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# Influence of non-surgical periodontal therapy on type II diabetes mellitus

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**ABSTRACT**

Dental clinicians often come across patients having chronic systemic conditions, like diabetes, which has a direct influence on the onset, duration, and management of periodontal disease. Type II diabetes mellitus is considered as a contributing factor instead of being a primary etiologic factor, acting as an initiator of periodontitis. Type II is characterized by loss of ielts cells of Langerhans and survival is possible by external application of insulin. Prevalence of periodontal disease and diabetes is known to increase with an increasing age. Identification and characterization of diabetic patients with high risk of periodontal disease are needed and this is what the study focuses on. This research was an interventional study aiming to narrow the gap by acquiring possible relationship between type II diabetes and periodontal disease group of patients after surgical/non-surgical periodontal therapy in local Pakistani Population. This interventional study was conducted on 104 males and female patient suffering from T2DM (aged 25 to 65 years). Periodontal parameters were calculated by using the community periodontal index need, comprising bleeding on probing, tooth mobility and furcation involvement. Non-surgical periodontal treatment was performed and systemic Doxycycline treatment was prescribed for two weeks. The glycated hemoglobin, fasting and random blood glucose levels were determined, at the baseline before non-surgical periodontal therapy and after three months of treatment using commercially available kits. The periodontal parameters significantly improved after the treatment, along with the reduction in the results levels of glycemic parameters. In conclusion, poor glycemic control is an important risk factor for developing periodontal disease and once established, periodontal inflammation negatively affects glycemic control. In the current study, non-surgical periodontal treatment improved glycemic control in T2DM subjects affected with periodontitis.

**Keywords:** T2DM, glycated hemoglobin, fasting and random blood glucose levels, periodontitis, periodontal pocket depth, bleeding on probing.

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## INTRODUCTION

Diabetes Mellitus (DM) is a frequently occurring endocrine disease in humans, in which patients has known the chronic hyperglycemic state, and long-term systemic complications affecting both quality and quantity

of life. Periodontitis is a common oral disorder that may be involved in altering systemic physiology. The evidence suggested that together with the oral problems, periodontitis may aggravate and/or cause systemic disorders, such as diabetes, cardiovascular disease and adverse pregnancy outcomes (Amar and Han, 2003). It has also been suggested that chronic gram-negative periodontal infections and inflammation are able to cause alterations in insulin signaling as well as insulin sensitivity, ultimately inducing insulin resistance and poor glycemic control (Mealy et al., 2006). Thus, inflammation acts as a critical player that causes an association between these two chronic conditions (Genco et al., 2005). Moreover, it is regarded as a principal component in the development of systemic conditions previously thought to be of different etiology, such as atherosclerosis, diabetes etc (Colombo et al., 2011).

The molecular mechanism involved in inflammation, includes bacterially induced activation of cell-mediated immunity, resulting in production of a number of inflammatory cytokines (TNF-a, (IL)1and 6 for example tumor necrosis factor – alpha, Interleukins , as well as synthesis and production of prostaglandins (PG) (Hansson, 2005). These cytokines can produce an insulin resistance syndrome and initiates obliteration of pancreatic beta cells resulting in the development of diabetes (Iacopino, 2001).

Initially, DM was regarded as a threat to cause periodontal disease but recent literature proposed that the periodontal disease may be a threat for diabetic decomposition, a hypothesis that has been supported by a range of studies (Lim et al., 2007). Though it has been documented that the periodontal treatment may have an advantageous outcome on glycemic management (Kiran et al., 2005), however, not all studies reported this improvement (Jones et al., 2007); therefore the scientific evidence remains inadequate and inconclusive.

A study by Kocak et al. (2016) established a relationship between Type II diabetes mellitus and Periodontitis by simple scaling, root planning and periodontal laser therapy. The study concluded a reduction in glycated hemoglobin HbA1c from 6.54 to 6.31% for scaling and root planning group and 6.91 to 6.49% for scaling and root planning + periodontal laser therapy group, after three months of post-operative therapy. All these findings corroborate with previous observations that periodontal therapy can indeed lower the glycated hemoglobin levels in type II diabetes mellitus patients (Iwamoto et al., 2001; Kiran et al., 2005; Koromantzos et al., 2011; Navarro-Sanchez et al., 2007).

In view of the increasing prevalence of both type 2DM with long-term complications and chronic periodontitis in Pakistani population, a study was designed in which we observe the effects of non-surgical periodontal therapy on glycemic status of diabetes and the impact of glycemic control over periodontal status. Since there is a lack of systemically collected data using objective measurements in our population, these findings are expected to assist in achieving better control of diabetes as well as periodontal disease.

## SUBJECTS AND METHODS

### Subjects

This interventional study was conducted on 104 diagnosed patients (70 males and 34 females) of T2DM, both male and female aged 25 to 65 years (SEOM 0.213), who were literate and belonged to low socioeconomic class. Patients below 25 years and above the age of 65 years and patients suffering from type-1 insulin dependent DM or any other systemic diseases were excluded from the study. The overall mean age of patients was 47.72 ± 9.82.

The study was approved by the Board of Advanced Studies and Ethical Review Committee at University of Karachi (No.BASR/2026-06/Phy). Patients were explained about the research project and their written consents were obtained before starting the clinical examination. Investigations and treatment were carried out in the outpatient department of Periodontology, Fatima Jinnah Dental College, and Hospital; Karachi from 2007 to 2009. A standardized evaluation form was used to record personal history, medical and dental history of all patients.

All individuals recruited in the study were closely monitored for associated habits and factors like diet and smoking habits, throughout the course of study. No female smokers were present in the study. Male smokers were instructed to cease smoking or reduce to a minimum for the duration of the study and were closely monitored on random visits. The same method was adopted for betal nut and tobacco chewers. A diet modification plan was made and participants were encouraged high-fibre, low-glycaemic-index sources of carbohydrate in the diet, such as fruit, vegetables, wholegrain and pulses, and to Include low-fat dairy products and oily fish.

### Glycemic parameters

Glycemic level in the blood was evaluated at the baseline and three months after periodontal treatment. Blood samples were taken for assessing the level of glycated hemoglobin HbA1c (Well controlled metabolism 4.5 to 7%) using fast ion exchange resin separation method. Fasting blood glucose level (FBG < 126 mg/dl) and random glucose levels (RBG > 140 mg/dl) were determined using a glucometer. (ACCU CHECK, Advantage system/sensor Comfort strips, Roche diagnostics, Mannheim, Germany). Blood samples were analyzed in the same laboratory to standardize the results and minimize the error in two measurements.

### Periodontal parameters

Patients' periodontal status was evaluated by using community periodontal index of treatment need (CPTIN), in which all four surfaces of gingiva, from the gingival margins to the base of periodontal pockets, bleeding on probing were measured. After obtaining the glycemic and periodontal parameters data, scaling was done with the help of ultrasonic scalar and systemic antibiotic treatment (doxycycline 100 mg/day for fourteen days) was prescribed. Oral hygiene instructions including brushing techniques, along with the use of mouthwash for ten days was given to the patients. Instructions were also given to continue control of diet and

use of medication.

After three months, patients were recalled and data was obtained for the periodontal and glycemic parameters. All the examination and data collection was carried out by a single observer to minimize the bias.

### Statistical analysis

The data was tabulated and analyzed using the SPSS version 15. Paired t-test was applied for fasting and random glucose levels .Wilcoxon Sign ranked test was applied to compare the results of HbA1c. All the dental parameters were computed by frequency and percentages.

## RESULTS

This study was carried out for the assessment of effects of periodontal treatment on glycemic status together with periodontal status and comparison of data before and after treatment.

### Periodontal parameters

Patients were examined for periodontal pocket depth before and after treatment according to community periodontal index of treatment need (CPTIN). Four categories of pocket depth were taken as standard which includes 1 to 2 mm, 3 to 4 mm, 5 to 6 mm and ≥ 6 mm (Ainamo et al., 1982). The pre-treatment patients with the 1 to 2 mm depth of pocket were initially 34.62% which increased to 50.96% after the treatment, clearly depicting the reduction in the number of patients having increased pocket depth.

The prevalence of periodontal disease in Pakistan is also becoming very high in all age groups. The data indicated that only 28% of the 12-year-olds have healthy gums and more than 93% persons above age 65 have some gum or periodontal problem (Ministry of Health, Pakistan, 2003).

The pre-treatment pocket depth of 3 to 4 mm was found to be present in 42.31% of patients, which after treatment reduced to 35.58%. The pocket depth of 5 to 6 mm was initially present in 18.27% of patients which reduced to 10.58% after treatment. Similarly, pocket depth of > 6 mm found in 4.81% patients was observed only in 2.88% subjects after treatment (Table 1, Figure 1).

Before treatment, 50% of patients had no bleeding on probing (normal), while 50% were observed to have to bleed on probing. After treatment percentage of normal patients without bleeding increased to 83.65%, whereas only 16.35% individuals were found to have bleeding problem (Figure 2).

For the comparison of pre- and post-treatment dental parameters, Wilcoxon signed rank test was applied. The test showed significant differences (P value < 0.001) among pre- and post-treatment group for gingival pocket depth, bleeding on probing and tooth mobility tests whereas furcation involvement were not found to be significant (Table 2).

### Glycemic profile

The glycemic profile was checked by two statistical methods; for the fasting and random blood glucose levels, paired sample t-test applied as both are continuous variables and for the HbA1c, Wilcoxon signed rank test was applied as it was categorical data.

The mean FBG levels before treatment were found to be 130.6 ± 34.63 which reduced to a level of 122.94 ± 35.24 after dental treatment (Table 3). The mean value of RBG of all subjects was found to be 189.1 ± 64.01 while post treatment reduced the levels significantly to 179.6 ± 56.06 (p-value < 0.001). This was found to be highly significant (Table 3).

HbA1c was measured by categorizing the patients in three groups, that is, patients with normal HbA1c level (≤4.5%), patients with HbA1c controlled with medicine (4.5 to 7%) and patients with uncontrolled HbA1c (≥7%). The percent increase of patients in normal group was found to be 29.81% from 16.35% after treatment. Moreover, in the controlled group, the % of patients before treatment was 37.50% which increased to 49.04% after treatment, while in uncontrolled group 46.15% pre-treatment was found decreased to 21.15% after treatment. A significant decrease in the pre- and post-treatment levels was observed (P value < 0.001), (Table 4). Thus, a significant difference was observed in controlled group (P value < 09.001) (Figure 3).

**Table 1.** Pre and post treatment periodontal pocket depth.

| Pocket depth values (mm) | Pretreatment % | Post treatment % |
|---|---|---|
| 1-2 | 34.6 | 50.96 |
| 3-4 | 42.31 | 35.58 |
| 5-6 | 18-27 | 10.58 |
| >6 | 4.81 | 2.88 |

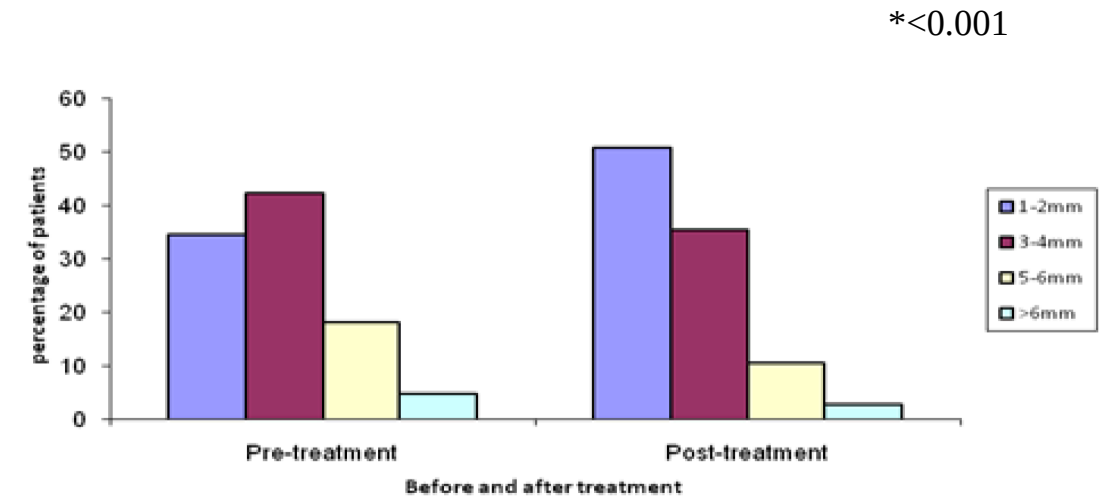


**Figure 1.** Periodontal pocket depth before and after treatment in all patients (* P-value).

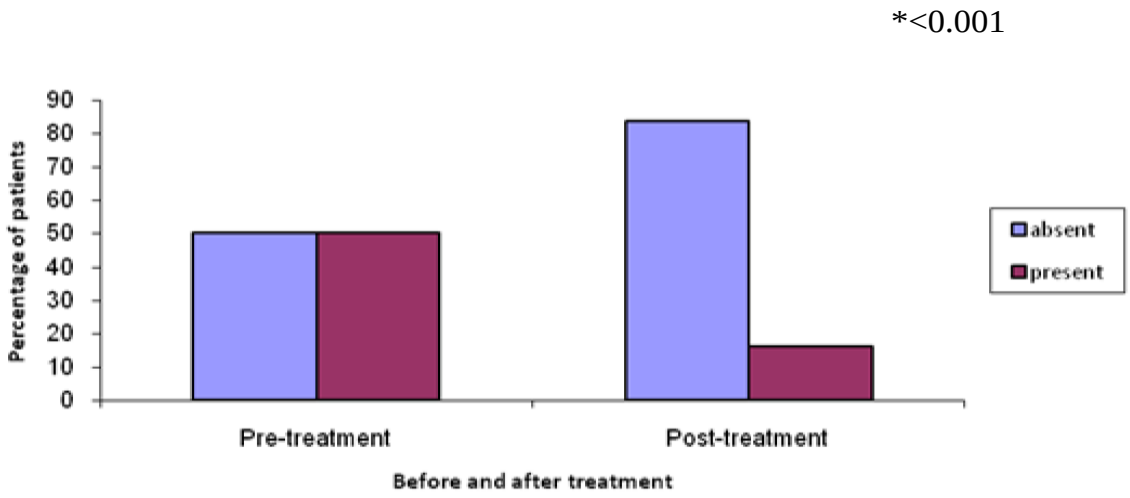


**Figure 2.** Bleeding on probing before and after treatment (*P-value).

**Table 2.** Comparison of pre and post-treatment dental parameters based on Wilcoxon Signed Rank Test.

| Pre and Post-treatment | Z statistics | P value |
|---|---|---|
| Pocket depth | 5.19 | < 0.001 |
| Bleeding on probing | 5.74 | < 0.001 |

**Table 3.** Fasting and random blood glucose levels of all patients' pre and post treatment.

| Characteristics | Pre-treatment (means ± SD) | Post-treatment (means ± SD) | P value |
|---|---|---|---|
| Fasting blood glucose (mg/dl) | 130.6 ± 34.63 | 122.94± 35.24 | 0.007 |
| Random blood glucose (mg/dl) | 189.1± 64.01 | 179.6± 56.06 | 0.001 |

P value significant at < .005.

**Table 4.** Pre and post-treatment values of HbA1c in all patients.

| HbA1c | Pre-treatment n (%) | Post-treatment n (%) | P value |
|---|---|---|---|
| Normal | 17 (16.35) | 31 ( 29.81) | <0.001 |
| Controlled | 39 (37.50) | 51 ( 49.04) | <0.001 |
| Uncontrolled | 48 (46.15) | 22 (21.15) | <0.001 |

P value significant at < .005.

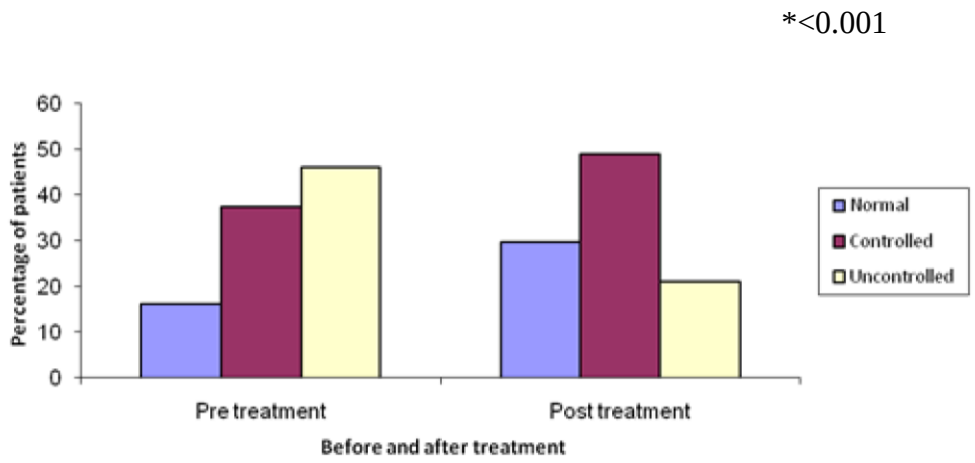


**Figure 3.** Comparison of results of HbA1c of all patients before and after treatment (*P-value).

## DISCUSSION

Since past few decades, T2DM has shown a magnificent increase, being the commonest endocrine abnormality, related with a chronic hyperglycemic condition, having wide implications on various target organs of the body. It is also responsible for the metabolic derangements associated with abnormal carbohydrate, fat and protein metabolism. On the other hand, periodontal infection is recently considered to influence the pathogenesis of the disease as well as has the tendency to develop systemic disorder such as diabetes (Garcı´a et al., 2001).

Globally, diabetes is one of the most chronic endocrine disorders. It is the fourth or fifth leading cause of death in most high-income countries and there is significant evidence that it is epidemic in many low- and middle-income countries (Al-Nozha et al., 2004).

Diabetes has been reported to affect an estimated 5 to 10% of the adult population in industrialized Western countries, Asia, Africa, Central America and South America, and it has a large impact on society (Elhadd et al., 2007).

Diabetic patients with hyperglycemia are 2.8 times more liable to damage periodontium as well as more susceptible to oral infections and 4.2 to 5 times more prone to be partially edentulous than non-diabetic subjects (Soskolne and Klinger, 2001). Thus, diabetes and periodontitis have a synergistic effect on one another as indicated by an overwhelming number of studies and meta-analysis, suggesting periodontitis to be the sixth complication of diabetes (Loe, 1993). Various studies have confirmed that the periodontal therapy has the beneficial impact on controlling the glycemic level in diabetic patients (Rodrigues et al., 2003). Recently, a study also confirmed that the abolition of periodontal inflammation, with the help of periodontal therapy along with adjunctive therapy may significantly decrease glycated hemoglobin levels in the diabetic patients with HbA1c ≤8.8% (Al Mubarak et al., 2010).

In our study, baseline differences in levels of disease are accredited because of potential difference in the healing of periodontium between pre and post groups. In the diabetic patients significantly higher percentage of periodontal pockets and probing depth were observed in the periodontal examination between pre and post groups without changing medical treatment and lifestyle so that the results of the study remains unbiased. Some patients experienced a major improvement in glycemic control as compared to the others which show little change in glycemic control, at the completion of the study.

The mean FBG level of all the patients before and after treatment in this study was found to be 130.6 ± 34.63 and 122.94 ± 35.24 respectively, showing a significant reduction in mean values before and after treatment.

Likewise, the mean RBG level before treatment was 189.1 ± 64.01 which was reduced to 179.6 ± 56.06, showing statistically significant difference (P-value ≤ 0.001).

The HbA1c value provides an approximation of the average glycemic control over the 30 to 90 days preceding the test. The number of patients in normal group was increased from 17 before treatment to 31 after treatment. Similarly, in the second group, the number of patients was increased from 39 to 51 and in an uncontrolled group, it was decreased from 48 to 22. Therefore, it was evident from the results of this study that all the three parameters of glycemic status showed a significant reduction after periodontal treatment, suggesting a direct link between these two conditions.

Researchers conducted a controlled clinical trial in which 13 Japanese individuals were included in the study, suggesting a significant reduction in the HbA1c plasma levels from 8.0 to 7.1% with a mean reduction of 0.8% in T2DM patients (Iwamoto et al., 2001), thereby strongly supporting the results of our study. Both the studies suggested that there will be an improvement in glycemic control related to insulin resistance. This occurs due to reduced periodontal inflammation that causes decrease inflammatory mediator level in the serum.

Our study also revealed a significant reduction in the pocket depth after treatment. The percentage of patients with the gingival pocket depth of 1 to 2 mm was increased by 16.34% after treatment (P ≤ 0.001). The percentage of patients with pocket depth of 3 to 4 mm pre-treatment was 42.31% which after treatment reduced to 35.58%, while 4.81% have the probing pocket depth of ≥ 6 mm initially, which were reduced up to 2.88% after treatment.

Bleeding on probing was present in 50% patients before treatment and remaining 50% were normal without bleeding .The percentage of patients without bleeding increased to 83.65% (P ≤ 0.001) after treatment, showing an improvement of 33.65%.

These studies have also suggested the possibility of treating with full-mouth ultrasonic debridement in combination with systemic tetracycline to improve the diabetic condition (Zanatta et al., 2006).

Also, a study has documented that after non-surgical treatment and the stabilization of the periodontal condition with mechanical therapy there is an improvement in periodontal patients (Christgau et al., 1998).

Systemic or local antimicrobial administration combined with mechanical treatment is considered to be a periodontal therapy that will improve the hyperglycemic level of diabetic patients in young and middle-aged groups (Genco et al., 2005). A study also demonstrated that the patients receiving a combination treatment of amoxicillin/clavulanic acid for the duration of 2 months with mechanical debridement have significant effects on type 2 diabetic patients (Soskolne and Klinger, 2001). A major reduction in HbA1c was observed (P ≤ 0.005) in the group receiving mechanical debridement alone, thereby indicating that the group receiving treatment with systemic antibiotic shows less favorable response.

Among diabetic patients, the impact of periodontal treatment on the HbA1c level has been quantified in a meta-analysis of 10 interventional trials. According to this analysis, a decrease in absolute HbA1c values was observed after scaling and root planning, which was statistically insignificant. There was a reduction in post-treatment HbA1c values (0.7%) after scaling and root planning treatment along with systemic antibiotic treatment. This value is considered to be clinically significant in medical terms (Janket et al., 2005).

Data on the effectiveness of periodontal care on improving glycemic status in poorly controlled diabetics are equivocal (Taylor, 2001, 2003). But the present study clearly depicts the association between periodontitis and diabetes (Iacopino, 2001).

## Conclusion

The results of this study proved, that following periodontal therapy, there was a marked improvement in glycemic control with T2DM individuals. When the frequency distribution of the pre and post-treatment changes in glucose control was examined among diabetics, it appeared that these differences represented broad changes among the groups and were not due to large changes among a few subjects.

### *Strengths of study*

The study question was very important in view of increasing prevalence of diabetes and periodontitis in our population as there is an urgent need for prioritization of these diseases as key issues. The study design, data collection, and analysis were accurate and unbiased. The interpretation and result of study are significant as they will guide not only the dentists for proper control and care of diabetic patients but also help in awareness of the general public to consult a dentist well in time for better control of these chronic diseases.

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