ORIGINAL ARTICLE

Association between diabetes mellitus and periodontal status in north Indian adults

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ABSTRACT

Objective: The aim of the present study was to investigate the prevalence of periodontal diseases among individuals with type I and type II diabetes in north India and evaluate the association of this condition with behavioral and clinical variables. **Materials and Methods:** A cross-sectional study was carried out on a calculated sample of 300 individuals with diabetes. Periodontitis was defined as clinical attachment loss (CAL) >3 mm in two or more non-adjacent teeth or those that exhibited CAL >5 mm in 30.0% of teeth. All subjects were over 30 years of age and underwent a periodontal examination. Behavioral characteristics as well as medical history and dental history were obtained with a structured interview. Discrete (categorical) groups were compared by Chi-square (χ^2) test. A two-tailed (α=2) P<0.05 was considered statistically significant. GraphPad Prism (version 5.0) was used for the analysis. **Results:** A total of 6.7% exhibited a healthy periodontium; 68.0% exhibited gingivitis; and 25.3% exhibited periodontitis. The univariate analysis revealed that periodontitis was statistically more prevalent among men (P=0.001); among participants with type II diabetes (P=0.009); those with more than five years of diabetes (P=0.065); those with tobacco smoking habits (P<0.001); and those who had not visited the dentist in the previous year (P<0.001). **Conclusion:** Multiple determinants are associated with the prevalence of periodontitis among patients with diabetes.

Key words
Diabetes, dental health services, epidemiology, periodontitis

INTRODUCTION

Diabetes is an important public health problem, affecting 245 million people worldwide. Each year, seven million individuals develop diabetes and the projection for the year 2030 expects that 366 million people will have the disease worldwide.[1]

Periodontitis is one of the main oral health problems, which is predominantly a Gram-negative infection resulting in severe inflammation, with potential for vascular dissemination (via the sulcular epithelium) of microorganisms and their products such as Lipopolysaccharides (LPS) throughout the body.[2] The worldwide prevalence of periodontal disease varies from 5 to 20% of the adult population.[3] By far, it is the most common oral infection in India, with a prevalence rate of 66.2% among individuals of age 15 years and about 89.2% among adults in the age group of 35-44 years.[4] The association between diabetes and periodontal diseases has been recognized in dental literature for many years.[5] Periodontitis is considered one of the main, oral health problems encountered in patients with diabetes. With the increase in the incidence of diabetes worldwide, its negative impact on oral health should be considered. Scientific evidence has shown for some time that diabetes is a risk factor for the development of periodontitis. Recent revisions confirm that type 2 diabetes can be considered a risk factor for periodontitis.[6]

The postulated mechanism for the effect of diabetes on periodontal disease is that diabetes-enhanced inflammation and apoptosis specifically affects periodontal tissues. Moreover, the increased severity of periodontal disease in diabetes mellitus may reflect an alteration in the pathogenic potential of bacteria, enhancing the breakdown of periodontal tissues, resulting in more

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frequent and severe periodontal-tissue destruction.[7] Despite advances in recent years, the public healthcare system in India offers limited access to dental services. This problem is also perceived in relation to individuals with diabetes, treatment of whom is not prioritized by the system. The aim of the present study was to investigate the prevalence of periodontal diseases among individuals with type I and type II diabetes in north India and evaluate the association of this condition with behavioral and clinical variables.

MATERIALS AND METHODS

Subjects

The present study was carried out from September to November 2011 in north India. The sample was a total of 300 dentulous male and female individuals, over 30 years of age. Stratified random sampling was performed. No patient refused to participate in our study. Type I diabetes was determined in individuals with a previous medical diagnosis of beta-cell destruction, usually leading to absolute insulin deficiency. Type 2 diabetes was determined in individuals with previous medical diagnosis of diabetes, ranging from predominantly insulin resistance with relative insulin deficiency to predominantly an insulin secretory defect with insulin resistance.

Questionnaire

The self-administered questionnaire included demographic (i.e., age and gender) and smoking status information (i.e., non-smoker, past-smoker and current-smoker).

Medical examination

Subjects undertook a routine medical examination, including a blood chemical analysis for hemoglobin A1c (HbA1c) level. The following criteria were used to diagnose diabetes: 1) HbAlc ≥6.1, 2) use of insulin, or 3) use of hypoglycemic medicines.

Dental examination

Clinical examinations were performed by a single examiner in the dental office, using a reflector for illumination and a triple syringe to dry teeth. Biosafety norms were followed. Periodontal probes (Hu-Friedy®, Chicago, USA), mouth mirrors and gauze were used. All faces of the teeth were examined. The CPI index[8] was used for the periodental assessment, in which the dentition was divided into sextants. The highest CPI code was recorded in each segment (code 0: No signs of periodontal disease, code 1: Gingival bleeding after gentle probing, code 2: Supragingival or subgingival calculus, code 3: 4 to 5 mm deep pathologic pockets, code 4: 6 mm or deeper pathologic pockets and code X: Missing index teeth). Periodontal status was divided into three categories according to the CPI code: 0, 1 and 2, 3 and 4, and X.

The other parameters considered in the diagnosis were: Gingivitis, individuals who exhibited at least one site of bleeding on probing based on the criteria of the American Academy of Periodontology (2000)[9]; and periodontitis, individuals who exhibited clinical attachment loss (CAL) 3 mm in two or more non-adjacent teeth or those who exhibited CAL 5 mm in 30.0% of teeth based on the criteria proposed by Tonetti and Claffey (2005).[10] The oral hygiene condition was visually evaluated by examining all teeth present without using disclosing solution as: 1) good, plaque covering less than one-third of tooth surfaces; 2) fair, plaque covering more than one-third but less than two-thirds of tooth surfaces; and, 3) poor, plaque covering more than two-thirds of tooth surfaces.

Statistical analysis

Discrete (categorical) groups were compared by the Chi-square (χ^2) test. A two-tailed (α=2) P<0.05 was considered statistically significant. GraphPad Prism (version 5.0) was used for the analysis.

RESULTS

The average age of the study population was 55.3 years with a median age of 55 years. Average duration of diabetes was 5.1 years. The sample comprised mostly of women (60.0%).15.3% of the patients were tobacco smokers, 28.7% had type I diabetes and 71.3% had type II diabetes [Table 1].

A total of 6.7% exhibited a healthy periodontium; 68.0% exhibited gingivitis; and 25.3% exhibited periodontitis. The univariate analysis revealed that periodontitis was statistically more prevalent among men (P=0.001); among participants with type II diabetes (P=0.009); those with more than five years of diabetes (P=0.065); those with tobacco smoking habits (P<0.001); and those who had not visited the dentist in the previous year (P<0.001).

DISCUSSION

Periodontitis is the second largest health problem[11] and advanced periodontal disease affects 10 to 15% of the population worldwide.[12] It is the most common oral infection in India, with a prevalence rate of 66.2% among individuals of age 15 years and about 89.2% among adults in the age group of 35-44 years.[4] In the present study, there was a 25.3% prevalence of periodontitis among individuals with diabetes. The results of this study demonstrate that diabetic individuals have a higher prevalence of periodontal disease than individuals without diabetes. Recognition of the mounting evidence on the relationship between oral and systemic health will confront dentists, physicians, and other healthcare workers with the importance of working together. Nowhere is this more important than in the early identification of individuals with undiagnosed diabetes

Table 1: Univariate analysis of the independent variables and risk of periodontitis in north Indian adults

Variables	Absence of periodontitis *n* (%)	Presence of periodontitis *n* (%)	Relative risk 95% CI	*P* value
Gender				
Female	142 (78.9)	38 (21.1)	1.28 (1.09-1.50)	0.001
Male	74 (61.7)	46 (38.3)		
Age				
30-55 yrs	114 (77.0)	34 (23.0)	1.11 (0.96-1.27)	0.153
>55 yrs	106 (69.7)	46 (30.3)		
Diabetes mellitus				
Type 1	54 (62.8)	32 (37.2)	0.81 (0.68-0.97)	0.009
Type 2	166 (77.6)	48 (22.4)		
Duration of diabetes				
≤5 yrs	118 (78.7)	32 (21.3)	1.14 (0.99-1.30)	0.065
>5 yrs	104 (69.3)	46 (30.7)		
Tobacco smoking habits				
Yes	16 (34.8)	30 (65.2)	0.46 (0.30-0.68)	*P*<0.001
No	194 (76.4)	60 (23.6)		
Dental care in previous year				
Yes	77 (70.0)	33 (30.0)	2.02 (1.60-2.54)	*P*<0.001
No	66 (34.7)	124 (65.3)		

and the co-management of oral and overall health in patients with diabetes. There is sufficient evidence of the bidirectional relationship between diabetes and periodontal disease to formulate guidelines for screening undiagnosed diabetes and the co-management of patients with diabetes in the clinical practice of dentistry and dental hygiene. There is also sufficient evidence regarding the role periodontal disease plays in increasing systemic inflammation to suggest that non-dental healthcare providers should screen patients for periodontal disease. For dental and non-dental practitioners who embrace the opportunity to become more actively involved in this important arena of healthcare, this new and exciting level of clinical practice is certain to benefit patients and be professionally rewarding.[13]

In a population of diabetic individuals in a public hospital, Drumond-Santana *et al.* (2007) found a 49.1% prevalence of periodontitis, which is higher than the value found in the present study.[14] The reason may be due to the sample assessed was restricted to a general hospital, which may reflect a lesser proximity to the actual situation of periodontal health of the diabetic population. Other studies have mentioned that individuals with diabetes have higher percentages of deep pockets and severe attachment loss than non-diabetic individuals and individuals with diabetes have a three-fold greater chance of suffering the loss of periodontal support tissue.[12]

In the present study, there was a statistically significant association between periodontitis and gender (*P*=0.001). This corroborates other studies reporting that periodontal problems are more prevalent and more severe among diabetic men. Such a finding implies that public healthcare services need to actively seek changes in clinic hours and other measures that address care for men with diabetes, as males seek health services less often than women.[15]

There was no statistically significant association between the time from which the patient was diagnosed with diabetes and the presence of periodontitis (*P*=0.065). Some studies have found a relationship between the duration of diabetes and periodontal conditions, whereas others have reported no differences when comparing the duration of diabetes with the periodontal parameters of bleeding, probing depth, and clinical attachment loss.[16]

According to the World Health Organization (2007),[3] tobacco smoking is a risk factor for the development of periodontal disease. In the present study, tobacco smoking was associated with periodontitis (*P*<0.001). This finding corroborates studies that have found that tobacco modifies clinical gingival characteristics and is considered a risk factor for periodontal disease.[9] It has also been reported that individuals with diabetes who smoke are 1.71 times more likely to exhibit periodontal disease than those who do not smoke.[14]

In the present study, there was a statistically significant association between periodontitis and those who had not visited the dentist in the previous year (*P*<0.001). Dental care for individuals with diabetes is deficient in India, as access to dental services in the country is limited to a portion of the population and there are no priorities for any special groups. It is estimated that 40% Indians have never been to a dental office, despite the fact that the country has one of the highest numbers of dentists in the world. The Indian public healthcare system is an organization of considerable importance from the standpoint of access to dental services, but still plays a proportionately small role when considering the oral health needs of the Indian population.

CONCLUSION

The results of the present study indicate a high prevalence of gingivitis (68.0%) and periodontitis (25.3%) among individuals with diabetes, who utilize public health services in the north India. This prevalence was much higher than that found in the Indian population without diabetes as well as higher than the one found in other studies investigating the prevalence of periodontitis in diabetic populations. Multiple determinants, such as clinical and behavioral factors, are associated to the prevalence of periodontitis among patients with diabetes. Public healthcare strategies are needed in order to broaden access to oral health care services in India and to integrate healthcare professionals regarding care for individuals with diabetes.

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