REVIEW ARTICLE

Diabetes and Oral Health

Sahana U.Baratakke[1], Rekha Raju[2], Sushi Kadanakuppe[3], Nagashree Savanur Ravindranth[4], Radha Gubbihal[5], Pallavi Swami Kausalya[6]

1-BDS, Post Graduate student, Public Health Dentistry, V S Dental College and Hospital Bengaluru, Karnataka. 2-MDS, Professor and Head of the Department, Public Health Dentistry, V S Dental College and Hospital Bengaluru, Karnataka. 3,4- MDS, Senior Lecturer, Public Health Dentistry, V S Dental College and Hospital Bengaluru, Karnataka. 5,6- MDS, Reader, Public Health Dentistry, V S Dental College and Hospital Bengaluru, Karnataka.

Correspondence to:
Dr. Sahana U.Baratakke, BDS, Post Graduate student, Public Health Dentistry, V S Dental College and Hospital Bengaluru, Karnataka.
Contact Us: www.ijohmr.com

ABSTRACT

Diabetes is a common chronic disease with oral manifestations impacting dental care. "Diabetes Mellitus" is characterized by elevated levels of glucose in the blood and abnormalities of carbohydrate, fat and protein metabolism. A number of oral diseases and disorders have been associated with it. The purpose of this review is to summarize the prevalence, complications and dental treatment considerations for the patient with diabetes. The literature suggests that oral health care providers have a positive effect on the oral and general health of patients with Diabetes Mellitus. For safe management of Diabetes Mellitus patients requires effective communication among health care providers. Dentists should know techniques to diagnose, treat and prevent stomatological disorders in Diabetes Mellitus patients. Dentists will be treating more patients with diabetes in the future and provides an overview of the systemic and oral aspects of the disease that impact dental treatment.

KEYWORDS: Diabetes, Oral Health, Candidiasis, Gingivitis

INTRODUCTION

Good oral health is an integral component of good general health. Although enjoying good oral health includes more than just having healthy teeth. General health and oral health are linked together. Continuous source of infectious agents in oral cavity reflects the progression of systemic pathologies. Oral infections were localized to the oral cavity except in the case of some associated syndromes and untreated odontogenic abscesses. There was a change in this notion and further new concept arises regarding oral health status and its impact on systemic health. One among them is diabetes mellitus which has an impact on oral cavity.[1]

The earliest description of diabetes can be seen in the writings of Hindu scholars as early as in 1500 BC. Diabetes was described as a "mysterious disease causing thirst, enormous urine output and wasting away of the body. Sushruta was the first to recognize diabetes and defined it as Madhumeha and further explained it with obesity and life style, advising exercises to help cure it. Another description dating to the same era comes from the Egypt; Egypt physician Hesy-Ra of the third Dynasty mentions diabetes and the description are found on the Ebers Papyrus which lists remedies to combat the 'passing of too much urine'. The term Diabetes was coined by Apollonius of Memphis around 250 BC, which literally means more fluid is drained than a person could consume. Later Mellitus, a Latin word, was added because patients had sweet urine.[2]

Early research linked diabetes to glycogen metabolism and Paul Langerhans, a medical student discovered the islet cells of pancreas.[4] It was in 1916 that Sharpey-Schafer suggested that a single chemical was missing from the pancreas and named it as insulin. EL Scott and Nikolae Paulescu were successful in extracting insulin from the pancreas of experimental dogs.[3]

Diabetes mellitus is a chronic disease resulting from a relative or absolute deficiency of insulin, where it is affecting metabolism of carbohydrate, protein, and fat. The most obvious abnormality is a high level of blood glucose, especially following a meal. Diabetes occurs in two major forms, type I and type II diabetes. Type I diabetes is the result of a reduction in or the elimination of insulin production by beta cells in the pancreas. Type II diabetes is characterized by a deficient response to insulin by target cells, although insulin production is typically normal or even enhanced in these individuals.[4]

WHO GLOBAL REPORT ON DIABETES

The number of people living with diabetes and its prevalence is growing in all regions of the world. In 2014, diabetes were seen among 422 million adults (8.5% of the population compared with 108 million (4.7%) in 1980 and more than 1 in 3 adults over 18 years of age were overweight and more than 1 in 10 were obese. Estimated of 1.5 million deaths were caused by diabetes and 2.2 million deaths were attributable to high blood glucose in 2012[5].

Indian scenario: According to WHO, diabetes countries profile 2016, the prevalence of diabetes in India is 7.8%, among them 7.9% for males and 7.5% for females[6]. In 2000, India (31.7 million) was having the highest number of people with diabetes mellitus followed by China (20.8

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million) and United States (17.7 million).According to Wild et al[8], who predicted that the prevalence of diabetes to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase was seen in India and by 2030 Diabetes Mellitus may afflict up to 79.4 million individuals in India, while China (42.3 million) and the United States (30.3 million) will also see significant increase.[7-8]

Results from a study conducted by the Indian Council of Medical research (ICMR) reported that less population is affected in states of Northern India (Chandigarh 0.12 million, Jharkhand 0.96 million) as compared to Maharashtra (9.2 million) and Tamil Nadu (4.8 million).[9] The National Urban Survey conducted across the metropolitan cities of India revealed the prevalence of diabetes is 11.7% in Kolkata,6.1% in Kashmir Valley[10],11.6% in New Delhi and 9.3% in Mumbai compared with 13.5% in Chennai, 16.6% in Hyderabad, and 12.4% Bangalore.[11]

ORAL COMPLICATIONS OF DIABETES MELLITUS

Diabetes has been recognized as an important risk factor for more severe and progressive periodontitis, infection or lesions resulting in the destruction of tissues and supporting bone around the tooth. Periodontal disease is the sixth complication of diabetes along with neuropathy, nephropathy, retinopathy and micro- and macrovascular diseases[12] and other oral complications have been reported like Xerostomia, Dental Caries, Candida Infection, Burning Mouth Syndrome and Lichen Planus.

Gingivitis and Periodontitis: Diabetes has been confirmed as a major risk factor for periodontitis[13-15]. The risk of periodontitis is increased by approximately threefold in diabetic individuals compared with non-diabetic individuals.[16] The key importance in determining increased risk is level of glycemic control. In the US based National Health and Nutrition Examination Survey (NHANES) III, adults whose HbA1c level of >9% after controlling for age, ethnicity, education, sex and smoking reported higher prevalence of severe periodontitis than those without diabetes.[17]

Diabetes Mellitus forms a major risk factor for periodontitis since 1990s and a number of cross-sectional and longitudinal studies on Pima Indian population revealed that prevalence and incidence of periodontitis were greater among Pima Indians who had type 2 diabetes mellitus compared with those who did not with threefold increased risk for periodontitis.Most of the research has been focused on type 2 diabetes mellitus as a risk factor for periodontitis and tended to develop in patients in their 40s and 50s.[18-20]

However, type 1 diabetes mellitus patients also increases the risk of developing periodontitis including children and young adults. Literature identified that 10% of children (<18 years) with type 1 diabetes mellitus had increased attachment loss and bone loss compared with controls, even though they have comparable plaque scores.[21] More recently, in a study among diabetic children (6– 18 years old) versus non-diabetic controls (350 each) reported that the periodontitis was greater in the children with diabetes (>20% versus 8% of sites, respectively). [22]

Xerostomia and Dental caries: Diabetes can lead to marked dysfunction of the secretory capacity of the salivary glands leads to salivary gland dysfunction[23]. Malhotra VK et al 2014[24] conducted a study to assess whether or not there was any change in the dental caries and salivary flow rate of Insulin-Dependent Diabetes Mellitus (IDDM) patients and concluded that 76% had carious lesion among diabetic group and 85.3% had carious lesion in non-diabetic group. Diminished unstimulated and stimulated salivary flow rate in diabetic than non diabetic group.

Oral Candidiasis: Oral candida is an infection of the yeast fungus C. Albicans. As a result of side effect of taking medications such as antibiotics, antihistamines or chemotherapy drugs. Other disorders are associated with the development of xerostomia which includes diabetes, drug abuse, malnutrition, immune deficiencies and old age. In almost half of the population, Candida is present in the oral cavity and has been shown more prevalent in people with diabetes as well.[25-26] Studies have shown a higher prevalence of candida in diabetic versus non diabetic individuals.[27]

Burning mouth syndrome: Burning mouth syndrome is a chronic, oral pain associated with burning sensations of the tongue, lips and mucosal regions of the mouth. The pathophysiology is idiopathic but can be associated with uncontrolled diabetes, hormone therapy, psychological disorder, neuropathy, xerostomia, and candidiasis.[28] Moore PA 2007[29] conducted a study in Pittsburgh to know burning mouth syndrome and peripheral neuropathy among type 1 diabetes mellitus patients reported that BMS or related discomforts occurred slightly more frequently among type 1 diabetes mellitus than in the control group.

Oral lichen planus: Oral lichen planus is a chronic inflammatory disease that causes bilateral white striations, papules or plaques on the buccal mucosa, tongue, and gingiva. Erythema, erosions, and blisters may or may not be present. The pathogenesis is unknown for the disorder.

Evidence suggested that lichen planus is a Tcell–mediated autoimmune disease in which cytotoxic CD8+ T-cells trigger apoptosis of the oral epithelial cells.[30] Microscopically, a lymphocytic infiltrate is composed of T-cells and many of the T cells in the epithelium are activated CD8+ lymphocytes. Lichen planus may predispose individuals to cancer and oral C. Albicans superinfection.[31-32] Fewer than 5% of these patients will develop oral squamous cell carcinoma (SCC) (Atrophic, Erosive and plaque lesions) may develop a greater risk of malignant change, although SCC may arise in the unaffected oral mucosa.[33] A study among 40 lichen

planus patients reported that 11 patients had latent diabetes, compared with none in the control group.[34]

MANAGING THE DENTAL CARE OF PATIENTS WITH DIABETES MELLITUS

Hypoglycemia is the major issue that usually confronts dental practitioners when they are treating patients with DM, especially if patients are asked to fast before undergoing a procedure. Although patients with DM usually recognize hypoglycemia and take action before becoming unconscious, occasionally they may not. Dental practitioners should be trained to recognize and treat patients who have hypoglycemia. Patients who have DM and exhibit unusual behavior should raise suspicion among staff members, and a glucometer should be used to test their blood glucose levels. Every dental office should have a protocol for treating hypoglycemia in conscious and unconscious patients.[35]

Treatment of oral complications of diabetes: Dentists must be cognizant for treating effectively the oral complications of diabetes mellitus. Many treatments are not different from those recommended for general population without diabetes. However, managing diabetes patients do require more rigorous follow-up, more aggressive interventional therapy rather than observation, regular communication with physicians and greater attention to prevention. Diabetes patients, with a history of poor glycemic control and oral infections, require frequent recall visits and fastidious attention should be given to acute oral infections[36].

Periodontal disease and its impact on diabetic control: In most cases, the dental clinician can manage the well-controlled type 1 or type 2 diabetic patient in a manner consistent with the management of a healthy non diabetic person. The dentist can perform periodontal surgical procedures, although it is important for the patient to maintain a normal diet during the postsurgical phase. The practitioner should collect any previous history of diabetic complications, determine the recent test results (eg., glycosylated hemoglobin and postprandial blood glucose levels) and maintain an ongoing dialogue with the patient's physician. Supportive periodontal therapy should be given at 2 to 3 months intervals because few studies indicates that there is slight tendency to progressive periodontal destruction even after effective metabolic control.[37]

The management of the insulin-dependent diabetic requires additional considerations. Before periodontal surgery, it may be appropriate consultation with the patient's physician, to ask the patient to administer a small bolus of rapid-acting insulin. This bolus may reduce the hyperglycemia associated with infection, pain, and stress. If the patient on the multiple-injection dose regimen is unable to eat after surgery, then the patient must modify the regimen. The patient can eliminate or significantly reduce all rapid-acting insulin for the remainder of the day; this reduces the likelihood of hypoglycemia in the absence of food during the postsurgical phase. At the same time, the patient can also reduce his long-acting insulin by a half of the usual recommended dose to prevent hypoglycemia. Therefore, the patient will have an ongoing basal level of long-acting insulin, although reduced, that will still ensure glucose homeostasis but prevent further hyperglycemia.[37]

A patient using an insulin pump follows different algorithms for insulin management. If patients are unable to eat during the postsurgical phase, they may require no adjustment in the basal insulin program or profile. The programmed insulin release over the 24- hour period may be adequate to ensure glucose homeostasis. The risk of hypoglycemia is also less than with the multiple insulin injection regimens because the patient is using the pump. If the patients are unable to eat for more than 24 hours, they may need to modify the basal profile by increasing the insulin dosage. Prolonged fasting depletes the finite glycogen stores in the liver. In such a starvation mode, the liver then uses the pathway of gluconeogenesis to synthesize new glucose from protein; this glucose is then released into the bloodstream, leading to hyperglycemia. Thus, the patient should increase the insulin dosage in the basal profile of the pump to maintain glucose homeostasis. If the periodontal infection is particularly severe, then the patient should also reprogram the basal profile in the pump to increase the insulin dosage during the postsurgical phase in treatment.[37]

By increasing the insulin dose, the pain and stress from infection and the bacterial endotoxins are less likely to exert a counter-regulatory effect on the liver, which may cause glycogenolysis and rapid hyperglycemia with ketoacidosis. These management algorithms are particularly critical because the patient using an insulin pump is more prone to severe hyperglycemia and Diabetic Ketoacidosis. Once there is the adequate resolution of the periodontal infection and return to a normal diet, the patient can then reprogram the insulin dosage to the previous basal profile. A diabetic patient who has the disease under control generally does not require antibiotics after surgical procedures. However, the administration of antibiotics during the postsurgical phase is appropriate, particularly if there is a significant infection, pain, and stress. A recent study has shown that the elimination of periodontal infection through the use of systemic antibiotic (doxycycline) improved the metabolic control of diabetes, as was shown by a reduction in the patient's glycosylated hemoglobin value.[37]

Treatment regimens for candidiasis: Given the centrality of candidiasis as a marker of marginally or uncontrolled diabetes and its secondary relationship to salivary dysfunction, there are some representative topical and systemic medications for the treatment of oral candidiasis. Oral candidiasis in a patient with poorly controlled diabetes mellitus is shown in Figure 1. The dorsum of the tongue is erythematous, and numerous hyphae were present microscopically.[38]

Figure 1: Candidiasis

It generally is advised that the dentist first assesses the sugar content in some of the antifungal preparations before prescribing them. For example, clotrimazole troches should be avoided as they have a relatively high sugar content that may warrant against their use in patients with diabetes. Some of these combination creams contain corticosteroids that provide an anti-inflammatory and antipruritic effect to aid healing; however, steroids can have an antagonistic or counter-regulatory effect on the action of insulin and thus, have the potential to cause hyperglycemia. Nonetheless, it is unlikely that such combination creams will cause a significant elevation of blood glucose, particularly if these are applied to a relatively small area of angular cheilitis[38].

Management of salivary gland dysfunction and xerostomia: The rationale for the treatment of xerostomia is to provide salivary stimulation or replacement therapy to keep the mouth moist, prevent caries and candidal infection and provide palliative relief. The management approach for dry mouth can include the use of saliva substitutes and stimulants; this approach may minimize progression or prevent the development of, dental caries.[39]

Management of burning mouth syndrome: For the adult patient with burning mouth syndrome, multiple factors may interact synergistically. In uncontrolled diabetes, xerostomia and candidiasis can contribute to the symptoms associated with burning mouth. In addition to the treatment of these conditions, an improvement in glycemic control is essential to mitigate the symptoms. Given in low dosages, benzodiazepines, tricyclic antidepressants and anticonvulsants can be helpful in reducing or eliminating the symptoms after several weeks or months. The dosage of these drugs is adjusted to the patient's symptoms. A potential side effect includes xerostomia. Consultation with the patient's physician is necessary because of the potential of these drugs for addiction and dependence. Commonly used medications include amitriptyline, nortriptyline, clonazepam, and gabapentin.Interestingly, amitriptyline has also been used to treat autonomic neuropathy in diabetes.[40]

Surgical considerations and periodontal management: The dentist can perform periodontal surgical procedures, although it is important for the patient to maintain a normal diet during the postsurgical phase to avoid hypoglycemia (low blood sugar and insulin shock) and ensure effective repair. The dental practitioner should know about previous history of any complications then assess the patient's glycemic control and maintain an ongoing dialogue with the patient's physician and nutritionist. If duration of the diabetes is longer, greater chances of the patient's developing severe periodontal disease. Supportive periodontal therapy should be provided at two to three months intervals. Periodontal infections may complicate the severity of diabetes mellitus and the degree of metabolic control. The adult patient with well-controlled diabetes generally does not require antibiotics. However, the administration of antibiotics during the postsurgical phase is appropriate, particularly if there is a significant infection, pain, and stress.[41] Multiple factors predicts selection of antibiotics (for example, sensitivity and specificity results, a spread of infection) and should be conducted in consultation with the patient's physician. The periodontal therapy for patients with diabetes is nonsurgical, given that surgical procedures may necessitate modification of the patient's medications before and after treatment and also may lead to a prolonged healing phase owing to diabetes. The combination of nonsurgical debridement and tetracycline antibiotic therapy in patients with diabetes mellitus who have advanced periodontitis may have a potentially positive influence on glycemic control. The use of tetracycline in the treatment of periodontal disease was associated with an improvement in glycemic control as assessed by HbA1c assays.[41] Several published papers have reported an additional therapeutic benefit from tetracyclines in periodontal therapy, principally as inhibitors of the connective tissue–degrading enzymes, the human matrix metalloproteinases. For example, low-dose doxycycline has been shown to inhibit human gingival crevicular fluid collagenase at doses that are not antimicrobial, significantly eliminating the risk of bacterial resistance. Tetracyclines can thus function as inhibitors of bone resorption or bone loss and this property are independent of their antimicrobial use, providing an added dimension to the therapeutic management of periodontitis.[41]

Oral disease management with corticosteroids: Therapies with corticosteroids and immunomodulating drugs have the potential for side effects. Therefore, close collaboration with the patient's physician is needed. The use of steroids in the treatment of erosive lichen planus in the adult patient with diabetes is of considerable concern because steroids can antagonize the action of insulin and lead to hyperglycemia. The patient should be given instructions to self-monitor blood glucose levels frequently during steroid therapy. Prolonged use of topical steroids (for a period of greater than two weeks continuously) may result in mucosal atrophy and

secondary candidiasis conditions that also commonly occur in uncontrolled diabetes.[40]

Once the erosive oral lichen planus has resolved, topical steroids should be tapered to alternate-day or less-frequent therapy, depending on the control of the erosions and the tendency toward recurrence. Emerging nonsteroidal immunomodulator drugs (for example, tacrolimus ointment, topical thalidomide) may be useful in the medical management of the patient with the concomitant oral mucosal disease and uncontrolled diabetes.[40]

CONCLUSION

Diabetes mellitus affects all age people and its prevalence has been increasing. To provide safe and effective oral medical care for diabetic patients needs to understand the disease and should be familiar about its oral manifestations. The goal of therapy is oral health promotion in diabetic patients and prevention and diagnosis of diabetes in dental patients who are receiving routine stomatological care and enhancing the quality of life for patients.

Goal of dental health care is to maintain a healthy dentition for the purpose of aesthetics, dietary intake, nutrition, and quality of life. More dental care should be focused on efficient, preventive, and therapeutic management for public awareness and education efforts. The dentist plays a major role with allied members of the health team in helping a patient maintain glycemic control by properly treating oral infections and by instructing the patient with diabetes to maintain rigorous oral hygiene and a proper diet. The dental practitioner also plays a role in referring undiagnosed diabetic patients to a physician for evaluation. Finally, as an integral member of the team, the dentist can counsel patients with diabetes to stop smoking a risk factor that may exacerbate some of the vascular complications associated with diabetes.

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