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Effect of non-surgical periodontal therapy on glycemic control of patients with chronic periodontitis and type-2 diabetes mellitus: A 3 month follow-up intervention study

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Abstract

Periodontal pathogens and their by-products trigger production of cytokines, acute phase proteins and oxidative stress molecules that impair insulin sensitivity or action. The effect of mechanical treatment alone on metabolic control in diabetes is controversial. The present study compared changes in glycaemic control following full-mouth scaling and root planing (SRP) by measuring glycated haemoglobin (HbA1c) level in 15 chronic periodontitis patients with diabetes. At baseline, periodontal examination, HbA1c evaluation and full-mouth SRP was done. Periodontal examination and HbA1c evaluation were repeated after 3 months. Change in HbA1c levels at 3 months was the primary outcome and changes in clinical parameters were secondary outcomes. Statistically significant improvement in periodontal status and HbA1c levels were seen after a follow up of 3 months following SRP. Periodontal treatment improved clinical measures of chronic periodontitis in patients with diabetes, supporting use of nonsurgical periodontal treatment for lowering HbA1c levels.

Keywords: Glycated haemoglobin, periodontitis, periodontal therapy, glycaemic control

1. Introduction

Diabetes mellitus and periodontal disease are two highly prevalent chronic disorders. The association between periodontal disease and diabetes has been demonstrated in several studies over the years, and periodontal diseases are now recognised as “the sixth complication” of diabetes [1].

A common hypothesis postulates that periodontal inflammation and pathogenic bacteria and their by-products trigger the production of cytokines, acute phase proteins and oxidative stress molecules that over time impair insulin sensitivity or action [2].

In view of the proposed bidirectional relationship between diabetes and periodontitis, researchers have studied whether periodontal treatment improves metabolic control in patients with diabetes.

Contemporary diabetic management with oral hypoglycaemic agents (OHAs) and/or insulin are challenged by the risks of lack of pharmacological responsiveness, developing insulin resistance, and rising production costs. Hence, adjunctive modalities are speculated to minimize diabetic complications. Reduction in systemic inflammation is one of the proven methods to achieve glycaemic control.

Research has shown improvement in clinical periodontal variables by the sole use of mechanical treatment. However, the effects of mechanical treatment alone on metabolic control in diabetes are controversial, with some authors observing no influence on metabolic variables [3,4] and others reporting an improvement [5,6].

Since then, many randomized controlled trials have been done and now, the research community has recognized the need for data from large, high-quality, multi-centered RCTs as the basis for clinical practice recommendations [7].

HbA1c represents serum glucose levels during the 120-day life of the red blood cell, and is a robust indicant of glycaemic control [8]. In this aspect, different studies clearly show that estimation of glycated haemoglobin can be an important and reliable parameter to judge the effective periodontal treatment on the level of glycaemic control.

Thus in this study, a treatment protocol was designed to manage periodontal disease associated with diabetes and to compare the changes in glycaemic control following one-stage full-mouth scaling and root planing by measuring the level of the glycated haemoglobin (HbA1c) in chronic periodontitis patients with diabetes.

2. Methods

15 subjects diagnosed with type 2 diabetes and chronic periodontal disease were recruited for the study. The subjects were explained about the study protocol and written informed consent was obtained. The study was approved by the Institutional Ethics Committee and was conducted in accordance with the Declaration of Helsinki 1975, as revised in 2013.

2.1 Selection criteria

The inclusion criteria were as follows:

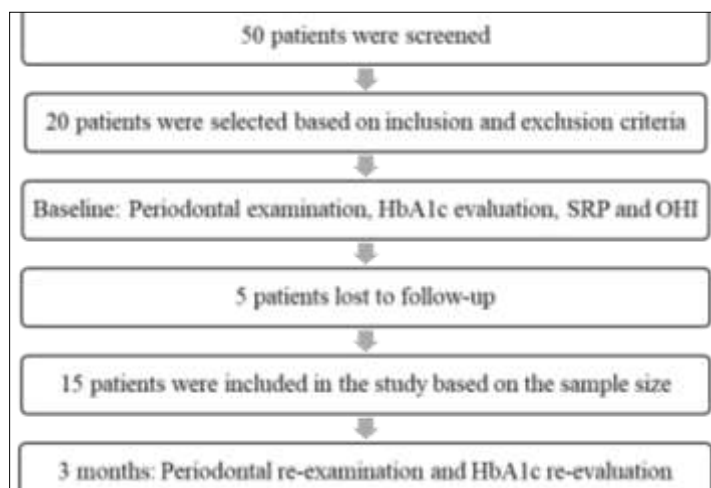
1. Patients aged between 18-70 years,
2. Diagnosed with type 2 diabetes mellitus with HbA1c levels $\geq 6\%$,
3. Presence of chronic generalized periodontitis according to the American Academy of Periodontology (AAP) criteria [9] and
4. Non-smokers.

The following were the exclusion criteria

1. Presence of any other systemic disease that could influence the course of periodontal disease or haemoglobin levels in blood,
2. Pregnant and lactating women.
3. Patients who had taken systemic antibiotic therapy within 6 months of recruitment
4. Patients who had undergone periodontal treatment in the previous 6 months.

2.2 Sample size and sampling techniques

The sample size has been estimated using the GPower software v. 3.1.9.2. Considering the effect size to be measured (dz) at 80% for Two-tailed hypothesis, power of the study at 80% and the margin of the error at 5%, the sample size needed was 15.



Chat 1: Consort chart

2.3 Study design

The present study was a prospective, longitudinal interventional study. After initial screening of the subjects, medical history was obtained as well as a complete periodontal examination including probing depths (PD), Plaque index (PI) [10], Gingival index (GI) [11], presence/absence of bleeding on probing (BOP) was done. Probing depth was recorded with a UNC 15 probe at six sites per tooth (mesio-buccal, disto-buccal, mid-facial, mesio-lingual, disto-lingual, and mid-lingual) using a customized acrylic stent as a reference to determine the site and angle of the measurements, ensuring reproducibility during the examinations. Patient education regarding periodontal disease and its association with diabetes was given along with oral hygiene instructions. Blood was drawn for initial HbA1c values. Scaling and root planing was performed with an ultrasonic scaler and Gracey curettes (Hu-Friedy, Chicago, IL, USA). Subjects were seen 3 months after baseline examination for periodontal re-evaluation [12]. At this appointment, all periodontal measurements were repeated and blood was drawn for final HbA1c values. Change in HbA1c levels at 3 months was the primary outcome. Changes in

clinical periodontal parameters at 3 months were the secondary outcomes.

2.4 Statistical analysis

All data extracted from the studies were submitted and analyzed using GPower software v. 3.1.9.2. This interventional study was performed, comparing the HbA1c before and 3 months after scaling and root planing. Mean values of Plaque Index and probing depth was done using Student paired t Test. Bleeding on probing before and after SRP was done using McNemar's Test. Comparison of mean HbA1c (%) before and after SRP among study subjects was done using Student Paired t Test.

3. Results

Total of 15 participants with primary outcome change in glycated haemoglobin and / fasting plasma glucose having a minimum of 3 months follow up were included in the study. There was significant difference seen in mean PI scores (Table 1, Figure 1), PD (Table 2, Figure 2) and BOP (Table 3, Figure 3) after 3 months ($p < 0.001$).

Table 1: Plaque index (PI) scores before and after SRP

Comparison of mean PI scores before and after SRP among study subjects using Student Paired t Test						
Time	N	Mean	SD	Mean Diff	t	P-Value
Pre-treatment	15	2.40	0.63	1.40	8.573	<0.001*
Post-treatment	15	1.00	0.00			

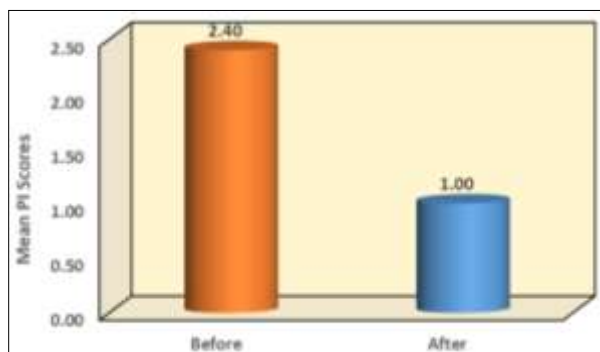


Fig 1: Mean Plaque Index (PI) scores before and after SRP

Table 2: Pocked depth (PD) levels before and after SRP

Comparison of mean PD Levels (in mm) before and after SRP among study subjects using Student Paired t Test						
Time	N	Mean	SD	Mean Diff	t	P-Value
Pre-treatment	15	5.07	0.70	1.07	16.000	<0.001*
Post-treatment	15	4.00	0.76			

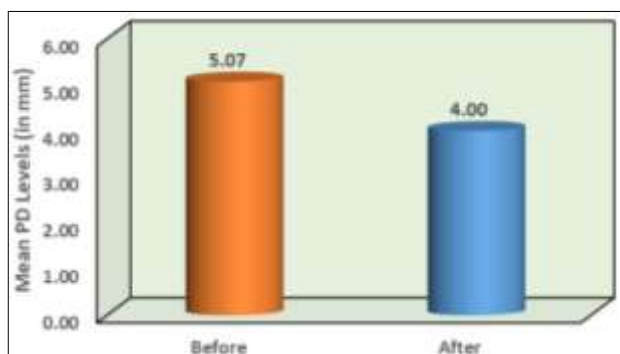


Fig 2: Mean Pocked Depth (PD) before and after SRP

Table 3: Presence of Bleeding on Probing (BOP) before and after SRP

Comparison of presence of Bleeding on Probing Before and After SRP among study subjects using McNemar's Test					
BOP	Before SRP		After SRP		P-Value
	n	%	n	%	
Present	15	100%	15	100%	1.00
Absent	0	0%	0	0%	

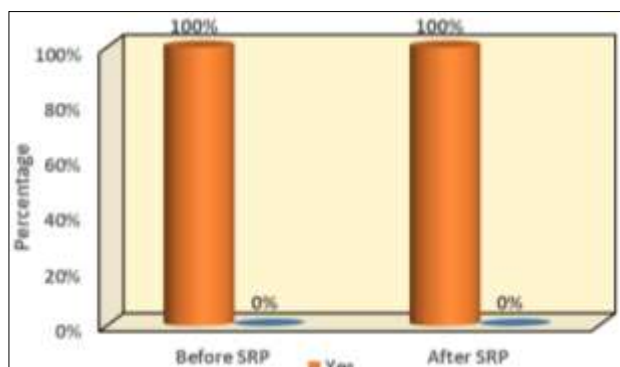


Fig 3: Presence of bleeding on probing before and after SRP

Mean HbA1c (%) levels before SRP was 8.25 and after SRP it was 7.91 among study subjects (Table 4, Figure 4). There was a significant reduction of glycated hemoglobin after 3 months follow up.

Table 4: HbA1c levels before and after SRP

Pearson Correlation test to assess the relationship b/w HbA1c & Clinical Parameters before and After SRP among study subjects							
Variables	Before SRP			After SRP			
	Values	PI	PD	Variables	Values	PI	PD
HbA1c (%)	r	0.11	0.38	HbA1c (%)	r	0.15	0.40
	P-Value	0.71	0.17		P-Value	0.64	0.15
	N	15	15		N	15	15

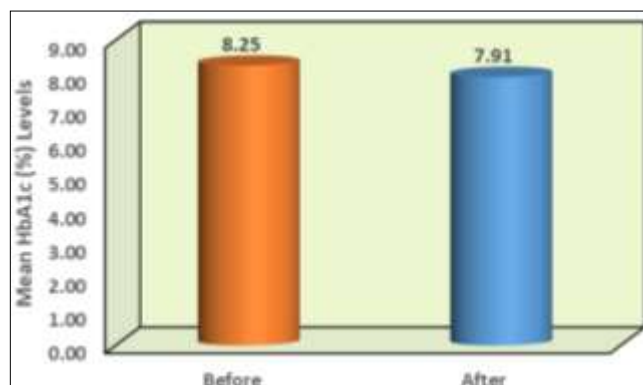


Fig 4: Mean HbA1c levels before and after SRP

4. Discussion

The presence of infection, specifically periodontal disease, can influence an individual systemic condition. The current study showed reduction in infection and periodontal inflammation, as well as reduced HbA1c levels after 3 months.

The exact mechanisms by which periodontal disease and its treatment may affect glycaemic control in patients with diabetes have not been fully elucidated. A popular hypothesis states that periodontal disease may affect insulin signalling through pro-inflammatory mediators. The pro-inflammatory cytokine TNF impairs insulin signalling by increasing adipose secretion of free fatty acids. Thus, periodontal therapy might improve glycaemic control by decreasing pro-inflammatory mediators [13, 14].

Previous studies have shown the beneficial effect of periodontal treatment on glycaemic levels in type 2 diabetic patients. Although data from large, multi-center trials, enrolling participants from diverse populations, are needed to better inform the dental and medical communities regarding the value of diagnosing and treating periodontitis in this patient population. This study was designed to add into this important knowledge gap.

The data of present study showed significant improvement in clinical periodontal condition i.e., pocket depth, plaque index, gingival index and bleeding on probing; thus confirming the favourable response of diabetic patients to periodontal therapy. The metabolic control of diabetes was also observed; there was a reduction in HbA1c levels from baseline in patients receiving non-surgical periodontal therapy. It is suggested that the improvement in the HbA1c values could have been due to reduction in GI and bleeding on probing [15]. Both periodontal disease and diabetes mellitus have multifactorial characteristics. The variables that might have influenced the result of therapy and actual control of diabetes could be: motivation of patient, genetic predisposition, degree of micro- and macrovascular complications.

The result is similar to meta-analysis that showed a modest and significant reduction in HbA1c levels following periodontal therapy ^[16], whereas, a contrasting finding was observed in a multicentre randomized clinical trial which do not support the use of non-surgical periodontal surgery for purpose of lowering levels of HbA1c ^[17].

Another study including 132 male veteran administration participants failed to demonstrate a positive effect on glycaemic control ^[18]. The result of this study is consistent with the clinical study of periodontal treatment and glycaemic control (n=157) reported a statistical significant 0.36% reduction in HbA1c levels in treatment group after 3 months ^[19].

Few of the limitations of this study, small sample size which could not ensure adequate statistical power to detect a worthwhile clinical difference in HbA1c level. And, also examination of subjects at single 3 month follow-up time point. Researchers have proposed different periods for reassessing periodontal parameters following non-surgical treatment. Morrison *et al.*, 1980 ^[20] and Lowenguth *et al.*, 2000 ^[21] suggested a one-month period while Badersten *et al.*, 1981 ^[22] believed that maximum tissue reattachment in deepened periodontal pockets (4-7 mm) occurs 4-5 months after non-surgical periodontal therapy and little change occurred during the rest of their 13-month observation period. While periodontal therapies result in a reduction in HbA1c level, a diabetes patient on an average will benefit from periodontal therapy. Additionally, in hospitalized diabetes patient, it should be taken as a window of opportunity to look for any oral infections, which are otherwise neglected routinely. Thus, a routine oral examination should be included for every diabetic patient and appropriate periodontal therapy should be instituted, if required ^[23].

5. Conclusion

Periodontal treatment improved clinical measures of chronic periodontitis in patients with diabetes, thus supporting the use of nonsurgical periodontal treatment for the purpose of lowering levels of HbA1c.

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