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Case Report

Influence of non-surgical periodontal therapy on the glycemic control of type 2 diabetic patients: case reports

Maria Caroline Rios Piecha[1]
Taciane Menezes da Silveira[1]
Caroline Fernandes e Silva[1]
Natália Marcumini Pola[1]

Corresponding author:
Natália Marcumini Pola
Rua Gonçalves Chaves, 457 – Centro
CEP 96015-560 – Pelotas – RS – Brazil
E-mail: nataliampola@gmail.com

[1] Universidade Federal de Pelotas, Faculty of Dentistry – Pelotas – RS – Brazil.

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Abstract

Introduction: Periodontal disease and diabetes mellitus present a bidirectional relationship in which one condition may influence the other. It is assumed that non-surgical periodontal therapy (scaling and root planning) could decrease the pro-inflammatory mediators, restoring periodontal health and the balance of glycemic control. **Objective:** To report the glycemic control of two type-2 diabetes patients with periodontal disease, who received non-surgical periodontal therapy and supportive periodontal therapy. **Case report:** Both patients were initially evaluated, and the delineated treatment plan included prophylaxis, manual scaling and root planning sessions and oral hygiene instructions. The patients were evaluated at baseline and after 30- and 60-days post-treatment, for the clinical parameters (visible plaque index, gingival bleeding index, probing pocket depth, clinical attachment level, bleeding on probing and dental mobility) and 90-days post treatment for the glycated hemoglobin and fasting plasma glucose. **Results:** The results showed a significant improvement in periodontal clinical parameters in both patients, as well as a decrease in their glycemic indices. **Conclusion:** Non-surgical periodontal therapy promoted improvement of periodontal parameters and also systemic health of individuals.

Introduction

Diabetes mellitus (DM) is a chronic metabolic disease generated by the lack of secretion of the insulin hormone or by the failure in the action of this hormone [12]. Produced by the pancreas, insulin is responsible for reducing blood glucose by promoting the entry of glucose into cells [3]. When its function fails, blood glucose levels increase, causing the state of chronic hyperglycemia, the main characteristic of diabetes [19].

This condition presents two main types: type 1 diabetes mellitus (DM1), and type 2 diabetes mellitus (DM2). DM1 is characterized by an autoimmune response of the organism that leads to deficient or non-existent insulin production, requiring the replacement of this hormone daily [26]. Its cause is associated with genetic factors, and young patients are the most affected population [26]. In DM2, there is a failure in the action of insulin due to the exacerbated increase in the production of this hormone to reverse the installed hyperglycemia, triggering the body's resistance to insulin. According to the American Diabetes Association, DM2 is the most common, comprehending 90% of cases [3]. As it is asymptomatic, when diagnosed, the patient usually already has other complications associated with the hyperglycemic condition. Overweight conditions, physical inactivity, advanced age, and genetic characteristics are the main risk factors for the occurrence of DM2 [20].

Data from the International Diabetes Federation showed that in 2017 there were 425 million people with diabetes in the world, and the estimative for 2045 would be an increase of 48% [9]. In Brazil, 6.2% of the population reported a diagnosis of diabetes, equivalent to 9.1 million people [8]. The state of chronic hyperglycemia can generate changes in the individual's immune system, increasing pro-inflammatory cytokines, and resulting in an individual more susceptible to opportunistic diseases [16]. In this context, the main complications associated with DM are cardiovascular diseases, retinopathy, renal failure, neuropathy, and oral changes [26]. Currently, periodontal disease (PD) is considered the sixth biggest complication of DM [13].

PD is developed through a specific inflammatory process, induced by periodontal pathogens, and initially affects the gingival tissue [18]. The accumulation of biofilm over the long-term results in its maturation, generating a persistent inflammation with irreversible loss of support structures of the teeth, characterizes periodontitis [5]. Currently, PD affects 7.4% of the world population and is considered the sixth most prevalent disease in the world [10]. In relation to the etiopathogenesis of the disease, PD can be influenced by a series of risk factors, including systemic conditions such as diabetes, immunodeficiency, stress, hypertension, and osteoporosis [16].

Longitudinal studies have shown that the relationship between DM and PD is bidirectional, with an increase in the destruction of periodontal tissue in diabetic individuals and a worse glycemic control in diabetic patients with PD [6, 7, 22]. The improvement in glycemic control after periodontal treatment was observed mainly in patients with DM2 [1, 23]. *In-vitro* studies have demonstrated a direct effect of hypo/hyperglycemia on periodontal cells and an indirect adverse effect of hyperglycemia stimulating the cells of the immune system to release inflammatory cytokines, contributing to the progression of PD [17].

Studies carried out to evaluate the effect of periodontal therapy on improving glycemic indices are still recent and contradictory. Some authors support the effectiveness of periodontal therapy with reduction of glycated hemoglobin (HbA1c) of 0.4% after the non-surgical periodontal approach [1, 19, 22]. Despite that, other authors have not found effects of periodontal treatment on HbA1c levels in patients with DM2 [2, 24, 25], however controlled and randomized clinical trials, as well as longitudinal studies, are necessary to support this evidence [20].

The aim of this article was to report two clinical cases of periodontal treatment in DM2 patients, and the control of systemic and clinical parameters of the diseases.

Cases report

This paper reports two cases of patients with DM2, who was admitted to the dental care at the School of Dentistry of Universidade Federal de Pelotas with the main complaint of "need of professional teeth cleaning".

Case 1 refers to a male patient, 52 years old, a former smoker for 18 years, diabetic for 17 years, hypertensive, with kidney and gastric problems, and hypercholesterolemia. At the time of dental care, the patient reported being under medical treatment, using several medications to control his general health: furosemide, rosuvastatin calcium, amlodipine besylate, losartan potassium, atenolol, spironolactone, and application of Humulin-N (insulin) three times a day. He already had complications related to diabetes, such as

peripheral neuropathy, with difficulty in healing the lesions, and retinopathy, with loss of vision in the left eye. In the first session, he mentioned to brush his teeth three times a day, and not using dental floss. He also reported that was not eating and exercising properly, but demonstrated intention to change his habits.

Case 2 refers to a female patient, 66 years old, non-smoker, diabetic for three years, and hypertensive. She related complications from diabetes, including neuropathy and deafness, and reported difficulties with wound healing and the occurrence of hemorrhage in some dental extractions that she had previously performed. The patient informed the use of general health medications, prescribed for medical treatment: dapagliflozin, glibenclamide, metformin, atenolol, isosorbide mononitrate, and rosuvastatin calcium. She reported to brush her teeth three times a day and not using dental floss.

In the first session, both patients were informed that they would participate in the study and signed the Informed Consent Form. The anamnesis and the complete periodontal clinical exam of the patients were carried out. Besides, patients were asked to undergo a recent hematological examination to record HbA1c and fasting plasma glucose (FPG) indices at baseline. After evaluating the glycemic index and periodontal diagnosis, the treatment plans were described.

The following clinical periodontal parameters were performed:

- visible plaque index (VPI), corresponding to a visual examination, which evaluates the presence or absence of visible plaque assessing the quality of the patient's plaque control;
- gingival bleeding index (GBI), that corresponds to the absence or presence of bleeding from the gingival margin to the probe, performed with a periodontal probe in an approximate position of 45º in relation to the long axis of the tooth;
- probing pocket depth (PPD), which is equivalent to the distance from the gingival margin and the most apical point of the gingival sulcus or periodontal pocket;
- clinical attachment level (CAL), that corresponds to the distance between the cementoenamel junction (CEJ) and the most apical point of the gingival sulcus or periodontal pocket;
- bleeding on probing (BOP), referring to the bleeding that occurs 10 seconds after the periodontal probe insertion to measure the PPD, dichotomized as absent or present;
- dental mobility, classified according to tooth horizontal movement and distinguished in degree I (horizontal movement up to 1 mm), degree II (horizontal movement greater than 1 mm) and degree III (horizontal and vertical movement) [14].

A single and calibrated examiner performed all the exams with a calibrated millimeter probe of Williams (Trinity Dentistry, São Paulo, SP, Brazil), to measure the PPD and CAL at six sites on each tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, and distolingual aspects). The clinical parameters were evaluated at baseline, 30- and 60-days post-treatment. Periodontal disease was categorized according to the Classification of Periodontal and Peri-Implant Diseases and Conditions proposed in 2018 [4]. The diagnosis of the two patients was generalized periodontitis, stage III, grade C.

The therapeutic protocol performed on both patients included, in the first session, the supragingival mechanical control procedures of the teeth, that showed positive GBI and BOP, through scaling and root planning. These procedures were associated with oral hygiene instruction (OHI). In the second session, an intermediate examination of previously treated sites and subgingival mechanical control of sites that still had bleeding were carried out by scaling and root planning. This procedure was also associated with strengthening oral hygiene.

The sessions were planned and executed within the seven-day interval. By the involvement of several teeth and sites, the treatment sessions were performed by sextants. Manual mechanical instrumentation was used with Gracey curettes, McCall and Goldman-Fox curettes (Trinity, Trinity Odontologia, São Paulo, SP, Brazil). A Piezoelectric scaler (Mini Piezon, EMS, Nyon, Switzerland) was also used, with tips for supragingival and subgingival scaling. Subgingival treatments were performed under local anesthesia, in a predetermined sequence. All patients received OHI and motivation for hygiene. The condition of DM as a risk factor for PD and its likely influence on glycemic control were also explained to patients. After 30- and 60-days post-treatment, the periodontal parameters were re-evaluated, and after 90 days a new hematological exam was requested, to analyze the patients' glycemic indices.

Both patients agreed with the treatment plans. Periodontal treatment sessions were finalized, and patients were referred to the Faculty of Dentistry to meet other dental needs. It is important to report that in both cases they were unaware of the relationship between DM and PD.

Results

The records of the periodontal parameters evaluated at baseline, at 30- and at 60-days post-treatment are pointed out in Table I. VPI, GBI and BOP indices are presented as a percentage of evaluated sites affected by visible plaque, gingival bleeding, and bleeding on probing, respectively. The PPD and CAL parameters were calculated as means of the measures of PPD and CAL in the evaluated sites in each follow-up.

The values of glycemic indices (HbA1c and FPG) in cases 1 and 2, before periodontal treatment and 90 days after treatment, are in Table II.

Table I – Periodontal indices evaluated at baseline, at 30- and at 60-days post-treatment in cases 1 and 2

		Case 1			Case 2		
	Baseline	**30 days**	**60 days**	**Baseline**	**30 days**	**60 days**	
Periodontal indices	**VPI (%)**	52.2	49.2	44	90.9	78.7	54
	GBI (%)	69.6	53	34	31.8	49.2	15.1
	PPD (mm)	3.1	2.8	2.6	3.6	3.1	2.7
	CAL (mm)	3.4	3.2	2.9	4.5	4.1	3.8
	BOP (%)	67.4	60.6	27.2	74.2	65.1	19.6

VPI: visible plaque index; GBI: gingival bleeding index; PPD: probing pocket depth; CAL: clinical attachment level; BOP: bleeding on probing

Table II – FPG and HbA1c values at baseline and after three months of periodontal treatment in cases 1 and 2

	FPG (mg/dL)		**HbA1c (%)**	
	Case 1	Case 2	Case 1	Case 2
Baseline	283	169	12.2	7.6
90 days	153	134	9.9	7.3

FPG: fasting plasma glucose; HbA1c: glycated hemoglobin

Discussion

The present study discusses the importance of the DM and PD interrelation, and diabetes as one of the main risk factors, when in an uncontrolled state, to influence the development and progression of PD. Some factors like the exacerbation of the general inflammatory condition of patients with the diseases, the impaired immune system, and inflammation agents that are antagonistic to the action of insulin seem to be related to the complications of both conditions [19].

In the clinical cases reported in this study, a small improvement in periodontal parameters was observed in the session after 30 days of intervention. This fact becomes relevant mainly

because the control of inflammation in diabetic patients is more complex [20]. The status of chronic inflammation associated with diabetes stimulates the production of pro-inflammatory cytokines, such as interleukins (IL) 1β, IL-6 and the relationship between the receptor activator of nuclear factor-kappa B ligand (RANKL) and osteoprotegerin (OPG), elevated in individuals with DM and periodontitis [20]. Although neutrophils are often hypofunctional in diabetics, it is believed that hyper-responsive monocytes/macrophages are responsible for much of the observed periodontal degradation [21].

Regarding oral hygiene, it is important to inform that both patients did not cooperate adequately until 30 days after treatment, although they were instructed and motivated during periodontal treatment. The VPI and GBI values of both cases did not present great differences in 30 days, and the patients presented the accumulation of supragingival biofilm, especially in the fifth sextant region. At 60 days, greater control of gingival inflammation was observed in these patients, with a considerable decrease in GBI and BOP. It was also possible to verify a gain in CAL in relation to baseline records in both cases. The correct OHI associated with the motivation of the patients performed by the dentist in 30-days post-treatment may explain the improvements observed. At 60 days, a significant reduction in BOP was also noticed, proving the importance of a late reassessment in diabetic patients. The complexity of healing in the hyperglycemic state makes the perception of results delayed in relation to systemically healthy individuals.

A systematic review evaluated the effect of periodontal treatment on glycemic control in individuals with DM2 and pointed out that in 14 studies (1,499 participants) an average reduction of 0.29% in HbA1c was found in the period from three to four months after periodontal treatment [19]. In a recent randomized controlled clinical study, the improvements in periodontal parameters and HbA1c reduction were also observed in patients with chronic periodontitis and decompensated DM2 who were treated with scaling and root planning [23]. The results of both cases of the present study corroborated with these previous studies [19, 22, 23], with an improvement of 2.3% in case 1 and 0.30% in case 2 of HbA1c values, at 90 days after periodontal treatment.

As this study presents only isolated cases, it is impossible to establish a causal relationship of treatment with the reduction of glycemic indices. However, it may be suggested that this is another factor associated with the improvement of diabetic condition in these patients. The physical exercises, a balanced diet, and the continuous use of medication are also important factors that should be considered in this improvement.

Although the evidence about the effect of periodontal treatment in glycemic control of diabetic patients is still inconsistent [2, 24, 25], it is necessary to highlight that periodontal treatment allows a decrease in circulatory inflammation levels, which may act favorably in glycemic control [15]. The main action of periodontal treatment is to reduce inflammatory cytokines present in the periodontal tissues, which can stimulate the improvement in insulin sensitivity and, thus, contribute both to periodontal condition and diabetes, and also its implications [22]. According to Khaw *et al*. [11], the average reduction of 0.20% in HbA1c levels could be associated with a 10% reduction in the mortality of diabetic individuals.

Finally, it is emphasized that both patients reported better oral health throughout the treatment, with reduced bleeding during brushing, as well as greater care in brushing and flossing more frequently. The absence of follow-up intraoral images can be interpreted as a limitation, but it was not possible to perform it at the moment. However, improvements in periodontal clinical parameters have led to greater encouragement of oral health care by patients, which is extremely relevant, especially in cases of chronic hyperglycemia. Besides, it is possible to highlight the importance of periodontal treatment in these patients, reinforcing its influence not only on oral health, but also on quality of life [24].

Conclusion

According to the cases reports, it can be concluded that the non-surgical periodontal therapy promoted an improvement in periodontal parameters and glycemic control in diabetic patients with severe periodontal conditions.

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