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The Effect of Non-Surgical Periodontal Treatment on Metabolic Control among Uncontrolled Type 2 Diabetic Patients

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Abstract

Background: The possible relationship between decreased inflammatory processes in periodontitis and improved metabolic control in diabetes is still a controversial topic, despite the existing studies. Thus, the aim of the present study was to evaluate the effects of reductions in periodontal infection among individuals with uncontrolled type 2 diabetes mellitus, by means of a glycated hemoglobin assay.

Methods: Fifty-six patients with uncontrolled type 2 diabetes were treated clinically at the Diabetes Center of Feira de Santana, Bahia. They were divided into two groups: DP (28), with severe chronic periodontitis (test group); and DWP (28), who did not have periodontitis (control group). Both groups were evaluated after 90 and 180 days with measurements of the plaque index, bleeding on probing, probing depth, clinical attachment loss and plasma concentration of glycated hemoglobin. Both groups started to receive periodontal treatment after the first examination.

Results: The test and control groups both showed statistically significant effects regarding plaque index and bleeding on probing, after periodontal treatment. The test group showed clinical improvement in the severity of periodontal status. The control group showed no significant changes in the clinical severity parameters of probing depth and clinical attachment loss. The HbA1c levels in both groups after six months had decreased significantly.

Conclusions: Non-surgical periodontal therapy resulted in reducing the levels of periodontal infection and inflammation. This significant improvement in periodontal conditions was associated with a reduction in glycated hemoglobin levels and consequently an increase in glycemic control.

Keywords: *Chronic Periodontitis; Glycemic Control; Type 2 Diabetes Mellitus*

Introduction

Susceptibility to periodontitis involves a trio formed of bacteria, hosts and environmental factors [1]. Certain systemic conditions and abnormalities in hosts are additional factors [2]. Diabetes mellitus, for example, is a risk factor for periodontitis since it increases the likelihood of damage caused by this infectious disease. However, diabetes is not a determinant for the development of periodontitis [3].

King, Aubert and Herman [4] estimated that the prevalence of diabetes worldwide would increase from 4% in 1995 to 5.4% in 2025, thus affecting approximately 300 million individuals. The three countries most affected by this disease are India, China and the United States and it has been estimated that 75% of diabetic individuals will be in developing countries by 2025; the majority of these individuals will be women and people living in urban areas. Diabetes is a highly prevalent disease in Brazil, and epidemiological estimates point towards increases in its occurrence in this country. There are currently around five million diabetics in Brazil, but half of them are unaware that they have this disease. Between 5 and 14% of public funding destined for healthcare goes towards treating diabetic patients [5].

Diabetes characteristically presents five classical complications: retinopathy, peripheral neuropathy, microangiopathy, macroangiopathy and nephropathy. Löe [6] concluded that periodontitis is more severe and more prevalent among diabetics and that it should be considered the sixth classical complication of diabetes mellitus.

Studies of periodontitis among individuals with diabetes have revealed that the subgingival microbiota of patients with severe periodontitis and non-insulin dependent diabetes was similar to that which was observed among non-diabetic patients with severe periodontitis [7,8]. Nevertheless, the severity, prevalence and incidence of periodontitis have been found to be greater among diabetics than among metabolically healthy individuals [9-13]. According to Ervasti., *et al*. [14] and Oliver and Tervonen [15], inadequate metabolic control is correlated with a greater severity of periodontitis and an increased risk that diabetic individuals will develop it. On the other hand, Hayden and Buckley [16] stated that there was no interrelation between periodontitis and metabolic control and the duration of diabetes. However, according to Hugoson., *et al*. [17] Cerda., *et al*. [18] and Firatli Yilmaz and Onan [19], the duration of diabetes would have a large influence on the severity of periodontitis.

Lalla, Lamster and Schmidt [20] stated that the non-enzymatic glycosylation of proteins and lipids is a consequence of hyperglycemia, thus resulting in the formation of advanced glycosylation end products (AGEs), which are normally accumulated in both plasma and tissue. The latter is exacerbated in diabetics. The interaction between AGEs and their receptor (RAGE) increases the production of tumor necrosis factor alpha (TNF-), thereby resulting in an exacerbation of the inflammatory process.

Elimination of inflammatory infectious processes gives rise to diminished concentrations of pro-inflammatory cytokines, including TNF- . This cytokine is one of the main factors involved in insulin resistance [2]; therefore, the elimination or diminution of the inflammatory process observed in periodontitis would favor metabolic control among diabetic patients.

One possible relationship between diminution of the inflammatory process and an improvement in metabolic control was first pointed out by Williams and Mahan [21], who highlighted the effect of controlling periodontal infectious processes on metabolic control. Subsequently, Miller., *et al*. [22] and Grossi., *et al*. [23] concluded that periodontal therapy would be important in relation to metabolic control for diabetes. However, this was not observed by Smith., *et al* [24].

Given that this topic is still a matter of controversy, the present study had the aim of observing the effect of controlling the periodontal inflammatory process on the glycemic levels of individuals presenting different periodontal conditions, by means of evaluating the glycosylated hemoglobin rate among individuals with type 2 diabetes.

Materials and Methods

Population

All diabetic patients attended by the Feira de Santana Diabetes Center who presented need for dental care were referred to the Cooperfeira Clinic for Dental care. All patients were treated according to their needs, regardless of whether they fit into the research protocol or not. In the universe of patients treated, 95 were assessed using the inclusion criteria for this study. Of these, 9 were excluded because they did not attend all of the necessary consultations according to the rigid protocol proposed, 25 had their drug protocols changed during the data collection period, 2 patients returned to smoking and 3 patients required antibiotic therapy during the data collection period. Thus, the final number of patients was 56.

The sample was composed of 56 individuals of mixed race according to the criteria of Azevedo [25], aged between 40 and 70 years. These were distributed into two groups: DP - 28 diabetic individuals with severe generalized chronic periodontitis; and DWP - 28 diabetic individuals without periodontitis. These individuals were monitored between February and December 2005.

All individuals in this study had been diagnosed with type 2 diabetes mellitus for at least two years, in accordance with the criteria established by the American Diabetes Association [26]. The diagnosis and follow-up for these individuals was performed at the Diabetes Center of the municipal authorities of Feira de Santana, and was conducted by endocrinologists and ophthalmologists, among other specialties.

The individuals who formed the DP group presented severe chronic periodontitis characterized by a minimum of four teeth presenting at least one site with a probing depth greater than or equal to 4 mm, attachment loss greater than or equal to 5 mm and the occurrence of bleeding on probing [27]. In addition, they needed to have proven physical and motor ability that would ensure efficient control over bacterial plaque.

Smokers and individuals with oral infection for which drainage was indicated were not included in the sample. Those who did not attend all of the consultations, those who required changes to the metabolic control medication currently in use and those who had received prescriptions for antibiotics, anti-inflammatory agents, corticosteroids, anti-depressives, hormones other than insulin or anticonvulsants over the four months preceding the start of the study were also excluded. This study had previously been approved by the Research Ethics Committee of the Bahia Foundation for the Development of Science, Salvador, Bahia, Brazil (Protocol no. 07/2004). Also, it received financial support from the Bahia State Research Support Fund (FAPESB); Support that did not represent any type of conflict of interest.

Data collection

Individuals with a diagnosis of type 2 diabetes were sent, without any restrictions, by the Diabetes Center of the municipal authorities of Feira de Santana, for periodontal examination at the dental clinic of Feira de Santana State University (UEFS). All of the diabetic individuals who were examined, regardless of whether they were included in the research protocol or not, were evaluated with regard to their periodontal condition and, when necessary, underwent non-surgical periodontal therapy.

After screening, the individuals selected for the two groups attended the dental clinic of UEFS on three occasions, separated by 90-day intervals: time 1 (initial examination) and times 2 and 3. On all three occasions, blood samples were taken to evaluate the degree of metabolic control and periodontal clinical data were obtained: O'Leary's plaque index, as described by Baderstein, Nilveus and Egelberg [28], percentage of tooth faces presenting bleeding on probing [29], measurement of probing depth in the sulcus/pocket [30], classified according to the criteria of Badersten, Nilvéus, and Egelberg [31] and measurement of the clinical attachment loss [32], in which the levels were grouped according to the classification proposed by Armitage [33].

The periodontal clinical parameters were obtained with the aid of a standardized Williams-type periodontal probe graduated in millimeters (model XP23/UNC15, made by Hu-Friedy). Six sites were investigated per tooth: mid-vestibular, mesiovestibular, distovestibular, mid-lingual, distolingual and mesiolingual, as described by Pihlstrom, Ortiz-Campos and Mchugh [30].

All of the periodontal evaluation parameters were measured by a single investigator, who was a specialist. The mean intra-examiner concordance was 92.68%. For this, 10 patients were examined at two different times, with a 21-day interval. A total of 1,104 faces from 184 dental units were examined.

At all three times, 1.0 ml of peripheral blood was collected in a sterile manner for the glycosylated hemoglobin assay. This was performed by means of an ion capture test, through which the percentage of glycosylated hemoglobin in whole human blood was measured (Abbot Laboratories, 1994). The results were valid as indicators of the blood glucose concentration over a one to three-month period. For this test, normal values are between 4.4% and 6.4%.

Periodontal treatment

The 56 individuals who formed the DP and DWP groups returned to the dental clinic of UEFS for non-surgical periodontal treatment, when necessary. The DP group had as many consultations as needed to reestablish periodontal health. The DWP group was treated with plaque control and calculus removal. Also, both groups were given guidance about oral hygiene.

The 28 individuals who made up the DP group (with severe chronic periodontitis) underwent more extensive periodontal treatment than the individuals in the DWP group, because of the greater severity of disease.

Statistical analysis procedure

The quantitative variables of the study were subjected to the Kolmogorov-Smirnov test to determine whether they presented normal distribution. The results were compared using Student's t test for paired samples and Wilcoxon's t test for unpaired samples. In comparisons between independent groups, when variables were measured at least on ordinal scales but without presenting normal distribution, the Mann-Whitney test was used. When the presupposition of normal distribution was met, the unpaired Student's t test was used. The significance level was set at 5%.

Results

As shown in table 1, the DP group was composed of 13 women and 15 men, while the DWP group was composed of 18 women and 10 men. No statistically significant differences between the groups were observed in relation to gender (p = 0.179) or age (p = 0.361). However, in relation to the length of time since this endocrine disease was diagnosed, a statistically significant difference between the groups was observed (p = 0.011). In the DP and DWP groups, the mean lengths of time since the diagnosis were 8.25 and 12.75 years, respectively.

		Age (years)		Gender N (%)		Length of time since diagnosis (years)	
Group	N	X	DP	M	F	x	SD
DWP	28	57.8	± 1.91	10 (36)	18 (64)	12.75	± 1.20*
DP	28	55.3	± 1.92	15 (54)	13 (46)	8.25	± 1.20

Table 1: *Demographic characteristics and length of time since receiving the diagnosis of diabetes, among the individuals in the sample.*

*DP: Diabetics with Severe Chronic Periodontitis; DWP: Diabetics without Periodontitis; x: Mean; SD: Standard Deviation of the Mean; M: Male; F: Female; *P value: 0.011.*

The clinical and laboratory findings were grouped into four tables. Tables 2 to 4 relate to the following periodontal clinical parameters: plaque index and percentages of tooth faces with bleeding on probing, measurement of probing depth, and measurement of clinical attachment loss. Table 5 relates to the glycosylated hemoglobin assay, which was the quantitative laboratory parameter used as an indicator for metabolic control. The data were collected at the three pre-established times (times 1, 2 and 3).

With regard to plaque index, the DP group showed a significant difference between times t1 and t3. However, there were no statistically significant differences between times 1 and 2 or between times 2 and 3. The DWP group showed statistically significant reductions in plaque index between times 1 and 2 and between times 1 and 3. Comparison between the values for DP and DWP at the three times only revealed a significant difference at time 1 (Table 2).

There were significant differences in the percentages of tooth faces showing bleeding on probing between the times in each group, and between the groups at the three times (Table 2).

The percentages of probed sites were grouped in accordance with Badersten, Nilvéus and Egelberg (1985) [31], into three levels of probing depth: SPD – shallow probing depth (0 - 3 mm); MPD – medium probing depth (4 - 6 mm); and PPD – deep probing depth (7 mm).

Plaque Index						
	md	min-max	DP vs. DWP	t_1 vs. t_2	t_1 vs. t_3	t_2 vs. t_3
Group	%	%	*P*	*P*	*P*	*P*
DP				0.534	0.042	0.101
t_1	86.40	40.6 - 100.00	0.028			
t_2	60.85	30.4 - 100.00	0.657			
t_3	61.75	19.5 - 100.00	0.395			
DWP				< 0.001	< 0.001	0.831
t_1	78.00	0.0 - 100.00				
t_2	67.00	22.3 - 97.00				
t_3	60.40	0.0 - 100.00				
Percentage of tooth faces with bleeding on probing						
	md	min-max	DP vs. DWP	t_1 vs. t_2	t_1 vs. t_3	t_2 vs. t_3
Group	%	%	*P*	*P*	*P*	*P*
DP				< 0.001	< 0.001	< 0.001
t_1	40.30	16.90 - 90.40	< 0.001			
t_2	15.95	0.0 - 36.90	< 0.001			
t_3	9.45	0.0 - 34.50	< 0.001			
DWP				0.004	0.002	< 0.001
t_1	12.35	0.0 - 53.00				
t_2	5.55	0.0 - 22.00				
t_3	3.55	0.0 - 15.00				

Table 2: *Distribution of the plaque index and percentage of tooth faces with bleeding on probing, between the two study groups (DP and DWP), at the different investigation times.*

*DP: Diabetics with Severe Chronic Periodontitis; DWP: Diabetics without Periodontitis; md: Median; max: Maximum; min: Minimum; $t_{1, 2, 3}$: Investigation Times 1, 2 and 3; * P - value. Statistical significance: P ≤ 0.05.*

In the DP group, there was a significant increase in the numbers of tooth faces grouped at the SPD level between times 1 and 3, and a progressive decrease at the MPD and PPD levels at times 2 and 3 in relation to time 1. There were no statistically significant differences in comparisons between the SPD, MPD and PPD levels in the DWP group at the three times. Comparisons between the DP and DWP groups at the three times showed statistically significant differences in the three depth levels of the two groups, except for time 1 at the MPD and PPD levels (Table 3).

The measurement of clinical attachment loss at each tooth site was classified and divided into three levels: SAL – slight attachment loss (0 - 2 mm); MAL – moderate attachment loss (3 - 4 mm); and SEAL – severe attachment loss (5 mm), in accordance with the criteria used by Armitage [33] (Table 4). There were progressive and significant increases in the percentages of tooth sites at the SAL level from time 1 to time 3 in the DP group. On the other hand, there was a decrease in the proportion of sites at the SAL level between times 1 and 3 in the DWP group, although this was not statistically significant, while no significant changes between the times were observed in the DT group. The number of sites at the MAL level presented a statistically significant decrease between times 1 and 3 in the DP group, while there was a highly significant increase from time 1 to times 2 and 3 in the DWP group. There were no statistically significant differences between the three times at the SEAL level in the DWP group, while a statistically significant progressive decrease in the number of sites

at three times was observed in the DP group. Furthermore, comparison of the values for the four clinical attachment loss s of the DP and DWP groups at the three times showed statistically significant differences.

Number of tooth faces according to probing depth						
	md	min-max	DP vs. DWP	t_1 vs. t_2	t_1 vs. t_3	t_2 vs. t_3
Group / t	n	N	*P**	*P**	*P**	*P**
DP						
SPD t_1	62.50	26.00 - 141.00	0.002	< 0.001	< 0.001	0.260
t_2	74.50	32.00 - 138.00	< 0.001			
t_3	79.50	41.00 - 142.00	0.005			
MPD t_1	23.00	6.00 - 67.00	NS	< 0.001	< 0.001	0.839
t_2	15.00	0.00 - 71.00	< 0.001			
t_3	12.50	1.00 - 51.00	0.001			
PPD t_1	1.50	0.00 - 53.00	NS	0.006	< 0.001	0.039
t_2	0.00	0.00 - 9.00	< 0.001			
t_3	0.00	0.00 - 9.00	0.017			
DWP						
SPD t_1	99.00	36.00 - 192.00		NS	NS	NS
t_2	93.00	0.00 - 192.00				
t_3	93.00	0.00 - 192.00				
MPD t_1	0.00	0.00 - 0.00		NS	NS	NS
t_2	0.00	0.00 - 0.00				
t_3	0.00	0.00 - 0.00				
PPD t_1	0.00	0.00 - 0.00		NS	NS	NS
t_2	0.00	0.00 - 0.00				
t_3	0.00	0.00 - 0.00				

Table 3: *Distribution of the number of tooth faces according to the three probing depth levels, between the two study groups (DP and DWP), at the different investigation times.*

*DP: Diabetics with Severe Chronic Periodontitis; DWP: Diabetics without Periodontitis; md: Median; max: Maximum; min: Minimum; $t_{1, 2, 3}$: Investigation Times 1, 2 and 3; SPD: Shallow Probing Depth 1 - 3 mm; MPD: Moderate Probing Depth 4 - 6 mm; PPD: Profound Probing Depth ≥ 7 mm; * P - value. Statistical significance: P ≤ 0.05.*

Number of tooth faces according to attachment loss						
	md	min-max	DP vs. DWP	t_1 vs. t_2	t_1 vs. t_3	t_2 vs. t_3
Group / t	n	N	*P**	*P**	*P**	*P**
DP						
SAL t_1	34.50	0.00 - 110.00	0.001	0.008	0.001	0.007
t_2	42.50	1.00 - 106.00	< 0.001			
t_3	56.00	3.00 - 106.32	< 0.001			
MAL t_1	22.50	1.00 - 58.00	< 0.001	0.014	0.011	0.001

t_2	19.50	5.00 - 67.00	< 0.001			
t_3	14.00	2.00 - 65.00	0.017			
SEAL t_1	30.50	3.00 - 114.00	< 0.001	< 0.001	0.006	0.001
t_2	15.50	0.00 - 101.00	0.001			
t_3	13.00	0.00 - 98.00	< 0.001			
DWP						
SAL t_1	92.50	5.00 - 145.00		NS	NS	NS
t_2	99.00	5.00 - 145.00				
t_3	99.00	0.00 - 147.00				
MAL t_1	0.00	0.00 - 3.00		0.017	0.005	NS
t_2	0.00	0.00 - 15.00				
t_3	0.00	0.00 - 42.00				
SEAL t_1	0.00	0.00 - 0.00		NS	NS	NS
t_2	0.00	0.00 - 0.00				
t_3	0.00	0.00 - 0.00				

Table 4: *Distribution of the number of tooth faces according to the four clinical attachment losses between the two study groups (DP and DWP), at the different investigation times.*

*DP: Diabetics with Severe Chronic Periodontitis; DWP: Diabetics without Periodontitis; md: Median; max: Maximum; min: Minimum; $t_{1, 2, 3}$: Investigation Times 1, 2 and 3; SAL: Percentage of Sites with Slight Attachment Loss (1 - 2 mm); MAL: Percentage of Sites with Moderate Attachment Loss (3 - 4 mm); SEAL: Percentage of Sites with Severe Attachment Loss (≥ 5 mm); * P - value. Statistical significance: P ≤ 0.05.*

The glycosylated hemoglobin rates presented statistically significant differences between times 1 and 3 and between times 2 and 3 in the DWP group, and between times 1 and 3 in the DP group. On the other hand, no statistically significant differences between the groups were observed at the three times (Table 5).

Percentage of glycosylated hemoglobin						
	md	min-max	DP vs. DWP	t_1 vs. t_2	t_1 vs. t_3	t_2 vs. t_3
Group	%	%	*P**	*P**	*P**	*P**
DP				NS	0.033	NS
t_1	10.25	8.9 - 16.00	NS			
t_2	9.75	4.8 - 14.60	NS			
t_3	8.85	4.8 - 15.10	NS			
DWP				NS	0.005	0.046
t_1	10.45	8.9 - 16.40				
t_2	10.35	5.1 - 13.90				
t_3	9.20	4.5 - 14.80				

Table 5: *Distribution of the percentage of glycosylated hemoglobin, between the two study groups (DP and DWP), at the different investigation times.*

*DP: Diabetics with Severe Chronic Periodontitis; DWP: Diabetics without Periodontitis; md: Median; max: Maximum; min: Minimum; P1: Different Times in the Same Group; P2: Different Groups with the Same Time; $t_{1, 2, 3}$: Investigation Times 1, 2 and 3; * P-value. Statistical significance: P ≤ 0.05.*

Discussion

Differing from the studies by Miller., *et al*. [22], Grossi., *et al*. [23], Stewart., *et al.* [34], Kiran., *et al*. [35] and Prosmsudthi., *et al*. [36] in which the control group did not undergo periodontal therapy, non-surgical periodontal treatment was provided to either the DP or DWP groups in the present study. Reduction of the inflammatory infectious process resulted in improvements in the periodontal clinical parameters, as described by Westfelt., *et al* [37]. The reduction of the inflammatory condition was greater in the DP group, and therefore a greater improvement in periodontal clinical parameters and consequently in metabolic control would be expected in this group. However, no significant difference in the reduction of the glycosylated hemoglobin rate was observed between the groups. The reduction in this rate in the DWP group (the control group, without severe chronic periodontitis) may have been due to the inclusion of individuals with gingivitis. On the other hand, a significant improvement in metabolic control around six months after the periodontal treatment was observed in both groups. This treatment was probably the factor responsible for the improvement observed, since individuals who had undergone any change in their diets or medication protocols, or had undergone antibiotic therapy, were excluded from the study.

Because it is a group composed of individuals who do not have periodontitis, it is expected that the systemic effect of the treatment in the control group will not be as intense as in the test group. In the latter, the proposed treatment resulted in an intense reduction of the inflammatory infectious process, with a consequent decrease in the concentration of pro-inflammatory cytokines and an improvement in glycemic control. We found that the systemic outcome of basic periodontal therapy was imperceptible in the group of healthy individuals with gingivitis, not invalidating their role as a control in relation to both periodontal and treatment-related disease.

The association between improvement in metabolic control among individuals with type 2 diabetes who had presented inadequate metabolic control, and the diminution of the periodontal inflammatory process, was also observed by Stewart., *et al*. [34] and Kiran., *et al* [35]. In these studies, the subjects also only underwent basic periodontal therapy. The reduction in glycosylated hemoglobin rates following reduction in the inflammatory process was also observed by Williams and Mahan [21], Miller., *et al*. [22] and Grossi., *et al* [23]. However, in these studies, antimicrobial therapy may also have had an important role in the effect observed, with regard to the glycemic levels among patients with either type 1 or type 2 diabetes who underwent root scaling and planing. On the other hand, Smith., *et al*. [24] and Promsudthi., *et al*. [36] did not observe a decrease in the percentage of glycosylated hemoglobin in the group that underwent the same type of treatment.

According to Hotamisligil., *et al*. [38] and Mccall, Tuckey and Parry [39], the pro-inflammatory cytokine TNF- is associated with resistance to insulin action. Nishimura., *et al*. [40] observed that diminishing the periodontal inflammatory process significantly reduced the levels of this cytokine. Thus, the improvement in metabolic control in this and other studies was probably due to the decreased synthesis of TNF- subsequent to reducing the periodontal inflammatory process.

Statistically significant differences were observed in comparisons between the DP and DWP groups at time 1, in relation to the following periodontal clinical parameters: plaque, gingival bleeding on probing, probing depth and clinical attachment loss. These differences reflected the greater degree of periodontal damage among the group with severe generalized chronic periodontitis. The state of oral hygiene, as assessed using the plaque index, presented a statistically significant improvement between times 1 and 3, both in the DWP and in the DP group. Although the improvement in the degree of oral hygiene subsequent to periodontal treatment was significant, it continued to be at a critical level.

The DP group presented an improvement in the periodontal infectious condition following the non-surgical periodontal treatment. This is supported by the statistically significant increase in the number of tooth faces appearing in the SPD subgroup and the decrease in the number of tooth faces in the subgroups that were associated with the presence of periodontal pockets (MPD and PPD), between times 1 and 3. In the DWP group, no statistically significant changes in distribution of the tooth sites were observed in the three subgroups at times 2 and 3 in relation to time 1. These findings are in agreement with the observations of Miller., *et al.* [22], Smith., *et al*. [24], Grossi., *et al*. [23], Stewart., *et al*. [34], Kiran., *et al*. [35] and Prosmsudthi., *et al*. [36].

The improvement in the degree of periodontitis was observed by means of the clinical attachment loss. In the DP group, a statistically significant progressive increase in the number of tooth faces in the SAL subgroup was observed between times 1 and 3. There was also a significant progressive decrease in the number of tooth faces in the MAL and SEAL subgroups, which represented moderate and severe attachment loss, respectively. In the DWP group, no significant changes in the number of tooth faces in the SEAL subgroup were seen. On the other hand, there was a statistically significant increase in the number of tooth faces in the MAL subgroup and a statistically significant decrease in the number of tooth faces in the SAL subgroup. These data characterize any worsening of the periodontal clinical condition and are in agreement with the study by Badersten, Nilvéus and Egelberg (1985) [31]. This author concluded that tooth sites that presented shallow sulci/pockets (3.5 mm) tended to undergo attachment loss subsequent to root scaling and planing, whereas the opposite occurred at sites in which the sulcus/pocket was deep (7 mm), where attachment gains were observed following periodontal treatment.

In the present sample, no statistically significant difference was observed in relation to gender or age. Borrel and Papapanou [3] observed that there was no association between gender and susceptibility to periodontitis. On the other hand, with regard to the length of time since the diagnosis, the diabetic patients with periodontitis presented a mean that was significantly smaller than the mean for the group of diabetics that were periodontally healthy (8.25 and 12.75 years, respectively). Cerda., *et al*. [18], Firatli Yilmaz and Onan [19] and Monteiro, Araújo and Gomes Filho [41] stated that the longer the time elapsed since the diagnosis, the greater the severity of the periodontitis.

Conclusions

The results from this study confirm the positive role of periodontal therapy on periodontal clinical parameters and indicate the existence of an association between elimination of the periodontal infectious process and improvement of metabolic control, among individuals with type 2 diabetes without metabolic compensation.

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