



**Daffodil**  
*International*  
**University**

**A review on the burden of Diabetes, It's Oral  
Complications, Prevention and Management.**

[In the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy]

**Submitted To**

The Department of Pharmacy,  
Faculty of Allied Health Sciences,  
Daffodil International University

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## APPROVAL

This project paper, “**A review on the burden of Diabetes, Its Oral Complications, Prevention and Management**”, submitted to the Department of Pharmacy, Faculty of Allied Health Sciences, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of therequirements for the degree of Bachelor of Pharmacy and approved as to its style and contents.

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## DECLARATION

I hereby declare that this project report, “**A review on The burden of Diabetes, Its Oral Complications, Prevention and Management**”. I am declaring that this Project is my original work. I also declare that neither this project nor any part thereof has been submitted elsewhere for the award of Bachelor or any degree.



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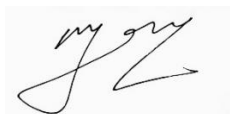
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## Certificate

This is to certify that the results of the investigation that are embodied in this thesis works are original and have not been submitted before in substance for any degree or diploma of this university. The entire present work submitted as a thesis work for the partial fulfillment of the degree of Bachelor of Pharmacy.



.....

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-A. M. Abu Sayem Rahman

# Dedication

*To my Parents and Teachers,  
The people who are constantly supportive of me in all aspects  
of my life.*

## **Abstract**

Diabetes is a widespread condition that has oral complications that affect dental care. This review's goal is to provide an overview of diabetes prevalence, symptoms, diagnoses, and treatments, as well as dental care considerations for diabetic patients. Effective communication between various healthcare professionals is necessary for managing the patient with diabetes safely. Dentists need to be knowledgeable about methods for identifying, managing, and preventing stomatological diseases in diabetic patients. Future people with diabetes will require greater dental care, and this page gives a general summary of the systemic and oral features of the condition that affect dental care. every year. A little more than 20% of persons over 65 have DM. The dental professional will be caring for more DM patients as a result of the ageing American population and improved diagnostic techniques. Therefore, understanding medical and dental management is crucial for dentists. Dentists should be a part of an interdisciplinary team of healthcare professionals, and patients should be encouraged to visit them frequently. To maintain ideal periodontal health in diabetes patients, routine periodontal evaluations and scaling and root planning are required. The oral symptoms of diabetes should be better understood by healthcare professionals, who should also collaborate to manage the condition and avoid complications.

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# **Chapter 1**

## **Introduction**

## **1. Introduction**

Hyperglycemia caused by abnormalities in insulin secretion, action, or both characterises the group of metabolic illnesses known as diabetes mellitus, or DM. (Gavin III et al.,1997) The prevalence of DM has been progressively rising in the United States. Six percent of Americans, or 16 million people, are thought to have DM. Every year, about 800,000 new cases are diagnosed. Nearly 20% of adults over 65 years old have DM. The dental professional will be caring for more DM patients as a result of the ageing American population and improved diagnostic techniques. Due to this growing patient population, it is crucial for dentists to be aware of medical and dental management considerations. (US Department of Health and Human Services, 2011)

### **1.1. Etiologic Classification of DM**

The following updated nomenclature and classification system was accepted by the American Diabetes Association's Expert Committee on the Diagnosis and Classification of Diabetes Mellitus in 1999. (Gavin III et al.,1997) It is based on disease aetiology rather than the particular type of medicine used to manage the disease:

**Type 1 DM.** This kind of diabetes, which accounts for 5 to 10 percent of DM cases, is typically brought on by an autoimmune attack on the pancreatic beta cells that produce insulin. Immune-mediated diabetes mellitus (DM) can strike at any age, however it typically strikes children and adolescents. It typically results in complete insulin shortage, and patients frequently have serious side effects such ketoacidosis. In addition, autoimmune diseases such Graves' disease, Hashimoto's thyroiditis, and Addison's disease are more common in type 1 DM patients. Some types of type 1 DM may be caused by environmental factors or viral infections that are still poorly understood.

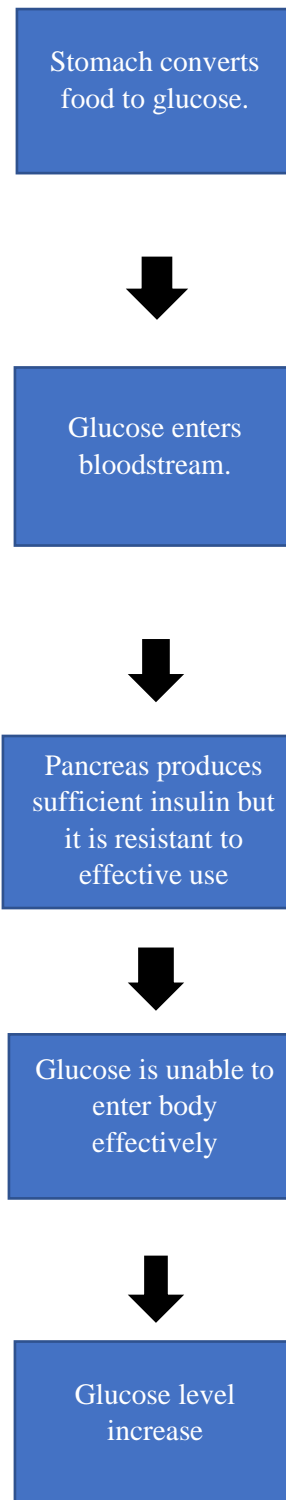
**Type 2 DM.** This type of diabetes, which accounts for 90–95% of cases of DM, is brought on by impaired insulin function (insulin resistance). It's more common for people with type 2 diabetes to have relative than absolute insulin insufficiency. Beta cell autoimmune destruction does not take place, despite the fact that the precise reasons of this type of diabetes remain unknown. Although ketoacidosis is not common, persistent

hyperglycemia can cause hyperosmolar nonketotic acidosis. Age, weight, and inactivity all raise the risk of type 2 diabetes mellitus.

People with dyslipidemia or hypertension are also more likely to have type 2 diabetes. The condition is more prevalent among African-American, Hispanic, and American Indian communities, and there is frequently a high hereditary susceptibility.

**Gestational diabetes mellitus, or GDM.** Any degree of glucose intolerance with onset or initial recognition during pregnancy is what is meant by this. Approximately 4% of all pregnancies in the US are complicated by GDM. Most of the time, after delivery, glucose regulation will return to normal. However, women who have had GDM are more likely to later develop type 2 DM.

Notably, the terms "adult-onset diabetes," "juvenile-onset diabetes," "insulin-dependent diabetes mellitus," and "non-insulin-dependent diabetes mellitus" as well as the abbreviations IDDM and NIDDM are no longer in use. The terms "type 1 DM" and "type 2 DM" are still used, however Arabic numerals are used in place of Roman ones.



**Figure 1:** Condition of diabetes mellitus

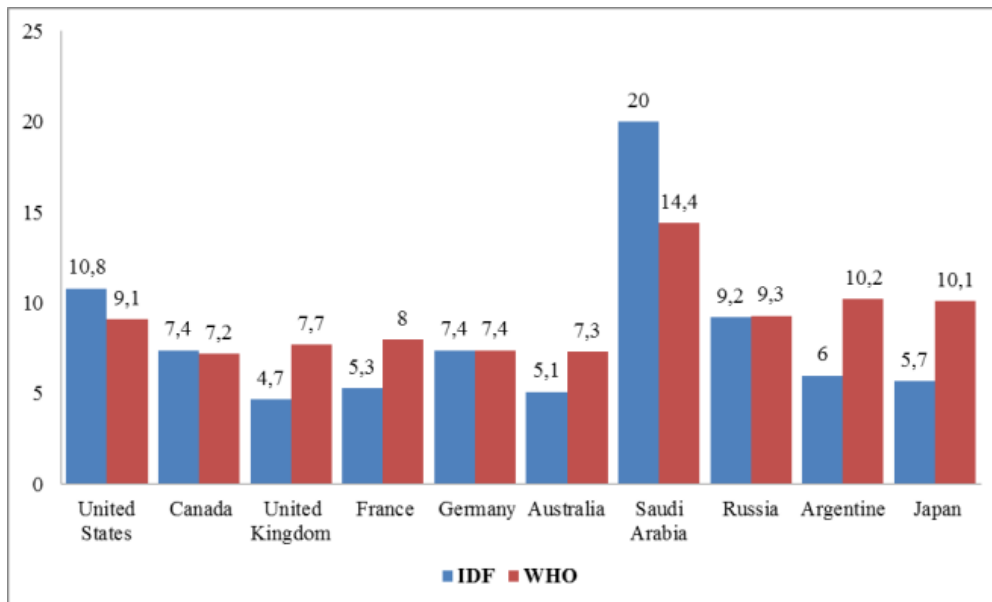
## **1.2. Burden of Diabetes**

DM is one of the most prevalent metabolic illnesses, affecting 20% of people worldwide and 2-5% of people in Europe. (Mariam, T. G et al., 2017) Adults with diabetes now account for 422 million people worldwide, up from 108 million in 1980. (World Health Organization, 2016) In 2008, the standardised age prevalence of diabetes mellitus was 9.8% for men and 9.2% for women, up from 8.3% and 7.5%, respectively, in 1980. (Danaei, G. et al., 2011) According to a recent study, the fatality rate from diabetes rose by 60.7%, from 12.1 per 100,000 people in 1990 to 19.5 per 100,000 people in 2013. (Moradi-Lakeh et al., 2017) An estimated 592 million people will have DM diagnoses by the year 2035. (Capozzi et al., 2017)

## **1.3. Diabetes mellitus & Oral health**

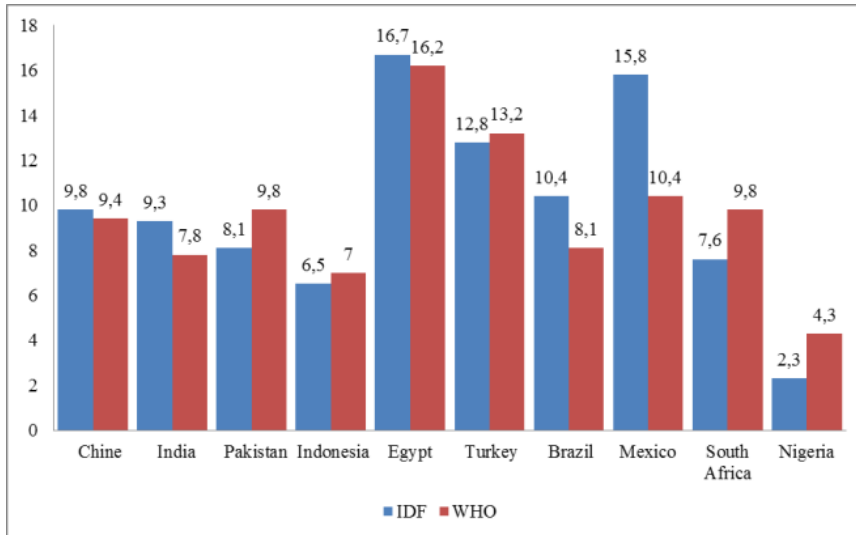
A diverse collection of clinical and hereditary metabolic illnesses known as diabetes mellitus (DM) are characterized by unusually high blood glucose levels. Diabetes mellitus type 1 (DM I) and diabetes mellitus type 2 (DM II) are the two main classifications. Due to the death of  $\beta$ -cells in DM I, there is a complete reduction in insulin secretion. The most prevalent type of diabetes, known as DM II or non-insulin dependent, is brought on by a gradual deficiency in insulin secretion or by resistance to the effects of insulin. (de Diabetes, A. A, 2011) There are no separate global estimates of prevalence for DM I and II since complex laboratory testing are typically needed to differentiate between the two diseases. (World Health Organization, 2016) In the United States, there were 30.3 million people with DM (9.4% of the population), of whom 23.1 million had diabetes diagnoses and 7.2 million had not yet received one. (Jalili, M., & Niroomand, M, 2016) Dental caries, xerostomia, periodontal disease, sensory difficulties, taste issues, salivary gland dysfunction, and oral infections are all prevalent in diabetic individuals. One of the most prevalent chronic inflammatory disorders, periodontal disease is distinguished by the breakdown of the connective tissue that surrounds the teeth and gradually results in tooth loss. Additionally, people who have periodontal disease are more likely to develop DM complications. (Indurkar et al., 2016) Due to westernised lifestyles, bad eating habits, and the rising prevalence of obesity, younger populations are increasingly suffering with DM at an increasing rate. (Kim et al., 2016)

#### 1.4. Prevalence of diabetes in the world



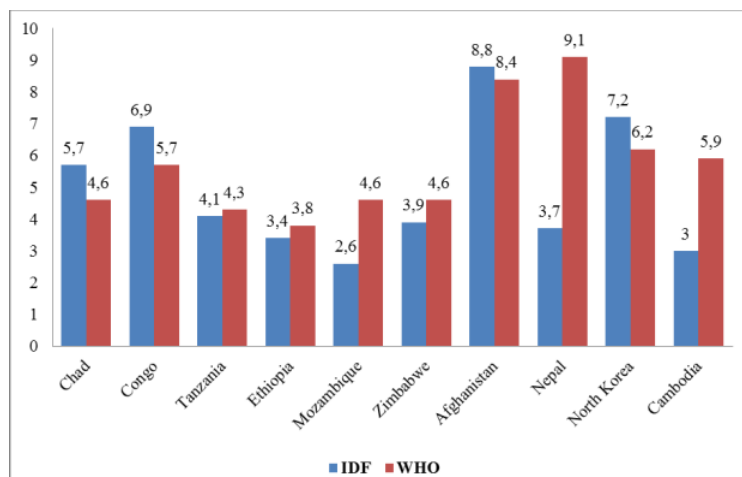
**Figure 2:** Prevalence of diabetes in high-income countries (Namayandeh et al., 2019) (Atlas, D., 2015)

Egyptians are estimated to have the greatest rates of DM prevalence, followed by Turks and Mexicans (Figure 3). Nigeria has the lowest prevalence of diabetes mellitus (DM) among the chosen middle-income nations.



**Figure 3:** Prevalence of diabetes in middle-income countries (Namayandeh et al., 2019)  
(Atlas, D., 2015)

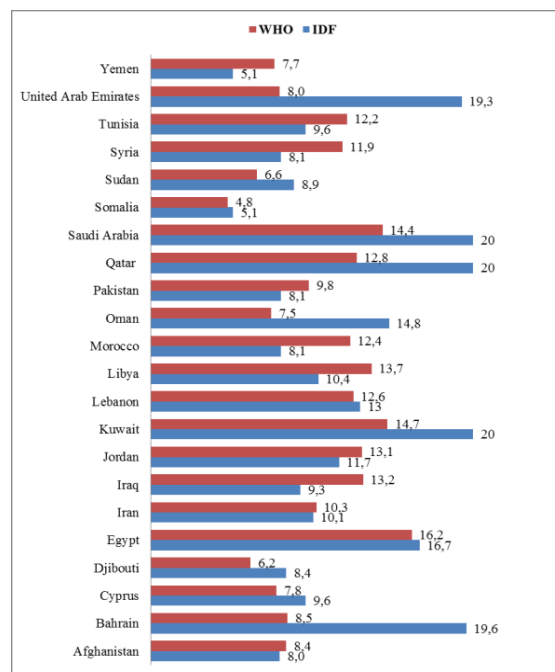
The prevalence in these middle-income nations was 9.76 on average. The overall prevalence of DM in these low-income nations was 5.3, with Afghanistan having the highest prevalence (Figure 4).



**Figure 4:** Prevalence of diabetes among low-income countries (Namayandeh et al., 2019)  
(Atlas, D., 2015)



In most nations, DM is regarded as one of the main causes of early disease and mortality. (Akhtar, S. N., & Dhillon, P, 2017) Cancers of the pancreas, liver, breast, urinary system, and colon are more common in DM patients. Similar to this, smokers have a 30%–40% higher risk than non-smokers of developing diabetes. Additionally, it was noted that adults in the general population did not have a higher prevalence of DM than HIV patients did. 75% of individuals with DM pass away from cardiovascular disease, which is a substantial risk factor for coronary artery disease. (Naito, R., & Miyauchi, K., 2017)



**Figure 5:** Prevalence of diabetes in the Eastern Mediterranean Region (Namayandeh et al., 2019)

# **Chapter 2**

## Literature Review

## 2. Literature review

- ✚ There are numerous problems associated with diabetes mellitus, which are often inversely correlated with the severity and persistence of hyperglycemia. The objective of this systematic study was to examine the many oral symptoms of diabetes mellitus. Despite the fact that DM has a variety of oral manifestations, there is insufficient knowledge on the links between diabetes, oral health, and overall health. To make an early diagnosis of diabetes, doctors and dentists must be aware of the numerous oral symptoms of the disease. ( Nazir et al., 2018)
- ✚ Over the past few decades, there has been a lot of focus on the connection between DM and oral diseases. However, the majority of studies only address periodontitis and continue to view DM solely from the standpoint of elevated blood glucose levels. Aside from dental caries, dry mouth, oral mucosal lesions, oral cancer, taste disturbances, temporomandibular disorders, burning mouth syndrome, apical periodontitis, and peri-implant diseases are other potential oral complications that will be evaluated in this review. Each oral consequence will be briefly discussed, and then the literature examining epidemiological connections with DM will be evaluated. We'll go into more detail on the pathogenic processes that could account for links between DM and oral problems. In order to achieve this, we seek to broaden our understanding of DM by taking into account research on not just high blood glucose levels but also other significant pathogenic pathways such as insulin resistance, dyslipidemia, hypertension, and immunological dysfunction. (Verhulst et al., 2019)
- ✚ There are currently 285 million people worldwide who have diabetes mellitus, and this number is certain to rise. The most frequent side effects of diabetic periodontal disease are tooth decay and tooth loss, requiring specialised care for oral health. The goal of the study was to evaluate socio-demographic factors, the CPOD index, the edentulous rate, as well as the needs for stomatologic treatment, general health condition, and habits, in order to determine the behaviour of clinical-epidemiological variables related to the oral health of people with diabetes mellitus over 20 who attended the Ciro Redondo "Ral Ortiz" polyclinic's stomatology service during the year 2013. The study included 628 patients, of which 64.45% were women and 34.5% were men. 81.75% of

people had tooth decay, with a 9.52 CPOD score for people aged 34 to 44 and a 5.65 index for people aged 60 to 74. 69.27% of the population had no teeth or only partial teeth. More than half of patients with missing teeth displayed movement, thought, and bleeding. Diabetes mellitus increases the likelihood of changes like gingivitis, mobility, and even higher tooth loss but not the risk of tooth rot. (González et al., 2015)

# **Chapter 3**

## Purpose of the study

### **3. General Objective**

This review's goal is to provide an overview of diabetes prevalence, symptoms, diagnoses, and treatments, as well as oral health care considerations for diabetic patients.

#### **Specific objective**

- a) Effective communication between various healthcare professionals is necessary for managing the patient with diabetes safely.
- b) Dentists need to be knowledgeable about methods for identifying, managing, and preventing stomatological diseases in diabetic patients.
- c) Future people with diabetes will require greater dental care, and this article provides a general summary of the systemic and oral features of the condition that affect dental care.

# **Chapter 4**

## **Method & Materials**

## **4. Method**

The literature was searched using electronic resources like Google Scholar, Medline via PubMed, Scopus, and Web of Science.

In addition to that, I utilized a few more regular tools and programs. As- Microsoft Word, Sci-hub, Quillbot, Turnitin, Grammarly.

### **4.1. Materials & Procedures**

The methods utilized for the assessment are covered in this chapter. It provides a description of the instructional setting. The study sample, research tool, technique, and data processing are just a few of the numerous factors to consider.



# **Chapter 5**

## Results & Discussion

## **5. Result and Discussion**

### **5.1. Oral manifestations and complications**

Both types of DM are associated with a number of oral complications, including oral candidiasis, halitosis, delayed wound healing, burning mouth syndrome, taste and salivary dysfunction, tooth decay, lichen planus, geographic tongue, and issues with dental implants. (Neidell et al., 2017) (Mauri-Obradors et al., 2015) The level of metabolic control and the length of DM both affect the prevalence and incidence of periodontal disease and the extent of periodontal tissue degradation. (Llambés, F et al., 2015) (Artese et al., 2015) Patients with poorly controlled diabetes frequently have deep pockets and attachment loss, and periodontitis affects 34% to 68 percent of them. (Bajaj et al., 2012) Patients with poorly controlled diabetes have an 11 times higher risk of losing their alveolar bones than people without diabetes.

### **5.2. Periodontal disease**

The basis for an autoimmune role in the pathogenesis of periodontal disease is the production of antibodies in response to microorganisms in periodontal tissues, as well as the presence of natural killer T cells, autoreactive B cells, heat shock proteins, autoantibodies, and genetic predispositions. (Kaur et al., 2017) Autoimmunity manifests in diabetic individuals in reaction to a flaw in the normal self-control process brought on by a chronic infection or tissue disintegration. The autoimmune process has the ability to target and kill insulin-producing cells (-cell), limiting their ability to produce insulin and fostering hyperglycemia. Due to the lymphocyte (B cell) generation of autoantibodies and a T-cell-mediated autoimmune response, -cells are destroyed. (Kawasaki, 2014) Epidemiologically, the association between diabetes (DM I) and periodontal disease is also related to the presence of autoimmune components in each of these diseases. (Koutouzis et al., 2009)

Periodontal disease and diabetes mellitus are correlated in both directions, and periodontal therapy can improve metabolic results in DM patients. After receiving non-surgical periodontal treatment, diabetic individuals' haemoglobin A1c levels decreased moderately, according to a meta-analysis of 9 randomised clinical trials. ( Li et al., 2015) With periodontal care at 3–4 months, there was a 0.29% reduction in haemoglobin A1c, according to another meta-analysis. Additionally, periodontal therapy reduced inflammatory biomarkers like tumour necrosis factor-alpha and C-reactive protein in diabetic patients, according to a meta-analysis of nine clinical trials. However, there is a lack of strong data regarding the long-term benefits of



salivary glucose in diabetic patients can promote candidal growth and raise the risk of developing oral candidiasis. Most of the *Candida albicans* species found in dental plaque are responsible for oral infections. Compared to non-diabetic participants, diabetes patients exhibit larger levels of candidal colony-forming units in their saliva, which have been linked to higher levels of salivary glucose. It was discovered that elevated serum glucose levels were substantially correlated with elevated salivary glucose levels. It was therefore suggested that salivary glucose levels may be utilised to assess the patients' state of diabetes and to keep track of their glycemic control. (Balan et al., 2015)



**Figure 7:** Oral candidiasis (Millsop et al., 2016)

#### **5.4. Tooth loss**

Patients with diabetes frequently lose their teeth. According to a recent cross-sectional study, just 6.4% of diabetic patients had all of their natural teeth remaining, and tooth loss was linked to older age and diabetic retinopathy. In addition, 15.3% of diabetic patients lost all of their teeth. (Izuora et al., 2016) When compared to people without diabetes, diabetic patients had 1.46 times the likelihood of having one tooth extracted. Despite the fact that regular dental visits are advantageous for diabetic patients, it has been discovered that diabetic people underuse dental care services. The severity of periodontal disease, which causes alveolar bone degradation and ultimately results in tooth removal, is connected to the increased tooth loss

among diabetic patients . Smoking and teeth grinding are strongly linked to periodontal disease-related tooth loss. (Martinez-Canut, P, 2015)

### **5.5. Xerostomia**

The existence of systemic disorders, such as DM, has been connected to the aetiology of xerostomia, which might impact oral functions and jeopardise a patient's health. In a recent study, it was discovered that 92.5% of diabetes patients (aged 65 to 91) had decreased salivary flow. According to a meta-analysis of 32 studies, diabetes patients had a prevalence of xerostomia of 46.09%, and their salivary flow rates were lower than those of the general population. Salivary secretions play a crucial role in maintaining dental health because they help with mechanical cleaning and support protective actions via physiological and biochemical pathways. (Lima et al., 2017)

### **5.6. Halitosis**

Halitosis was discovered to be the second most prevalent oral problem among diabetics, affecting 52% of individuals. Among patients with uncontrolled diabetes, the frequency increased to 76%. On the other hand, 16% of diabetic individuals were found to have halitosis in a research. In comparison to non-diabetic individuals, diabetic patients with chronic periodontitis had a considerably higher concentration of odoriferous microorganisms in the tongue coating and subgingival plaque. In diabetic patients, these odoriferous bacteria cause oral malodor due to the production of volatile sulphur compounds. (Kamaraj et al., 2011)

### **5.7. Burning mouth syndrome**

1.3 million Americans suffer from burning mouth syndrome. Dysgeusia and xerostomia are frequently coupled with a burning, unpleasant sensation in the mouth. Its symptoms typically get better in the morning, get worse during the day, and get better at night. A burning sensation on the tongue or other oral areas is a defining feature of the illness. Burning mouth syndrome is more likely to occur in people with DM, depression, and different nutritional deficits. However, a neuropathic basis explains the burning sensations that are frequently accompanied

by a change in taste (dysgeusia) or other sensory distortions in diabetic patients. Oral mucosal conditions like candida infections, lichen planus, and dryness can also cause burning sensations in diabetic patients. Because of this, patients with peripheral diabetic neuropathy are more likely to experience burning in their oral tissues. (Gandara et al., 2011)

When compared to non-diabetics, diabetic patients have a higher prevalence of dental caries. Dental cavities and demineralization are brought on by an accumulation of microbial plaque flora. In diabetic patients, decreasing salivary flow lowers the capacity to clean and buffer, as well as lowering calcium levels, which encourage tooth decay. Saliva production is reduced, and this lowers resistance to microorganisms that cause tooth decay. Additionally, diabetic patients' saliva has high glucose levels, which raises the proportion of fermentable carbohydrates available to oral bacteria. Studies on DM I patients have provided the majority of the current evidence supporting the link between DM and dental caries; nevertheless, DM II patients have a higher prevalence of caries than non-diabetic individuals. ( Singh et al., 2016)

### **5.8. Prevention of oral manifestations**

The available evidence is insufficient to prevent type 1 DM. By encouraging patients to attend the dentist for regular checkups, encouraging correct brushing and flossing habits, and managing blood glucose levels, it is possible to prevent the oral manifestations of type 2 diabetes. (Nazir et al., 2018)

Many people with DM aren't aware of the link between their dental health and their condition. Patients with DM are not sufficiently aware of the value of keeping good dental health. In addition, only a small portion of people with DM attend their dentists for periodontal examinations. Every diabetes patient should be screened for periodontal disease and informed about the value of maintaining good oral health and scheduling routine dental visits. (Nazir et al., 2018) According to a survey, more than 90% of DM patients developed oral symptoms as a result of not getting regular dental checkups. It has been hypothesised that people with higher levels of education were more concerned with preventing and managing the condition. As a

result, spreading knowledge will increase awareness and aid in the prevention of DM oral complications.

It will be more effective to screen and prevent oral illnesses if oral health care providers are included in measures to identify people at risk for DM. If dental professionals are aware of the dental implications and risk factors for DM, better treatment outcomes can be obtained. Through diabetic and dental care centres, patients with DM should be encouraged to visit the dentist for reinforcement and instruction on oral health information. Systemic health and oral health are linked, especially in diabetics, which raises the need for patient dental and medical management. Collaboration between patients, doctors, and dentists is necessary to improve the general and dental health of diabetic patients. (Bossart et al., 2016)

The use of fluoride mouthwash to prevent caries and antiplaque mouthwash to avoid periodontal issues should be recommended by dentists. To promote plaque control, dental flossing once per day and twice daily use of fluoride toothpaste should be encouraged. Dentures should be removed at night and properly cleaned for people who wear them. More than 55% of DM patients may be impacted by family members and friends, thus educating them about oral health could be helpful as well. Given that more people are using the Internet, it can be used to educate DM patients. Patients with DM should have access to accurate and current oral health education materials via a variety of communication modes. Dental professionals should take part in educational initiatives at the organisational level to educate diabetics about oral health issues. Governmental organisations and dental professionals alike have a responsibility to prevent harmful complications by raising awareness through various campaigns. (Foryciarz et al., 2016)

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In conclusion, a number of preventive interventions, such as blood glucose control, practising DM self-care, and maintaining good dental health, may help to lessen the oral symptoms of DM. Additionally, by taking these steps, diabetic patients can spend less on medical expenses.

A dentist's active involvement in making the diagnosis of DM in previously undiagnosed people is necessary for the early identification, assessment, and care of patients who are at risk of acquiring the condition. Patients with diabetes should schedule routine dental appointments every three months. Before beginning any dental procedure, a thorough history and oral cavity examination are required. (Tummuru et al., 2017) The dentist should be knowledgeable in treating DM medically and be able to identify the warning signs and symptoms of an undetected or uncontrolled condition.

Patients who have periodontitis and DM can benefit from routine home and professional periodontal care. Since high levels of postprandial plasma glucose (PPg) and HbA1c are the main causes of oral complications, poor glycaemic control over an extended period of time can result in impaired healing and severe periodontal disease. Early morning appointment times should be used to minimize disruptions to patients' daily medical routines. (Kapellas et al., 2017) Adrenaline and other vasoconstrictors used in dental local anaesthetic cartridges have the potential to lower blood sugar levels. As a result, people with poorly controlled insulin-dependent diabetes should have less adrenaline. Before seeing a dentist, people taking insulin or other anti-diabetic medications should continue taking them as prescribed. You should bring these drugs, as well as a snack or lunch, to the dentist's office. (Herlich et al., 2015)

According to reports, scaling and root planning, with or without antibiotics, can help diabetes patients with their periodontal health. For up to three months, scaling and root planning can



lower haemoglobin A1c, a measure of the average blood sugar level, by 0.29% (3–4 mmol/l). An implant therapy relative contraindication is DM that is not well managed. Maintaining a patient's blood glucose level, however, can assist slow the deterioration of their periodontal health, stop bone loss, and enhance osteoblastic activity. (Al Amri et al., 2016) Dental professionals should offer a six-month periodontal and peri-implant maintenance phase that includes oral hygiene advice and whole mouth scaling and root planning around natural teeth and implants. (Nazir et al., 2018)

# **Chapter 6**

## Conclusion

## **6. Conclusion**

In conclusion, diabetes mellitus (DM) is a public health emergency, and medical professionals should take responsibility for preventing and managing the disease, as well as its oral and other systemic consequences. Particularly in high- and middle-income countries, DM is very common. The prevalence of DM is highest in the Eastern Mediterranean region. A sizeable segment of the population is undiagnosed in addition to the millions of persons with DM who have been given a diagnosis. In addition to increasing morbidity and mortality, the illness places a heavy financial and economic strain on the healthcare systems. Periodontal disease, hyposalivation, dental caries, halitosis, delayed wound healing, taste and salivary dysfunctions, candidiasis, and burning mouth syndrome are only a few of the many oral consequences of DM. Patients' quality of life can be enhanced by raising awareness among them about DM, its link to oral health, including oral complications, which can help avoid DM. Diabetes patients should be encouraged to practice proper oral hygiene and manage their blood sugar levels appropriately to prevent oral problems. To help people manage diabetes and accompanying oral issues, healthcare professionals might create specific programmes. Dentists should be a part of an interdisciplinary team of healthcare professionals, and patients should be encouraged to visit them frequently. To maintain ideal periodontal health in diabetes patients, routine periodontal evaluations and scaling and root planning are required. The oral symptoms of diabetes should be better understood by healthcare professionals, who should also collaborate to manage the condition and avoid complications.

# **Chapter 7**

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