OPEN ACCESS

Saudi Journal of Oral and Dental Research

Abbreviated Key Title: Saudi J Oral Dent Res
ISSN 2518-1300 (Print) | ISSN 2518-1297 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Review Article **Dentistry**

Association of Oral Health and Diabetes

Hassan Alsheikh[1*], Abdullah Hazzazi[2], Abdullah Alannaz[3], Lujain Abualkhair[4]

[1]My Clinic Polyclinic, Dental Department, Jeddah, Saudi Arabia
[2]Department of Basic and Clinical Oral Sciences, Faculty of Dentistry, Umm Al-Qura University, Makkah, Saudi Arabia
[3]Department of Dentistry, Royal Commission Medical Center, Yanbu, Saudi Arabia
[4]Yanbu General Hospital, Madina Health Cluster, Ministry of Health, Yanbu, Saudi Arabia

DOI: https://doi.org/10.36348/sjodr.2025.v10i04.003 | **Received:** 05.03.2025 | **Accepted:** 11.04.2025 | **Published:** 14.04.2025

***Corresponding author:** Hassan Alsheikh
My Clinic Polyclinic, Dental Department, Jeddah, Saudi Arabia

Abstract

Diabetes mellitus (DM) is one of the most common diseases worldwide. Its effects on oral and dental health are well distinguished. As this disease is increasing worldwide, it is essential for dental care providers to be fully aware of the disease diagnosis and management and to deal with it confidently. This review discusses the oral manifestations and dental considerations that should be followed when treating patients with DM.

Keywords: Diabetes, Endocrine, Infection, Insulin, Dental, Hypoglycemia.

INTRODUCTION

Diabetes mellitus (DM) is an endocrine disorder marked by elevated blood glucose levels due to a partial or complete lack of insulin [1]. This increase in blood sugar results in osmotic diuresis, which in turn causes common symptoms such as excessive thirst, frequent urination, nighttime urination, fatigue, and weight loss [2]. Diabetes is classified into three types: type I, type II, and gestational diabetes.

Type I diabetes is triggered by an autoimmune response that occurs suddenly and necessitates insulin treatment [3]. In contrast, Type II diabetes can remain undetected for many years and might not require insulin therapy. Gestational diabetes develops during pregnancy, posing significant risks to both the mother and the baby, and it can also heighten the likelihood of developing Type II diabetes later in life [3]. Both Type I and Type II diabetes share symptoms such as frequent urination, increased thirst, and heightened hunger [4].

DM is recognized as the leading cause of hospital admissions [5]. Although DM affects less than 10% of the population in certain countries, it accounts for 30% of visits to primary care facilities [5]. The impact of DM on oral and dental health is well known. With the global rise in DM cases, it is crucial for dental professionals to be thoroughly informed about diagnosing and managing this condition and to approach it with confidence.

This review explores the oral symptoms and dental considerations necessary when treating patients with DM.

Clinical Manifestations of Diabetes

The clinical manifestations of DM differ based on the type and related complications. Hyperglycemia is characterized by symptoms such as excessive thirst, frequent urination, weight loss, blurred vision, headaches, fatigue, and sometimes increased hunger [2]. Additionally, high blood sugar levels can lead to stunted growth and a higher susceptibility to infections [2]. Type I DM may appear suddenly, with hyperglycemia potentially advancing to ketoacidosis. Essentially, prolonged DM heightens the risk of atherosclerosis, which can impact numerous vital body systems and notably raises the likelihood of cardiovascular, retinal, and kidney diseases [6]. DM complications can cause harm to various organs and systems, including the kidneys, feet, eyes, and heart, and if left untreated, may result in premature death [3]. These complications are categorized as either acute or chronic [2].

Acute and Chronic Complications

DM may result in either hyperglycemia or hypoglycemia comas. Because insulin medication and

food consumption are not balanced, insulin-treated diabetic individuals are more likely to have hypoglycemia coma [4]. Rapid loss of consciousness due to hypoglycemia need prompt medical attention to prevent harm to the central nervous system (CNS) [4]. Compared to hypoglycemia episodes, hyperglycemia coma is less frequent, has a delayed onset, and is not typically accompanied by unconsciousness. Dehydration, dry skin, a weak pulse, hypotension, and hyperventilation of ketosis breath are symptoms of this kind of coma [7].

Microvascular and macrovascular disorders, which can impact several bodily systems, are the cause of chronic complications of diabetes mellitus [4].

Macrovascular and Microvascular Complications

Ischemic heart disease, peripheral vascular disease, and strokes are examples of macrovascular consequences [4]. The primary cause of DM morbidity and death is macrovascular complications. Compared to those without diabetes mellitus, patients with hyperglycemia have a three to five times higher risk of myocardial infarctions and a twofold higher risk of strokes [8].

Tissue ischaemia is the outcome of microvascular problems, which are brought on by local endothelial dysfunction. Nephropathy, neuropathy, and retinopathy are among them. Young people may develop microvascular problems 10–20 years after being diagnosed with diabetes mellitus [9].

Diagnostic Assessment Tools

Either the 2-hour plasma glucose (2-PG) result following 75g of an oral glucose tolerance test (OGTT) or the fasting plasma glucose (FPG) value are used to diagnose diabetes [10]. For a minimum of three months, the glycosylated haemoglobin (HbA1C) can also be used to track the long-term regulation of blood glucose levels [10]. Another assay is the fructosamine test. This provides an estimate of a state of hyperglycemia throughout the preceding 12–21 days. The many evaluation instruments used to diagnose diabetes are presented in Table 1.

Table 1: Different assessment tools used to diagnosis DM

Test used	Definition	Measurement
Fasting blood glucose (FBG)	Measures the blood glucose after not having anything to eat or drink (except water) for at least 8 hours	≥ 7.0 mmol/L (126 mg/dL)
HbA1C (glycated hemoglobin test)	Measures and monitors the blood glucose level over the past 3 months	≥ 48 mmol/mol (6.5%)
2-hour plasma glucose (2-PG)	Measures the blood glucose level after 2 hours of a meal	≥ 11.1 mmol/L (200 mg/dL)
Random (casual) plasma glucose level	Measures the blood glucose level at any time during the day	
Fructosamine test (glycated protein)	Measures the average level of blood glucose control over the past 12-21 days	

Medical Management of Diabetes

The ideal management of glucose levels involves maintaining them between 4–7 mmol/l (72 -126 mg/dL) before meals and ensuring they do not exceed 10 mmol/l (180 mg/dL) two hours after a meal. This control can be achieved through a combination of medication and lifestyle adjustments. Recommended lifestyle changes include quitting smoking, limiting alcohol consumption, managing weight, engaging in regular physical activity, and following a balanced diet. The primary medications used in the treatment of diabetes mellitus consist of oral hypoglycemic agents and insulin.

Several different preparations are available for insulin treatment of type I DM. Regular basal and bolus dosing plans or continuous pump delivery are commonly employed in type I diabetic patients [5]. The different insulin preparations are according to the duration of action as noted in Table 2.

Table 2: Types of insulin and their duration of action

Type of insulin	Duration of action
Rapid-acting insulin	4–5 hours
Short-acting insulin	6–8 hours
Intermediate-acting insulin	
Long-acting insulin	14–24 hours

In type II DM, oral hypoglycemic agents are considered the first-line treatment. Their mode of action is to either enhance the action of insulin at target cells or to increase the insulin secretion from the pancreas [5]. Table 3 lists oral hypoglycemic agents' mode of action [5].

Table 3: Commonly prescribed oral hypoglycemic agents and their mode of action

Agent	Mode of action
Sulfonylureas (i.e., Gliclazide®)	Insulin secretagogues
Meglitinides	
Biguanides (i.e., Metformin®)	Insulin sensitizers
Thiazolidinediones	
α- Glucosidase inhibitors	Decreased intestinal absorption and breakdown of carbohydrates
Dipeptidyl peptidase IV inhibitors	Incretin pathway

Oral Manifestations

A broad spectrum of oral symptoms has been reported in the literature [11]. DM can give rise to immunological and salivary dysfunction that will increase the risk of common oral diseases such as caries and periodontitis [12].

Salivary Dysfunction (Xerostomia)

Xerostomia has been extensively documented in the literature as a consequence of glandular dysfunction associated with hyperglycemia and peripheral autonomic neuropathy [13]. It is a frequent concern among patients with diabetes mellitus (DM), although the precise cause remains unclear. Symptoms of dry mouth may indicate elevated glucose levels, which can result in a thicker saliva consistency [9]. Additionally, sialosis, characterized by the enlargement of the salivary glands due to the expansion of acinar cells, can occur independently of xerostomia symptoms. Research indicates that higher HbA1c levels are correlated with a reduction in salivary flow rate [14].

Dental Caries

Dentists need to recognize that salivary dysfunction can lead to decreased saliva production and an increased glucose concentration in saliva, which may subjectively elevate the risk of caries [4]. Research indicates that when standard oral health preventive measures are implemented alongside effective diabetes management, diabetic patients do not exhibit a higher incidence of caries compared to the general population [9]. However, diabetic individuals may experience more dental caries due to inadequate oral hygiene or a greater frequency of meals [15]. Furthermore, children with type II diabetes mellitus (DM) are often subjected to a diet that contains more carcinogenic substances than that of children with type I DM, largely due to the link between obesity and type II DM. This dietary factor can contribute to a higher prevalence of caries in children with type II DM. Additionally, the buffering capacity of saliva in diabetic patients is reduced, further increasing their susceptibility to dental caries [16].

Oral Mucosal Lesions

Oral lichen planus can arise as a consequence of sulfonylurea therapy, while candida infection manifests as pseudomembranous candidiasis or median rhomboid glossitis can occasionally occur [4]. The former may reflect impaired phagocytic function due to a lack of compliance with, or inappropriate insulin therapy [4-16]. There have been several reports of geographic tongue (erythema migrans) in patients with DM [15].

Periodontal Diseases

Gingival and periodontal diseases are prevalent among individuals with diabetes mellitus (DM), and dental professionals regard them as the primary oral health issue. Inadequate management of DM correlates with a higher incidence of severe periodontitis compared to individuals without diabetes [28]. Periodontal diseases are a well-established and acknowledged complication associated with DM [17]. This understanding is reinforced by epidemiological research and studies conducted on animal models, which have also contributed to elucidating the pathophysiology of periodontal diseases in the context of DM [18].

Impaired Wound Healing

Abnormalities in the migration, proliferation, differentiation, and apoptosis of keratinocytes and fibroblasts can lead to compromised wound healing in individuals with diabetes. Additionally, factors such as reduced vascularization, dysfunctional endothelial progenitor cells (EPCs) and mesenchymal stem cells (MSCs), along with atypical macrophage polarization, may also play a role in the complex mechanisms underlying delayed wound healing. Moreover, studies have indicated that individuals with diabetes mellitus (DM) exhibit prolonged levels of TNF-α, which adversely affects the healing process [19]. It is believed that diabetic patients experience disrupted homeostasis and diminished phagocyte/macrophage activity due to elevated levels of matrix metalloproteinases, further contributing to the delay in wound healing [9].

Taste Disturbance

Approximately one-third of adults with DM may experience hypogeusia. As a result, this condition can impact 80% of individuals with uncontrolled type II DM and 50% of those with controlled type II DM [20]. Taste alterations can influence the perception of salty, sweet, and sour flavors. Current literature does not establish a correlation between the degree of gustatory impairment and HbA1c levels [20]. Additionally, diabetic patients have reported other neurological disorders, including burning mouth syndrome and dysphagia.

Trigeminal Neuropathy

DM can influence the functioning of the trigeminal nerve. In a study involving 40 patients

diagnosed with trigeminal neuralgia, it was found that 48% of them had diabetes mellitus. Additionally, another investigation that examined 30 patients with trigeminal neuropathy revealed that 10 of these individuals exhibited elevated blood glucose levels.

Special Implications for Dentistry

Surgical intervention in patients with DM can include the risk of infection and delayed healing due to impaired immunity. This can be managed by performing any dental procedure as atraumatic as possible by using chlorhexidine mouthwash (0.2%) and ensuring that controlled blood sugar levels are in place pre-operatively [8]. Therefore, liaising with the diabetic team is necessary to ensure all precautions are in place. This can include obtaining the profile of the blood glucose level of the patient and discussing the planned dental procedure with the diabetic team to consider the need for any antibiotics pre or post-operatively [5-13]. However, dentists should aim to avoid prescribing nonessential antibiotics to help reduce the possibility of antibiotic resistance [21].

Hypoglycemia is the major issue and risk that most dentists will confront when treating diabetic patients. This is particularly an issue if diabetic patients are asked to fast before any procedure such as general anesthesia or receiving insulin therapy [8]. In addition, long dental procedures that may disturb regular food regimes or any procedures that require conscious sedation or systematic anesthesia are associated with high risk of hypoglycemia. All dental staff should be well-trained to manage such an emergency [22]. A full awareness of the signs and symptoms of hypoglycemia such as unusual behavior should raise suspicion in staff, and proper management should be implemented before becoming unconscious [5]. Every practice should have detailed and effective emergency management protocols, and all members of staff should be confident enough to treat any suspected emergency [22].

Hyperglycemia or ketoacidosis is considered rare compared to hypoglycemia. It is sensible that if blood glucose levels are high enough dental treatment should be postponed until reasonable blood glucose levels are achieved [5]. Blood glucose levels should be monitored before any procedure [5]. They should be as close as possible to normal.

A multidisciplinary care pathway is essential to allow professional and effective management with no associated risks that can alter the safety of the treatment provided. Dental care providers should always clearly appreciate a patient's diabetic status, seek additional advice when necessary (e.g., liaise with the patient's general medical practitioner), and modify clinical care procedures when necessary [5-9]. Postoperative instructions should necessitate the importance of well-controlled blood glucose levels during the healing period to allow infection-free and healthy wound healing. The association of DM with all other risk factors such as hypertension, ischemic heart diseases, obesity, hypercholesterolemia, peripheral vascular diseases, and stroke are all able to challenge the management of patients with DM. It is also well established that osteoporosis is associated with type I DM and, therefore, requires extra care when clinicians are operating in procedures involving bone due to the high risk of developing bony fractures should be considered [5-23].

Delivering dental treatment under local anesthesia and conscious sedation can be safe and effective as long as the previous precautions are considered. The main challenge is providing dental treatment under general anesthesia as the patient should fast for at least six hours and therefore increase the risk of hypoglycemia. Dental appointment length and time should not interfere with treatment and the control regime of diabetes. Consideration should be reflected in having a stress-free appointment to reduce the incidence of diabetic emergencies. Early morning or early afternoon appointments not interfering with the routine of food and drugs should be considered to reduce the risk of a hypoglycemia emergency [9].

CONCLUSION

The long-term preservation of oral health in patients with DM can contribute to improved glycemic control and may also postpone the onset of painful symptoms that could necessitate invasive clinical interventions. If dental healthcare professionals understand the critical ways in which DM impacts oral health and dentistry and implement the appropriate measures, it is improbable that oral health care will exacerbate patient morbidity. A fundamental aspect of managing patients with DM, as well as those in good health, should be the prevention of prevalent acquired oral diseases, such as caries and periodontitis. These conditions can lead to pain, disrupt oral function, diminish quality of life, and potentially result in unnecessary invasive dental treatments.

REFERENCES

1. Mealey BL, Oates TW. Diabetes Mellitus and Periodontal Diseases. J Periodontol [Internet]. 2006 Aug;77(8):1289–303. Available from: https://aap.onlinelibrary.wiley.com/doi/10.1902/jop.2006.050459
2. Classification and diagnosis of diabetes. Diabetes Care. 2017 Jan 1;40:S11–24.
3. Aguiree F, Brown A, Cho NH, Dahlquist G, Dodd S, Dunning T, et al. International Diabetes Federation; 2013. IDF diabetes atlas. 2013;29–35.
4. Wilson MH, Fitpatrick JJ, McArdle NS. Diabetes mellitus and its relevance to the practice of dentistry. 2010.
5. Kidambi S, Patel SB. Diabetes mellitus. Considerations for dentistry. Vol. 139, Journal of the

American Dental Association. American Dental Association; 2008. p. 8S-18S.
6. Ogurtsova K, da Rocha Fernandes JD, Huang Y, Linnenkamp U, Guariguata L, Cho NH, et al. IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Res Clin Pract. 2017 Jun 1;128:40–50.
7. Scully C. Scully's Medical Problems in Dentistry E-Book. Elsevier Health Sciences; Scully's Medical Problems in Dentistry E-Book. 2014 Jul 21.
8. McCulloch DK, Nathan DM, Mulder JE. Glycemic control and vascular complications in type 2 diabetes mellitus. Waltham, MA: UpToDate. 2012.
9. Mohamed K RA, Yates J, Roberts A. Diabetes mellitus: considerations for the dental practitioner. Dent Update. 2014 Mar 2;41(2):54–144.
10. Gillett MJ. International expert committee report on the role of the A1c assay in the diagnosis of diabetes: diabetes care. Clin Biochem Rev. 2009 Nov 30;32(7):1327–34.
11. Manfredi M, Mccullough MJ, Vescovi P, Al-Kaarawi ZM, Porter SR. Update on diabetes mellitus and related oral diseases [Internet]. Vol. 10, Oral Diseases. 2004. Available from: http://www.blackwellmunksgaard.com
12. Priya BM, ShivaKumar V, Anitha V, Shanmugam M. Diabetes & dental diseases. CHC Med J. 2012;1(4):91–188.
13. Lewis D, Fiske J, Dougall A. Access to special care dentistry, part 7. Special care dentistry services: Seamless care for people in their middle years - Part 1. Br Dent J. 2008 Sep 27;205(6):305–17.
14. Leite RS, Marlow NM, Fernandes JK. Oral health and type 2 diabetes. In: American Journal of the Medical Sciences. 2013. p. 271–3.
15. Lamster IB, Lalla E, Borgnakke WS, Taylor GW. The relationship between oral health and diabetes mellitus. Vol. 139, Journal of the American Dental Association. American Dental Association; 2008. p. 19S-24S.
16. Al-Maskari AY, Al-Maskari MY, Al-Sudairy S. Oral manifestations and complications of diabetes mellitus: a review. Sultan Qaboos Univ Med J. 2011 May 15;2.
17. Chapple ILC, Genco R. Diabetes and periodontal diseases: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. J Periodontol [Internet]. 2013 Apr;84(4S). Available from: https://aap.onlinelibrary.wiley.com/doi/10.1902/jop.2013.1340011
18. Pontes Andersen CC, Flyvbjerg A, Buschard K, Holmstrup P. Relationship Between Periodontitis and Diabetes: Lessons From Rodent Studies. J Periodontol. 2007 Jul;78(7):1264–75.
19. Xu F, Zhang C, Graves DT. Abnormal cell responses and role of TNF- α in impaired diabetic wound healing. Vol. 2013, BioMed Research International. 2013.
20. Imoscopi A, Inelmen EM, Sergi G, Miotto F, Manzato E. Taste loss in the elderly: epidemiology, causes and consequences. Aging clinical and experimental research. 2012 Dec;23(6):9–570.
21. Alzahrani AS, Abed HH. To what extent should dental implant placement be adopted as a standard for diabetic patients? Vol. 37, Saudi Medical Journal. Saudi Arabian Armed Forces Hospital; 2016. p. 1179–83.
22. Jevon P. Resuscitation in the dental practice. Br Dent J. 2016 Mar 11;220(5):261–3.
23. Kim J, Amar S. Periodontal disease and systemic conditions: A bidirectional relationship. Vol. 94, Odontology. 2006. p. 10–21.