 %	17.6 %	85.9 %
Xerostomia	No	100 %	83.8 %	15.3 %
	Yes	0	16.2 %	84.7 %
Burning mouth syndrome	No	100 %	89.7 %	36.5 %
	Yes	0	10.3 %	63.5 %

Tongue color	White	95.1 %	76.5 %	12.9 %
	Pale Yellow	4.9 %	17.6 %	29.4 %
	Yellow	0	5.9 %	57.6 %
Tongue fissure	No	100 %	92.6 %	8.2 %
	Yes	0	7.4 %	91.8 %
Ulcerations	No	100 %	91.2 %	56.5 %
	Yes	0	8.8 %	43.5 %
Consistency of saliva	Thick ropy	4.9 %	17.6 %	87.1 %
	Thin	95.1 %	82.4 %	12.9 %

In cross-sectional research done in 2022, individuals with three or more typical or warning symptoms, such as polydipsia, polyuria, polyphagia, and overall weakness, were thought to have undetected diabetes. The hemoglobin A1c (HbA1c) study was done after a thorough oral examination for the signs of gingivitis, periodontitis, halitosis, xerostomia, and tongue symptoms. The study concluded that oral symptoms might be important for diagnosing undiagnosed DM patients[42] (Table 4).

7.2. General management considerations for diabetic patients

Before, during, and after any dental treatment, the points that should be taken into consideration are:
1) Consult with the patient's medical doctor to discuss glycemic control.
2) Verify that the patient had meals and taken their prescriptions before therapy.
3)Update medical histories and medications and review systems at every appointment.
4) Immediately prevent, treat, and eradicate infections and diseases.
5) Be cautious of and ready to handle hypoglycemia.
6) Never recommend or use anything that contains aspirin.
7) Obtain profound local anesthesia.
8) Keep the oral cavity healthy and give extensive preventative treatment.
9) Encourage regular food and medication adherence before and after appointments.
10) check for blood sugar levels with a glucometer if the patient is high risk or on insulin or undergoing surgery[41].

7.3. Emergency Management of Hypoglycemia in Dental Office

In case of any emergency in a dental setup, immediately stop dental treatment. In awake patients, give fifteen gm of carbohydrates orally. In addition, 180 ml of orange juice, a glucose tablet, 15–25 ml of sugar, or a simple sugar candy can be given. If required, repeat the carbohydrate dose and monitor blood sugar. If necessary, a clinician should seek emergency medical aid for a patient who is not cooperating. An intravenous infusion of 20 to 50 mL of a 50% dextrose solution after injecting 1 mg of glucagon subcutaneously or intramuscularly. While treating an unconscious patient, inject 20–50 mL of a 50% dextrose solution and 1 mg of glucagon subcutaneously or intramuscularly at nearly any location[41].

8. CONCLUSION

Xerostomia, dental caries, periodontal disease, gingivitis, candidiasis, other oral infections, burning mouth syndrome, taste dysfunction, oral mucosal alterations, delayed wound healing, and localized osteitis are common oral manifestations of DM. Patient's quality of life may be negatively impacted by oral complications in DM patients, which are regarded as severe illness consequences. Thus, it is important to control and avoid diabetes-related oral problems. Dentists can lower diabetes-related morbidity and mortality by ensuring their patients' oral health. Enhancing glycemic control lowers the likelihood of problems, including xerostomia and candidiasis. Although this is only sometimes the case for the oral health concerns we addressed, it is impossible to overlook their typically higher occurrence. We frequently cannot confirm or disprove apparent correlations between DM and oral illnesses and disorders because of a lack of high-quality studies. Consequently, an extensive, well-designed study is required. Although this review has shed some light on the subject, it will still be difficult for diabetes care professionals to identify the warning signs and symptoms of oral problems. To handle potential oral consequences, we thus strongly recommend an interdisciplinary approach between DM care experts and dental field professionals, as is the case for well-known diabetic complications.

9. AUTHORS CONTRIBUTION STATEMENT

Dr. Prasanna R. Sonar wrote the manuscript with input from all authors. Dr. Aarati S. Panchbhai conceived the presented idea. Dr. Aarati S. Panchbhai encouraged Dr. Prasanna R. Sonar for this work. Dr. Aarati S. Panchbhai, Dr. Sunil Mishra, and Dr. Suwarna B. Dangore conceived the study and helped with overall direction and planning.

10. CONFLICT OF INTEREST

Conflict of interest declared none.

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