DIABETES MELLITUS AND ITS ORAL COMPLICATIONS: A BRIEF REVIEW

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ABSTRACT

Oral health is an integral part of systemic and nutritional health and plays a significant role in the maintenance of optimum general health status. Several factors affect oral health including metabolic disorders such as diabetes mellitus. The purpose of this review is to gather and highlights various studies concerning diabetes mellitus and its potential effects on oral health. The english-language MEDLINE publications (experimental, observational and clinical studies) from 1966 through January 2006 having relation with Diabetes mellitus and oral health were reviewed. A total of 54 publications were evaluated based on their relevance, strength and quality of design and methods; and 32 publications were selected for this review. The body of short, long and epidemiological literature suggests that the most frequently reported symptoms in diabetic patients in relation to oral cavity are; poor oral hygiene, inflammation ofgums (gingivitis), oral candidiasis, calculus and pockets formation, dental caries, non carious tooth surface loss, peri-apical abscess, taste impairment, burning mouth syndrome, rhomboid glossitis, denture stomatitis, angular cheilitis, hyposalivation, halitosis and oroantral fistula. Based on the literature reviewed; it could be concluded that diabetes mellitus can cause all the above stated oral conditions.

Key words: *Diabetes mellitus, oral health, oral hygiene, dental caries, periodontal disease.*

INTRODUCTION

Historical Background: Diabetes is a Greek word that means siphon; it was named and described by Aretaeus of Cappadocia. He described it as a great flow of wonderfully sweet urine. The cardinal symptoms of the disease such as polyuria, polyphagia, polydipsia and loss of weight were described by Celsus. The ancient noticed that ants were attracted by the sweetness of urine. Thomas Willis found the urine of diabetics as wondrous sweet, as if imbued with honey, and a century later William Dobson realized that the serum of diabetic patients was also sweet. Cullen added the word mellitus to the name diabetes which means honey'. More recently, diabetes mellitus is defined as a chronic, progressive metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, action or both.

Prevalence of Diabetes Mellitus: Diabetes mellitus affects more than 140 million people worldwide and presently considered as one of the most frequent chronic disease[2]. Diabetes mellitus is increasing world-wide at an alarming rate with a global prevalence of 4% in 1995 and an expected rise to 5.4% by the year 2025, representing an estimated 300 million affected indi-viduals, compared with 135 million in 1995[3]. Some other reports indicate that this rate is expected to be rise at 9% by the year 2025[4]. Although diabetes has a worldwide distribution, it is seen more commonly in the

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developed European countries, US and Middle-East countries[5]. Recent estimates suggest that more than 100,000, inhabitants in the Middle-East suffer from type I diabetes and 6000 individuals in the region develop the disease each years. The prevalence rate is higher in Saudi Arabia compared to other Arab countries such as United Arab Emirates, Yemen, Qatar, Oman, Bahrain, Jordan and Libya'. The most probable reason of the high incidence in Saudi Arabia is the economical development over the last 20 years; this has resulted in the adaptation of Western life style with respect to nutritional habits and physical activity[6].

Diabetes mellitus is associated with long term damage, dysfunction and failure ofvarious organs', and its complications are mainly a consequence of macro-vascular and micro-vascular damage. The complications of diabetes mellitus include cardiovascular disease, nephropathy, diabetic retinopathy, neuropathy and respiratory failure. Diabetes mellitus increases the expression of adhesion molecules through hyperglycemia; these molecules play an important role in the patho-physiological dysfunction of the vasculature[8].

Types of Diabetes Mellitus: Type 1 diabetes mellitus results primarily from destruction of the beta-cells in the islets of Langerhans of the pancreas. This condition often leads to absolute insulin deficiency. The cause may be idiopathic or due to a disturbance in the autoimmune process. The onset of the disease is often abrupt, and patients with this type of diabetes are more prone to ketoacidosis and wide fluctuations in plasma glucose levels. Type 2 diabetes mellitus is due to a range from insulin resistance with relative insulin deficiency to a predominantly secretory defect accompanied by insulin resistance. The onset is generally more gradual than for type 1, and this condition is often associated with obesity. In addition, the risk of type 2 diabetes increases with age and lack of physical activity, this form of diabetes is more prevalent among people with hypertension or dyslipidemia. Type 2 diabetes has a strong genetic component; individuals with type 2 diabetes constitute 90% of the diabetic population. However, the gestational diabetes mellitus (GDM) is glucose intolerance that begins during pregnancy. The children of mothers with GDM are at greater risk of experiencing obesity and diabetes as young adults; there is a greater risk to the mother of developing type 2 diabetes in the futures.

Risk Factors for Diabetes Mellitus: The most frequently reported risk factors for diabetes mellitus are; family history of diabetes mellitus, previous gestational diabetes, dyslipidemia, infertility, hirsutism, obesity and smoking [10].

Oral Complications of Diabetes Mellitus: Oral health plays a significant role in the general health status, an optimum oral health prevents the community from many diseases not only at oral cavity level but also systemic level of the body11. However, patients with diabetes mellitus are said to exhibit poorer oral health[12].

The oral complications of diabetes mellitus, particularly from poorly controlled disease, are numerous and devastating. These complications include xerostomia (dry mouth), an increased susceptibility to bacterial, viral, and fungal infections (oral candidiasis), increased risk for dental caries, poor wound healing, gingivitis, periodontal disease, peri-apical abscesses, taste impairment and burning mouth syndrome[13-14].

Oral candidiasis is a common opportunistic infection of the oral cavity caused by an overgrowth of candida species, the commonest being candida albicans. The incidence varies depending on age and certain predisposing factors including impaired salivary gland function, drugs, dentures, smoking, Cushing's syndrome, malignancies, immunosuppressive conditions and diabetes mellitus[15].

Candida in the Oral Cavity of Diabetic Patients: It has been demonstrated that colonization and carriage of Candida in the oral cavity is found to be higher in diabetic subjects than in non-diabetics. Furthermore, colony forming unit (CFU) of Candida in the oral cavity ranking in groups was Type 1 diabetes mellitus greater than type 2 diabetes mellitus, and type 2 diabetes mellitus was greater than non-diabetic subjects.

Diabetes Mellitus and Impaired Salivary Gland Function: Sandberg et al (2000)[12] found a significantly higher degree of xerostomia in type 2 diabetes mellitus. Similarly, xerostomia has been observed in undiagnosed diabetes mellitus with the evidence of salivary hypofunction[16]. Guggenheimer et al. (2000)[17] concluded that Candida pseudohyphae and oral soft tissue manifestations of candidiasis such as median rhomboid glossitis, denture stomatitis and angular cheilitis were more prevalent in type **1** diabetes mellitus. The other acknowledged oral manifestations are burning mouth syndrome, altered taste, lichen planus and parotid enlargement[18-19].

Ogunbodede et al. (2005)[20] showed a significant difference in hyposalivation between diabetic patients

and controls and they reported that hypos alivation was present in 30.8% of the cases. Hyposalivation is said to be a very common symptom of the disease and has been linked with dysfunction of the parenchyma of the major salivary glands.

Halitosis: Halitosis is primarily caused by bacterial putrefaction and the generation of volatile sulfur compounds. Ninety percent of patients suffering from halitosis have oral causes such as poor oral hygiene, periodontal disease, tongue coat, food impaction, unclean dentures, faulty restorations, oral carcinomas and throat infections. The remaining 10 percent of halitosis sufferers have systemic causes that include renal or hepatic failure, carcinomas, and diabetes mellitus[21].

Periodontal Disease: Periodontal diseases are bacterial infections and lesions affecting the tissues that form the attachment apparatus of a tooth or teeth and can result in the destruction of tissues supporting the teeth. It has been also demonstrated that periodontal disease is a micro-vascular complication of diabetes mellitus[22-25]. Bi-directional relationship between diabetes and periodontal diseases can stimulate the chronic release of pro-inflammatory cytokines that have a deleterious effect on periodontal tissues. The chronic systemic elevation ofpro-inflammatory cytokines caused by periodontitis may even predispose individuals to the development of type 2 diabetes mellitus". An individual with uncontrolled diabetes will have an increased risk of infection and abnormal healing time that will compromise the health of the oral cavity" . Patients with diabetes mellitus are also said to exhibit poor gingival health and higher plaque index levels compared to non diabetics[27]. One of the following periodontal conditions may be associated with diabetes mellitus.

Aggressive Periodontitis: Aggressive periodontitis occurs in patients who are clinically healthy, the common features include rapid attachment loss, bone destruction and familial aggregation.

Chronic Periodontitis: Chronic periodontal disease is resulting in inflammation within the supporting tissues of the teeth, progressive attachment and bone loss and is characterized by pocket formation and/or recession of the gingiva. It is recognized as the most frequently occurring form of periodontitis and is prevalent in adults at any age. Progression of attachment loss usually occurs slowly, but periods of rapid progression may also occur.

Necrotizing Periodontal Diseases: Necrotizing periodontal disease is infection characterized by necrosis of gingival tissues, periodontal ligament and alveolar bone. These lesions are most commonly observed in

TABLE. SUMMARY OF DIFFERENT ORAL SYMPTOMS ASSOCIATED WITH DIABETES MELLITUS.

Authors Name	Journal' Name	Publication Year	Oral Symptoms
Sandberg et al.	Diabetes Res Clin Pract	2000	Poor oral hygiene
Field et al.	Br J Oral Maxilf. Surg	1997	Xerostomia, salivary hypo function
Rees	Periodontol	2000	Bacterial, viral, & fungal infections, periodontal disease
Vernillo	Global Health Nexus	2003	Xerostomia, dental caries, gingivitis, periodontal disease, peri-apical abscesses, taste impairment &and burning mouth syndrome.
Akpan & Morgan	Postgrad Med J	2002	Oral candidiasis, impaired salivary function
Guggenheimer	Oral Surg Oral Med Oral Pathol Oral Radiol Endod	2000	Median rhomboid gloss its, denature stomatitis, angular cheilitis
Murrah	J Oral Pathol	1985	Lichen planus, parotid enlargement
Gibson et al.	J Oral Pathol Med	1990	Lichen planus, parotid enlargement
Ogunboded et al.	J Contemp Dent Pract.	2005	Hypo-salivation
Spielman et al.	N Y State Dent J	1996	Halitosos
Loe	Diabetes Care	1993	Destruction of tissues supporting the teeth
Bell et al.	Dent Update	1999	Destruction of tissues supporting the teeth
Stegman	Home Health Nurse.	2005	Oral cavity infection

individuals with systemic conditions including, but not limited to HIV infection, malnutrition and immunosuppression.[28]

Periodontal Disease Markers: The saliva and gingival crevicular fluid (GCF) have been used to evaluate the risk for an individual to develop periodontal disease and monitor the host response to periodontal therapy. Furthermore, one commercially available genetic test has been reported to have the potential to be used to predict the periodontal disease, but there are controversial reports on this genetic susceptibility test[28-29]. In addition, Eley and Cox (1998)30 have attempted to relate the Aspartate amino transferase (AST) and lactate dehydrogenase (LDH) enzymes to periodontal disease severity and activity.

Oro-antral Fistula: Erdogan et al (2005)[31] reported a case report of a 43-year-old female with type I diabetes mellitus with a chronic oro-antral fistula in the right second molar region. The patient had bony necrosis in the donor site following palatal rotational flap operation.

Prevention of Oral Complications

The chances of the oral complications are minimized if the disease is well-controlled. A regular visit to the dentist is very important in diabetic patients for timely prevention and management of oral complications.

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