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DIABETES: A RISK FACTOR FOR PERIODONTITIS

Shaju Jacob* | Sonia Nath** | Muthu Arunchalam***

Abstract

Severe periodontitis is the major reason for tooth loss in adults. Diabetes is one of the major risk factor for progression of periodontitis. Over 200 articles have been published in the English literature in the past 50 years examining the relationship between these two chronic diseases. The purpose of this review is to provide the reader with practical knowledge concerning the relationship between diabetes mellitus and periodontal diseases. Pubmed and medInd were searched and suitable publications were reviewed. Data interpretation is often confounded by varying definitions of diabetes and periodontitis and different clinical criteria applied to prevalence, extent, and severity of periodontal diseases, levels of glycemic control, and complications associated with diabetes.

Keywords: Diabetes mellitus - periodontitis - risk factor.

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LE DIABÈTE: UN FACTEUR DE RISQUE POUR LA PARODONTITE

Résumé

Les maladies parodontales et principalement les formes sévères sont la principale raison de la perte des dents chez les adultes. Le diabète est un facteur de risque majeur pour la progression de la parodontite. Plus de 200 articles ont été publiés dans la littérature anglaise au cours des 50 dernières années portant sur la relation entre ces deux maladies chroniques. Le but de cette revue est de fournir au lecteur des connaissances pratiques concernant la relation entre le diabète et les maladies parodontales. Pubmed et medIND ont été fouillés et des publications appropriées ont été examinés. L'interprétation des données est souvent confondue par les différentes définitions du diabète et la parodontite et les différents critères cliniques appliqués à la prévalence, l'étendue et la gravité des maladies parodontales, les niveaux de contrôle de la glycémie et les complications associées au diabète.

Mots-clés: diabète sucré – parodontite - facteur de risque.

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Introduction

Diabetes mellitus is a clinically and genetically heterogeneous group of disorders affecting the metabolism of carbohydrates, lipids, and proteins [1]. It is a syndrome in which chronic hyperglycemia leads to long-term damage to various organs including the heart, eyes, kidneys, nerves, and vascular system.

Periodontitis is an infectious disease that can destroy the supporting tissues of the teeth. Severe periodontitis, the main reason of tooth loss

in adults, is prevalent in 19 to 32% of the Indian population [2]. The high prevalence of diabetes in a population will affect the prevalence of periodontitis adversely. This review tries to present the evidences which can help us understand why diabetes is considered a risk factor for periodontitis.

Materials and Methods

The information presented in this review is based on a survey of English language literature published in the last 20 years. The search was conduc-

ted using keywords such as “diabetes” in combination with “periodontitis” or “periodontal disease”, in Pubmed and medIND.

98 publications were selected, but only 31 studies were included in the review. Results of these studies are presented and divided according to the study design (prospective, case control and cross sectional studies).

Prospective studies

A prospective study conducted by the WHO [3] compared the cli-

nical periodontal status of 44 insulin-dependent diabetic children and adolescents and 20 healthy control subjects of mean age 12 years at baseline for a period of approximately 5 years. The clinical attachment level (CAL) was significantly higher in the diabetic group compared to the controls, and a significant positive correlation was observed between the duration of diabetes and CAL. Mean CAL significantly increased between baseline (2.39mm) and the 5-year follow-up (3.51mm) in the diabetic group while the difference in the control group remained non significant.

Firatli [4] evaluated the relationship between clinical periodontal status and insulin-dependent diabetes mellitus in a 5-year prospective study; 36 diabetics and 10 non diabetics aged between 24-36 years were compared. The author found that the periodontal status in diabetic patients was correlated to the diabetes control. Diabetic patients with good control and no complications and those with moderate control with/without retinopathy had similar periodontal status than non-diabetic controls. Whereas diabetic subjects with poor metabolic control and/or multiple complications exhibited higher extent of CAL and higher recurrence of pockets, during follow-up.

In their longitudinal study, Tervonen et al. [5] found the same association between diabetes control level and the progression of bone loss among patients with periodontal diseases.

Taylor et al. [6] confirmed that non-insulin-dependant diabetes mellitus (NIDDM) is a significant risk factor for alveolar bone loss, as well as for more severe bone loss progression in a two-year longitudinal study. NIDDM was associated to a worse bone score with an odds ratio of 4.23 (95% CI: 1.8–9.9) when compared with non-diabetics.

Different results were found by Sbordone et al. [7] when they compared the periodontal conditions of a group of 16 insulin-dependent diabetes mellitus patients to that of their

16 healthy cohabiting siblings, for 3 years-follow-up period. Periodontal parameters (probing depth (PD), attachment level (AL), sulcus bleeding index (SBI), and plaque index (PI)) were measured at baseline, after 2 and 3 years. No significant differences in clinical parameters were found between diabetics and healthy siblings at any examination including mean values of probing depth and clinical attachment level.

Case - control studies

The relation between diabetes and periodontal disease has been as well evaluated in many case-control studies. The study of Bridges et al. [8] demonstrated that diabetic patients (n=118) had more severe periodontal disease than matched, non-diabetic patients (n=115), expressed by significantly higher probing depth, loss of attachment, and missing teeth than the control group. Also, Lalla et al. [9] found that the number of teeth with evidence of attachment loss was significantly greater in children with diabetes (5.79 ± 5.34) compared to healthy subjects (1.53 ± 3.05).

The case-control study of Novaes et al. [10] didn't show any difference in mean pocket depth between diabetics (30) and non-diabetics (n=30). Only the alveolar bone loss was significantly more important in the upper and lower anterior regions in the diabetic group compared to non diabetic group.

Diabetes - periodontal disease relation was studied in different age groups: In the study of Firatli et al. [11], the periodontal status of 77 diabetic children and adolescents were compared to that of 77 paired systemically-healthy, sex- and age-matched control subjects. The results showed significantly higher mean of periodontal pocket depths and clinical attachment levels in the diabetic group.

Age and sex matched 40 to 70 year-old insulin dependent diabetics (n=83) and non diabetics (n=99) were compared in another study conducted by Thorstensson et al. [12]. The authors

found that the age of onset of diabetes appears to be an important risk factor for future periodontal destruction.

Hugoson et al. [13] found that the diabetes duration is a serious risk factor, since significantly more tooth surfaces with probing depth ≥ 6 mm and extensive alveolar bone loss were found in long-duration diabetics than non-diabetics. On the contrary, Sandberg [14] et al., in their case-control study who included 102 randomly sampled type 2 diabetic patients and 102 age- and gender-matched non-diabetic subjects in Sweden found that diabetic subjects show a greater need of periodontal treatment ($p=0.05$) while diabetes duration or metabolic control of the disease was not related to periodontal status.

Different results were observed in the case-control study of Rylander et al. [15]; it compared one group of 46 individuals (19-25 years old; test group T) who had suffered from diabetes mellitus (type 1) for 10 years or more, and another group of 41 non-diabetic controls (18-26 years old; control group C). The authors found no significant differences between the 2 groups regarding their oral hygiene status, frequency of sites with probing depths greater than 3 mm and the position of the interproximal alveolar bone margin.

Same conclusions were drawn in the case-control study of Campus et al. [16], who compared 71 NIDDM patients and 141 non diabetic controls, from an isolated population with a very similar genetic background; the level of periodontal disease by number and percentage of pockets were similar in the two groups. Statistically, deeper periodontal pockets (> 4 mm) were observed in the poorly controlled diabetic persons. These results are very similar to those of Bacic et al. [17] who also found significant differences between the poorly controlled diabetics and the control groups ($p < 0.01$) for both the probing pocket depth and periodontal attachment.

Few studies addressed the problem of gestational diabetes. The

case-control study conducted by Xiong et al. [17] included 53 pregnant women with gestational diabetes (GDM) and 106 pregnant women without GDM. Periodontitis was defined as the presence of any site with a probing depth (PD) ≥ 4 mm or a clinical attachment loss (AL) ≥ 4 mm. The percentage of periodontitis was 77.4% in women with GDM and 57.5% in women without GDM, with an odds ratio of 2.5 (CI 1.2 - 5.3). After adjusting for confounding variables of maternal age, parity, race, marital status, education, family income, smoking, alcohol consumption, systemic antibiotics during pregnancy, family history of diabetes, income, dental insurance coverage, and body mass index, the adjusted OR (95% CI) was 2.6 (1.1 - 6.1).

Cross-sectional studies

In the study of Hyman et al. [19], sample population was drawn from participants in the NHANES III. The mean AL was used to define periodontitis; it was categorized into five groups: 0–0.99, 1–1.99, 2.00–2.99, 3–3.99 mm, and ≥ 4 mm. Prevalence of diabetes in the 20–49 age group ($n=8208$) was 3.3% and was 13% in the ≥ 50 age group ($n=4117$). Diabetes was not related to an increased risk for varying levels of severity of mean attachment level in the less than 50 years age group and was significant in the severity level of 3 – 3.99 mm (OR = 2.06) for persons ≥ 50 years.

Data on 4343 persons between 45–90 years from the NHANES III were also analyzed by Tsai et al. [20]; an association between glycemic control in persons with NIDDM and severe periodontitis (≥ 2 sites with ≥ 6 mm loss of attachment and at least one site with probing pocket depth of ≥ 5 mm) was evident. Adults with poorly controlled diabetes had a 2.9-fold increased risk of having periodontitis compared to non-diabetic adult subjects after adjustment for age, education, smoking status, and calculus; conversely, well-controlled diabetic subjects had

no significant increase in the risk of periodontitis.

In the cross-sectional study of Torrungruang et al. [21] in 2005 on elderly Thais, diabetes was present in 15.8% of the sample. Diabetes displayed a trend toward increased odds for moderate periodontitis (OR = 1.3; $p = 0.08$), and significantly increased odds for severe periodontitis (OR = 1.6, $p = 0.02$) after adjustment in multinomial logistic regression analysis.

A cross-sectional study [22] investigated behavioral and sociodemographic risk indicators of attachment loss (AL) at baseline in 873 (45+ years) subjects of the Florida Dental Care Study. In a logistic regression model for the outcome of subjects with one or more severe sites of ≥ 7 mm AL, current smokers and diabetics were 1.9 times more likely to have severe AL as compared to non-smokers and non-diabetics. Another cross-sectional survey [23] on 1,342 Pima Indians, a tribe of Native Americans with type 2 diabetes mellitus found that diabetic status was significantly and strongly related to both prevalence and severity of disease after adjusting for the effects of demographic variables and several indices of oral health including the Plaque Index. Subjects with type 2 diabetes had an increased risk of destructive periodontitis with an odds ratio of 2.81 (95% confidence interval 1.91 to 4.13) when attachment loss was used to measure the disease.

Discussion

The aim of the review was to provide knowledge on diabetes as a risk factor for periodontal disease.

Diabetes mellitus and chronic periodontitis are common chronic diseases in adults [24]. The former is a metabolic disorder characterized by hyperglycemia due to the defective secretion or activity of insulin, or both. It can be divided into three types according to signs and symptoms: type 1, type 2, and gestational [1].

Type 1 diabetes mellitus results from the destruction of beta-cells wit-

hin the islets of Langerhans of the pancreas, which leads to complete insulin deficiency, whereas, type 2 ranges from insulin resistance progressively leading to pancreatic beta-cell failure. Lastly, gestational diabetes mellitus is a glucose intolerance that begins during pregnancy [25]. Dysregulation of protein and lipid metabolism also occurs. Susceptible individuals or those with chronic poor metabolic control may experience one or more commonly recognized complication in the eyes, heart, blood vessels, kidney, and nervous system.

Periodontal disease has been cited as the sixth complication of diabetes [25]. Patients with uncontrolled diabetes have a high risk for periodontal diseases. Chronic periodontitis is a potentially progressive bacterial infection resulting in inflammation and destruction of tooth supporting tissues. Severe periodontitis is the main reason of tooth loss in adults and is present in 19 to 32% of the Indian population [3]. Both epidemiological studies and clinical case reports have shown diabetes to be a major risk factor for periodontitis.

The biologic mechanisms important in diabetes affecting periodontal health are likely to be multifactorial. Mechanisms such as micro-angiopathy, alterations in the gingival crevicular fluid, alterations in collagen metabolism, altered host inflammatory response, altered subgingival microflora and genetic predisposition have been proposed as contributory [26].

In this literature review, the evidence on the effects of diabetes on periodontal health was evaluated. Studies were broadly classified by different epidemiological designs; prospective, case-control and cross-sectional studies.

Diabetes is a modifiable factor in the sense that it can be controlled [27]. Studies that have examined the relationship between diabetes and periodontitis are heterogeneous in design and aim. Thus, both positive and negative conclusions have been drawn with respect to the relationship

between the two diseases. Diabetic parameters examined have included glycemic control, duration of disease, and presence of other diabetes-associated complications.

Periodontal parameters examined have included gingival inflammation, pathologic or increased probing depth, loss of periodontal attachment, and/or radiographic evidence of alveolar bone. The studies have also used various parameters to summarize periodontal disease occurrence like prevalence, incidence, extent, severity or progression. Some of the earlier studies showing a relationship between diabetes and periodontal disease were conducted in type 1 diabetes [4].

The duration of DM appears to affect periodontal disease severity. Cross-sectional studies on Pima Indians [28], show an odds ratio of 2.6 for developing periodontal disease in type 2 diabetics compared to non-diabetic patients.

Studies have shown a relationship between poor glycemic control and periodontal disease parameters and suggested a bi-directional relationship between these two entities.

The studies included in this review reported the adverse effects of diabetes on periodontal health; they describe findings of convenience samples, principally from outpatients in hospitals and clinics. They were conducted in distinctly different settings with populations from different ethnicity, different age mixes. These limitations considered, the literature provides consistent evidence of greater prevalence, severity or extent of at least one manifestation of periodontal disease in the large majority of studies.

Conclusion

Variability in research methodology and in studied populations, the small number of subjects participating

in the studies, and the various definitions of diabetes, glycemic control and periodontal disease limit the possibility of comparing studies' results even though the same biases or confounding factors apply in all the studies and provide support for concluding that diabetes is a risk factor for periodontal disease incidence, progression and severity. There is clear evidence from various studies that diabetes is an important risk factor for periodontitis. Poorly controlled diabetic status and higher duration of diabetes appears to influence periodontitis. In the absence of adequate data on the relation or association between diabetes and periodontitis in the Indian population, no comparison can be made.

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