EFFECT OF STRICT GLYCEMIC CONTROL ON PERIODONTITIS IN NON INSULIN DEPENDENT PATIENTS: A QUASI EXPERIMENTAL STUDY

Umair Farukh[1], Inayat Shah[1], Abid Rahim[2], Syed Midhat Batool[3], Zain Ayub[2], Aneela Shabbir[4], Izhar Khan[5], Zuhra Akhtar[2]

[1]Department of Physiology, IBMS, Khyber Medical University, Peshawar Pakistan
[2]Department of Periodontology Sardar Begum Dental College, Peshawar Pakistan
[3]Department of Periodontology, CIMS Dental College, Multan Pakistan
[4]Department of Periodontology Avicenna Medical & Dental College, Lahore Pakistan
[5]Department of Periodontology HITEC Institute of Medical & Dental Sciences, Texila Pakistan

ABSTRACT

Objectives: *To evaluate the effect of strict glycemic control on pocket depth (PD), bleeding on probing (BOP), fasting blood sugar (FBS), C reactive protein (CRP), and HbA1c.*

Methods and materials: *This quasi-experimental design study was conducted from March to September 2021 taking 32 cases (A) and equal controls (B) with non-insulin uncontrolled diabetes (HbA1c more than 8, whereas the effect of strict glycemic control on clinical periodontitis was carried out. Pocket Depth (PD), bleeding on probing (BOP), fasting blood sugar (FBS), C reactive protein (CRP), and HbA1c levels were assessed before and after the intervention.*

Results: *Most of the variables HbA1c (p=0.03), CRP (p=0.007), PD (p=0.006), and BOP (p=0.023) showed improvement showing a better glycemic control in the post-intervention stage; particularly for patients recruited in Group A. HbA1c levels at 3 months post-intervention showed significant reduction (p=0.03) to 8.1 ± 1.7 in Group A in comparison to 9.9 ± 2.3 in the pre-intervention stage with a mean difference of -1.8 showing improvement in the glycemic control. PD (mm) for Group A was reduced from 2.4 ± 0.5 mm to 2.2 ± 0.5. Whereas the PD ≥ 4mm (%) also showed a significant reduction from 27.9 ± 28.4 in the pre-intervention to 19.4 ± 27.0 in the post-intervention stage for Group A. Group B also showed reduction but this was more prominent in group A. Bleeding on Probing (%) in group A was also significantly reduced from 29.4 ± 21.4 in pre-intervention stage to 23.1 ± 23.2 in the post-intervention stage.*

Conclusion: *The present study concludes that strict glycemic control (group A) has a role in clinically correcting/improving periodontitis in non-insulin dependent diabetic patients. It can be further concluded that periodontal treatment has a role in the improvement of glycemic control in type 2 diabetic patients at 3 months.*

Key words: *Glycemic Control, Periodontitis, Non Insulin, Periodontal Treatment*

INTRODUCTION

Diabetes and periodontitis both are the most prevailing health conditions these days[1]. Many reports by dental professionals have shown that there is a well-established and well-recognized association between these two common diseases[2]. In various epidemiological researches, it has been clarified that diabetes is a major risk factor for many conditions including periodontitis[3]. The risk of periodontitis in people having diabetes (with poor control of hyperglycemia) is threefold more in contrast to people who don't have diabetes. In today's life, the accurate

Correspondence:
Dr. Abid Rahim
Lecturer Department of Periodontology
Sardar Begum Dental College, Peshawar Pakistan
Cell: +923455958380
Email: abidrahim@asia.com

association between these two diseases is a hot topic for researchers as both are highly prevalent diseases and affect daily lifestyles[4]. Furthermore, research on this relationship has significant inference for physicians, endocrinologists, dental professionals, and most importantly the patients[5].

The epidemiology-based research studies have constantly revealed that diabetes is linked with an increased risk of many ailments including periodontitis. Both type 1 and 2 diabetes show an almost similar effect on the risk for periodontitis[6]. The intensity of the risk is proved to be dependent on the level of glycaemic control, similar to all other problems of diabetes. In many studies, it has been shown that in controlled diabetes (HbA1c = 7%, 53 mmol/mol or lower) the risk of periodontitis appears to be lower, while the risk rises exponentially with disturbed glycaemic control. In a general context, the estimated risk of periodontitis for diabetic people in contrast to non-diabetic people is 2-3 times[7]. High blood sugar level increases the occurrence of periodontitis, intensifying the severity and extent (number of teeth involved) of periodontitis. It is also observed in several studies that people with persistently raised blood sugar levels may consult the dental professionals with multiple recurring periodontal abscesses, and such conditions may be sometimes atypical. Hence, there may be some different conditions that may not be similar to normal clinical features of the disease[8]. Along with periodontitis, many other oral conditions can also be associated with diabetes. In some cases, diabetic people using Ca++ channels blocking drugs (nifedipine, amlodipine, etc.) for managing hypertension (as a co-morbid condition) may have an overgrowth of the gingiva[9]. Very rarely lichenoid mucosal reactions may be observed with drugs like glimepiride[10]. Several oral issues of diabetes such as dry mouth (xerostomia) cause a rise in risk for chronic oral ulcers, caries, and candida infections[11].

The exact mechanism which links periodontitis and diabetes is not clear but maybe involve certain facets of neutrophil activity, immune functioning, inflammation, and cytokine biology[12]. Generally, there is an increase in the levels of systemic markers of inflammation in diabetes. In periodontal tissues, diabetes causes inflammation by raising the levels of inflammatory mediators including tumor necrosis factor- α and interleukin-1β[13]. Periodontal diseases have been proved to have a relation to increased levels of inflammatory mediators such as TNF-α in people with diabetes[14]. The oxidative stress, accumulation of reactive oxygen species, and interactions between advanced glycation end products (AGEs) in the periodontal tissues and their receptors (RAGE, the receptor for advanced glycation end-products), all these factors play a vital role in enhancing inflammation in the periodontal tissues in diabetic people[15].

The objective of this study was to determine the effect of strict glycemic control on parameters like pocket depth (PD), bleeding on probing (BOP), fasting blood sugar (FBS), Creactive protein (CRP) and HbA1c.

MATERIALS AND METHODS

This quasi-experimental study was conducted from March to September 2021 in districts Peshawar and Charsadda, KPK after approval by the Graduate Study Committee of the Institute of Basic Medical Sciences, the Advance Studies Research Board (ASRB), and the ethical review board of Khyber Medical University. A total of 64 non-insulin-dependent diabetic patients with poor glycaemic control and periodontitis were selected for the study. The participants were randomly categorized into two equal groups (n=32) A/experimental group and the B/non-experimental group. Randomizations of the patients were done with the help of online software (randomizer). Group A received strict and supervised diabetes and periodontitis treatment (Scaling and polishing along with oral hygiene instructions) along with diet and lifestyle modification while group B received treatment only for periodontitis. The study parameters, pocket depth (PD), bleeding on probing (BOP), fasting blood sugar (FBS), C reactive protein (CRP) and HbA1c were determined before and after intervention/treatment. Pocket depth was determined with the help of the CPITN (Community Periodontal Index of Treatment Needs) probe under proper light. Similarly, bleeding on probing was observed 20-30 seconds after probing with CPITN. FBS level was determined by using an automatic stylus for pricking the fingers where blood was directly transferred to the blood glucose meter (Accucheck Freestyle) and read within 10 seconds. Blood for HbA1c was transferred to an EDTA tube while for CRP, it was collected in a gel tube, which was centrifuged at 4000 rpm for 10 minutes. After separation, the serum for CRP analysis was immediately stored at -80C for

analysis.

SPSS version 26 was used for the analysis of the data. Comparison (mean difference) between the two groups' treatment for continuous variables such as pocket depth, CRP, HbA1c, and FBS were carried out through an independent sample T-test. A comparison before and after the intervention was carried out through a pair sample T-Test.

RESULT

Patients with periodontitis visiting Sardar Begum dental college and private clinic were informed about the study in detail. After written informed consent, the initial screenings for diabetes (FBS, HbA1c) were done and a detailed history of their diabetes and oral health was taken. All those patients with HbA1c of more than 8 mg/dl and having periodontitis were recruited for the study. Out of the 90 patients with known diabetes screened, a total of 64 patients were found to be fitting the inclusion criteria.

They were randomly divided into Group A (treatment of periodontitis and diabetes) and group B (Treatment of periodontitis only). The characteristics of all the individuals are given in Table 1 and subdivided into groups for comparing their anthropometric and biochemical parameters. These observations were made at the pre-test stage.

PRE- INTERVENTIONAL STAGE

As per the findings in table 1, only a significant difference was observed for weight and BMI (p = 0.05 for both). The rest of the parameters including age, height, years of diabetes, SBP, and DBP were not significantly different in both the groups. Similarly, the different parameters under consideration between group A and group B were also determined through the procedure already outlined in the methodology section. These parameters are given in Table 2 with a difference between the groups has been determined through the independent sample T-test. No difference in mean was observed for all parameters under investigation. Figure 1 shows the group-wise severity of periodontitis at pre interventional stage.

POST- INTERVENTIONAL STAGE

Most of the variables showed improvement in their values exhibiting a better glycemic control in the post-intervention stage; this is particularly true for patients/subjects recruited in Group A. HbA1c levels at 3 months post-intervention showed significant reduction (p=0.03) to 8.1 ± 1.7 in Group A in comparison to 9.9 ± 2.3 in the pre-intervention stage with a mean difference of -1.8 showing improvement in glycemic control.

C-Reactive protein which is a marker of infection and also showed a significant reduction (0.07) in Group A from 5.15 ± 1.78 to 2.15 ± 1.85 with a mean difference of - 3 showing improvement in the glycemic control and the periodontitis in group A. Group B also showed a significant reduction from 4.20 ± 1.04 to 3.19 ± .79 with a mean difference of -1.01.

Pocket depth (mm) was reduced from 2.4 ± 0.5 mm to 2.2 ± 0.5. Whereas the PD ≥ 4mm (%) also showed a significant reduction from 27.9 ± 28.4 in the pre-intervention to 19.4 ± 27.0 in the post-intervention stage for Group A. Group B also showed reduction but this was more prominent in group A.

Bleeding on Probing (%) in group A was also significantly reduced from 29.4 ± 21.4 in the pre-intervention stage to 23.1 ± 23.2 in the post-intervention stage. Both groups showed significant reduction but like all other variables, this was also more prominent in intervention group A in comparison to group B.

Table-1: Demographics of the participants

	Total	Group A	Group B	P-Value
Size (n)	64	32	32	
Age (Years)	40.7 ± 7.80	42.5 ± 5.02	40.17 ± 6.7	0.21
Height (m)	1.65 ± 0.12	1.64 ± 0.05	1.65 ± 0.3	0.30
Weight (kg)	79.04 ± 8.24	81.3 ± 5.7	76.8 ± 5.07	0.05
BMI (kg/m2)	26.62 ± 1.77	27.23 ± 1.65	25.82 ± 0.85	0.05
Years of diabetes	8.3 ± 5.2	8.1 ± 4.6	8.4 ± 7.3	0.30
SBP	127 ± 13	134 ± 8	126 ± 10	0.25
DBP	89 ± 11	86 ± 16	92 ± 6	0.36

Characteristics of the participants as compared through independent sample T-Test. The values are denoted as mean ± SD, Body Mass Index (BMI); Systolic blood pressure, (SBP); Diastolic blood pressure (DBP)

Figure 2 shows the group-wise severity of periodontitis at post interventional stage.

To know the changes in all variables in the same group under consideration paired sample statistics were carried out for both experimental and control groups. The details are given in the table. Significant improvement for FBS, HbA1C, CRP, Pocket depth, and Bleeding on probing was observed in the experimental group

DISCUSSION

To the best of our knowledge, this study is the first quasi-experimental clinical trial to investigate

Table-2: mean ± SD values for different variables of groups A and B in the pre-intervention stage

	Group A	Group B	P-Value
FBS (mg/dl)	193 ± 36	180 ± 60	0.15
HbA1C (%)	9.9 ± 2.3	9.4 ± 2.26	0.63
CRP	5.15 ± 1.78	5.30 ± 1.04	0.77
Pocket depth mm	4.3 ± 1.4	4.4 ± 1.5	0.8
Bleeding on Probing %	75	80	0.9
Mild periodontitis	8 (25%)	10 (31%)	0.7
Moderate Periodontitis	23 (72%)	21(66%	
Severe Periodontitis	1(3%)	1 (3%)	

Glycated Haemoglobin (HbA1C), Fasting Blood sugar (FBS); C reactive protein (CRP); For Bleeding on Probing (BOP), and comparison of different categories of Periodontitis, the % of events were compared through Chi-square statistics

Table-3: Mean ± SD values for different variables of groups A and B in the Post-intervention stage

	Group A	Group B	P-Value
FBS (mg/dl)	115 ± 36	171 ± 60	0.01
HbA1C (%)	6.9 ± 1.3	8.9 ± 2.26	0.001
CRP	2.5 ± 1.78	5.1 ± 2.04	0.02
Pocket depth mm	2.2 ± 0.5	3.9 ± 1.9	0.006
Bleeding on Probing %	2 (6%)	18 (56%)	0.001
Normal	25 (78%)	6 (18%)	0.001
Mild periodontitis	5 (16%)	10 (32%)	
Moderate Periodontitis	2 (6%)	16 (50%)	

Glycated Haemoglobin (HbA1C), Fasting Blood sugar (FBS); C reactive protein (CRP); For Bleeding on Probing (BOP), and comparison of different categories of Periodontitis, the % of events were compared through Chi-square statistics

Table -4: Paired sample statistics results of all variables for both groups before and after intervension

Experimental Group A n = 32			
	Before	After	P-Value
FBS (mg/dl)	193 ± 36	115 ± 36	0.001
HbA1C (%)	9.9 ± 2.3	6.9 ± 1.3	<0.01
CRP	5.15 ± 1.78	2.5 ± 1.78	0.03
Pocket depth mm	4.3 ± 1.4	2.2 ± 0.5	0.04
Bleeding on Probing %	75	6	<0.01
Control Group B n=32			
FBS (mg/dl)	180 ± 60	171 ± 60	0.67
HbA1C (%)	9.4 ± 2.26	8.9 ± 2.26	0.72
CRP	5.30 ± 1.04	5.1 ± 2.04	0.81
Pocket depth mm	4.4 ± 1.5	3.9 ± 1.9	0.41
Bleeding on Probing %	80	56	0.09

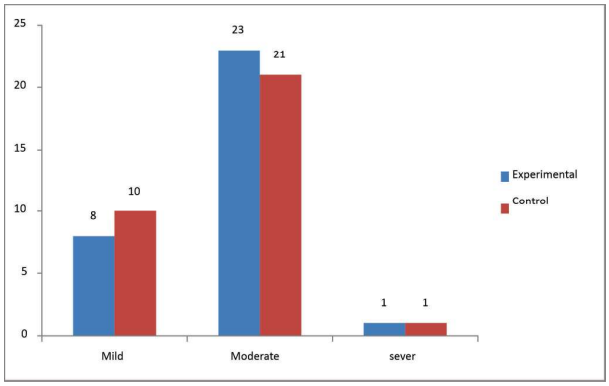

Figure 1: Bar Chart representing group-wise severity of Periodontitis at pre interventional stage

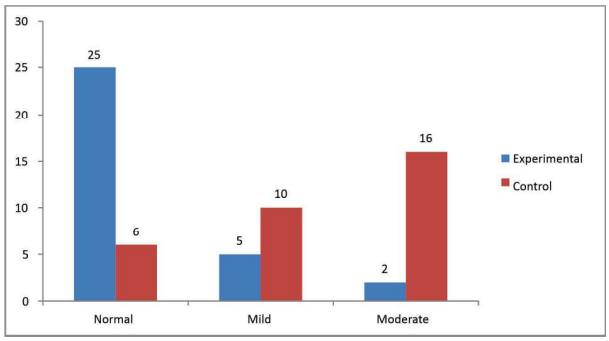

Figure 2: Bar Chart representing group-wise severity of Periodontitis at post interventional stage

the effect of strict glycemic control on clinical periodontitis in non-insulin dependent patients.

The effectiveness to improve and better the clinical measures of periodontitis, the periodontal therapy did also notably affect HbA1c levels at 3 months in the treatment group, A HbA1c levels at 3 months post-intervention showed significant reduction (p=0.03) to 8.1 ± 1.7 in group A in comparison to 9.9 ± 2.3 in the pre-intervention stage with a mean difference of -1.8 showing improvement in the glycemic control.

The results of our study were alike the previous large-scale randomized clinical trial[16]. PD and BOP were improved by the treatment and there were statistical differences between the pre and post-intervention stages in both the groups at 3 months. This was more pronounced in Group A. Satisfaction with diabetes treatment contributes to compliance[17]. Therefore, treatment of periodontitis in type 2 diabetics may be considered for its benefits in improving compliance and pathophysiology.

The primary outcome of glycemic control in this study is like a couple of recently published meta-analyses. These meta-analyses found out following periodontal treatment, statistically significant but modest reduction in the HbA1c levels was observed (0.36% [95% CI, -0.54% to -0.19%], p <0.0001(49); -0.48% (95% CI, -0.78% to 0.18%, p = 0.002 (47); -0.40% [95% CI, -0.78% to -0.01%], P = 0.04[18,19].)

The number of patients, who had changed their diabetes medications during the study, was quite small. This was similar between the two groups. It is worth noting that this aspect of the study design is critical for the reason as medications might carry a profound yet short-term effect on HbA1c levels. This is something not adequately documented in medical literature and previous studies.

A review found that the variety of HbA1c levels in a study population may influence the results[20]. The degree of improvement in the parameters of periodontal treatment may be small in this study. The mean difference of change in the mean PPD between the periodontal treatment group A and control group B was -0.2 mm (95% CI, P = 0.006) at 3 months of follow-up. A meta-analysis found this mean the difference to be -0.39 mm (95% CI, -0.64 mm to -0.15 mm) after 3±4 months of follow-up[21].

The complications of diabetes impair the patients' quality of life (QOL)[22,23]. Managing these complications (periodontitis) may contribute to a better QOL for diabetic patients. Further studies are therefore warranted to elucidate the factors that hinder the improvement of treatment compliance. Our study has several strengths. Firstly, the medications were observed during the follow-up visits. Secondly, the treatment was carried out under supervision. This resulted in a positive effect on the measure of clinical improvement in periodontitis (Group A).

Lastly, the test results were carried out in the laboratory with a centralized analysis of blood samples (HbA1c, FBS, and CRP) in a blinded manner. Making the results more valid and adding to the strength of the study. It can be seen in the graphs that the severity of periodontitis showed great improvement with treatment. Severe cases were completed and brought down to zero in the post-intervention stage. Most of the cases were in the mild to moderate range after the intervention with 31 patients showing complete remission of infection (Normal).

CONCLUSION

The present study concludes that strict glycemic control has a role in clinically correcting /improving periodontitis in non-insulin dependent patients. It can be further concluded that treatment of periodontitis has a role in improving glycemic control in type 2 diabetic patients at 3 months..

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