# Prevalence and severity of periodontal disease: type 2 diabetics versus non-diabetics

# Prevalence and Severity of Periodontal Disease: Type 2 Diabetics versus Non-diabetics

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## ABSTRACT

**Objective:** To compare the periodontal status of a group of diabetic Coloured and Black communities of South Africa with a non-diabetic group.

**Study design:** Sixty-seven type 2 diabetics (mean age: 49.3 ± 8.97) and 67 non-diabetics (mean age: 47.6 ± 8.85) were examined. The plaque index (P1I), gingival index (GI), probing depth (PD) and clinical attachment loss (CAL) were recorded on Ramfjord index teeth or their substitutes. Previous dental care, smoking status, alcohol consumption and socio-economic status were also assessed.

**Results:** Diabetics had significantly higher mean GI ($p = 0.001$), PD ($p = 0.031$) and CAL ($p = 0.022$) than non-diabetics. The mean P1I ($p = 0.531$) was not significantly different between the two groups.

**Conclusion:** This study showed that diabetics had more severe and a higher prevalence of periodontal disease. Diabetics and their health care givers should be informed of these findings so that diabetics can seek early management of periodontal disease.

## INTRODUCTION

Type 2 diabetes and periodontal disease are chronic diseases with complex aetiopathogenesis. This has led to difficulties in interpreting the relationship of these diseases.[1] The association of these two chronic diseases has been studied in various populations.[2-9] Most of these studies reported that the prevalence of periodontal disease is high and more severe in diabetics than in non-diabetics. This occurrence is worse if the diabetics have poor glycaemic control.[3] One study reported no difference in periodontal status between metabolically controlled diabetics and non-diabetics.[5] In addition, some authors warn against generalisation of their findings in other racial and ethnic groupings.[4,10] This is because the studies have been done in special populations with very high prevalence of diabetes.

Genetic predisposition plays a crucial role in pathogenesis of type 2 diabetes.[11] The genetic role in ethnic disparities of diabetic complications have been reported.[12] There is also a report of differences in the clinical presentation of type 2 diabetes. Caucasians and African-Americans have type 2 diabetes that is characterised by hyperinsulinaemia while in Black Africans type 2 diabetes is characterized by relative insulinopenia and acquired insulin resistance.[13] The report further states that the differences influence the clinical presentation and management of type 2 diabetes in Black Africans, making them require insulin sensitizers. The differences in presentation and management of type 2 diabetes may determine the occurrence and complications of type 2 diabetes in various communities.

Prevalence of type 2 diabetes in South Africa is high. It is feared that in future it will reach epidemic proportion.[14] Obesity, a risk factor of type 2 diabetes has become an epidemic in South Africa due to globalisation.[15] Globalisation has led to a nutritional transition. Increased freedom of movement of the Black population and exposure to the global market economy has led to a shift from traditional foods low in fat and rich in fibre, towards meat and dairy products containing high levels of saturated fats and more highly refined food. 15 Among the Cape Town Coloured community, an age-standardised prevalence of type 2 diabetes in the age group 30-65 years was 10.8% and that of Impaired Glucose Tolerance was 10.2%.[16] Urban Africans in the Cape Town region had a type 2 diabetes mellitus prevalence of 8% while the prevalence of impaired glucose tolerance was 7%.[17] A study assessing the glycaemic control of Black South African type 2 diabetics attending a peri-urban clinic found poor glycaemic control among the study group. This was thought to be due to insufficient motivation, lack of knowledge, incorrect beliefs about diabetes, and particular cultural values - all of which are recognised to be potential barriers to improving diabetic care for Blacks.[18]

Despite this huge burden of type 2 diabetes and its complications, not much research has been done on the relationship between type 2 diabetes and periodontal disease in South African communities. One small study (n=23) concluded that the dental health is poor in type 2 diabetic patients in rural South Africa.[3]

The aim of this study was to investigate the periodontal status of type 2 diabetics attending Mitchells Plain Day Hospital, in Western Cape and compare them to non-diabetic controls. Coloured (mixed ancestry) and Black communities of South Africa frequent

the hospital. These two communities are of interest for they were historically disadvantaged in the provision of health services.[19]

## MATERIALS AND METHODS

Persons attending at Mitchells Plain Day Hospital (MPDH) in Cape Town with a medical history of type 2 diabetes aged 35 years or older comprised the study population. Information concerning diabetic status was retrieved from the patients' medical records. A nurse who had been trained on the aspects of this study recruited participants into the study. Friends, spouses and neighbours accompanying the diabetic patients to the hospital were recruited as controls. Controls were considered non-diabetic by self-reported negative history of diabetes.

Persons were excluded from the study if they did not have at least three Ramfjord[20] teeth or their substitutes. In addition, individuals who were on antibiotic treatment one month prior to examination or pregnant, were also excluded.

A dentist conducted the intra-oral examination with the patient seated on a dental chair. A standard overhead light was used in a well-ventilated room with good natural light. Demographic information, medical, dental and social histories were recorded by a dental assistant who prior to the study had been trained for this purpose. The examiner was blinded on the medical history of the person being examined for periodontal disease. It was originally planned that some of the persons examined would be recalled for confirmation of diagnosis. However, the number of people re-examined was not enough for statistical computation.

Six Ramfjord teeth or their substitutes were scored for the Gingival index (GI), Plaque index (P1I), probing depths (PD) and clinical attachment loss (CAL). P1I as described by Loe[21] was used to score for bacterial plaque. Scoring for gingival health was done using GI as described by Loe.[21] The absence or presence of plaque and calculus was recorded. PD was measured with a graduated periodontal probe from the crest of the gingival margin to the base of the gingival pocket (epithelial attachment) on six points of each Ramfjord tooth. CAL was also measured with a graduated periodontal probe from the cemento-enamel junction to the bottom of the gingival pocket on six points of each index tooth. The number of teeth present was recorded.

Data were analysed using SPSS (version12.0.1). Means of variables were compared using Anova and t-test. Proportions were assessed using Chi-square. Statistical significance was set at p-value < 0.05.

The research proposal was approved by the Committee for Research on Human Subjects of the University of the Western Cape. Permission to conduct the research was granted by the Chief Medical Officer, Metropole District Health Services and the MPDH administration. All participants were requested to consent in writing before being included in the study.

## RESULTS

One-hundred-and–thirty-four subjects of whom 67 were diabetics and 67 non-diabetics were included in the study. The mean age of diabetic group was 49.3 years (SD ± 8.97) and that of non-diabetics was 47.6 years (SD ± 8.85). Twenty-eight were Black while 106 were Coloured (mixed ancestry).

There was no difference in gender distribution and socio-economic status between the two groups (Table 1). They also did not differ significantly in terms of their oral health status and perception for need of periodontal treatment. However, there were differences in their smoking status and alcohol consumption. Diabetics were significantly less likely to smoke and consume alcohol compared to the non-diabetics (Table 1).

While describing the involvement of periodontal tissues by gingivitis or periodontitis, it is customary required that both the severity and extent of these diseases be assessed. In this study, we used the mean gingival index (GI) and percentage of sites with GI ≥ 2 to assess severity and extent of gingivitis respectively. On the other hand, mean pocket depth (PD) and mean clinical attachment loss (CAL) were used to determine the severity of periodontitis. The extent of periodontitis was assessed using the percentage of sites with PD ≥ 4mm and CAL ≥ 6mm.

The means of PD, CAL and GI were significantly higher in the diabetics compared to the non-diabetics (Table 2). The means of P1I and percentage of teeth with calculus were higher amongst the diabetics, but these differences were not statistically significant. The mean number of teeth present was significantly lower in diabetics (mean=16) than in non-diabetics (mean=19) (p=0.011).

## DISCUSSION

The aim of this study was to investigate the prevalence and severity of periodontal disease among type 2 diabetics and compare them with non-diabetic controls. Several studies have shown that periodontal disease prevalence is higher and more severe in diabetics than non-diabetics.[4,7,8,22,23] Furthermore, there are reports of ethnic disparities in diabetic complications.[12] It was against this background that it was decided to study Black and Coloured (mixed ancestry) communities of Cape Town, South Africa.

In this study, the means of PD, CAL and GI were significantly higher in the diabetics compared to the non-diabetics. These parameters are the main determinant measures of periodontal disease; it implies that diabetics in this study suffered from more advanced periodontal disease than non-diabetics. This is consistent with the findings of other studies.[4,6,7,8,22,23] In addition, the mean number of teeth present was significantly lower in diabetics than in non-diabetics. Since advanced periodontal disease ultimately leads to tooth loss, lower number of teeth in diabetics than non-diabetic is an expected finding.

The average percentages of sites with PI1 greater than 2 and teeth with calculus were high in both diabetics and non-diabetics. This means that our study groups had poor plaque control. The poor plaque control contributed to a high prevalence of gingivitis as evidenced by the high percentage of sites with GI greater than 2 in both groups. However, the average percentage of sites with PD greater than 4 mm and average percentage of sites with CAL greater than 6 mm in both groups were low. Therefore, the extent of periodontal tissue destruction was low. This is consistent with other findings that only few periodontal sites in the mouth progress to destructive periodontal disease.[24, 25, 26]

The means of P1I and percentage of teeth with calculus were higher amongst the diabetics but these differences were not statistically significant (Table 2). Therefore, plaque, the primary aetiologic factor of periodontal disease, and local factors such as calculus were not the cause of the differences in our study group. Non-diabetics significantly smoked more than diabetics did. Smoking is a well-known risk factor for periodontitis. Despite this phenomenon,

Table 1: Relations between diabetic status and background variables (% and means)*

| Background variables | Non-diabetic (N=67) | Diabetic (N=67) | Chi-square p-value |
|---|---|---|---|
| **Sex** | | | |
| Male<br>Female | 57<br>43 | 58<br>42 | 0.861 |
| **Mean Age (SD)** | 47.6 ± 8.85 | 49.3 ± 8.97 | 0.275 ** |
| **Income (in Rands)** | | | |
| 0-499<br>500-2399<br>> 2399 | 31<br>45<br>24 | 27<br>51<br>22 | 0.774 |
| **Educational status** | | | |
| Primary<br>High<br>College<br>University | 37<br>55<br>6<br>2 | 33<br>66<br>2<br>0 | 0.308 |
| **Perceived need for gum treatment** | | | |
| No<br>Yes | 69<br>31 | 70<br>30 | 0.851 |
| **Perceived condition of teeth** | | | |
| Excellent<br>Very good<br>Good<br>Poor | 5<br>5<br>51<br>40 | 2<br>2<br>63<br>34 | 0.367 |
| **Mean years since last visit to a dentist** | 5.7 ± 6.15 | 5.4 ± 6.55 | 0.819 ** |
| **Smoking status** | | | |
| No<br>Yes | 66<br>34 | 81<br>19 | 0.051 |
| **Alcohol consumption** | | | |
| No<br>Yes | 67<br>33 | 82<br>18 | 0.047 |

* Due to rounding off of percentages, the sum of these may not add up to 100%
** Anova

diabetics who smoked less suffered from more periodontal destruction. There was no difference between diabetics and non-diabetics in terms of mean age, gender, socioeconomic status and oral health practices. These are risk factors of periodontal disease. Therefore, the risk factors of periodontitis did not influence the differences found between the two groups in this study.

Studies aimed at determining the association between periodontal disease and diabetes mellitus were done among the Pima Indians of United States of America.[4,8] The Pima Indians have the highest prevalence and incidence of type 2 diabetes in the world. These studies showed a strong association between periodontal disease and diabetes. However, the authors caution against generalisation of these findings to other racial and ethnic groupings since they are considered a special community.[4] One study found no differences between diabetics and non-diabetics.5 However, this study used Community Periodontal Index of Treatment Needs (CPITN) to assess periodontal health status. It is therefore difficult to compare our results with this study for we used different outcome measures to assess periodontal disease. Another study reported only a slight association between periodontitis and diabetes.[20] The slight difference was said to be because periodontitis in older subjects may approach similar levels of extent and severity regardless of whether they have diabetes. This argument can be supported by the fact that

Table 2: Comparison of periodontal status in the diabetic and non-diabetic groups

| Indices | Non-diabetic | Diabetic | p-value* |
|---|---|---|---|
| **Oral Hygiene** | | | |
| Average P1I<br>Average % sites with P1I ≥ 2<br>Average % of teeth with calculus | 1.29<br>37.4<br>46.5 | 1.35<br>38.5<br>47.7 | 0.513<br>0.840<br>0.864 |
| **Gingival status** | | | |
| Average GI<br>Average % sites with GI ≥ 2 | 1.13<br>32.7 | 1.46<br>46.4 | 0.001<br>0.006 |
| **Periodontal status** | | | |
| Average PD<br>Average % sites with PD ≥ 4 mm<br>Average CAL<br>Average % sites with CAL ≥ 6 mm | 2.35<br>4.7<br>3.39<br>3.5 | 2.54<br>11.9<br>3.83<br>12.6 | 0.031<br>0.001<br>0.022<br>0.004 |

* t-test

there is usually a decline in periodontitis after the age of 50-60 years.[27] This is because at this age most of the teeth affected by periodontal destruction have already been extracted.

Our study consisted of adults aged 35 years or older. It is in this age group that both chronic periodontitis and type 2 diabetes start to manifest.[9] Therefore, it unlikely that that the higher prevalence and more severe periodontitis in our study group was due to other manifestations of systemic diseases other than type 2 diabetes. Periodontitis as a manifestation of systemic diseases is more prevalent in children and adolescents who have genetic disorders and various syndromes.[28] However, it should be noted that an association between type 1 diabetes and periodontal destruction has been reported.[2]

This study has some limitations. Firstly, being a cross-sectional study, the results do not represent a causal association between type 2 diabetes and periodontal disease. However, the findings of this study add to the existing literature. Secondly, the study population was hospital-based and may not be representative of the general population. The control group was recruited from friends and relatives who accompanied the patients to the hospital during the time of the study. These persons were deemed suitable as controls since they were of the same racial group and socio-economic status as diabetics. Thirdly, scoring for periodontal disease was done on index teeth or their substitutes. It is said that the use of index teeth for scoring periodontal disease underestimates the disease.25 If this is so, then underestimation of periodontal disease occurred equally to both diabetics and non-diabetics. It therefore did not influence our results.

In conclusion, the results of this study are in agreement with those of other studies in that diabetes mellitus increases the prevalence and severity of periodontal disease. Diabetics and their health care givers should be well informed of this association so that appropriate measures are taken to monitor for early signs of periodontal disease.

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