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Periodontal treatment needs of diabetic adults

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Abstract

Aim: The aim of this study was to investigate diabetes-related factors in relation to periodontal treatment needs.

Material and Methods: A cross-sectional study was conducted among 299 dentate diabetics attending a diabetic clinic in Tehran, Iran. A self-administered questionnaire was administered during a dental appointment in order to gather information about year of birth, year of onset of diabetes, education and organ complications related to diabetes. Number of teeth, the Community Periodontal Index of Treatment Needs and visible plaque were recorded.

Results: None of the subjects had a healthy periodontium. Shallow periodontal pockets were the most prevalent finding. Periodontal pockets exceeding 5 mm and a higher number of missing teeth were associated with a low level of education. The sum of plaque scores [odds ratio (OR) = 1.3; 95% confidence interval (CI) 1.1–1.5] was related to the presence of deepened pockets when controlling for other factors. Among diabetes-related factors, the only significant association with CPITN $\geqslant 3$ was by HbA1c (OR = 0.7; 95% CI 0.6–0.9); for CPITN = 4, no associations with the diabetes-related factors appeared.

Conclusions: The poor periodontal status of our diabetic patients indicates a need to establish a comprehensive oral health promotion programme for diabetics based on collaboration between dental and general health care professionals involved in diabetic care.

Key words: dental plaque; diabetes; periodontal disease; treatment needs

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Diabetes Mellitus (DM) is a chronic metabolic disorder that currently affects more than 100 million people worldwide. This number is expected to treble by the year 2025 (Alberti & Zimmet 1998), when, according to an estimate, its prevalence in Iran will be 6.8% (King et al. 1998), affecting approximately 5.1 million Iranians (Larijani 2003).

The prevalence of DM and impaired glucose tolerance (IGT) in Tehran among adults above 30 years of age is 7.2% and 7.3%, respectively (Delavari et al. 2004). Owing to population shifts from rural areas to big cities, and – at the same time – changes in life style in general, it can be estimated that the number of diabetics is rapidly increasing. The prevalence of DM in urban areas is two times higher than in rural areas (Delavari et al. 2004).

DM is a systemic disease with several complications affecting both the quality and length of life. Periodontal disease is one of the major oral health problems encountered in patients with DM (Page & Beck 1997, Guneri et al. 2004). While periodontitis may impair the metabolic control and adequate treatment of diabetic patients, the treatment of periodontitis improves glycaemic control (Stewart et al. 2001, Rodrigues et al. 2003, Pucher & Stewart 2004) and has been shown to have a positive effect on the management of diabetes (Mealey & Rethman 2003).

There are no published data available on the prevalence of periodontal disease in adult diabetic patients in Iran. The present study was carried out in Tehran, Iran, to fill this gap and to increase the understanding of the role of DM in relation to periodontal health.

Material and Methods

The subjects consisted of patients with diabetes, who were regularly attending a diabetic clinic in Tehran that is associated with the Iranian Diabetic Association. The clinic caters to 6000 patients, treating on average 30 patients daily. The survey was conducted during a two-month period (May–July) in 2005. The study group was selected from a daily roster of patients, in a consecutive manner to include about 300 subjects, who were currently attending the clinic and who had volunteered to participate in the survey.

The criteria for inclusion were being at least 25 years of age and having at least one tooth. The subjects were called by telephone and invited to a dental clinic near the diabetic clinic. Twenty-two patients did not agree to participate in this study and another 50 who had agreed to participate did not attend the dental appointment, yielding a study group of 299 subjects. The most frequently mentioned reasons for missing appointments were forgetting the date and lack of time.

Information related to individual characteristics and medical history, including type of diabetes and the latest value for glycosylated haemoglobin level (HbA1c), was obtained from patient records.

A self-administered questionnaire was distributed to the patients during their dental appointment in order to obtain information about birth year, year of onset of diabetes, education and complications related to diabetes (such as nephropathy, neuropathy, retinopathy cardiovascular disease and numbness in feet). Illiterate subjects ($n = 15$) were interviewed by a secretary who assisted them in filling in the questionnaire.

The subjects were divided into three groups according to their level of education. A university degree represented a high level and a high school diploma a medium level of education. All the others were determined to have a low level of education.

The dental examination was carried out by one examiner (S. B.) in a dental clinic. Periodontal treatment needs were assessed using the Community Periodontal Index of Treatment Needs (CPITN; WHO 1984). Individual CPITN was made for each sextant containing at least two functional teeth, excluding third molars, according to the highest CPITN score. The presence of dental plaque on four surfaces of the six index teeth (upper right first molar, upper right central incisor, upper left first molar, lower left first molar, lower left central incisor and lower right first molar) was measured (Silness & Löe 1964) and recorded by tooth according to its highest plaque index (PI) score. A subject's oral cleanliness was described as the sum of the six tooth-based PI scores. The number of teeth was recorded for each subject according to the WHO criteria.

For data analysis, the variables were categorized as follows: diabetic types 1 or 2 (other type excluded), presence or absence of complications, age being under 45, 45–54 and 55 and more and the duration of disease: under 7, 7–12 and 13 years and more. Diabetic control level was determined to be good if the HbA1c value was less than 7.6%, moderate between 7.6% and 8.5% and above 8.5% as poor.

Basic statistical analyses were performed by the χ^2 test. Further analyses on the presence of deepened periodontal pockets were performed by means of a logistic regression model for definition of odds ratios (OR) and their 95% confidence intervals (95% CI).

Results

The mean age of the study population was 49 years (SD 7.6, range 25–69), and the mean duration of diabetes was 9.6 years (SD 6.6, range 1–44 years).

The subjects averaged 23.1 teeth. Dental plaque was found in all subjects; 66% had plaque on all of the six index teeth. The mean number of sextants with a PI score of 0 was 0.5; 91% of women and 82% of men ($p = 0.03$) had a score of 2 of PI. The sum of PI scores ranged from 1 to 12, and the mean was 7.6 (SD 2.3), with no gender difference.

None of the subjects had a healthy periodontium, 52% had shallow periodontal pockets (CPITN = 3) and 35% had deep periodontal pockets (CPITN = 4). No gender difference was observed. Of all subjects, 27% had sextants with less than two functional teeth. The proportion of subjects with one sextant with less than two functional teeth was 14%.

The general periodontal health of the subjects was poor. Figure 1 shows the distribution of individual CPITN scores in functional sextants by gender, age, education and complications related to diabetes. A statistically significant difference was observed between individual scores of CPITN = 4 and level of education, and between duration of disease and individual scores CPITN $\geqslant 3$ (Table 1). Periodontium in the maxillary anterior teeth was prevalently healthy and dental calculus was found most often in the lower anterior region. Among those who had sextants with less than two functional teeth, periodontal pockets 6 mm or deeper were statistically significantly more abundant (48% *versus* 31%, $p = 0.005$). Figure 2 shows the percentage of CPITN scores and sextants with less than two functional teeth separately for each sextant. Deepened periodontal pockets (CPI $\geqslant 3$) occurred more frequently among those with a PI score 2 (89% *versus* 71%; $p = 0.003$).

In order to determine relationships between the presence of deepened periodontal pockets and subject's background, dental findings and diabetes-related factors, similar logistic regression models were fitted to the data to explain separately the conditions of CPITN = 4 and CPITN $\geqslant 3$. In both models (Table 2), the strength of the sum of plaque scores (OR = 1.3; 95% CI 1.1, 1.5) was highly significant for the presence of deepened periodontal

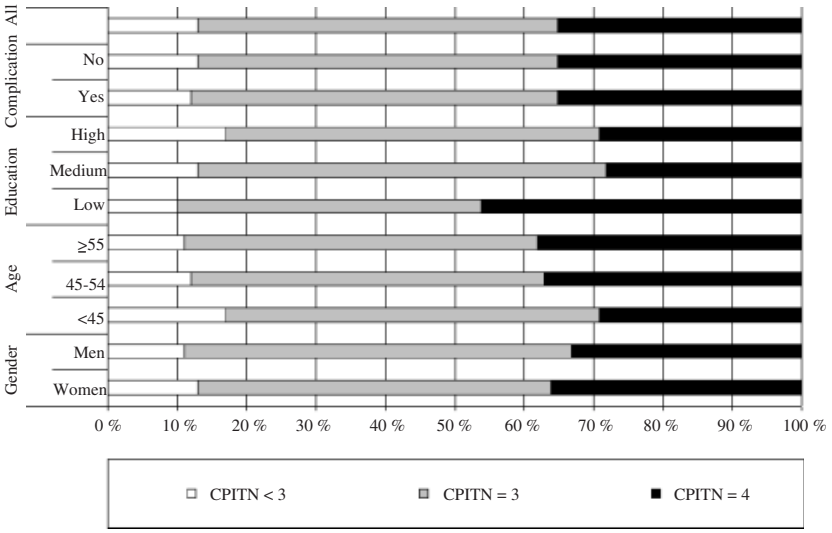

Fig. 1. Distribution of individual Community Periodontal Index of Treatment Needs (CPITN) scores among diabetic adults ($n = 299$) by gender, age, education and complications related to diabetes.

Table 1. Percentages of diabetic adults ($n = 299$) having their highest CPITN score of 4 and $\geqslant 3$, according to gender, age, level of education and diabetes-related factors

	n	CPITN 4		CPITN $\geqslant 3$	
		%	*p*	%	*p*
Gender			0.626		0.580
Female	217	36		87	
Male	82	33		89	
Age			0.474		0.500
<45 years	78	30		83	
45–54 years	147	37		88	
55+ years	74	38		89	
Education			0.008		0.332
Low	119	46		90	
Medium	122	28		87	
High	55	29		82	
Diabetic type			0.879		0.464
Type 1	50	36		84	
Type 2	238	35		88	
Other (excluded)	11				
Duration of disease			0.391		0.022
<7 years	121	40		84	
7–12 years	92	33		94	
13+ years	86	31		84	
HbA1c value			0.342		0.022
<7.6	160	37		92	
7.6–8.5	62	27		81	
8.6+	65	39		83	
Missing data	12				
Complication			0.911		0.851
No	161	35		87	
Yes	138	35		88	

Statistical evaluation was performed using the χ^2 test.
CPITN, Community Periodontal Index of Treatment Needs

pockets when controlling for all other factors in the model. Diabetes-related factors played a non-significant role in explaining the presence of deepened periodontal pockets, except for HbA1c, which showed a negative association with CPITN $\geqslant 3$.

Discussion

Three broad strategies for the prevention of periodontal disease have been advocated (i) a population strategy, (ii) a secondary prevention strategy and (iii) identification of high-risk groups for periodontitis (Sheiham 1991). If the goal is to identify high-risk groups, early detection of active disease and identification of subjects and groups who are more likely to develop destructive periodontal diseases in the future are important elements of any dental care system. This applies particularity to high-risk groups, such as adult diabetics.

The constant need of diabetics of regular intake of nutrition to maintain good blood glucose control facilitates growth of dental plaque, and, thus, the development of oral plaque derived diseases. The strength of the dental plaque sum index score in explaining the presence of periodontal disease observed in the present study emphasizes the necessity of oral hygiene counselling in diabetics.

The CPITN recordings have been applied in several studies worldwide (Pilot & Barmes 1987, Schürch et al. 1988, Österberg et al. 1995, Bourgeois et al. 1997) as it has been widely recommended (WHO 1997, Petersen & Ogawa 2005) to increase international uniformity. The CPITN is designed for rapid and practical assessment of various periodontal treatment needs in population surveys (Ainamo et al. 1982). The advantages of CPITN include simplicity, speed and reproducibility (Pilot & Miyazaki 1994, Petersen & Ogawa 2005). Also, the time needed to provide periodontal care can be estimated when using this index, which is the reference index for the WHO Global Oral Data Bank. Standard recordings do not include direct measures of tissue destruction, which has been considered a limitation of CPITN (Pilot & Barmes 1987, Baelum & Papapanou 1996).

Our subjects were residents of Tehran representing different levels of education and social background. The distribution of educational level of the study subjects is generally representative of the corresponding national data. There were few illiterate subjects (5%) in the present study, compared with the

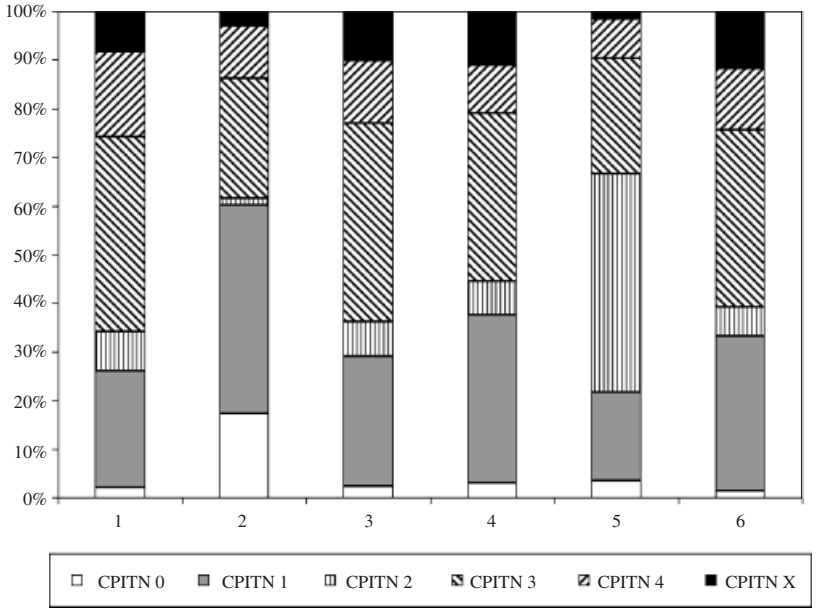

Fig. 2. Distribution (%) of Community Periodontal Index of Treatment Needs (CPITN) scores by sextant among diabetic adults ($n = 299$). Sextants with less than two functional teeth are indicated with CPITN X. 1, Upper right sextant; 2, Upper central sextant; 3, Upper left sextant; 4, Lower left sextant; 5, Lower central sextant; 6, Lower right sextant.

Table 2. Odds ratios among diabetic adults ($n = 299$) for having deepened periodontal pockets (CPITN 4 and CPITN $\geqslant 3$), as explained by their background information, dental findings and diabetes-related factors, by means of a logistic regression model

Factors included	Estimate of strength		Odds ratio and its 95% confidence interval		
	Estimate	SE	OR	95% CI	*p*-value
Model for CPITN = 4 ($p > 0.10$)					
Gender: 1 = female, 2 = male	0.054	0.330	1.0	0.5, 2.0	0.88
Age in year	0.011	0.020	1.0	0.9, 1.0	0.56
Level of education	−0.175	0.164	0.8	0.6, 1.1	0.29
Number of teeth	−0.139	0.037	0.8	0.8, 0.9	0.000
Sum of plaque scores	0.260	0.066	1.2	1.1, 1.5	0.000
Type of diabetes: 1 = Type 1, 2 = Type 2	−0.149	0.377	0.8	0.4, 1.8	0.69
Duration of disease (years)	−0.026	0.023	0.9	0.9, 1.0	0.26
HbA1c value	−0.007	0.075	0.9	0.8, 1.1	0.93
Number of complications	0.077	0.138	1.0	0.8, 1.4	0.58
Constant term	0.909	1.57			
Model for CPITN $\geqslant 3$ ($p > 0.10$)					
Gender: 1 = female, 2 = male	0.732	0.518	2.1	0.8, 5.7	0.16
Age in year	0.036	0.300	1.0	1.0, 1.1	0.23
Level of education	−0.492	0.243	0.6	0.4, 0.9	0.04
Number of teeth	−0.051	0.052	0.9	0.8, 1.0	0.32
Sum of plaque scores	0.268	0.097	1.3	1.1, 1.6	0.006
Type of diabetes: 1 = Type 1, 2 = Type 2	−0.052	0.535	0.9	0.3, 2.7	0.92
Duration of disease (year)	−0.011	0.033	0.9	0.9, 1.0	0.74
HbA1c value	−0.292	0.101	0.7	0.6, 0.9	0.004
Number of complications	−0.285	0.191	0.8	0.5, 1.1	0.14
Constant term	2.699	2.259			

CPITN, Community Periodontal Index of Treatment Needs; CI, Confidence Interval; OR, odds ratio

national illiteracy rate of 20% (Statistical Center of Iran 2002). This discrepancy may be explained by the fact that Tehran, being the capital city, offers better education opportunities for its inhabitants. Illiteracy itself has a negative effect on all efforts to promote health care and should be tackled accordingly.

As selection of representative groups of patients in a large city poses difficulties, a disease-based approach was chosen. An established clinic associated with the Iranian Diabetic Association and having a total number of 6000 patients was chosen so as to enhance proper geographical distribution of the subjects. Apparently, women tend to attend their appointments at the diabetic clinic more regularly than men, which resulted in a higher proportion of women in the study group. However, no gender difference was observed in the oral health indices of our subjects.

The clinical examination and measurements were performed by one examiner (S. B.), who was trained by a periodontist before collecting the clinical data. Owing to the natural history of periodontal disease, only individuals aged 25 years and older were included in this study.

The rate of individual CPITN = 3 (52%) and CPITN = 4 (30%) scores among 35–44-year-olds observed for diabetics in the present study was higher when compared with the values published for the whole population in the Iranian Adults Oral Health survey: 42.4% and 10.3%, respectively (Pakshir 2004). This difference support previous findings that diabetics are more susceptible to periodontal disease than are the non-diabetics (Bacic et al. 1988, Page & Beck 1997, Almas et al. 2001, Karikoski et al. 2002, Guneri et al. 2004).

In accordance with the findings of Bacic et al. (1988), no differences with regard to CPITN scores were found between the types 1 and 2 diabetic patients, and no relationship was found between the duration of diabetes and severity of periodontal disease. Neither was any relationship found between complications related to diabetes and periodontal pockets 4 mm or deeper, which is in agreement with the findings of Karikoski et al. (2002), but contrary to a report by Thorstensson et al. (1996) of an association between some complications related to diabetes, such as renal disease, cardiovascular complication and severe periodontitis. Karjalainen et al. (1994) have shown that severity of periodontal disease (pocket depth more than 4 mm) increases with severity of organ complications, especially severity of retinopathy. In contrast to the findings of Tervonen & Oliver (1993) and Karikoski et al. (2002), our study revealed a statistically significant association between HbA1c level less than 7.6 and the individual scores of CPITN $\geqslant 3$, but not for CPITN = 4. This may indicate that poor diabetic control does not affect periodontal disease severity. However, differences in classification of HbA1c values used in earlier studies do not allow drawing detailed conclusion on this issue.

The presence of dental plaque instead was a significant factor to explain the presence of deepened pockets, regarding both scores CPITN $\geqslant 3$ and CPITN = 4, which is in contrast to the findings of Karikoski et al. (2002).

In the present study, a smaller number of missing teeth was observed than what is reported for the whole population of Iran (Pakshir 2004). This finding conflicts with the report of Lagervall et al. (2003) that a small number of remaining teeth is significantly and positively correlated to the presence of diabetes. This discrepancy may be due to the tendency of our subjects to attend to their general and oral health more carefully, as indicated by their regular attendance at the diabetic clinic. On the other hand, the severity of periodontitis in the present study population indicates insufficient professional periodontal care. There seems to be a discrepancy between the supply of and demand for dental care (Buckley 1993). In addition, lack of awareness of periodontal disease among diabetic patients and insufficient accessibility of periodontal treatment may be other reasons for the poor periodontal health of our patients.

The periodontal health of our diabetic subjects reinforces the need to establish a comprehensive oral health promotion programme for diabetic patients. More cooperation is needed between those involved in general health and dental care of diabetics, with emphasis on increasing the understanding of the relationship between diabetes and oral health, particularly periodontal disease.

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Clinical Relevance

Scientific rationale for the study: Diabetic control has been suggested to be associated with oral health. Periodontal disease is a major oral health challenge encountered in diabetic patients. Adults with diabetes have both a higher prevalence of periodontal disease and a more severe form of the disease.

Principal findings: The present study revealed poor periodontal health among diabetic adults.

Practical implications: Diagnostics of periodontal diseases often fail to receive enough importance from dentists because of lack of subjective symptoms among patients, often resulting in treatment of subjective symptoms only. Enhancing adequate diabetic control through maintenance of periodontal health requires both the patients' awareness of the necessity of good oral hygiene as well as the dentists' awareness of the significance of careful diagnosis and treatment.