



RESEARCH ARTICLE

RELATION BETWEEN PERIODONTAL DISEASE AND DIABETES MELLITUS

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ABSTRACT

Unfavorable systemic conditions condition a low resistance of the host to the virulence of the aggressive agent, causing in a more rapid evolution of the periodontal disease and being able to lead to difficulties in the therapeutic response. The longer the duration of diabetes mellitus (DM), the greater the severity of periodontal disease and loss of insertion. The objective of the present literature review was to evaluate the relationship between periodontal disease and diabetes mellitus. The mechanisms that explain the association between diabetes and periodontal disease suggest that diabetic patients present reduced polymorphonuclear leukocyte function and chemotaxis, reduced collagen synthesis by gingival fibroblasts and glycosaminoglycans, increasing the collagenase activity of the crevicular fluid, resulting in loss of periodontal fibers and loss of alveolar bone support. Epidemiological studies have found a high degree of association between DM and periodontal disease. It has also been shown that this relationship is bidirectional, with periodontitis exerting an effect on DM. Thus, the high prevalence of periodontal disease in DM indicates the need to evaluate glucose levels in patients with periodontal disease. Intervention studies have shown that treatment of periodontal disease improves glycemic control.

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INTRODUCTION

Diabetes mellitus (DM) is a disease characterized by a metabolic imbalance, resulting from a change in glucose tolerance and deficiency in the metabolism of lipids and carbohydrates, resulting in hyperglycemia (Solskone and Klinger, 2001). Hyperglycemia develops as a result of a defective insulin secretion or altered insulin action, presenting the classical triad of symptoms: polyuria, polydipsia and polyphagia (Mealey and Oates, 2006). Patients who fall into this category are often obese and glucose tolerance can be controlled through diet and weight control and exhibit deficiency in the insulin molecule or alteration in the cell surface receptor, generating a deficiency in insulin function (Graves et al., 2004). Diabetic patients with chronic hyperglycemia present greater systemic complications. Chronic elevation of glucose in the blood results in major dysfunctions and damage in various organs such as eyes, liver, kidneys, heart, nerves and blood vessels (Schallhorn, 2016; Garber, Seidel, Armbruster, 2004). This condition is also

associated with increased susceptibility to oral infections, such as periodontitis (Taylor et al., 1998). Unfavorable systemic conditions condition a low resistance of the host to the virulence of the aggressive agent, causing in a more rapid evolution of the periodontal disease and being able to lead to difficulties in the therapeutic response. The longer the duration of diabetes, the greater the severity of periodontal disease and loss of insertion. Papapanou (1996) observed a significant association between diabetes and periodontitis, and diabetes may increase the risk of periodontal destruction over time. This correlation between duration of diabetes and loss of periodontal insertion and progression of periodontal destruction is similar for other complications such as nephropathy, retinopathy and vascular diseases. Reports of epidemiological studies, such as the Health and Nutrition Examination Survey (NHANES) III in the United States, show that the prevalence of periodontal disease in diabetic patients is twice as high as in non-diabetic patients (12.5% versus 6.3%). Nelson et al. (1990) and Emerich et al. (1991) in sectional studies with Pima Indians also demonstrated a higher prevalence of periodontal disease in type 2 diabetic individuals when compared to non-diabetic subjects. Nichols et al. (1978) pioneered the evaluation with a group of 54 patients with diabetes mellitus to assess the levels of periodontal disease.

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They did not observe a significant relationship between the levels of periodontal disease and the duration of diabetes. Periodontal disease in the diabetic showed the same etiologic factors, plaque, calculus, neglect, as would be expected in non-diabetic patients. Several factors could be associated with the higher prevalence and severity of periodontal disease in diabetics (Joseph *et al.*, 2017). Among these, the reduction in polymorphonuclear neutrophil function (PMNs), including chemotaxis, adhesion, phagocytosis and alteration of collagen metabolism. The poor function of PMNs may prevent the effective elimination of bacterial or bacterial products in the periodontal tissues. Subsequent persistence in the tissues leads to increased secretion of proinflammatory cytokines, resulting in increased periodontal destruction. These factors, together, lead to a change in the immune-inflammatory response of the host, resulting in less resistance to infection and restorative capacity. Therefore, the authors emphasize the importance of periodontal treatment, because by controlling the dental biofilm at levels compatible with health, local microbial load is reduced and, consequently, the levels of pro-inflammatory cytokines circulating in the bloodstream are reduced (Salvi *et al.*, 1997).

Although proven to diabetes mellitus is considered a risk factor for periodontal disease, it has been proposed the possibility of periodontal infection compromising control of diabetes. Nishimura *et al.* (2003) hypothesized that circulating TNF- α in an exacerbated gingival inflammatory process may be directly associated with the mechanism of insulin resistance by influencing organs such as liver, muscle and adipose tissue and indirectly by increasing the release of molecules, such as free fatty acids, which also produce insulin resistance. Bascones *et al.* (2014), reported a clinical improvement in clinical and immunological parameters of periodontitis and glycemic control in patients with diabetes after long-term treatment of periodontal disease. In addition, scientific evidence has confirmed that poorer glycemic control contributes to a worse periodontal condition. Corlan *et al.* (2016) performed a study with 75 patients with diabetes mellitus and periodontal disease, where they found that this association is predominantly found after 50 years of life and especially in women. Of systemic diseases associated with periodontal disease and diabetes mellitus, it was observed that 66.6% of the patients also had cardiovascular disease and 37.33% were obese. Pranckeviciene *et al.* (2017) compared the impact of periodontal surgery and glycemic control in type 1 and 2 diabetic and non-diabetic patients with severe periodontitis for 12 months. The periodontal parameters were: the depth of the pocket, the loss of clinical insertion and the bleeding the probing. Periodontal status in all diabetics improved after 3 months and remained so for 12 months, mean HbA1c values decreased in patients with type 2 diabetes mellitus after 3 months and remained stable. There was no improvement in glycemic control in patients with type 1 diabetes mellitus. Schulze *et al.*, 2016, investigated differences in periodontal status and oral hygiene among diabetic and non-diabetic patients. The main parameters evaluated were periodontitis and oral hygiene behavior. The male insulin therapy group presented a worse performance regarding oral hygiene behavior in relation to the insulin therapy group of the women. Regarding diabetics and non-diabetics, it was shown that diabetic women had a worse performance than non-diabetics. In general, patients with insulin therapy had a worse oral health status. Regarding gender, men presented a worse performance, mainly due to the behavior regarding oral hygiene.

MATERIALS AND METHODS

The articles included in this review came from the Pubmed database. The following keywords were used: periodontal treatment and diabetes; periodontal disease and diabetes mellitus; periodontal status and diabetes; periodontal treatment and glycaemic control; periodontitis and diabetes mellitus; chronic periodontitis and diabetes. Selected articles were published in English between 1970 and 2016.

DISCUSSION

Of the associations observed between the state of oral health and the chronic systemic pathologies, the greatest connection is between periodontal disease and Diabetes Mellitus. Diabetes affects around 177 million people worldwide and the World Health Organization (WHO) predicts that this number could double by 2030 due to population aging, incorrect eating habits, obesity and sedentary lifestyle. The oral complications of this pathology are multiple and include xerostomia, increased risk of dental caries and presence of periodontal problems (75% of diabetic patients). Patients with diabetes mellitus present a greater susceptibility to acute infections and inflammatory conditions, which increase glucose levels and insulin utilization, as well as promote complications in the metabolic control of diabetes (Nishimura *et al.*, 2003; Corlan *et al.* 2016). This factor is of great importance, since diabetic patients with poor glycemic control may present greater risks for the development of complications, such as ocular and vascular lesions. Periodontal disease in diabetic patients causes a change in endocrine metabolism, leading to difficulty in controlling blood sugar and increasing insulin resistance. The treatment and control of the periodontal condition, is of extreme importance, since it facilitates the metabolic control of the patients with diabetes (Simpson *et al.*, 2017). As for the influence of metabolic control on the prevalence and severity of periodontal disease, poor glycemic control in diabetic patients may be associated with an increased risk of loss of periodontal attachment and loss of alveolar bone over time (Papapanou 1996; Schultze *et al.*, 2016). The mechanisms that explain the association between diabetes and periodontal disease suggest that diabetic patients present a reduction in polymorphonuclear leukocyte function and chemotaxis, a reduction in collagen synthesis by gingival fibroblasts and glycosaminoglycans, increasing the collagenase activity of the crevicular fluid, resulting in loss of periodontal fibers and loss of alveolar bone support and formation of advanced glycation endproducts (AGEs), in which they can bind to macrophage and monocyte receptors resulting in increased secretion of tumor necrosis factor - α (TNF- α) and interleukin-1 β (IL-1 β) (Schallhorn, 2016). These mechanisms suggest a change in the host defense response, presenting a deficiency in scarring and exaggerated inflammatory response.

Epidemiological studies have found a high degree of association between DM and periodontal disease (Maeley and Oates, 2006; Bascones *et al.*, 2014, Pranckeviciene *et al.*, 2017 and Goel,Pradhan, Bhattarai, 2017). It has also been shown that this relationship is bidirectional, with periodontitis exerting an effect on DM (Sima and Van Dyke, 2016). Thus, the high prevalence of periodontal disease in DM indicates the need to evaluate glucose levels in patients with periodontal disease. Intervention studies have shown that treatment of periodontal disease improves glycemic control. The interaction between the two conditions underscores the importance of

good communication between the physician and dentist in diabetic patients, always considering the possibility that both diseases may be simultaneously occurring in order to ensure an early diagnosis of both.

REFERENCES

- Bascones-Martínez A, Muñoz-Corcuera M, Bascones-Ilundain J. 2015. Diabetes and periodontitis: A bidirectional relationship. *Med Clin.*, 6;145(1):31-5.
- Corlan Puşcu D, Ciuluvică RC, Anghel A, Mălăescu GD, Ciursaş AN, Popa GV, Agop Forna D, Busuioc CJ, Siloşi I. 2016. Periodontal disease in diabetic patients - clinical and histopathological aspects. *Rom J Morphol Embryol.*, 57(4):1323-1329.
- Emrich LJ, Shlossman M, Genco RJ. 1991. Periodontal disease in non-insulin-dependent diabetes mellitus. *J Periodontol.*, 62(2):123-31.
- Garber AJ, Seidel J, Armbruster M. 2004. Current standards of care for inpatient glycemic management and metabolic control: is it time for definite standards and targets? *Endocr Pract.*, 10 Suppl 2:10-2.
- Goel K, Pradhan S, Bhattarai MD. 2017. Effects of nonsurgical periodontal therapy in patients with moderately controlled type 2 diabetes mellitus and chronic periodontitis in Nepalese population. *Clin Cosmet Investig Dent.*, 17; 9:73-80.
- Graves DT, Al-Mashat H, Liu R. 2004. Evidence that diabetes mellitus aggravates periodontal diseases and modifies the response to an oral pathogen in animal models. *Compend Contin Educ Dent*, 25(7 Suppl 1):38-45.
- Joseph R, Sasikumar M, Mammen J, Joseraj MG, Radhakrishnan C. 2017. Nonsurgical periodontal-therapy improves glycosylated hemoglobin levels in pre-diabetic patients with chronic periodontitis. *World J Diabetes*, 15; 8(5):213-221.
- Mealey BL, Oates TW. 2006. Diabetes mellitus and periodontal diseases. *J Periodontol.*, 77(8):1289-303.
- Nelson RG, Shlossman M, Budding. LM, Pettitt DJ, Saad MF, Genco RJ. 1990. Periodontal disease and NIDDM in Pima Indians. *Diabetes Care*, 13:836-40.
- Nichols C, Laster LL, Bodak-Gyovai LZ. 1978. Diabetes mellitus and periodontal disease. *J Periodontol.*, 49(2):85-8.
- Nishimura F, Iwamoto Y, Mineshiba J, Shimizu A, Soga Y, Murayama Y. 2003. Periodontal disease and diabetes mellitus: the role of tumor necrosis factor-alpha in a 2-way relationship. *J Periodontol.*, 74(1):97-102. Review.
- Papapanou PN. 1996. Periodontal diseases: epidemiology. *Ann Periodontol.*, 1(1):1-36.
- Pranckeviciene A, Siudikiene J, Ostrauskas R, Machiulskiene V. 2017. Long-term effect of periodontal surgery on oral health and metabolic control of diabetics. *Clin Oral Investig.*, 21(3):735-743
- Salvi GE, Yalda B, Collins JG, Jones BH, Smith FW, Arnold RR, Offenbacher S. 1997. Inflammatory mediator response as a potential risk marker for periodontal diseases in insulin-dependent diabetes mellitus patients. *J Periodontol.*, 68(2):127-35.
- Schallhorn RA. 2016. Understanding the Inter-relationship Between Periodontitis and Diabetes: Current Evidence and Clinical Implications. *Compend Contin Educ Dent.*, 37(6):368-370.
- Schulze A, Busse M. 2016. Gender Differences in Periodontal Status and Oral Hygiene of Non-Diabetic and Type 2 Diabetic Patients. *Open Dent J.*, 10: 287-297.
- Sima C, Van Dyke TE. 2016. Therapeutic Targets for Management of Periodontitis and Diabetes. *Curr Pharm Des.*, 22(15):2216-37.
- Simpson TC, Weldon JC, Worthington HV, Needleman I, Wild SH, Moles DR, Stevenson B, Furness S, Iheozor-Ejirofor Z. 2015. Treatment of periodontal disease for glycaemic control in people with diabetes mellitus. *Cochrane Database Syst Rev.*, 6;(11):CD004714.
- Soskolne WA, Klinger A. 2001. The relationship between periodontal diseases and diabetes: an overview. *Ann of Periodontology*, 6 (1):91-98.
- Taylor GW, Burt BA, Becker MP, Genco RJ, Shlossman M, Knowler WC, Pettitt DJ. 1998. Non-insulin dependent diabetes mellitus and alveolar bone loss progression over 2years. *J Periodontol.*, 69(1):76-83.
