The Effect of Oral Hygiene Instructions On Diabetic Type 2 Male Patients With Periodontal Diseases

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Abstract

Periodontal disease and diabetes are two common chronic diseases affecting humans. The aim of this study was to assess the effect of oral hygiene instructions on periodontal disease among type 2 male diabetic Saudi subjects. Sixty subjects completed the study and were divided into three groups of 20: healthy (non-diabetic) with periodontal disease, type 2 diabetic with early or moderate periodontal disease, and type 2 diabetic with advanced periodontitis. The age ranged from 24-64 (42 ± 13.60) years. The subjects were examined at King Saud University, College of Dentistry, Riyadh, Saudi Arabia. Oral hygiene practices and smoking habits were recorded. Oral hygiene instructions given to patients were to use an Oral B medium toothbrush and brush three times daily for 7 days using the by Bass technique for 2 minutes. Fasting blood glucose level (FBGL), gingival crevicular fluid (GCF), community periodontal index of treatment needs (CPITN), and plaque index (PlI) were used to assess patients' profiles at baseline and at recall visit after 7 days. The results showed there was a significant overall decrease in FBGL, baseline 172.67 mg/dl (±64.69) to recall visit 162.20 (±58.78) P = 0.000, and GCF volume decreased from .4041 µl (±.1260) to .3698 µl (±.1164) P = 0.000. There was a significant reduction in subjects' CPITN mean scores (from 13.98 (±8.24) to 13.32 (±8.97) P = 0.000), but there was no significant difference in Group 3 with advanced periodontitis, i.e., 22.25 (±1.37) to 22.30 (±1.38).

There was more than a 47% reduction in the overall percentage of plaque scores. The decrease ranged from 82.27 (±19.34) to 34.45 (±17.04) at baseline and recall visit respectively. It is concluded oral hygiene instructions (a standardized regimen) has an effect on FBGL, GCF, CPITN, and PlI. It is also concluded CPITN is not very sensitive to assess change in periodontal status over a 7 days period.

Further studies are needed among diabetic and healthy subjects with a larger sample size and over a longer period of time.

Keywords: Oral hygiene instructions, Diabetes type 2, diabetes mellitus, DM, periodontal disease, GCF, CPITN, Saudi Arabia

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Introduction
Among the most common chronic disorders of modern time, Diabetes Mellitus (DM) remains unique because of its multisystem ramifications.[1] DM is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[2] Type 2 DM is a complex disease with both metabolic and vascular components that affects more than 100 million people worldwide of which 13-15 million are Americans.[3] Prevalence of DM is about 3-7% in the western countries.[4] In Saudi Arabia, where modernization and industrialization are rapidly increasing, the incidence of DM appears to be on the rise. A high prevalence of DM has been noted in Saudi populations (2.55-5.32% among males and females respectively).[5]

Periodontitis is a bacterial infection caused by gram-negative anaerobes, which populate the subgingival plaque[6] causing a chronic inflammatory condition characterized by loss of connective tissue attachment and alveolar bone.[7] The prevalence of periodontal disease among individuals with type 2 DM is generally higher than those free of the systemic disorder.[8,9]

A study of the relationship between periodontal disease and blood glucose level among type 2 diabetic patients revealed that periodontal disease severity was high among diabetic subjects with a high blood glucose level and an increased community periodontal index of treatment needs (CPITN) score.[10] In one study, the effect of periodontal treatment on glycemic control in patients with type 2 DM revealed periodontal therapy was associated with improved glycemic control in the subjects.[11]

Oral self-care plays a role in maintaining and promoting periodontal health and the prevalence of periodontal disease varies according to individual health behavior. Despite the high risk of periodontal diseases, oral self-care in patients with DM has not been adequately studied.[12] There is evidence the control of periodontal inflammation has the potential to influence glucose metabolism[13], but knowledge about the ability of periodontal therapy to improve metabolic control of diabetes is still incomplete.[14] On the other hand, most well-controlled diabetics who practiced good oral hygiene and apparently maintained themselves generally seem not to be at an increased risk of developing periodontal disease compared with healthy subjects.[15] An extensive literature search has revealed there are no studies on the role of oral hygiene instruction as part of periodontal therapy among type 2 DM Saudi patients.

As a result, the aims of this study are (1) to assess the effect of oral hygiene instructions on periodontal disease and (2) to assess the glycemic changes in healthy, type 2 male diabetic Saudi patients.

Subjects and Methods
Ninety Saudi male subjects were considered as a convenient sample from King Saud University, College of Dentistry, Interns' and Periodontal Clinics.

They were divided into three groups:
- Group 1, healthy (non-diabetic) with periodontal disease
- Group 2, type 2 diabetic with early or moderate periodontitis
- Group 3, type 2 diabetic with advanced periodontitis

The age ranged from 24-64 (42 ± 13.60) years. The patients were informed about the study and informed consent was obtained before the start of the clinical examination. A standardized periodontal evaluation form was used for a pre-test (baseline) and a post-test (recall visit, follow-up oral hygiene instructions). Oral hygiene practices and smoking habits were recorded.

The following examinations were performed on the subjects:

Blood Examination
The following examinations were done at baseline and after one week follow-up visit, the fasting blood glucose level (FBGL) was assessed by "One Touch TM®" Complete Glucose Monitoring System, Johnson & Johnson, California, USA. (Figure 1)

Gingival Crevicular Fluid (GCF)
The gingival crevicular fluid (GCF) was collected by using Periotron System (Periotron 6000, Harco Electronics Ltd., USA). The system included Periotron GCF meter and Periopaper GCF Strip. (Figure 2)

Figure 1a. One Touch TM® Complete Glucose Monitoring System.

Figure 1b. The One Touch TM® sample analyzing device.

Figure 3a. The Periotron GCF meter prior to sampling.

Figure 3b. The Periotron GCF meter after sampling.

Figure 2. Periopaper GCF Strip.

The following technique was used to collect baseline visit and follow-up visit GCF:

1. The area was isolated with cotton rolls, supragingival plaque was removed, and the clean surface dried with a gentle stream of air.
2. Six teeth # 16, 11, 26, 36, 32, and 46 were examined at mid buccal surfaces.
3. A sterile dry filter paper strip, 15 mm x 3 mm, was inserted at the entrance to the gingival sulcus (intra-crevicular technique)[16] for 3 seconds to empty the crevicular pool; this filter strip was removed and discarded. After 27 seconds, another sterile dry filter paper strip was placed at the sulcus orifice for three seconds, with the total elapsed time being 30 seconds.
4. The filter paper strip was immediately placed between recording sensors so the entire moistened area of the filter strip was in contact with the sensors. With the switch on the no hold mode, the highest numerical readings were recorded. The digital numerical values were converted to fluid volume by dividing the reading by 200. (Figure 3)
5. After each measurement, the sensors were dried with sterile cotton rolls.

Community Periodontal Index of Treatment Needs (CPITN)

The CPITN was used for the assessment of periodontal disease. The criteria was used as described by Ainamo et al.:[17]

O = healthy
1 = bleeding
2 = calculus
3 = shallow pockets (3.5 – 5.5 mm)
4 = deep pocket (6 mm +)

Plaque Index (PlI)

The PlI score was calculated by using plaque disclosing solution.

The formuls follows

$$\frac{\textit{Teeth surfaces with plaque}}{\textit{Total no. of surfaces}} \times 100 = \% \text{ plaque score}$$

Oral hygiene instructions were given to patients as follows: "Use the Oral B medium textured toothbrush provided to you three times daily after breakfast, after lunch, and before going to bed." The time was adjusted for two minute durations at each brushing event using the Bass tooth brushing technique.
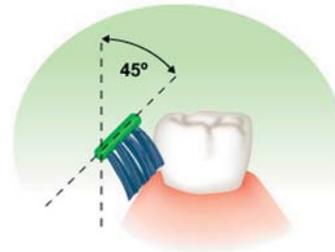
Bass Tooth Brushing Technique

The FBGL, GCF, CPITN and PlI were recorded at the first visit (baseline) and again at the second visit (follow-up) after 7 days of using the prescribed oral hygiene regimen. A pilot study was done on 5% of the subjects to standardize the methods employed. The study was completed in six months. The data was analyzed by using the Statistical package for Social Sciences (SPSS version 10). Frequency distributions were generated for descriptive data analysis. ANOVA was used for comparisons of mean values and significance level was set at 0.05.

Results

Sixty patients completed the study out of the 90 initial subjects which resulted in 20 patients per group. Thirty five percent of the patients did not brush their teeth. Twenty-three percent used miswak (a fibrous wooden cleaning stick) and only 12% had the habit of brushing three times per day. Smoking was prevalent among 30% of the subjects. There was a reduction in the FBGL in all three groups. There was a marked reduction of FBGL in Group 3 diabetics with advanced periodontitis. The FBGL decreased from 233.55 mg/dl to 212.95 mg/dl (p = 0.000). (Table 1)

There was a significant decrease in mean GCF in all three groups at baseline and recall visit. The overall reduction was from 0.4041 µl to 0.3698 µl (p = 0.000). (Table 2)

There was also a decrease in the mean CPITN score. The overall decrease in all groups ranged from 13.98 to 13.32 (p = 0.000). There was no significant change in Group 3 with advanced periodontitis. (Figure 4)

A mean plaque score decrease was observed in all three groups. The largest reduction in plaque score was observed in Group 3 with advanced periodontitis. It ranged from 94.30% to 41.85% at baseline and recall visits respectively (p = 0.000). More than a 47% reduction was recorded in the total group mean score. (Figure 5.)
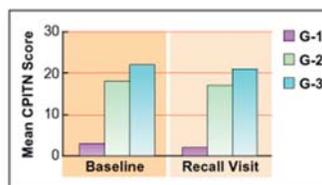
Figure 4. The mean Community Periodontal Index of Treatment Needs (CPITN) score change at baseline and the recall visit.
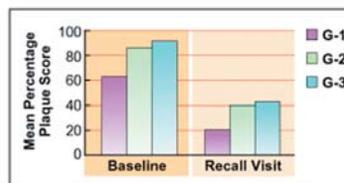
Figure 5. Mean percentage plaque score change at baseline and recall visit.

Discussion

The study was conducted to determine the effect of oral hygiene instructions (regular tooth brushing) on periodontal disease among type 2 male diabetic Saudi patients. The study was planned for ninety subjects, while only sixty complied with the study design. Oral hygiene was poor and the number of smokers was high in the selected patient population. This is characteristic of the local lifestyle.

Although the objective of the study was to determine the effect of oral hygiene, the non-complying patients were not excluded from the study. The rationale for including these patients was based on the premise that poor compliance of the patients does not reflect their disagreement with the oral hygiene regimen, but reflects the social commitments and low priority to health mat-

Table 1. Mean Fasting Blood Glucose (FBGL) level at baseline and recall visit.

Group	Patients No.	Baseline FBGL mean (± SD)	Recall visit FBGL mean (± SD)	Sig. level p-value
G-1	20	90.60 (3.84)	86.50 (3.07)	0.004
G-2	20	193.85 (32.47)	187.15 (32.28)	0.002
G-3	20	233.55 (21.53)	212.95 (16.71)	0.000
Total	60	172.67 (64.69)	162.20 (58.78)	0.000

Table 2. Mean Gingival Crevicular Fluid (GCF) change at baseline and recall visit (post 7 days).

Group	Patients No.	Baseline GCF mean (± SD)	Recall visit mean (± SD)	Sig. level p-value
G-1	20	.2661 (± 4.86)	.2429 (± 4.47)	0.000
G-2	20	.3988 (± 5.02)	.3623 (± 4.47)	0.000
G-3	20	.5473 (± 5.23)	.5040 (± 4.56)	0.000
Total	60	.4041 (± .1260)	.3698 (± .1164)	0.000

ters. Clinical compliance is very difficult in Saudi Arabia due to the difficult living environment that results in alternate priorities of the patients.

It is well-established marginal periodontitis and cardiovascular disease share some common risk factors such as DM, smoking, and poor health-care habits.[18] It has been stated periodontitis is considered the sixth greatest complication of DM.[20] In the present study, it was found that FBGL decreased significantly after one week of oral hygiene instructions. Poor glycemic control is an established risk factor for periodontitis, however, there is also some evidence the reciprocal is true; severe periodontitis may negatively affect glycemic control.[21,22]

In this study, it was observed the severity of periodontal disease increased with an increase in blood glucose level. This finding is an indicator of the need for improving oral health status among diabetic patients. The present findings are in accord with a previous study.[10]

It has been shown the flow of GCF is a sensitive parameter of gingival inflammation.[23] Cimasoni noted "a positive correlation was always found between the clinical appreciation of gingival inflammation and the amount of gingival fluid."[23] The amount of gingival fluid is greater when inflammation is present.[24] The results of present studies agree with the above findings as there was a steady increase in the GCF level with an increase in severity of periodontal disease, and significant reduction was observed in follow-up visit due to plaque control and decrease in inflammation. Although the full mouth CPITN screening method was used for a quick assessment of periodontal status, it was not a sensitive measure of short-term changes in periodontal status. The lack of sensitivity may be attributed to two factors: (1) the minimal changes seen in a one week period were not detectable using the CPITN and (2) the CPITN is an inherently flawed test of small changes in inflammatory status.[25]

In the present study, a reduction in the plaque score was a very positive finding. Previously it has been shown that improvements in personal oral hygiene were associated with reduced amounts of plaque and calculus (due to professional cleaning) and frequent dental visits.[26]

Frequent professional care has been highly recommended for adult diabetic patients[25], and the findings in this study indicate improvement in personal and oral hygiene are also beneficial.

In terms of community health among diabetics, there is a need for a mass media campaign advocating diabetes control as well as the control of other related risk factors to periodontal disease. Tooth brushing frequency and efficiency should be strongly emphasized.[10] Medical colleagues and diabetic patients should be urged to consider oral health as an important factor for periodontal disease control.

Since diabetes is a risk factor for ischemic heart disease and complications of DM has devastating effects on the patient's life and health budget5, there is a need for a comprehensive program for the control of diabetes. Such a program should include oral hygiene messages in the news media promoting oral health activities, a healthy life style and smoking cessation. Further, research is needed in both male and female diabetics as far as oral health behavior changes and promotional activities are concerned.

Conclusion and Recommendations
Within the confines of this study, it is concluded that:

- Structured oral hygiene instructions can have a positive effect on the metabolic control of type 2 diabetes. FBGL and GCF scores were reduced due to oral hygiene instructions. PlI also decreased remarkably.
- CPITN had very limited change, reflecting low sensitivity to assess change in periodontal status over a one week period.

Further studies are needed among diabetic and healthy subjects with a large sample size and for a longer period of time in both male and female patients. General dental practitioners should emphasize the benefits of practicing regular and effective tooth brushing for diabetic patients.

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