INTRODUCTION

Pakistan, Hong Kong and Singapore are among the countries with the highest prevalence of diabetes in the adult population. Worldwide adult diabetes prevalence was 4.0% in 1995 and is expected to increase up to 5.4% by the year 2025. In Pakistan the prevalence of diabetes mellitus (DM) was 5.2 million people in 2000, and the number is estimated to increase to 13.9 million by the year 2030.

Diabetes is one of the main causes of periodontitis, and is now considered the sixth complication of diabetes microvasculopathy. Poorly controlled diabetes and the accumulation of advanced glycation end products (AGEs) in the gingival tissue of the diabetics are thought to be the primary cause for oral and other complications of diabetes.

Pathogenesis of periodontal disease is complex because it is the combination of the initiation and maintenance of the chronic inflammatory process by a diverse microbial flora, leads to the destruction of tissue. People who do not maintain good oral hygiene or good metabolic control of their diabetes are more prone to get periodontitis; those who are of old age, with diabetes of long duration, or with other complications.

Patients with diabetes are likely to have more severe periodontitis in terms of average plaque index (PI), average gingival index (GI), and clinical attachment loss, but exhibit the same extent of periodontal disease. These long-term consequences of diabetes have been widely studied in recent years, and this has led to improvements in the prevention and therapy, thus giving diabetic patients a better quality of life.

Chronic inflammatory mediators and metabolic imbalances in the tissues cause the immune system of diabetics to be compromised that can lead to infections and thus causes the initiation, maintenance and progression of periodontal disease. It is difficult to conclude the relationship between metabolic control of diabetics and periodontal manifestations. Adults with uncontrolled diabetes had 2.9 fold increased risk of having periodontal problems compared to non-diabetic adult subjects; on the other hand, good glycemic control had no significant increase in the risk of periodontitis. For type-1 DM a cross-sectional study was conducted, for a mean duration of over 16 years, on subjects with poor metabolic control of diabetes had more interproximal attachment loss and bone loss than well-controlled subjects.

Another recent study in Pakistan regarding oral health knowledge, attitudes, practices and sources of information for diabetic patients revealed lack of knowledge and care about relationship of diabetes with oral health.

ABSTRACT

Objective: To assess the association between glycemic control and the periodontal status of an urban population with poor oral hygiene.

Study Design: Cross-sectional study.

Place and Duration of Study: Memon Dental Care Centre and Memon Diabetic and Diagnostic Centre, Karachi, from July to December 2010.

Methodology: One hundred and forty-one individuals with controlled diabetes and 143 with uncontrolled diabetes were recruited from the dental clinic. All underwent clinical examination and grades on plaque index, gingival index, periodontal index and calculus index were recorded and compared.

Results: The group with uncontrolled diabetes included 56 males (38.9%) and 88 females (61.1%), and the controlled diabetic group included 49 males (34.8%) and 92 females (65.2%). Periodontal index, gingival index and plaque index showed significant differences in both the groups (p-value < 0.016, < 0.001, < 0.002, respectively) while the difference of calculus was not significant i.e. 0.056. The mean number of teeth present in both the groups was 22. Most of the subjects cleaned their teeth once daily with the help of tooth brush, while the patients brushing twice daily were 16%.

Conclusion: Uncontrolled diabetes had significantly severe impact on periodontal status in the studied groups with poor oral hygiene; diabetic patients have more number of missing teeth, and more plaque.

complications. Oral hygiene measures were found to be very poor; with only 2% brushing three times a day and 22% brushed twice daily.\textsuperscript{9}

The aim of the present study was to test the hypothesis that uncontrolled diabetes has a highly negative influence on periodontium as compared to controlled glycemic control of diabetes.

**METHODOLOGY**

This was a cross-sectional study, done in Karachi, Pakistan. The study population was selected from the Memon Dental Care Centre and included people of 25-65 years of age group. A total of n=284 diabetic patients were included (controlled DM n=141, uncontrolled DM n=143). According to the study done for 2,273 Pima Indians, the age- and gender-adjusted prevalence of periodontal disease was 60% in type-2 diabetic patients and at the first examination in non-diabetics was 36%.\textsuperscript{10} In the same way, the rate of periodontal disease in subjects with diabetes was 2.6 times (5%, CI 1.0 - 6.6, controlled for age and gender) higher that in those without diabetes.\textsuperscript{10} The sample size of 300 was determined by the references of study mentioned above, with the help of Epi Info software. To reach this sample size, Memon Dental Care Centre and Memon Diabetic and Diagnostic centre was chosen, 4 diabetic patients were recruited each day for 6 months (July - December 2010) by simple random sampling method and 284 subjects were selected. The Proforma was used to recruit the study subjects, including demographic characteristics, brushing habits, medical history, drug history and current status of periodontium on the basis of indices i.e. gingival index, periodontal index, plaque index and calculus index. Included patients were type-2 DM patients since ≥ 5 years and who were on drug treatment for diabetes, aged ≥ 25 years and who were dentate persons with ≥ 6 remaining teeth, excluding third molars. DM was diagnosed according to the American Diabetes Association recommendations, 2002.\textsuperscript{11} The diagnosis of type-2 diabetes was confirmed by a recent blood glucose analysis (HbA1c) from a recognized laboratory. Further grouping was done on the basis of HbA1c levels, patients with HbA1c ≤ 7.5 were considered controlled diabetics and the subjects with HbA1c levels > 7.5 were considered as uncontrolled diabetics. Patients who were edentulous or with any type of oral ulcers were excluded. Education level was calculated according to the number of years of study. Patients who were cigarette smokers were considered smokers, whereas those who had already quit smoking for at least 1 year were considered non-smokers. Oral examination was performed, included an inspection of the oral cavity to assess presence of plaque and calculus, gingival, periodontal status, tooth count and location. Brushing 2 times per day with or without flossing was considered proper dental care and included brushing as well as using miswak or finger. Clinical assessment of periodontal status was undertaken by the principal investigator (AT). All 28 teeth, excluding 3rd molars, were examined in normal, direct operational light with the help of mouth mirror and gentle probing. Periodontal health was assessed at four sites on each tooth.

Plaque index was used; four surfaces of the same teeth were scored as 0 - 3 scale. The plaque was measured according to its thickness at the gingival margin rather than its coronal extent.\textsuperscript{12} Modified gingival index was used and four gingival units per tooth (2 marginal, 2 papillary) were assessed. A full mouth assessment was performed. A mean score for an individual was calculated by summing a gingival unit score and dividing by the number of gingival units examined.\textsuperscript{13} Periodontal index was used to assess the supporting tissues for each tooth. An individual score was taken as the sum of the tooth scores divided by the number of teeth examined. Periodontal probing was not recommended.\textsuperscript{13} Calculus index was used to assess the presence of calculus.\textsuperscript{13} The oral mucosa was examined and changes were registered if found. The use of betel nut was also registered.

The study was approved by the local ethics committee at Ziauddin University Hospital, Karachi. Written informed consent was obtained from all participants.

SPSS version 15 was used for data analysis. Continuous variables were summarized as the mean ± SD. Categorical variables were summarized as percentages. Frequency differences between various groups were calculated with the chi-square test. Univariate comparisons of 2 means were carried out with an unpaired student t-test. The level of significance was set to be < 0.05 throughout the analysis.

**RESULTS**

The demographic characteristics of 284 patients are listed in Table I. The mean age of controlled and uncontrolled diabetic groups was 49.75 ± 10.06 and 48.72 ± 8.88 years respectively. Women comprised 65.2% of controlled diabetics and 61.1% of the uncontrolled diabetics (Table I). The average number of teeth present in controlled and uncontrolled diabetics was nearly same (22.62 ± 6). Plaque is prevalent in controlled and uncontrolled diabetics, while subjects with poor glycemic control shows more plaque accumulation (p-value < 0.002) with insignificant difference in values of calculus i.e. 0.056. Uncontrolled diabetic patients tended to have more periodontal inflammation as compared to controlled subjects (p-value < 0.016). Gingival index also showed a significant difference with p-value of < 0.001. Brushing at least 2 times a day was seen only in 23 subjects (16.3%) of both groups, while most of the patients cleaned their teeth daily. Of controlled diabetics, 38.9% were smokers vs. 61.1% of the uncontrolled diabetic patients; most of
the subjects in both the groups took 10 cigarettes per day. More diabetic patients, both controlled (84.39%) and uncontrolled (79.02%) individuals were toothbrush users and 6% patients were miswak users in both the groups, while 8.51% subjects were finger users in controlled diabetic group and 14.68% among uncontrolled diabetic subjects (Table II). However, the differences did not reach the significance level (Table II). Betel nut chewing was found in 21 patients (42.9%) in controlled diabetic group and in 28 patients (57.1%) in uncontrolled group. There was no significant difference with the control of diabetes, gingival and periodontal status by means of educational level, gender and smoking habit in our set of data, while mean age shows significant difference with a p-value of < 0.036.

**DISCUSSION**

Periodontitis is the characteristic complication of diabetes mellitus and significantly varies with the glycemic control. In this study, there was a higher frequency of periodontitis in the measures of indices used, and shows the marked difference in the controlled and uncontrolled group of diabetic patients. This finding concurs with that of many previous studies proposing that diabetes is a risk factor for periodontal disease. In another study where pocket depth was considered as a marker of severity of periodontal disease, moderate disease was more common among the diabetics than the controls. No significant association between DM and periodontal disease was found by using the deep periodontal pockets as the clinical parameter for periodontal disease severity.

Individuals in both the groups in this study had more plaque and calculus, despite the fact that the use of a toothbrush was more common, the proportion of people cleaning their teeth daily was similar in both groups. It is suggested that the probable reason for the accumulation of more plaque in uncontrolled diabetic patients could be poor self-efficacy, resulting in less effective cleaning. Increased level of glucose in gingival crevicular fluid (GCF) and saliva per se could be another possibility, leading to a higher accumulation of plaque and calculus.

More missing teeth among diabetic patient is a characteristic of a population with poor oral hygiene. In this regard this study found similarity in both the groups. A comparative Saudi study has shown that in the diabetic patient group, 81% of patients had 9 - 20 missing teeth, while in the non-diabetic group it was 19%. Another study by Kawamura and co-workers showed that diabetic patients had 6.7 missing teeth compared to 4.3 teeth in the control group.

The education level of these patients was low. The oral hygiene was very poor; only 16.3% of the included patients were brushing at least 2 times a day. Oral health behaviours among patients with type 1 and 2 DM were studied by Spangler and Konen. The percentage of diabetic patients who were brushing daily was 97.9% and 99.3% (controlled and uncontrolled diabetics respectively). In our part of the world miswak and finger is also used as cleansing regime, but in our study only 6% were miswak users. Miswak is a traditional chewing stick that acts as a natural toothbrush. It has an antibacterial effect and is as good as tooth brush in removing dental plaque and reducing gingivitis. A study from India revealed that chewing stems is believed to
facilitate salivary secretion and, thereby help in plaque control, while some stems have an anti-bacterial actions as well for example Neem datum.\textsuperscript{20} Syrjä and colleagues reported 50\% rate for brushing twice daily.\textsuperscript{21} Bartold and colleagues concluded that the incidence of severe periodontal disease is affected by the improved oral hygiene, and the continuous assessment of at risk patients and regular, thorough subgingival debridement leads to the successful management of the disease.\textsuperscript{22} It was also concluded in two Finnish studies that perception of dental self-efficacy plays a decisive role and has a positive influence on compliance in relation to oral health behaviour.\textsuperscript{23,24} Smoking does have its effects on both glycemc control and periodontal health. We could not find significant difference between the two groups. In both groups, subjects had almost the same number of cigarettes smoked per day i.e. 10.40 ± 7.76 (controlled diabetes) and 12.092 ± 8.6 (uncontrolled diabetes).

In this context, individuals unaware of their diabetic status could get an important clue towards diagnosis by dental examination. This study is restricted to subjects already diagnosed with type-2 diabetes. Borrell suggested screening for unidentified diabetics in the population on the basis of their self-reported family history of diabetes, hypertension, hypercholesterolemia and periodontal status.\textsuperscript{25} Hence, diabetes is a disorder of importance to dentists and dental hygienists and to patients seen in the dental office as it has this bi-directional relationship with periodontitis.\textsuperscript{26}

**CONCLUSION**

Improper oral hygiene and poor glycemic control has strong negative impact on the periodontal health, which is evident by increased scores on indices scale of gingival, periodontal, plaque and calculus. Poor metabolic control of diabetes further compounds the effect of gingival inflammation and leads to attachment loss.

**REFERENCES**