

Diabetes Mellitus and Periodontal Disease

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Abstract

Introduction: The association between diabetes mellitus and periodontal disease has been studied in the last years, and several studies conclude that diabetes mellitus is a risk factor for the development of gingivitis and/or periodontitis in both diabetes type 1 and 2. In this review article we intend to demonstrate the possible association between diabetes mellitus and periodontal disease, assessing their main characteristics, the association with social status and the influence of periodontal disease control on Diabetes mellitus. **Materials and methods:** A literature research for the completion of this review article was performed by using the Pubmed and Science Direct database. The keywords "Diabetes mellitus", "periodontal disease", "gingivitis", "peridontitis" and "periodontal therapy" were used for the selection of articles and books used in this current study. At the end, we selected 31 scientific articles and 8 textbooks that allowed the preparation of this review article on the topic. **Results:** Scientific research in recent years regarding this specific issue has allowed the establishment of a clear association between periodontal disease and diabetes mellitus among diabetics type 1 and 2. The main complications of diabetes mellitus are angiopathy, neuropathy, nephropathy and retinopathy. Several studies have demonstrated the oral manifestations of diabetes mellitus, assuming particular highlight the periodontal disease. Periodontal disease can negatively influence glycemic control in diabetics. However, it is questionable the association between periodontal therapy and the improvement blood glucose levels control in diabetic patients. **Conclusions:** There should be an interaction between general practitioners and dentists so that such patients have the appropriate preventive care and persistent periodontal therapy in specialized medical and dental clinics.

Key Words: Diabetes mellitus, Periodontal disease, Gingivitis, Chronic periodontitis, Periodontal therapy

Introduction

Diabetes mellitus is a silent disease, which means that without medical tests the patient may be unaware of having this disorder. In an early stage, the patient may not present signs and symptoms compatible with the disease [1]. It's a common disease worldwide, mainly in the United States of America (USA), affecting 7.6% of the adult population, between 30 and 69 years old, and 0.3% of pregnant women. Impaired glucose tolerance is observed in 12% of adults and 7% of pregnant women. It is estimated that about 50% of diabetic patients are unaware of the diagnosis. According to an international projection, due to a growing sedentary lifestyle, obesity and population ageing, diabetes will increase worldwide by over 50% in 2025 [2].

Diabetes is in the top five of the highest mortality rate diseases in the world and is getting closer to the top of the list. Over the past 20 years the number of diabetics in North America has increased considerably. In 2005, there were about 20.8 million people with diabetes in the USA alone. According to the American Diabetes Association there are about 6.2 million people undiagnosed and about 41 million people who could be considered pre-diabetic [3].

Periodontal disease is an infectious inflammatory illness that may compromise gums and its attachment tissues, such as, cementum, periodontal ligament and alveolar bone. It is characterized by insertion loss of the periodontal ligament and bone destruction of adjacent tissue. The development of this process leads to teeth loss and destruction of the periodontal ligament by bacterial action. Dental plaque and calculus inflame these structures leading to the formation of periodontal pockets, thereby to tooth mobility [4,5]. Concerning oral pathologies, periodontal disease is one of the most prevalent oral diseases worldwide along with dental

caries and is associated with various systemic diseases, particularly diabetes mellitus [6,7]. In this review article we intend to demonstrate the possible association between diabetes mellitus and periodontal disease, assessing their main characteristics, associations with social status and influence of periodontal disease monitoring in diabetes mellitus.

Materials and methods

We carried out a bibliographic review using PubMed and ScienceDirect databases. The keywords were "diabetes mellitus", "periodontal disease", "gingivitis", "peridontitis", "periodontal therapy" and their combinations, limiting the search to 32 scientific articles and 8 books. Selection criteria included articles published from 1985 to the present year of 2016 that described an association between diabetes mellitus and periodontal disease and the influence of periodontal therapy in improving diabetics' glycemic control.

Diabetes mellitus

Diabetes mellitus is a group of metabolic diseases which is characterized by hyperglycemia. Its prevalence has been increasing in recent decades, both in developed and in developing countries [8]. Diabetes can be classified into the following general categories:

Type 1 diabetes: it is characterized by changes in pancreatic β -cells, lack of insuline production and insuline secretion and tendency to ketoacidosis. It corresponds to 5% to 10% of cases, being more frequent among children and adolescents, with a peak incidence in both genders, between 11 and 14 years old, although it can occur in any age group. In most cases (85-90%) occur in patients with human leukocyte antigens, or associated with a strong genetic predisposition. The genetic predisposition linked to environmental factors,

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such as mumps virus and coxsackievirus B4 promotes a destructive autoimmune process, and highly selective pancreatic β -cells. When there is no evidence of autoimmunity it is considered idiopathic diabetes. The slowly progressive form generally occurs in adults and is referred as latent autoimmune diabetes of adults [9-11].

Type 2 diabetes: It is the most common being responsible for 85% to 90% of cases and is characterized by a reduced sensitivity to insulin coupled with an insulin deficiency. Type 2 diabetes is more prevalent in patients aged over 40, obese and that do not practice physical exercise. Usually, most type 2 diabetics can use oral antidiabetic agents in the early years after diagnosis. However, they may need insulin for a good glycemic control through the years [9-11].

Other specific types of diabetes mellitus: includes all diabetes cases in which the etiological factor is known, but having a lower incidence. For example, functional genetic defects of β cells with deficiency in insulin secretion; genetic defects in insulin action; diseases of exocrine pancreas (pancreatitis, trauma, infection, pancreatic cancer, hemochromatosis, cystic fibrosis); endocrine diseases that cause hyperglycemia (acromegaly); certain drugs and chemicals; viral infections; genetic syndromes (Down syndrome, Turner syndrome) [9-12].

Gestational diabetes: it is characterized by glucose intolerance diagnosed during pregnancy and may or may not persist after pregnancy. Women with increased body weight, over 25 years old and a familial history of diabetes mellitus have a medium or high risk for developing this type of diabetes, and thus should be monitored throughout pregnancy [9-12].

In any form, the absence of insulin can cause chronic and acute metabolic disorders [13]. Systemic and oral signs and symptoms aid in the evaluation and diagnosis of diabetes. These signs and symptoms include polyuria, polydipsia, polyphagia, weight loss, fatigue, blurred vision, nausea, drowsiness, dehydration [10,11]. Systemic chronic complications of diabetes mellitus affect multiple body systems and there may be cases of retinopathy, neuropathy, nephropathy, peripheral vascular diseases, coronary heart disease, central and peripheral nervous system and dermatological problems [14].

In the oral cavity, the most frequent complications related to diabetes mellitus are: acetone breath, red furry tongue, increased asymptomatic parotid, gingival hypertrophy, alveolar resorption, tooth mobility, higher prevalence of stomatitis, increased incidence of dental caries due to the increase enamel hypoplasia and hypocalcification, increased susceptibility to oral candidiasis and angular cheilitis due to xerostomia [15].

Periodontal Disease

It is a disease in the oral cavity characterized by inflammation of teeth supporting tissues that evolve continuously, having periods of exacerbation and periods of remission [4,5]. There are two ways to classify this disease:

Gingivitis: It is characterized by soft tissues' inflammation but connective tissue remains attached to the tooth and does not occur insertion loss and if not promptly treated, may develop into periodontitis [4,5,16,17].

Periodontitis: It is the most severe form of periodontal disease affecting the deeper structures and is characterized by destruction of the periodontal ligament and apical migration of connective tissue. In a periodontal disease, accumulation of dental plaque leads to insertion loss due to resorption of the alveolar bone [4,5,16,17].

Both forms are characterized by several signs and symptoms that should be analyzed during periodontal examination, in order to use the most appropriate therapy. Gingivitis is clinically characterized by bleeding on probing, increased flow of crevicular fluid, hyperplasia, smooth and shiny gums, and radiologically by no bone loss. Periodontitis is clinically characterized by erythema and exudate, bleeding on probing, gingival recession, tooth mobility, insertion loss, furcation involvement halitosis; radiographic there is a horizontal and/or vertical bone loss that can be classified as mild, moderate or advanced [5,17]. Periodontal disease has become a worldwide public health issue affecting more the adult population. It usually starts as a gingivitis progressing quickly to a destructive periodontitis. Its development is influenced by multiple systemic, local and environmental factors.

Diabetes mellitus and periodontal disease are two common chronic diseases and, according to several research studies, are biologically interconnected [18]. Periodontal disease is a result of microvascular diabetes mellitus. There is scientific evidence showing that diabetes is a risk factor for gingivitis and periodontitis and that blood glucose control is crucial in this interaction [5,19,20]. Thus, periodontal disease is clearly a clinical manifestation associated with several systemic diseases including diabetes [21-23]. There is supremacy of Gram - anaerobic bacteria in periodontal pockets and/or gingival sulcus that stimulate the immune system cells and consequently release inflammatory mediators. These mediators get into the bloodstream and increase inflammation present in diabetes and interfere with blood glucose levels' regulation, leading to development and aggravation of diabetic complications [19,20].

Thus, periodontal treatments like root scaling associated with antibiotic therapy, reduce periodontal pathogens, inhibit the secretion of inflammatory cytokines and also inhibit non-enzymatic glycosylation. It is important to submit diabetic patients to regular periodontal therapy in order to avoid reinfection and maintaining good metabolic control [21,23].

Association between diabetes mellitus and periodontal disease

Several studies demonstrate an association between diabetes mellitus and periodontal disease. Following, there is a summary of some studies suggesting the association between these two disorders (*Table 1*) and another one that shows

several studies presenting diabetes' control due to periodontal therapy performed in diabetic patients (Table 2).

Table 1. Summary of epidemiological studies regarding the association between diabetes mellitus and periodontal disease.

Authors	Study Design	Methods	Results
Hugoson et al.[24]	Cohort	82 patients with type 1 diabetes (long term). 72 patients with type 1 diabetes (short term). Periodontal probing, premolars and molars x-rays for periodontal evaluation.	Long-term type I diabetics have more tooth surfaces with periodontal pockets higher than 6mm than non-diabetics.
Emrich et al.[25]	Cross-sectional	1342 patients with type 2 diabetes and 1877 non-diabetic patients, aged between 15-55 years old. Periodontal evaluation by probing and analysis of alveolar bone loss.	Type 2 diabetics have a higher risk of periodontal disease regardless their age.
Thorstensson et al.[26]	Cross-sectional	83 patients with type 1 diabetes and 99 non-diabetic patients, aged between 40-69 years old. Evaluation by probing, clinical characteristics of the gum, the alveolar bone level.	Diabetes mellitus is a risk factor for the development and progression of periodontitis.
Tervonen et al.[27]	Cross-sectional	35 patients with type 1 diabetes and 10 non-diabetic patients aged 29. Bone loss assessment. It has been considered glycemic control, duration and severity of diabetes.	Increased bone loss in type I diabetics and more significant in long-term diabetics.
Mattout et al.[28]	Cross-sectional	71 patients with type 2 diabetes and 2073 non-diabetic patients, aged between 35-75 years old. Assessment of gingivitis, periodontal pockets, periodontal attachment loss. Fasting blood glucose levels.	Periodontal disease is more severe in type 2 diabetics.
Bascones-Martínez et al.[29]	Literature review	---	There is an increased severity of periodontal disease in diabetics. Periodontal disease is considered to be the 6th major complication related to diabetes mellitus.
Kumar et al.[23]	Literature review	---	There is a clear association between the periodontal disease's severity and diabetes mellitus.

Diabetes mellitus and periodontal disease are two conditions that influence one another [22]. On the one hand, diabetes mellitus is a risk factor for developing gingivitis and/or periodontitis both in type 1 and 2 diabetics. On the

other hand, periodontal disease, may impair, difficult or even hinder the control of blood glucose levels in these patients [23-28].

Table 2. Review of studies concerning diabetes mellitus' control according to periodontal therapy performed on diabetic patients.

Authors	Methods	Periodontal treatment	Metabolic control	Results
Iwamoto et al.[30]	13 patients with type 2 diabetes, aged between 19-65 years old.	Local minocycline in periodontal pockets.	HbA1c	The treatment with minocycline was effective in improving metabolic control in diabetics.
Skaleric et al.[31]	10 patients with type 1 diabetes and 10 non-diabetic patients, aged between 26-58 years old. Duration of study: 24 months.	Scaling. Minocycline microspheres in pockets greater than 5mm.	HbA1c	Decrease HbA1c.
Janket et al.[32]	456 patients with type 1 and 2 diabetes. Duration of study: 25 years	Scaling Antibiotic therapy.	HbA1c	
Schara et al.[33]	10 patients with type 1 diabetes, aged 38. Duration of study: 10 months.	Scaling Oral chlorhexidine.	HbA1c	Decrease in HbA1c after 3 months of treatment.
Faria-Almeida et al.[34]	10 diabetics and 10 non-diabetic patients, aged between 35-70 years old. Duration of study: 6 months.	Scaling	HbA1c	Significant decrease in HbA1c.
Darré et al.[35]	9 clinical trials with 485 type 1 and 2 diabetics.	Periodontal treatment	HbA1c	Decrease in HbA1c.
Kormantz[36]	30 patients with type 2 diabetes and 30 non-diabetic patients, aged between 40-75 years old. Duration of study: 6 months.	Non-surgical periodontal treatment every 7 days.	HbA1c	Non-surgical periodontal treatment effective in patients with type 2 diabetes and moderate or severe periodontal disease because there was a reduction in HbA1c levels.
Wang et al.[37]	19 clinical trials with 143 patients having periodontal disease and type 2 diabetes mellitus.	Periodontal treatment with antibiotics and periodontal curettage.	HbA1c	Insufficient scientific evidence to justify a direct relationship between periodontal therapy and metabolic control.

However, taking into account results among the different studies analyzed for this literature review, we must bear in mind that the control of periodontal disease may not have direct influence in glycemic control and does not reflect a significant improvement in diabetes mellitus. It is important to take into account the multifactorial nature of the two pathologies studied, being difficult to establish a single direct relationship between them [38].

Most studies show that periodontal disease prevalence and severity is higher among diabetics when compared to non-diabetics and that periodontal therapy, with or without antibiotics, prevents the progression of this disease, allowing a significant improvement in the patient's oral health. Therefore, removing supragingival and subgingival dental plaque is the primary goal in the treatment and prevention of this disease, which should be monitored by the patient and his dentist [20,21,24-28,39].

Conclusion

It is necessary to reinforce the idea that the patient should be followed properly by skilled health professionals. The dentist's role in hospital environment is important for primary prevention strategies, allows acting in the disease's early stages with less aggressive therapies and better prognosis. Both the endocrinologist and the general practitioner have an

important role in assessing the oral cavity and orientate the patient to the dentist or periodontist. These health professionals should give all necessary indication for patients to know the importance of maintaining good oral health.

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