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Relationship between periodontal status and selected clinical characteristics in type 2 diabetic patients

Dr. Dalia Kudier Abbas.∗

Abstract

Diabetes mellitus (DM) is a systemic disease with several major complications. One of the important complications of diabetes mellitus is periodontal disease. The risk for this complication is not equal in all DM patients and thus some factors may increase its severity.

To study the relationship between selected clinical characteristics and periodontal disease in type 2 (DM) patients.

Two hundred and four type 2 diabetic patients were enrolled in this study; their ages were (28-71) years. The clinical characteristics included age, sex, body mass index (BMI), duration of (DM), smoking, and history of important diseases that complicate (DM) including hypertension, coronary heart disease, and arthritis. Periodontal status was evaluated by periodontal disease index (PDI) which included plaque, calculus, and periodontal components of this index. The means of plaque, calculus, and periodontal disease index were compared between patients who were grouped according to the presence or absence of the selected clinical characteristics.

There was a significant difference in mean value of calculus index between hypertensive and non hypertensive patients (0.56 ± 0.53 vs. 0.72 ± 0.43, $P< 0.05$). Also there was a significant difference in periodontal disease index between hypertensive diabetic patient compared to diabetic patients who had no hypertension (3.84 ± 0.75 vs. 3.2 ± 0.99, $P<0.001$).

Analysis of correlation showed that the correlations between plaque index and both calculus index and periodontal disease index were highly significant ($P<0.001$). The correlation was positive and highly significant between PDI and age ($P<0.001$) while it was significant between PDI and duration of DM ($P < 0.05$).

Hypertension seems to have a role in aggravating periodontitis in type 2 DM particularly with increasing age and duration of disease. Preventive periodontal disease programs should take in consideration presence of hypertension in type 2 DM.

Key words: Diabetes mellitus, Clinical characteristics, Periodontal disease.

Introduction

Diabetes mellitus (DM) is a systemic disease with several major complications affecting both the quality and length of life. There are two major forms of diabetes, Type 1 diabetes, occurs when the beta cells of the pancreas are damaged, and insufficient amounts of insulin are produced and Type 2 diabetes, is caused by resistance to insulin combined with a failure to produce enough additional insulin to

∗Department of Pedodontics, Orthodontics and Preventive dentistry, College of Dentistry /Al-Mustansiriya University

compensate for the insulin resistance [1].Diabetes mellitus is associated pathologically with microvascular and macrovascular complications as well as various other complications such as an increased susceptibility to infection. The microvascular complications of diabetes include retinopathy, nephropathy and neuropathy. Macrovascular complications include cardiovascular, peripheral vascular and cerebrovascular disease as well as hypertension and plasma lipid disorders [2].

The complications of diabetes are related to long-term elevation of blood glucose concentrations (hyperglycemia), which will results in the formation of advanced glycation end-products (AGEs). Accumulation of AGEs in the plasma and tissues of diabetic patients has been linked to these complications [3].

One of the important complications of diabetes mellitus is periodontitis [4]. Periodontal disease is a chronic inflammatory disease of the tissues that support and attach the teeth to the jaws [5]. It is the second main cause of oral cavity disorders affecting the population [6]. A number of studies found a higher prevalence of periodontal disease among diabetic patients than among healthy controls [7,8,9,10]. Other studies have shown that this risk is not equal in all patients with diabetes and some other factors may increase the severity of this disease [11].

Many studies have found that severe forms of periodontitis are associated with hypertension [12,13] and some dental professionals have speculated that people with arthritis or coronary heart disease (CHD) have more periodontal disease [14,15]. Such diseases are associated with type 2 DM. We hypothesize that clinical characteristics of type 2 diabetic patients may include aggravating factors for periodontal disease.

Materials and Methods

This study was conducted in the national center of diabetes – University of Al –Mustansiriya, Baghdad-Iraq in the period from December 2008 to February 2009.

Two hundred and four (105 males and 99 females) type 2 diabetic patients were enrolled in this study. Their ages were (28-71) years.

Medical examination: An extensive medical history was taken with the help of a printed questionnaire and by personal interviewing for about 20-30 minutes. All clinical measurements were performed by the same examiner. The following clinical characteristics were reported:
1- Sex and age
2- Weight and height to calculate body mass index (BMI)
3- Duration of diabetes mellitus (DM)
4- Smoking
5- History of some diseases which are commonly associated with DM including hypertension, coronary heart disease, and arthritis.

Dental examination: Dental measurements were performed by a single experienced examiner (the examiner passed both inter - and intraexaminer calibrations). Periodontal status was assessed using periodontal disease index according to Sigurd P. and Ramfjord 1959 including plaque, calculus, and periodontal component of the index [16].

Teeth examined: maxillary right first molar, maxillary left central, maxillary left first bicuspid, mandibular left first molar, mandibular right central, mandibular right first bicuspid, If any of the teeth are missing or unerupted, then only the teeth present are examined. The patients enrolled in this study had to have up to eleven teeth.

Statistical analysis:

Data was presented in simple statistical measures of number, percentage, rang, mean and standard deviation.

The following statistical analyses were done: Student's t- test for the significance of differences of the quantitative data and simple linear correlation determination of the correlation between two quantitative data in the different groups. A probability value (P< 0.05) was considered statistically significant.

Results

The patients recruited in this study had diabetes mellitus for duration of (1-25) years. The means of plaque, calculus, and periodontal disease index were 1.68±0.54, 0.65±0.50, and 3.61±0.89 respectively (Table 1).

The means of plaque, calculus, and periodontal disease index were compared between patients who were grouped according to the presence or absence of the selected clinical characteristics: (Table 2)

1- Smoking: The means of plaque, calculus, and periodontal disease index for smoker diabetic patients were (1.57±0.57, 0.73±0.53, and 3.48±1.14 respectively) while for non-smokers were (1.7±0.5, 0.63±0.50, and 3.64±0.84 respectively). No significant difference was detected between the two groups (Table2).

2- Hypertension: The means for hypertensive versus non-hypertensive's diabetic patients were (1.69±0.56, 0.56±0.53, and 3.84±0.75 vs. 1.69±0.51, 0.72±0.43, and 3.2±0.99 respectively). There was a significant difference in calculus index between hypertensive and non hypertensive patients (P< 0.05). Also there was a significant difference in periodontal disease index between hypertensive diabetic

patient compared to diabetic patients who had no hypertension (P<0.001).

3- Coronary heart disease (CHD): No significant difference between the means were detected between CHD versus no-CHD diabetic patients (1.78±0.57, 0.70±0.63, and 3.54±0.84 vs. 0.62±0.52, 1.07±0.66, and 3.66±0.97 respectively)

4- Arthritis: No significant difference between the means was detected between arthritis versus no-arthritis diabetic patients (1.7±0.6, 0.61±0.52, and 3.72±0.97 vs. 1.68±0.51, 0.66±0.50, and 3.56±0.84 respectively).

Analysis of correlation showed that the correlations between plaque index and both calculus index and periodontal disease index were highly significant (P<0.001) (Table 3). Also calculus index was of highly significant correlation with periodontal index (P<0.001). On the other hand, the number of teeth had a significant inverse significant correlation with periodontal disease index in type 2 diabetic patients (Table 3).

Correlations between periodontal disease index and age, duration of DM and BMI were also studied (Table 4).The correlation was positive and highly significant between PDI and age (P<0.001) while it was significant between PDI and duration of DM (P < 0.05). On the other hand the PDI was inversely and significantly correlated with BMI (P<0.05) (Table 4).

Discussion

Years of research have established a number of mechanisms by which diabetes can influence the periodontium. Many of these mechanisms share common features with those involved in classical complications of diabetes including microvascular complications such as

nephropathy and macrovascular complications such as hypertension [2].

Research initially focused on infective aspects of periodontal disease and the possible differences in the subgingival microbial flora of patients with and without diabetes. The inflammatory cells in periodontal disease have also been emphasized on in these researches. The function of neutrophils, monocytes and macrophages has been found to be altered in many people with diabetes. The adherence, chemotaxis and phagocytosis of neutrophils are often impaired [17].These cells are the first line of host defense, and inhibition of their function may prevent destruction of bacteria in the periodontal pocket, thereby increasing periodontal destruction.

The present study found that hypertension was associated with increased periodontal disease index in type 2 DM. Hypertension has been reported to be associated with severe periodontitis [12,13] so type 2 DM and hypertension may act synergistically to increase the severity of periodontitis. Antihypertensive drugs such as beta blockers and diuretics have been previously observed to decrease calculus formation [18] so this may explain the significant decrease of calculus index between our hypertensive and non hypertensive diabetic patients.

Although smoking, CHD and arthritis have also been reported to be associated with periodontitis [19,14,15], we found no additive or aggravating effect for them in type 2 DM in particular.

Our finding of highly significant correlations (P<0.001) between plaque index, calculus index and periodontal disease index is consistence with the fact that calculus is the last stage in the maturation of dental plaque and that periodontal disease is a dental plaque-induced disease [18,20].

The present study provided evidence for a significant correlation between periodontal disease index and both the age and duration of DM. Such correlations have been described in other studies [21]. On the other hand, our study detected an inverse correlation between BMI and PDI. Such an inverse relation has been detected in severe forms of periodontitis [22] and many of our diabetic patients have severe periodontitis that may explain such inverse correlation.

In conclusion hypertension seems to have a role in aggravating periodontitis in type 2 DM particularly with increasing age and duration of disease. Preventive periodontal disease programs should take consideration of hypertension in type 2 diabetics.

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Table 1: Clinical and dental characteristics and periodontal status of type 2 diabetic patients

Characteristic		Mean ± SD
Sex (N=204)	Male (N=105) Female (N=99)	
Age (28-71) years		54.72 ± 10.26
Duration of DM (1-25)year		8.55 ± 7.07
Body mass index (BMI)		31.28±5.92
Number of teeth (11-28)teeth		21.11 ± 10.24
Plaque Index (PI)		1.68 ± 0.54
Calculus Index (CI)		0.65 ± 0.50
Periodontal disease Index (PDI)		3.61 ± 0.89

N : number
SD: standard deviation

Table 2: Periodontal status of type 2 diabetic patients according to presence or absence of a selected clinical characteristic

Clinical characteristic (N=204)		Number (Percent %)	Plaque Index (PI) (Mean±SD)	Calculus Index (CI) (Mean±SD)	Periodontal disease Index (PDI) (Mean±SD)
Smoker (N= 204)	Positive	30(14.7)	1.57±0.57 NS	0.73±0.53 NS	3.48±1.14 NS
	Negative	174(85.3)	1.7±0.53	0.63±0.50	3.64±0.84
Hypertension (N= 202)	Positive	133(65.2)	1.69±0.56 NS	0.56±0.53 P<0.05	3.84±0.75 P<0.001
	Negative	69 (34.8)	1.69±0.51	0.72±0.43	3.2±0.99
Coronary heart disease (N=201)	Positive	54(26.9)	1.78±0.57 NS	0.70±0.63 NS	3.54±0.84 NS
	Negative	147(73.1)	1.64±0.53	0.62±0.52	3.66±0.97
Arthritis (N=204)	Positive	69 (33.8)	1.7±0.6 NS	0.61±0.52 NS	3.72±0.97 NS
	Negative	135(66.2)	1.68±0.51	0.66± 0.50	3.56±0.84

N : number
SD: standard deviation
NS: non significant
P<0.05: significant
P<0.01: highly significant

Table 3: Correlations between plaque index, calculus index, periodontal disease index and number of teeth in type 2 diabetic patients

	Calculus Index (CI)	Periodontal disease Index (PDI)	Number of teeth
Plaque Index (PI)	r = 0.248 P<0.001	r = 0.191 P<0.001	r = -0.057 NS
Calculus Index (CI)		r = 0.302 P<0.001	r = 0.003 NS
Periodontal disease Index (PDI)			r = -0.232 P<0.001

NS   : non significant
P<0.01 : highly significant

Table 4: Correlations between periodontal disease index and some clinical characteristics of type 2 diabetic patients

	Age	Duration of DM	BMI
Periodontal disease Index (PDI)	r = 0.373 P<0.001	r = 0.163 P<0.05	r = -0.144 P<0.05
Age		r = 0.427 P<0.001	r = -0.020 NS
Duration of DM	.		r = -0.054 NS

NS   : non significant
P<0.05: significant
P<0.01: highly significant