Clinical effects of supragingival plaque control on uncontrolled type 2 diabetes mellitus subjects with chronic periodontitis

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Abstract

Aim: To determine the clinical changes occurred in chronic periodontitis patients presenting uncontrolled type 2 diabetes mellitus after a supragingival plaque control period. Methods: Subjects presenting generalized chronic periodontitis were divided into two groups: Non-diabetics (n=20) – healthy subjects presenting chronic periodontitis; and Diabetics (n=14) – subjects with uncontrolled type 2 diabetes mellitus presenting chronic periodontitis. All subjects went through 28 days of supragingival plaque control - ST - (including prophylaxis, calculus removal, extraction of hopeless teeth and oral hygiene instructions) and were evaluated at baseline and after 28 days by the following parameters: Full-Mouth Plaque Score (FMPS) and Full-Mouth Bleeding Scores (FMBS), Periodontal Probing Depth (PPD), Gingival Recession (GR) and Clinical Attachment Level (CAL). ANOVA/Tukey’s test and Student’s t test were used for data analysis. Results: No statistically significant differences (p>0.05) between groups were observed at baseline for any parameter. Both groups presented a significant reduction in FMPS and FMBS after 28 days (p<0.05), but no statistically significant difference was found (p>0.05) between groups. Clinically, only the Non-diabetic group showed a significant improvement after ST, in PPD of initially deep pockets (p<0.05). However, no change in the clinical parameters was observed in the diabetic subjects (p>0.05). Conclusions: It may be concluded that uncontrolled diabetes mellitus reduces periodontal changes in the supragingival plaque control regimen of subjects presenting with chronic periodontitis.

Keywords: diabetes mellitus, plaque control, chronic periodontitis.

Introduction

Chronic periodontitis results from the presence of complex microbial communities in the subgingival sulcus¹, and diabetes mellitus, especially if poorly controlled, increases significantly risk for development of extensive and severe diseases². Hyperglycemia and resultant advanced glycation end product formation, which is one of several pathways thought to lead to the vascular complications with diabetes, are also involved in the pathophysiology of periodontitis in diabetic subjects³, leading to an imbalanced release of pro- and anti-inflammatory cytokines⁴⁵ and osteoclastogenesis-related factors⁶.
Despite the differences in pathogeneses, biofilm still remains the primary etiologic factor for the development of a destructive periodontal disease. Thus, the primary goal of periodontal therapy is to target the subgingival biofilm present in periodontally diseased sites that are associated with the progressive destruction of the supportive periodontal tissues. It is well documented that conventional therapy, i.e., subgingival scaling and root planing, is effective in achieving this goal. However, supragingival plaque control appears to have a significant effect on clinical and microbiological characteristics of periodontal pockets, which could be associated with the close relationship between those environments.

Previous studies have evaluated the relationship between supragingival plaque control and clinical and microbiological effects on subgingival areas, reporting a positive effect in systemically healthy subjects with periodontitis, i.e., a reduction in probing depth and some periodontal pathogens and preventing re-colonization. However, conflicting results of the impact of supragingival dental biofilm control on clinical features in untreated periodontal sites are found in the literature.

In this context, there is an interest in the possible effect of supragingival biofilm control on the subgingival environment in untreated periodontitis sites in diabetic patients, since, in previous studies, these patients presented with some altered biofilm compositions, with a higher prevalence of periodontal pathogens. Thus, the aim of the present study was to determine clinical changes in type 2 diabetic patients after 28 days of strict supragingival plaque control compared with non-diabetic patients.

Material and methods

Population Screening

Initially, manuscript design was approved by the institutional Ethics Committee (protocol number 014/09). Eligible patients were selected from those referred to the Graduate Clinic of Paulista University, Brazil. All patients received a complete periodontal examination, including full mouth periodontal probing, radiographic examination, and complete clinical interview. Moreover, type 2 diabetic patients were sent to the clinic by Vila Mariana Health Center (HCVM), São Paulo, Brazil after being diagnosed using the Fasting Plasma Glucose (FPG) > 110 mg/dL and the glycated hemoglobin (Hba1c) > 7% in two different examinations. All diabetic subjects were followed by a physician at HCVM. Subjects who did not have diabetes but who presented with periodontitis were also selected in order to compare the clinical response of both types of patients.

The study inclusion criteria were the following: Diagnosis of chronic periodontitis, according to the criteria of the 1999 international classification; at least 8 teeth with a periodontal probing depth (PPD) > 5 mm and bleeding on probing; presence of at least 20 teeth; and good general health. Patients who were pregnant or lactating, required antimicrobial pre-medication for the performance of periodontal examination and treatment, received a course of periodontal treatment within the last 6 months, smokers, those under use of long-term antiinflammatory drugs, suffered from any other systemic diseases (cardiovascular, pulmonary, liver, and cerebral diseases), or had received antimicrobial treatment in the previous 3 months were excluded from the study.

The sample size was determined after considering data in the literature and was aimed at obtaining a minimum power value of 0.8 to detect a difference and 0.8 mm between groups in clinical attachment level (CAL) (primary variable). A blinded and calibrated examiner was used (intra-class correlation for CAL) = 94% in a parallel design.

Supragingival Plaque Control therapy (ST)

After full mouth examination and participants’ informed consent, the patients in both groups received a full mouth prophylaxis, supragingival calculus, and biofilm removal using Gracey curettes, ultrasonic scaler, bicarbonate spray, and dental floss. Also, condemned teeth were extracted and biofilm retentive factors were removed. Moreover, the patients were individually instructed on how to perform oral self-care, including the Bass technique, inter-dental flossing, and tongue brushing. All subjects received a standard fluoride dentifrice, toothbrushes, and dental floss as necessary and were asked to perform complete oral self-care hygiene at least twice a day. A week after this first instruction session, patients returned for reinforcement of the oral self-care instructions. Twenty-eight days after ST, clinical re-evaluation was performed.

Groups

Subjects were distributed to the following groups: Diabetes (N=14): composed of individuals presenting with uncontrolled type 2 diabetes mellitus and generalized chronic periodontitis and Non-Diabetics (N=20): composed of individuals presenting with generalized chronic periodontitis.

Clinical Parameters

The following clinical parameters were assessed immediately before and 28 days after plaque control therapy using a PCP-15 periodontal probe (Hu-friedy, Chicago, IL, USA): Full-mouth Plaque Index (FMI) and Full-Mouth Bleeding Score (FMBS); represented by the percentage of positive sites; PPD – Distance from the bottom of the pocket to the gingival margin); Gingival Recession (GR – distance from the gingival margin to cement-enamel junction); CAL – distance from the bottom of the pocket to cement-enamel junction)

Glycemic status

A single laboratory performed the glycated hemoglobin (Hba1c) and fasting plasma glucose (FPG) tests in order to confirm Diabetes mellitus status. HbA1c (%) was measured using high-performance liquid chromatography, and FPG was performed using the glucose oxidase method. For
uncontrolled cut-off, HbA1c should be higher than 7% and FPG > 120 mg/dL. All patients were under physician monitoring and taken oral hypoglycemic pills.

Data Management and Statistical Analysis

For clinical parameters, a repeated-measures analysis of variance (ANOVA) was used to detect intra-group differences in clinical parameters (GR, PPD, CAL), considering the patient as a statistical unit. When a statistical difference was found, the analysis of the difference was determined using the Tukey’s test. The Friedman test was used to detect intra-group differences and Kruskal-Wallis was used for the intergroup analysis of the Full Mouth Plaque and Bleeding Index among all periods. The level of significance was set at 5%.

Results

Table 1 displays the demographic, clinical, and diabetic status of the population included in the present study. No difference was found regarding gender, age, and clinical parameters (PPD, CAL). Moreover, the FPG and HbA1c levels of diabetic subjects evidenced their poor glycemic control.

Table 2 shows changes in plaque and bleeding indices after supragingival plaque control. Both groups exhibited a reduction in plaque and bleeding (p<0.05) and no significant difference between them was observed at baseline or after the supragingival plaque control period (p>0.05).

Table 3 shows the clinical changes of shallow (PPD <4mm), moderate (5<PPD<6 mm), and deep (PPD >7mm) pockets after 28 days of strict plaque control.

Discussion

Periodontal disease and diabetes mellitus belong to a pathologic condition in which both diseases could negatively interfere with each other, constituting a bidirectional relationship. Diabetes mellitus, especially when uncontrolled, appears to be an important risk factor for periodontal destruction, since an alteration in host-response and microbiological aspects occurs in diabetic subjects. Periodontal destruction led to an increase in insulin resistance, which could impair glycemic control. This way, the control of periodontal disease is necessary for better systemic health in these individuals. Periodontal treatment relies on biofilm disruption and plaque control to prevent recolonization and recurrence of the disease. For this, an essential phase of this

| Table 1. Demographic characteristics of subjects. |
|---------------------------------|--------|--------|
| **Non-diabetics** | **Diabetics** |
| Age (Mean±SD) | 43.4 ± 6.45 | 56.14 ± 11.7 |
| (minimum-maximum) | (35 - 55) | (41 - 80) |
| Gender (n) | | |
| Male | 13 | 9 |
| Female | 7 | 5 |
| Glycemic status | | |
| Fasting Plasma | | 145±46.5 mg/dL |
| Glucose (mean±SD) | | |
| Glycated Hemoglobin | | 8.1±1.1 % |
| - HbA1c (mean±SD) | | |

| Table 2. Full mouth Plaque (FMPS) and bleeding scores (FMBS) in diabetic and non-diabetic subjects before and after supragingival therapy. |
|-----------------|-----------------|-----------------|
|                | Non-diabetics   | Diabetics       |
| **FMPS**       | **Baseline**    | **28 days**     |
|                | 84.2±7.5 A      | 83.5±12.4 A     |
| **FMBS**       | **Baseline**    | **28 days**     |
|                | 56.1±12.4 A     | 47.5±20.2 A     |

Different letters in column indicate a statistically significant difference within the group (ANOVA/Tukey, p<0.05)

| Table 3. Clinical parameters at shallow (PPD <4mm), moderate (5<PPD<6mm), and deep (PPD >7mm) pockets or shallow (CAL <4mm), moderate (5<CAL<6mm), and deep (CAL >7mm) CAL levels in diabetic and non-diabetic subjects before and after supragingival therapy. |
|-----------------|-----------------|-----------------|
| **Non-Diabetes** | **Diabetes**    | **PPD < 4**     |
| Baseline | 3.1±0.4 A | 3.5±0.7 A |
| 28 days | 3.0±0.2 A | 3.2±0.2 A |
| **PPD < 6** | **Baseline**    | **28 days**     |
| 5<PPD<6 | 5.4±0.2 A | 5.3±0.2 A |
| **PPD > 7** | **Baseline**    | **28 days**     |
| 8±1.0 A | 8.4±0.8 A |

Different letters in column indicate a statistically significant difference within the group (ANOVA/Tukey, p<0.05). Periodontal Probing Depth (PPD), Clinical Attachment Level (CAL).
treatment is supragingival plaque control. So, the present study evaluated the periodontal changes in type 2 diabetic subjects and non-diabetic subjects after a supragingival plaque control regimen. Diabetics did not show significant changes in their clinical aspects, although in non-diabetic subjects, a statistically significant change could be seen, especially in deep pockets.

Diabetic subjects with poor glycemic control present an altered release of pro and anti-inflammatory cytokines. Moreover, some previous studies have shown that the microbiota associated with diabetes does not appear different from the microbiota of non-diabetic patients. Glucose concentration in gingival crevicular fluid has been correlated with a high glucose concentration in the serum. Elevated glucose levels in saliva and gingival crevicular fluid could induce an increase in the number of saccharolytic bacteria associated with dental caries in the saliva and in the supragingival and subgingival plaque of diabetic patients, which could modify the biodiversity in diabetic subjects. Moreover, glycemic control could contribute to this harboring-microbiota profile, since different levels of plasma glucose may also indicate different levels of this carbohydrate in the subgingival area, probably altering environmental and microbiota characteristics. These patterns together make uncontrolled diabetes mellitus an important modifier of periodontal tissues and could impair periodontal response to treatment and be associated with this absence of significant changes after a supragingival plaque control regimen. At the same time, clinical improvement after supragingival plaque control was observed in non-diabetic subjects. Corroborating with our study, previous clinical and microbiological trials showed that supragingival plaque control are able to promote significant changes in periodontal conditions. Ribeiro et al. observed a gingival inflammation reduction, corroborating other studies that show a positive influence in shallow and moderate pockets, although some studies also showed a benefit in deep pockets. In sequential studies, Gomes et al. identified some clinical and microbiological improvement when supragingival plaque control was performed for 6 months. Although no statistically significant reduction has been observed regarding specific periodontal pathogens (Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis and Tannerella forsythia), the total number of subgingival bacteria were reduced when supragingival was performed.

More recently, Melmann et al. evaluated the impact of supragingival plaque control, following the same protocol used in the present study, a microbiological positive effect was observed, using a 16S cloning technique for biodiversity analysis. In this study, a reduction in some phylotypes was observed in higher frequency in non-smokers than smokers, especially those genera known as periodontal pathogens or observed in higher frequency in non-smokers than smokers, for example Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis and especially in deep pockets.

Changes in their clinical aspects, although in non-diabetic subjects. Ribeiro et al. observed a gingival inflammation reduction, corroborating other studies that show a positive influence in shallow and moderate pockets, although some studies also showed a benefit in deep pockets. In sequential studies, Gomes et al. identified some clinical and microbiological improvement when supragingival plaque control was performed for 6 months. Although no statistically significant reduction has been observed regarding specific periodontal pathogens (Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis and Tannerella forsythia), the total number of subgingival bacteria were reduced when supragingival was performed.

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Considering the results of the present study, it may be concluded that uncontrolled diabetes mellitus reduces periodontal changes in the supragingival plaque control regimen of subjects presenting with chronic periodontitis.

Acknowledgements

This study was supported by National Council for Scientific and Technological Development (PIBIC/CNPq - Grant 154857/2010-6).

References