



Effect of Non-surgical Periodontal Therapy With and Without 0.2% Chlorhexidine Rinse on Metabolic Control of Type 2 Diabetic Patients

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Abstract

Background: The prevalence of periodontal diseases in patients with type 2 diabetes and improper glucose control is significantly higher. The aim of this study is to investigate the effect of scaling and root planning and chlorhexidine digluconate rinse on metabolic control in type 2 diabetic patients.

Methods: A total of 60 patients with poorly controlled type 2 diabetes and moderate chronic periodontitis were selected, and randomly divided into three groups. We performed scaling and root planning in 2 test groups (T1, T2), with 0.2% chlorhexidine rinse used only for test group 2. Follow-up including one evaluation 3 months later and a visit 6 months later, was to evaluate glycemic control (FBS and HbA1c) and periodontal status (PI and CPI). Data were presented as mean \pm standard deviation (SD) and analyzed using Student's t test and Wilcoxon test in SPSS 20.0.

Results: The mean changes in all variables in both test groups except FBS were significantly reduced ($P < 0.01$). T2 group showed better results at 3-month evaluation.

Conclusions: Non-surgical periodontal therapy improves periodontal health indicators and metabolic control in type 2 diabetic patients. Chlorhexidine is more effective on periodontal status and metabolic control in the short term.

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Background

Diabetes mellitus is one of the highly prevalent metabolic disorders, accounting for a major global public health issue. It is predicted that 300 million people will have diabetes by 2025 worldwide (1).

Studies show the prevalence of diabetes in Iran to be around 6.8%, which means almost 5.1 million Iranians suffer from the disease (2).

Periodontitis is an infectious disease caused by different types of gram-negative anaerobic bacteria in subgingival microbial plaque. The prevalence of periodontal diseases is significantly higher in individuals with type 2 diabetes and improper glucose control than in those with a normal systemic condition (3).

The HbA1c test provides an estimate of glycemic control over a period of approximately 2-3 months before the test, and the normal value is less than 6% (4).

The relationship between periodontal diseases and diabetes has been clearly observed in clinical studies. Periodontal disease is now considered as one of the 6 leading complications of diabetes (5).

It has been shown that periodontitis incidence rate is approximately 3 times higher in diabetic patients; this finding is related to the data adjusted for age, sex and oral

Highlights

- ▶ Chlorhexidine is more effective on periodontal status and metabolic control in the short term usage for improving periodontal health indicators and metabolic control in type 2 diabetic patients.

hygiene status (6).

Some studies have shown periodontal mechanical debridement has significant positive effects on the level of glucose control in diabetics (7,8). However, some other studies indicate non-surgical periodontal therapy causes no significant improvement in glycemic control despite improvements in patients' periodontal health, thereby not significantly reducing the level of HbA1C in diabetic patients (9,10).

Some studies have evaluated the effect of scaling on glycemic control, and showed improvements in glycemic control (7,11), while Correa et al and de Cruz et al found no significant changes in HbA1C level after 3 months (12,13).

Other studies have investigated the use of chlorhexidine along with scaling, and showed improvements in glycemic control of diabetic patients (14,15).

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Given the prevalence of periodontal disease in diabetic patients and its effect in glycemic control, the aim of this study is to compare the effects of non-surgical debridement and chlorhexidine rinse on glycemic control in type two diabetic patients.

Methods

Subjects

A total of 60 patients with poorly controlled type 2 diabetes and moderate chronic periodontitis were selected from the Endocrine and Diabetes Center, of whom 23 were male and 37 were female. The age range of the patients was 38 to 86 (mean: 62) years.

In this randomized, controlled clinical trial, patients with poorly controlled diabetes (HbA1c >8%) were randomly divided into 3 groups of 20 each using random number table. We performed scaling and root planning in 2 test groups by piezoelectric, and 0.2% chlorhexidine rinse was used for one of these groups twice a day for 2 weeks. SRP and chlorhexidine rinse was not used in control group.

Follow-up included one evaluation 3 months later and a visit 6 months later according to this funding that most clinical changes in pocket probing depth of 4-7 mm are established within about 5 months after non-surgical therapy (16).

All clinical and laboratory measurements were repeated 3 and 6 months after baseline. The patients who did not complete the follow-up periods were excluded from the study (17).

The inclusion criteria were the following: 1. Having suffered from type 2 diabetes for at least 1 year; 2. No need for prophylaxis regimen; 3. Moderate periodontitis (at least 6 of them having ≥ 5 mm periodontal pocket, ≥ 2 mm loss of attachment, and bleeding on probing); 4. Lack of using any antibiotics for at least 3 months; 5. Systemically suffering from diabetes alone; and 6. Age range of 25- 55 (18,19).

The exclusion criteria were the following: 1. Other serious systemic disease; 2. Smoking; 3. Proper diabetic control (HbA1c $\leq 8\%$); 4. Pregnancy or lactation for women; 5. Significant changes in their diabetes medications during the last year; 6. Less than 15 teeth remaining; 7. The presence of an active infection other than periodontitis; 8. Any periodontal therapy during the last 6 months; and 9. Any antibiotic treatment in the past 6 months.

Periodontal Examination

Clinical examinations performed to examine the periodontium prior to a non-surgical periodontal therapy at 3 and 6-month follow ups included:

- Plaque index: Using proximal plaque index according to O'Leary Index (20).
- World Health Organization (WHO) community periodontal index (CPI) codes were recorded as an

estimate of periodontitis (21). The CPI examines the surfaces of the teeth so that the worst score of each 6 teeth is recorded. CPI (22) is as follow:

- 0= Healthy gingival
- 1= BOP
- 2= Calculus
- 3= Shallow pockets up to 5 mm
- 4= Pockets deeper than 6 mm.

Determination of Blood Glucose and HbA1c Level

The fasting blood sugar (FBS0) and HbA1c (HbA1c0) were first measured before any periodontal therapy. Then, these parameters were measured 3 and 6 months after periodontal therapy in 2 test groups and control group.

Periodontal Therapy

Periodontal treatment was: 1. Training how to take control of dental plaque and maintain good oral health; 2. Scaling and root planning; 3. 0.2% Chlorhexidine digluconate rinse (Darou Pakhsh Co., Tehran, Iran) (10 mL, 60 seconds, and twice a day for 2 weeks) in group 2 of the test groups.

Statistical analysis

All statistical analyses were carried out using the SPSS 20 (SPSS Inc., USA) for Windows. The changes at follow-ups in each group were analyzed by Wilcoxon test, and the differences between case and control groups were presented as mean \pm standard deviation (SD) and analyzed using Student's *t* test. $P < 0.05$ was considered as statistically significant.

Results

As results show in Table 1, the mean changes in plaque index (PI) and CPI in both test groups were significantly reduced ($P < 0.01$), so that results in the test group 2 were slightly better than the period between baseline and the first follow-up (3 months later). Similar results were observed for CPI 6 months later. The differences after 6 months were equal in the test groups for PI (Figures 1 and 2).

FBS measurements showed a reduction of 12 mg/cc in test groups and 8 mg/cc in control subjects, which were not statistically significant ($P > 0.05$) (Figure 3).

HbA1c decrease from baseline level to the levels at 3 and 6-month evaluations was significant in both test groups and slightly better in test group 2 (Figure 4).

Discussion

Nowadays, it is clearly obvious that prevalence and severity of periodontitis are higher in diabetic patients and individuals with periodontitis have an increased prevalence of diabetes, and diabetics with periodontitis have poorer glycemic control. The prevalence of diabetes is associated with rapid urbanisation (23). This study showed that non-surgical periodontal therapy improves

Table 1. Comparison of the Mean Changes in Clinical and Laboratory Measurements in the Case and Control Groups

	PI			CPI			HbA1c			FBS		
	T0	T1	T2	T0	T1	T2	T0	T1	T2	T0	T1	T2
Control	68.15±18.91	62.65±17	61.30±18.62	2.1±0.71	1.89±0.74	1.97±0.74	9.15±0.96	8.71±1.05	8.3±1.11	175.4±41.9	173.4±36.8	167.95±32.2
Test 1	67.8±14.98	53.8±14.2	46±12.93	2.13±0.68	1.8±0.72	1.66±0.63	9.2±0.94	8.5±0.95	8.2±1.04	175.4±40.1	170.8±36.4	163.3±33.3
Test 2	67.55±13.82	38.50±10.81	39.85±11.79	2.2±0.63	1.61±0.57	1.5±0.55	9.26±0.91	8.16±0.89	7.98±0.82	175.7±38.7	165.1±30.84	160.4±25.5

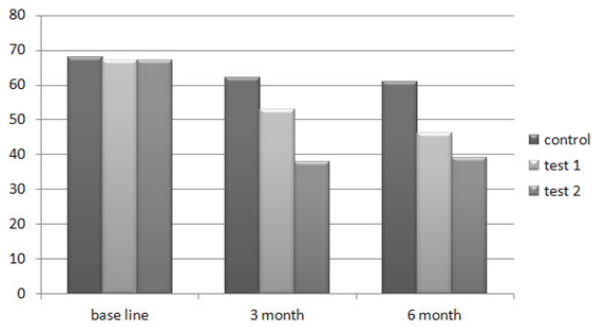


Figure 1. Comparison Between Plaque Index in Studied Groups at Follow-ups.

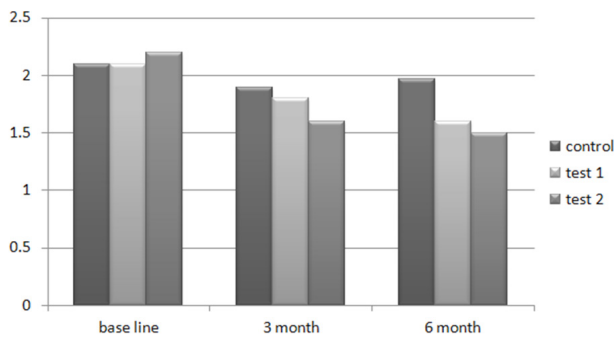


Figure 2. Comparison Between Community Periodontal Index in Studied Groups at Follow-ups.

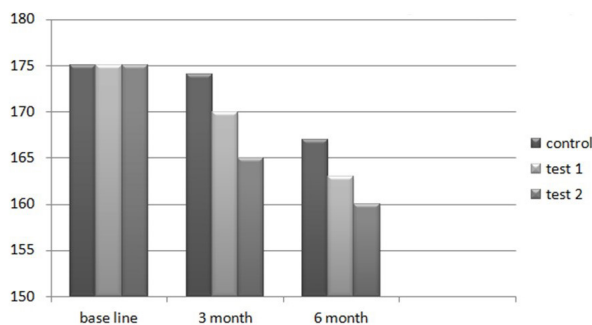


Figure 3. Comparison Between Fasting Blood Sugar Levels in Studied Groups at Follow-ups.

periodontal health indicators and metabolic control in type 2 diabetic patients.

After understanding the influence of periodontal inflammation on the composition of the subgingival

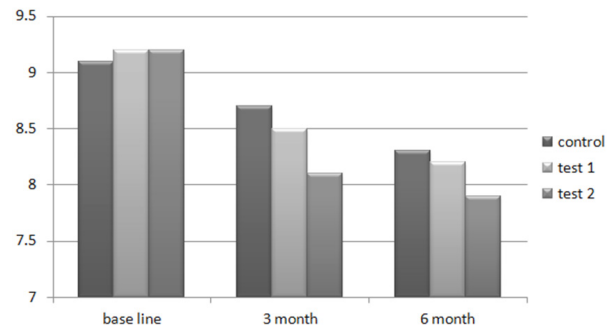


Figure 4. Comparison Between HbA1c Levels in Studied Groups at Follow-ups.

biofilm, the link between periodontitis and diabetes will be also better understood. A simultaneous increase in the number of anaerobic species in subgingival plaque occurs according to periodontal disease progression. The importance of systemic inflammation is highlighted by its exacerbation due to periodontal inflammation (24).

Several clinical trials have investigated the effect of periodontal therapy on improvement glycemic control. Some of them showed helpful effects (7,11,25) but some others could not find any effectiveness (9,10,12,13).

Mendonça et al evaluated changes in clinical and immunological variables of residual pockets after surgical and non-surgical debridement, associated with systemic antimicrobials in type 2 diabetic patients. They reported that surgical and non-surgical debridement associated with systemic antimicrobials did not differ in terms of clinical benefits for residual pockets in diabetics up to 6 months after treatment (17). Given this, it is clear that we can achieve favorable clinical outcomes by using non-surgical debridement; therefore, we used non-surgical periodontal therapy in our study.

Almas et al reported that oral hygiene instruction was effective on reduction of FBS, gingival crevicular fluid, community periodontal index of treatment needs (CPITN), and plaque index in type 2 diabetic patients with mild to moderate periodontitis. They also concluded that CPITN is not adequately sensitive to assess change in periodontal status over a 7-day period. Further studies are needed in diabetic and healthy subjects over a longer period of time (26,27). In our study, we conducted follow-ups at 3- and 6- month intervals. Although they

reported reduction of FBS, our study and other studies do not support this finding. The HbA1c is an indicator of the mean blood glucose concentration over the last 1–3 months, while fasting blood sugar reflects differences over a short period of time, which is clinically less relevant (28).

A study to compare the effect of ultrasonic scaling and root planning alone with that of subgingival water irrigation in (type 1 and 2) diabetic patients, showed a significant decrease in HbA1c levels in the 2 groups, though there was significant improvement in periodontal status in both groups (29).

Kiran et al reported a 10.94% reduction in HbA1c in type 2 diabetic patients (3 months after periodontal mechanical treatment). They also reported a 4.42% increase in HbA1c levels after non-surgical periodontal therapy in the control group. A significant difference between the groups was observed ($P=0.033$) (7).

da Cruz et al found only a reduction in the bacterial frequency with no statistically significant difference to that obtained 3 months after the treatment. Clinical and laboratory responses in one study were found to be similar in diabetes mellitus patients and healthy control adults 3 months after full-mouth scaling and root planing (13). This can be due to the small sample size of groups (10 for each), and comparison of treatment outcomes between diabetic patients and healthy individuals (instead of diabetic patients without periodontal therapy).

Correa et al reported significant improvement of all clinical parameters after treatment, which was associated with a significant reduction in Interleukin 1 beta (IL-1 β), elastase activity, and MMP-8 and -9 levels in deep sites. The shallow sites also showed significant reductions in IL-1 β and elastase activity levels. Treatment did not significantly reduce HbA1c concentrations in type 2 diabetes patients (12).

In one study, Dağ et al compared the effect of non-surgical periodontal therapy on serum tumor necrosis factor-alpha (TNF-alpha) and HbA1c levels in type 2 diabetic patients (2 groups of poor and well-controlled diabetes). Three groups of patients were enrolled (poorly controlled diabetes, well-controlled diabetes, and systemically healthy but suffering from periodontitis) in that study. Periodontal parameters (plaque index, gingival index, probing depth, clinical attachment loss, and gingival bleeding index), HbA1c and serum TNF-alpha levels were evaluated at baseline and 3 months after the non-surgical periodontal therapy. Significant reductions in periodontal parameters and serum TNF-alpha levels were observed 3 months after the non-surgical periodontal therapy. But reduction in HbA1c was seen only observed in well-controlled diabetic patients. They concluded that non-surgical periodontal therapy is insufficient for significantly reducing HbA1c levels without strict glycemic control in poorly controlled diabetic patients in the short term (30).

Garzon-Sanabria et al studied the effect of non-surgical periodontal therapy on the metabolic control, measured by HbA1c in uncontrolled type 2 diabetes mellitus patients with periodontitis. HbA1c was evaluated at baseline and 3 months after non-surgical periodontal therapy. A statistically significant reduction in HbA1c was observed ($P=0.026$) (31).

This finding confirms the short-term effect of non-surgical periodontal therapy on the metabolic control.

The study of Hungund et al was conducted on 30 patients; 15 diabetics and 15 non-diabetics, with chronic generalized periodontitis. Plaque index, bleeding index, gingival index, and probing depth were measured at 3 and 6 months after scaling and root planning. These clinical variables were all improved in both groups. There was a relationship between the levels of blood HbA1c and glucose and clinical response after 3 and 6 months of periodontal therapy. The mean HbA1c level at baseline (8.18 ± 1.56) reduced to 7.20 ± 1.37 and 6.73 ± 1.07 at 3 months and 6 months after non-surgical periodontal therapy in diabetic patients. Therefore, they reported positive metabolic response after non-surgical periodontal therapy (32). This study lacks a third group of diabetic patients without performing scaling and root planning. The group of non-diabetic people is useless from our point of view.

Rodriguez et al used amoxicillin aleuronic acid adjunct to scaling for 30 diabetic patients and the results showed PD reduction was significant in both control (scaling) and case (scaling + antibiotic) groups, and decrease in HbA1c level was from $8.8\pm 1.8\%$ to $7.6\pm 1.4\%$ in scaling group. They hypothesized non-significant difference of 2 modalities was the result of bacterial resistance to the antibiotic used. Higher reduction in HbA1c level was observed in patients with a higher level at baseline (33). It is therefore better to evaluate the effect of periodontal therapy without antibiotics. However, further studies are need to find the best antibiotics that are effective on periodontal disease and glycemic control.

Telgi et al concluded that reduced plaque levels, in turn, reduce the gram-negative bacteria in the plaque. This decreased plaque level would decrease gingival inflammation, which has an effect on reduction in insulin resistance. Using mouthwash alone does not completely eliminate the etiological factors like gingivitis-inducing plaque (28). It is noticeable that they used concentration of 0.12% once daily; therefore, we used 0.2% chlorhexidine rinse twice a day with scaling in the test group 2.

Correa et al in one study to investigate the effect of periodontal therapy on the circulating concentration of High-sensitivity C-reactive protein (hs-CRP), fibrinogen (FIB), IL-4, IL-6, IL-8, IL-10, TNF-alpha and the metabolic control in type 2 diabetes mellitus patients. Significant improvements were observed in all clinical parameters 3 months after the periodontal therapy. The most pronounced decrease was observed in TNF-alpha

and FIB. Periodontal therapy also reduced HbA1c and hs-CRP levels, albeit not significantly. The clinically successful non-surgical periodontal therapy tended to reduce systemic inflammation and the concentration of some circulating cytokines (25). This study supports our findings on the effect of periodontal therapy on metabolic control.

We faced certain limitations in this study such as patient compliance to mouth rinse use because of dental staining and follow-up sessions, and therefore we conducted dental stain removal for the patients.

Conclusions

Non-surgical periodontal therapy improves periodontal health indicators and metabolic control in type 2 diabetic patients. Chlorhexidine is more effective in periodontal status and metabolic control in the short term.

Authors' Contribution

PT: study conductor, data analysis. NR: data acquisition, study design.

Ethical Statement

Not applicable.

Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

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