

## ARTICLE

## Relationship Of Diabetes Control To Periodontal Status In Type 1 Diabetic Patients

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### Abstract

**Objectives:** To find the relationship of diabetes control to periodontal status in type 1 diabetic patients and to compare the severity of periodontal disease of type-1 diabetics (IDDM) and non-diabetics and to further compare the periodontal status in the controlled and uncontrolled diabetics in a group of Libyan population to form a baseline reference for future researches.

**Materials & Methods:** The periodontal status of 30 diabetic and 30 control subjects was examined. The diabetic group was further subdivided into controlled and uncontrolled groups.

**Results:** There were significant differences between the whole diabetic group and the control group in terms of the periodontal status. A comparison between the controls and diabetic subgroups revealed that controlled diabetic patients had poor periodontal health than controls. Within the diabetic subgroups, there was more loss of attachment in the uncontrolled diabetics.

**Conclusion:** Better periodontal health in the diabetic patients

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may be related to good control of diabetes, indicating better resistance of the periodontium.

**Key Words:** Periodontal status, Diabetes, Diabetes control & Periodontitis, Gingivitis, Periodontal health, Oral health, Libya.

### Introduction

It is no longer acceptable to consider all individuals to be at the same level of risk of developing periodontitis. Certain individuals or subgroups of the population are at higher risk than others. There are some diseases of which diabetes mellitus has received the greatest attention (1). Diabetes mellitus is a clinically and genetically heterogeneous group of disorders affecting the metabolism of carbohydrates, lipids, and proteins. Various studies have shown strong relationship between type 1 diabetes, gingival, and periodontal problems both in children and adults (2). The aim of this study was to find the relationship of diabetes control to periodontal status in type 1 diabetic patients and

to compare the severity of periodontal disease, age and sex matched to type 1 diabetes (insulin-dependent diabetes mellitus -IDDM) and non-diabetics and to further compare the periodontal status in the controlled and uncontrolled diabetics in a Libyan population. The rationale was to introduce data on the relationship of diabetes control, but not casualty, to the periodontal status in a Libyan population as very few such data exists from this region.

### Materials and Methods

The study was carried out in the Department of Periodontics, Faculty of Dentistry, Al-Arab Medical University (formerly, Garyuonis University), Benghazi, Libya. Patients with a history of type 1 diabetes attending to receive periodontal treatment at the Department of Periodontics during the course of this study were included.

The study was approved by the ethical committee of Faculty of Dentistry and verbal consent was obtained from patients before they were screened. Subjects consisted of 30 insulin dependent, diabetic dentate subjects aged 35 to 54 years. The same number of individuals was included in the control group who had no history of diabetes mellitus. The exclusion criteria were patients who were type 2 diabetics, excessively edentulous, had previous periodontal therapies, juvenile diabetic patients and pregnant diabetic patients. The current study is an example of a cross-sectional study. The diabetic status was determined after a final medical status report was registered by a medical practitioner. The glycemic control was based on the patient's fasting blood glucose levels, taken within 24 hours of the dental screening, as informed by the medical practitioner. However this would not exactly be an accurate method of assessing a glycemic control. In a patient with diagnosed diabetes, the haemoglobin A1c test (HbA1c) is used to monitor the patient's overall glycemic control. The test may not be used when anemia or other conditions are present (3).

The diabetic group was further divided into subgroups according to the degree of control of their diabetic states, well controlled (n = 10) and uncontrolled (n = 20). The control of diabetes was defined according to the normal fasting blood glucose level (80-120 mg/dl).

In the controlled diabetic group, the mean duration of diabetes was  $5.9 \pm 2.38$  years and mean fasting blood glucose level was  $113.4 \pm 8.0$  mg/dl. In the uncontrolled diabetic group, the mean duration of diabetes was  $6.1 \pm 2.73$  years and mean fasting blood glucose level was  $234.7 \pm 52.9$  mg/dl. Minitab 15 was used to statistically analyze the data.

### Diagnostic Criteria for Measurement of Periodontal

#### Status

##### *Number of remaining teeth*

All teeth except the third molars were recorded.

##### *Plaque*

The presence of plaque at four surfaces of each tooth as described in the index system of Sillness and Loe (4) was assessed.

##### *Calculus*

The presence of calculus was recorded for its presence and extent on facial and lingual surfaces of the teeth as described by Ramfjord (5).

##### *Gingival condition*

The occurrence of gingival inflammation of four surfaces of each tooth was assessed using the criteria of gingival index system of Loe and Sillness (6).

##### *Probing pocket depth*

It was measured to the nearest millimeter at the deepest part at four surfaces of the tooth by a William's periodontal probe.

##### *Probing attachment level*

It was measured to the nearest millimeter from the cemento-enamel junction (CEJ) to the deepest part of four surfaces of each tooth by a William's periodontal probe.

All recordings were noted down by the same experienced specialist.

### Statistical Analysis

The student t-test for unpaired data was used to determine the significance of difference between two independent groups.

### Results

#### Plaque index

The plaque index was higher in the whole diabetic group ( $2.029 \pm 0.665$ ) compared to the control group ( $1.095 \pm 0.552$ ). The uncontrolled diabetic group ( $2.270 \pm 0.612$ ) showed more plaque than the controlled diabetic group ( $1.548 \pm 0.498$ ). There was also increased plaque when controlled diabetics were compared to the controls. In all the three cases, the differences were statistically significant (Tables 1, 2, 3 & 4).

Table 1: Comparison of Means of Periodontal Parameters between Whole Diabetic and Control Patients

|                                   | Mean Plaque Index<br>± S. D. | Mean Calculus Index<br>± S. D. | Mean Gingival Index<br>± S. D. | Mean Probing Pocket Depth<br>± S. D. | Mean Probing Attachment Level ±<br>S. D. |
|-----------------------------------|------------------------------|--------------------------------|--------------------------------|--------------------------------------|--|
| <b>Diabetic Patients (n = 30)</b> | 2.029 ± 0.665                | 0.744 ± 0.362                  | 1.847 ± 0.676                  | 2.987 ± 0.610                        | 3.3642 ± 0.894                           |
| <b>Controls (n = 30)</b>          | 1.095 ± 0.552                | 0.655 ± 0.384                  | 0.952 ± 0.598                  | 2.331 ± 0.233                        | 2.513 ± 0.362                            |
| <b>P Value Significance</b>       | 0.000<br>H. S.               | 0.42<br>N. S.                  | 0.000<br>H. S.                 | 0.000<br>H. S.                       | 0.000<br>H. S.                           |

Table 2: Comparison of Means of Periodontal Parameters between Controlled Diabetic Patients and Controls

|                                      | Mean Plaque Index<br>± S. D. | Mean Calculus Index<br>± S. D. | Mean Gingival Index<br>± S. D. | Mean Probing Pocket Depth<br>± S. D. | Mean Probing Attachment Level<br>± S. D. |
|--------------------------------------|------------------------------|--------------------------------|--------------------------------|--------------------------------------|--|
| <b>Controlled Diabetics (n = 10)</b> | 1.548 ± 0.498                | 0.759 ± 0.334                  | 1.480 ± 0.499                  | 2.707 ± 0.496                        | 3.098 ± 0.791                            |
| <b>Controls (n = 30)</b>             | 1.095 ± 0.552                | 0.655 ± 0.384                  | 0.952 ± 0.598                  | 2.331 ± 0.233                        | 2.513 ± 0.362                            |
| <b>P Value Significance</b>          | P = 0.028<br>S               | P = 0.47<br>N. S.              | P = 0.013<br>H. S.             | P = 0.044<br>S                       | P = 0.047<br>S                           |

**Calculus index**

The calculus index was higher in the whole diabetic group ( $0.744 \pm 0.362$ ) than the controls ( $0.655 \pm 0.384$ )

The mean loss of attachment in the whole diabetic group ( $3.364 \pm 0.894$ ) was higher than the controls ( $2.513 \pm 0.362$ ). In the uncontrolled diabetics, the mean attachment level

Table 3: Comparison of Means of Periodontal Parameters between Uncontrolled Diabetics and Controls

|  | Mean Plaque Index<br>$\pm$ S. D. | Mean Calculus Index<br>$\pm$ S. D. | Mean Gingival Index<br>$\pm$ S. D. | Mean Probing Pocket Depth<br>$\pm$ S. D. | Mean Probing Attachment Level<br>$\pm$ S. D. |
|--|----------------------------------|------------------------------------|------------------------------------|--|--|
| <b>Uncontrolled Diabetics (n = 20)</b> | $2.270 \pm 0.612$                | $0.736 \pm 0.383$                  | $2.030 \pm 0.687$                  | $3.127 \pm 0.624$                        | $3.915 \pm 0.830$                            |
| <b>Controls (n = 30)</b>               | $1.095 \pm 0.552$                | $0.655 \pm 0.384$                  | $0.952 \pm 0.598$                  | $2.331 \pm 0.233$                        | $2.513 \pm 0.362$                            |
| <b>P Value Significance</b>            | 0.000<br>S                       | 0.53<br>N. S.                      | 0.000<br>H. S.                     | 0.000<br>H. S.                           | 0.000<br>H. S.                               |

0.255). In the uncontrolled diabetic group, the mean probing pocket depth ( $3.127 \pm 0.624$ ) was more than the controlled diabetics ( $2.707 \pm 0.496$ ). There was also increase in pocket depth when the controlled diabetic group was compared to the controls. In all the three cases, the differences were

microorganisms and progression of periodontal disease (10).

Comparison of means of periodontal parameters between

Table 4: Comparison of Means of Periodontal Parameters between Controlled and Uncontrolled Diabetic Patients

|  | Mean Plaque Index<br>$\pm$ S. D. | Mean Calculus Index<br>$\pm$ S. D. | Mean Gingival Index<br>$\pm$ S. D. | Mean Probing Pocket Depth<br>$\pm$ S. D. | Mean Probing Attachment Level<br>$\pm$ S. D. |
|--|----------------------------------|------------------------------------|------------------------------------|--|--|
| <b>Controlled Diabetics (n = 10)</b>   | $1.548 \pm 0.498$                | $0.759 \pm 0.334$                  | $1.480 \pm 0.499$                  | $2.707 \pm 0.496$                        | $3.098 \pm 0.791$                            |
| <b>Uncontrolled Diabetics (n = 20)</b> | $2.270 \pm 0.612$                | $0.736 \pm 0.383$                  | $2.030 \pm 0.687$                  | $3.127 \pm 0.624$                        | $3.915 \pm 0.830$                            |
| <b>P Value Significance</b>            | 0.0023<br>H. S.                  | 0.87<br>N. S.                      | 0.020<br>S                         | 0.058<br>N. S.                           | 0.017<br>S                                   |

N. S. – not significant, S – significant, H.S. – highly significant statistically significant (Tables 1, 2, 3 & 4).

**Probing attachment level**

whole diabetic and control patients, comparison of means of periodontal parameters between controlled diabetic patients and controls; and comparison of means of

periodontal parameters between uncontrolled diabetics and controls all show significant results favoring a need for a better diabetic control. The higher plaque score in poorly controlled diabetics compared to the controlled diabetics is explained in this observation and explains the link between the high plaque index, and consequently gingivitis in our diabetic patients compared to controls. In this study, there was no statistical difference in the calculus indices of the diabetics and controls. The patients with well controlled diabetes may also be more cooperative in following oral health care habits and dental care (8), but we observed that the controlled diabetics recorded more calculus than uncontrolled diabetics. This is an unusual observation and does not have any logical explanations, except for the fact that the controlled groups were selected based on the normal fasting blood glucose level within 24 hours of the dental screening, when in reality they could have had a long spell of uncontrolled glycemic levels.

Both diabetes and periodontitis can stimulate the chronic release of CRP, PGE2 and pro-inflammatory cytokines, e.g., IL-1 $\beta$ , IL-6, TNF- $\alpha$ , that have a deleterious effect on periodontal tissues. While these are considered split medical conditions, they may reciprocally aggravate one another by biochemical mechanisms at the cellular and molecular levels (11). However, the quantity, breadth, and strength of evidence based knowledge are currently insufficient to establish periodontal therapy as influential in improving glycemic control in either type 1 or type 2 diabetes (12). Another possible risk factor for the periodontal disease is the genetic linkage in IDDM found in the human leukocyte antigens (HLA). HLA-DR3 and DR4 are common in individuals with IDDM and HLA-DR4 more common in IDDM subjects with or without periodontitis and in non-diabetics with periodontitis (13).

The rationale for expecting a relationship between poor metabolic control and periodontitis is that during periods of poor diabetic control, the elevated blood glucose level in gingival crevicular fluid may favor the growth of certain pathogenic microorganisms in periodontal pockets (14, 15). Studies have identified *Capnocytophaga sputigena* and *Actinobacillus actinomycetemcomitans* as specific periodontal pathogens in type 1 diabetes (16, 17). There are also reports of decreased ingestion and killing of bacteria by neutrophils in poorly controlled patients (18, 19). Diabetic micro-angiopathies, which are related to decreasing control of diabetes may also add to the impaired host response in the sulcular area (20, 21). These clearly explain the increased pocket depths and attachment loss in our diabetic

groups. Each of the periods of poor metabolic control may thus result in cumulative periodontal destruction.

Karjalainen and Kaisa, did a study on adult patients with type 1 diabetes and the complex diabetic status was assessed by means of the level of metabolic control and/or the presence and severity of diabetic complications (22). They found that adult diabetic patients with poor metabolic control and/or complications exhibited more deepened pockets and clinical attachment loss. Another study concluded that untreated periodontal disease has been shown to contribute to poor glycemic control in diabetic patients (23). The poorly controlled diabetics when compared to the controlled diabetics also showed more loss of attachment in type 1 diabetes (24) and greater pocket depths (25). Though the controlled diabetics have a better periodontal health than uncontrolled diabetics, the periodontal status of controlled diabetics was poorer compared to the controls (26), which was the same finding in this study. A greater incidence and severity of periodontitis is observed in both type 1 and 2 long-term diabetics with poor metabolic control (27). The relation between periodontitis and diabetes is irrefutable and can result in multifaceted issues. The presence of calculus was associated with increased risk of periodontitis in diabetic patients (28).

This study recommends a stronger primary prevention programs in the form of health education and health promotion as the first step towards reducing the periodontal problems, and secondary prevention programs be implemented later depending on the availability of resources for oral health. The preventive program should also integrate prevention of common oral problems with the prevention of other non-communicable medical diseases. Participation from both governmental and non-governmental agencies is encouraged.

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