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Arely Saindaleth López Reyes*, Eder Patiño-Rivera, Ana Cristina García-Ulloa, Sergio Hernández-Jiménez and For the Group of Study CAIPaDi

Center of Comprehensive Care for the Patient with Diabetes, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán. Mexico City, Mexico

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***Corresponding author:** Arely Saindaleth López Reyes, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Vasco de Quiroga No. 15, Colonia Sección XVI, Delegación Tlalpan, CP 14080, Mexico City, Mexico, Tel: (52)54870900, 5045, (52)55737378; E-mail: arely.lopezr@incmnsz.mx

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Research Article

Periodontal status at two years of follow-up in patients with Newly Diagnosis of type 2 Diabetes Mellitus

Abstract

Background: Diabetes increases the risk of periodontal disease. Integrating periodontal care with the treatment of type 2 diabetes (T2DM) may facilitate the management of both diseases.

Aim of the study: To evaluate the periodontal status at two years in patients with T2DM and assess glycated hemoglobin (HbA1c) according to the severity and extension of periodontitis.

Methods: This is a descriptive cohort study. Full-mouth periodontal evaluation was performed and blood samples were obtained to analyze HbA1c at baseline, 3, 12 and 24 months. Clinical attachment level, probing depth, bleeding on probing and oral hygiene were measured. We analyzed mean HbA1c according to severity and extension of periodontitis.

Results: We included 160 patients with T2DM. Basal HbA1c was 7.7 ± 2.2%. Periodontal health increased 27.5 % at 24 months. At baseline, moderate and severe periodontitis was present in 29.9% and 13.4% patients, respectively. At two years, 22.5% and 11.8% had moderate and severe periodontitis, respectively.

Bleeding on probing decreased from 15.7% to 6.4% at 24 months. HbA1c was higher in subjects with severe and generalized periodontitis.

Conclusions: The periodontal status in patients with newly diagnosis of T2DM who received a comprehensive diabetes care improved at 3 months. This improvement was maintained at 24 months of follow-up.

Introduction

It has been shown that people with diabetes have a higher risk for development of periodontal disease and that periodontitis is more severe in patients with diabetes compared to those who do not have diabetes [1]. However, very few studies have evaluated the relationship of diabetes and periodontal health in Latin America [2].

Severe periodontitis is considered the sixth complication of diabetes. It implies a three times greater risk for developing periodontal disease in patients with diabetes, especially in those with poor glycemic control [3]. On the other hand, people with periodontitis have higher risk for hyperglycemia and insulin resistance. Also, periodontitis is associated with an increased risk of incident type 2 diabetes mellitus (T2DM) [4,5].

Additionally, some studies have demonstrated that periodontal treatment can lead to improvement in diabetes control [1,6].

Some studies demonstrated that patients with diabetes have insufficient oral health awareness [7]. Patients do not receive information about their increased risk for periodontitis and the importance of its management to optimize general health [8]. In Mexico, only 8.4% of people with diabetes attend dental check-ups as a preventive measure to avoid or delay the oral complications of diabetes [9].

Integrating periodontal health status into standard comprehensive evaluations for all adults with T2DM can be effectively undertaken by either dentists or dental hygienists. This approach facilitates the multidisciplinary management of comorbid chronic diseases [10,11].

The aim of this study is to evaluate the periodontal status in a comprehensive program and at two years of follow up in patients with recently diagnosed T2DM. Additionally, we assessed HbA1c levels according to the severity and extension of periodontitis.

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Materials and Methods

This is a descriptive cohort study in patients who attended the "Center of Comprehensive Care for the Patient with Diabetes" (CAIPaDi, an acronym for its name in Spanish) [12], located in the National Institute of Medical Sciences and Nutrition Salvador Zubirán (INCMNSZ), in Mexico City, between January 2014 and September 2017. We included patients with less than 5 years of diagnosis of diabetes, between 18 and 70 years, non-smokers, and without disabling chronic complications. The CAIPaDi program consists of four monthly visits, followed by annual evaluations. In every visit, the patients received professional care by endocrinologists, nutritionists, psychologists, psychiatrists, exercise physiologists, nurses, ophthalmologists, periodontists and diabetes educators. Standardized procedures for specialty care are followed in each intervention. For pharmacological treatment, specialists follow a prescription algorithm for glucose, lipids, blood pressure, antidepressants or anxiolytic drugs. Metabolic control goals (based on glycated hemoglobin, LDL cholesterol, and triglycerides) and blood pressure are established. In the other interventions, validated tools are used to assess mental health status, skills for self-care activities, retinal evaluation, renal function and strategies to avoid diabetic foot [12].

The research conducted in CAIPaDi was approved by the Research and Ethics Board of the INCMNSZ (Ref 1198) and registered in ClinicalTrials.gov (NCT02836808). All patients signed an informed consent form.

Periodontal examination

The periodontal status was determined in visit 1 (baseline), visit 4, 5 and 6 (3, 12 and 24 months of follow-up, respectively). A full-mouth periodontal evaluation was performed by two periodontists certified by Mexican Council of Periodontics. We used the periodontal probe Hu Friedy PUNC 15. Clinical attachment level (CA), probing depth (PD), and bleeding on probing (BoP) were measured in six sites of all present teeth, excluding third molars. We used the Simplified Oral Hygiene Index (IHOS) to evaluate oral hygiene, and examined six representative teeth of the entire mouth. Oral hygiene was classified according to the score obtained: 0, 0.1-1.2, 1.3-3 and 3.1-6 for excellent, good, regular and poor oral hygiene, respectively.

The clinical diagnosis of periodontal disease was established according to the 1999 Classification of Periodontal Diseases and Conditions of the American Academy of Periodontology [13,14]. Then, it was categorized into: periodontal health (PD < 3 mm, no clinical attachment loss (CAL) and absence of BoP), gingivitis (PD < 3 mm, no CAL, and presence of BoP), and periodontitis (PD > 4 mm and CAL). Likewise, chronic periodontitis was classified as mild (CAL 1-2 mm), moderate (CAL 3-4 mm) and severe (CAL > 5 mm). Regarding the extension, chronic periodontitis was classified as localized (<30% of affected sites) and generalized (>30% of affected sites). In addition to the periodontal evaluation, patients received oral hygiene instructions (OHI) in a 30-minute group session. In visit 2 we reinforced OHI and removed plaque and supra gingival calculus with ultrasound (Dentsply Cavitron Bobcat Pro). Visit 3 included OHI and non-surgical periodontal treatment (scaling and root planning) of localized sites with PD > 4 mm. The subgingival instrumentation was carried out with manual curettes (Hu Friedy, Gracey curettes) and ultrasound (Dentsply Cavitron Bobcat Pro).

The patients who needed additional sessions of non-surgical periodontal treatment, or surgical periodontal treatment (e.g. moderate and severe periodontitis) were referred to the dentist or periodontist to complete the therapy. Patients who needed dental extractions (poor periodontal prognosis), cavities removal, and replacement of poor dental restorations or dental prothesis for a proper mastication were also referred for specialized treatment. In the annual evaluations (visits 5 and 6) we asked patients if they attended the dentist in the last year for routine dental revision or to complete the treatment for which they were referred.

Glycated hemoglobin (HbA1c)

Blood samples were obtained from each patient after a fasting period of 8 to 12 hours. The HbA1c levels were estimated using high performance liquid chromatography (Bio-Rad, Variant II Turbo) in the Endocrinology and Metabolism Department (certified by the American College of Pathologists) in the INCMNSZ. Glycemic control was classified according to HbA1c levels as <7% for good control and >7% for bad control [10].

Statistical analyses

The distribution of the variables was examined with the Kolmogorov-Smirnov normality test. Categorical variables were analyzed with frequencies and percentages. Means and standard deviations (SD) were used for parametric variables. We used Wilcoxon test to compare BoP values between visits. To compare changes in periodontal status and IHOS throughout the visits we used Friedman test, and one-way ANOVA to compare mean HbA1c level according to severity of periodontitis. T-test for independent samples compared mean HbA1c levels regarding the extension of periodontitis. A value of $p < 0.05$ was considered statistically significant. The analyses were performed in SPSS 25.

Results

We included 160 patients with T2DM, mean age was 54.3 ± 8.8 years, 84 (52.5%) were women, time of diagnosis of diabetes was 1 year [1-5], and basal mean HbA1c 7.7 ± 2.2%. We analyzed the periodontal status and severity of periodontitis at two years of follow-up. We observed that the proportion of patients with periodontal health increased from 2.5% in baseline to 30% in the two-year evaluation. The presence of gingivitis decreased from 13.8% to 6.3%. The progression of the disease stopped in 20% of the patients with periodontitis, and achieved clinical conditions compatible with periodontal health ($p < 0.001$) (Table 1).

At baseline, mild, moderate and severe periodontitis was present in 56.7%, 29.9% and 13.4% respectively. At three

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months, moderate and severe periodontitis decrease to 15.1% and 11.8% respectively, and mild periodontitis increased to 73.1%. This improvement disappeared in visit 5, since severity of periodontitis was very similar than baseline (56.2%, 29.2% and 14.6% had mild, moderate and severe periodontitis). However, in the sixth visit, we observed that moderate and severe periodontitis decreased to 22.5% and 11.8%, respectively (Table 2).

BoP decreased from 15.7% (7.7-29.0) to 3.3 % (0.01-7.78) at 3 months (p<0.001). For the annual evaluations (visits 5 and 6), BoP was 9.3% (3.11-18.45) and 6.4% (1.66-16.66) respectively, and statistically significant lower compared to baseline (p<0.001). Similar findings regarding the presence of sites with PD 4-5 mm were observed. It decreased from 7.1% (1.8-14.3) to 2.0 % (0.0-6.3) at three months. At 1 and 2 years, we observed 2.4% (0.0-9.4) and 3.2% (0.0-10.2) of sites with PD 4-5 mm (p<0.001) (Table 3).

Oral hygiene improved from baseline to 3 months and was maintained throughout the study period (p< 0.001) (Table 4).

When we analyzed HbA1c values according to severity of periodontitis, we observed that patients with severe periodontitis had higher HbA1c compared to patients with moderate and mild periodontitis. However, only at three months the difference in HbA1c between the groups was statistically significant (p = 0.008) (Table 5). HbA1c was higher in patients with generalized periodontitis at baseline (HbA1c 9.9% ± 3.0), 12 months (HbA1c 7.7% ± 1.8) and 24 months (HbA1c 8.2% ± 2.3), compared to localized periodontitis (HbA1c 7.7% ± 2.2, 6.6% ± 1.0 and 7.1% ± 1.4 respectively). These differences were statistically significant at 12 and 24 months (Table 6).

In visit 6, 60.6% of the patients reported visiting the dentist at least once during the last year.

Discussion

In this study we observed a high prevalence of periodontal disease in patients with T2DM, since 97.6% had gingivitis or periodontitis and only 2.5 % had periodontal health at baseline. Advanced periodontitis (moderate and severe), was present in a high proportion of patients in the initial visit (43.3%), despite 56.3% having good and excellent oral hygiene. This may be due to the negative impact of glycemic control on the development and progression of periodontitis since 48.1% had HbA1c >7% at baseline (mean HbA1c was 7.7 ± 2.2%). In a recent cross-sectional study, Torrungruang et al. [15], found that 90% of patients with diabetes had moderate and severe periodontitis, and 10% had no or mild periodontitis. The differences in the results between that study and ours may be due to the categorization of degrees of periodontitis according to the case definitions for population-based surveillance of periodontitis. This is not intended nor approved for clinical use or biological research [16].

Although 60.6% of the patients in visit 6 reported attending the dentist during the last year, most of them received other dental treatment (mainly cavities removal and dental restorations) but not the periodontal therapy needed.

Table 1: Periodontal status of T2DM patients at two years of follow-up. p<0.001

Periodontal status	Baseline n %	3 months n %	12 months n %	24 months n %
Periodontal health	4 2.5	58 36.3	56 35	48 30
Gingivitis	22 13.8	9 5.6	15 9.4	10 6.3
Periodontitis	134 83.8	93 58.1	89 55.6	102 63.8

Table 2: Severity of periodontitis during the follow-up period.

Severity of periodontitis	Baseline n= 134 n %	3 months n= 93 n %	12 months n= 89 n %	24 months n=102 n %
Mild	76 56.7	68 73.1	50 56.2	67 65.7
Moderate	40 29.9	14 15. 1	26 29.2	23 22.5
Severe	18 13.4	11 11.8	13 14.6	12 11.8

Table 3: Periodontal clinical parameters during the follow-up period.

Periodontal parameters	Baseline median (rank)	3 months median (rank)	12 months median (rank)	24 months median (rank)
BoP (%)	15.7 (7.7-29.0)	3.3 (0.01-7.78)*	9.3 (3.11-18.45)*	6.4 (1.66-16.66)*
Sites with PD = 4-5 mm (%)	7.1 (1.8-14.3)	2.0 (0.0-6.3)*	2.4 (0.0-9.4)*	3.2 (0.0-10.2)*

* p<0.001 compared to baseline.

Table 4: Oral hygiene over the follow-up period.

Oral hygiene	Baseline n= 158 n %	3 months n= 152 n %	12 months n=160 n %	24 months n=157 n %
Excellent	4 2.5	37 24.3	21 13.1	35 22.3
Good	85 53.8	103 67.8	109 68.1	102 65.0
Regular	62 39.2	12 7.9	29 18.1	20 12.7
Poor	7 4.4	0 0	1 0.6	0 0

Table 5: Mean HbA1c according to severity of periodontitis at two years of follow-up.

Severity of periodontitis	Baseline mean ± SD HbA1c	3 months mean ± SD HbA1c	12 months Mean ± SD HbA1c	24 months Mean ± SD HbA1c
Mild	7.9 ± 2.4	*6.0 ± 0.6^	6.6 ± 1.0	7.2 ± 1.5
Moderate	7.4 ± 2.0	6.1 ± 0.7^	6.6 ± 0.9	6.9 ± 1.1
Severe	8.3 ± 2.2	*6.7 ± 1.0^	7.4 ± 1.6	7.6 ± 2.0

* p=0.006
^p=0.008

Table 6: Mean HbA1c according to extension of periodontitis during the follow-up period.

Extension of periodontitis	Baseline mean ± SD HbA1c	3 months mean ± SD HbA1c	12 months Mean ± SD HbA1c	24 months Mean ± SD HbA1c
Localized	7.7 ± 2.2	6.1 ± 0.7	6.6 ± 1.0*	7.1 ± 1.4**
Generalized	9.9 ± 3.0	5.8 ± 0.8	7.7 ± 1.8*	8.2 ± 2.3**

* (p=0.003).
** p=0.011)

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For this reason, we assume that the outcomes in periodontal parameters are attributable to the periodontal treatment given in CAIPaDi, even though in some of the patients we were not able to complete the therapy. We observed a statistically significant reduction in BoP at 3, 12 and 24 months of follow up compared to baseline. This is relevant because BoP is considered an important risk predictor for progression of periodontal disease (lower BoP values are compatible with periodontal health).

The percentage of sites with a PD of 4-5 mm reduced, and this improvement was maintained over the study period. These results showed that the intervention given is effective in preventing the progression of the disease at two years of follow up.

Regarding the association between periodontal status and HbA1c, we observed that patients with severe periodontitis had higher mean HbA1c compared to those with moderate and mild periodontitis in all the visits. The differences in HbA1c between the groups were statistically significant only at three months. Besides, patients with generalized periodontitis had higher HbA1c values, compared to those with localized periodontitis.

Similar results have been shown in three recent cross-sectional studies, showing that the greater the glycemic control, the greater the prevalence of periodontitis. Albuquerque et al. [17,] observed that moderate and severe periodontitis are associated with higher fasting glucose levels compared with milder forms of the disease. Teeuw et al. [18], found that patients with periodontitis had significantly higher HbA1c values compared to subjects with no periodontitis. Pumerantz et al. [8], showed that HbA1c was higher as the periodontal condition worsened.

A limitation of the study is that periodontal treatment was not carried out completely in some cases due to logistics of the program. Besides, periodontal support therapy was not performed, which is essential for the maintenance of periodontal health and prevent periodontitis progression. Another limitation is the population studied, since all are patients with recent diagnosis, without disabling complications, non-smokers, and with an age range of 18-70 years. These make that the results are not generalized to an open population.

One of the strengths of our study is that we evaluated the periodontal status of patients with diabetes who received a comprehensive care for the disease at baseline, 3 months and annually (12 and 24 months). Most of the studies that have evaluated the relationship between diabetes and periodontal disease are cross-sectional or short-term follow-up. Furthermore, most comprehensive care programs for patients with diabetes do not include an oral care service even though it has been demonstrated that periodontitis negatively affects glycemic control and oral health is imperative for a proper chewing and nutrition. Moreover, patients with diabetes are not often aware of the bidirectional relationship between periodontal disease and diabetes. Sixty two percent of patients do not know that periodontitis and diabetes may negatively influence each other[10]. In future studies it would be interesting to look for the impact of clinical and metabolic variables on periodontal disease, and vice versa. Another strength is that our intervention included education of patients about the importance of oral health, providing information about oral diseases and diabetes, as well as oral hygiene instructions. All of these are considered part of the treatment of periodontal disease [19].

The periodontal evaluation and treatment provided to the patients of CAIPaDi program are low-cost interventions consisting of 30-minute sessions once a month for 3 months and annual reevaluation visits. This strategy showed to be effective in stopping the progression of periodontitis, decreasing BoP and improving oral hygiene in patients with T2DM.

The inclusion of a periodontal intervention into a comprehensive care program for patients with diabetes helps to improve glycemic control through the prevention or resolution of periodontitis, or limiting the progression of periodontitis. Likewise, it could help avoid tooth loss that causes chewing impairment and decreases quality of life.

Conclusion

Improvement in periodontal status was obtained at three months and is maintained at 24 months. This intervention limited the progression of periodontal disease in patients with diabetes as a part of a comprehensive program.

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Group of study CAIPaDi

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