

# Periodontal Disease in Patient with Type 2 Diabetes Mellitus

Alexandru I. Precup<sup>a</sup>, Raluca Juncar<sup>b\*</sup>, Daniela Popa<sup>c\*</sup>, Loredana Popa<sup>d</sup>, Adrian M. Maghiar<sup>e</sup>, Mihai Juncar<sup>f</sup>

<sup>a,b,d,e,f</sup>Faculty of Medicine and Pharmacy, University of Oradea, Romania

<sup>c</sup>Department of Prosthetics and Dental Materials, "Iuliu Hațieganu" UMPH, 32 Clinicilor Street, Cluj-Napoca, 400006, Romania

<sup>b</sup>Email: [ralucajuncar@yahoo.ro](mailto:ralucajuncar@yahoo.ro)

<sup>c</sup>Email: [popa\\_dana@yahoo.com](mailto:popa_dana@yahoo.com)

## Abstract

Type 2 diabetes is one of the most important growing health problems worldwide causing several complications in different parts of the organism, including the oral cavity. Aim: The purpose of this study is to assess the periodontal disease of type 2 diabetes patients which came randomly and voluntarily for evaluation of their oral health. Materials and methods: 112 patients with marginal inflammatory pathology were selected and evaluated. The followed parameters were: age, gender, environment, status of diabetes, oral non-odontogenic lesions, local aspects of marginal tissue inflammation. Data were centralized in electronic format using Microsoft Excel software. Results: The average age of patients was 57.3, 56.25% of all patients had uncompensated diabetes with HbA1c levels over 7.5%. Most of them were males (52%) and lived in an urban community (83.93%). 52.27% had severe forms of periodontitis, requiring radical treatment, while the most common oral non-odontogenic pathology was candidosis (40.98%). Conclusion: By modifying local metabolism, diabetes increases the risk of inflammatory lesions, especially periodontitis.

**Keywords:** diabetes mellitus; periodontitis; odontogenic infection.

## 1. Introduction

Type 2 diabetes mellitus is probably the most common chronic metabolic disease [1] and together with its complications, are one of the most important and growing chronic health problems worldwide [2].

---

\* Corresponding author.

Diabetes mellitus (DM) is a group of metabolic disorders that is characterized by high levels of blood glucose and is classified into four general categories: type 1, type 2, gestational diabetes and other specific types of diabetes [3]. Hyperglycemia can cause several complications affecting different organ systems like eyes, nerves, kidneys, heart, and blood vessels [4]. Although not commonly discussed in diabetes care, this metabolic disorder increases the risk of developing oral health problems, in particular periodontal disease [5].

The link between type 2 diabetes and increased risk of developing periodontal disease was observed for the first time in 1970 [6]. Since then, many studies have established the direct relationship of diabetes with periodontitis; periodontitis affecting blood glucose levels and worsening diabetes complications [7]. Studies have revealed that about 743 million people worldwide are affected by periodontitis, this being the sixth most prevalent disease in the world [8].

The term periodontal disease defines an inflammatory disorder caused by a pathogenic flora in the biofilm that forms adjacent to the teeth, and includes gingivitis and periodontitis [9]. The first term refers to an inflammation confined in the gingiva, and is the mildest form of periodontal disease, being reversible with good oral hygiene, while periodontitis is the advanced stage, where the inflammation extends from the gingiva deep into the tissues, causing alveolar bone and periodontal ligament loss [9,10]. The bacteria within the periodontal pockets have the ability to survive in the blood stream and infect other parts of the body [11,12].

The aim of this study is to assess the periodontal disease on a representative group of type 2 diabetes patients . For reaching this purpose we prospectively selected a group of patients that came voluntarily for evaluation of their oral status and possible oral lesions.

## **2. Material and methods**

A total of 128 patients with diabetes type 2 treated in Maxilomed Clinic in Oradea, Romania were available for this study. The selection was made in a period of 4 months, and all patients presented oral inflammatory odontogenic pathology. Out of the total number, a subgroup of 112 patients which had marginal inflammatory pathology was selected. The protocol was approved by the Ethical Committee of University of Oradea, Romania (no. 4/20.04.2018) and all the patients had signed the informed consent.

The inclusion criteria in the study were: confirmed diagnostic of type 2 diabetes, the presence of marginal inflammatory disease, signed informed consent and adult age (at least 18 years old).

Exclusion criteria was: non diabetic patients, patients without marginal inflammatory disease or who didn't sign the informed consent, patients younger than 18 years, associated diseases interfering with surgical treatment options (chemotherapy, bisphosphonate treatment, etc. ), patients treated in other services.

Data was noted in patients' observation charts and the following variables were monitored: age, gender, environment, status of diabetes, oral non-odontogenic lesions, local or general aspects of marginal tissue inflammation.

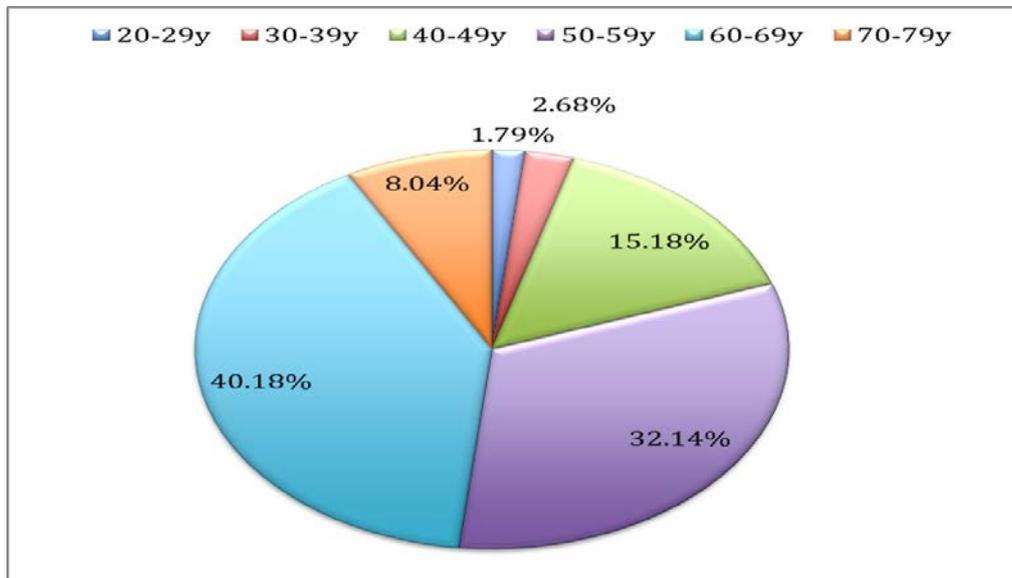
Data were centralized in electronic format using Microsoft Excel software. Descriptive statistics of the assessed cases was performed with a two decimal accuracy.

### 3. Results

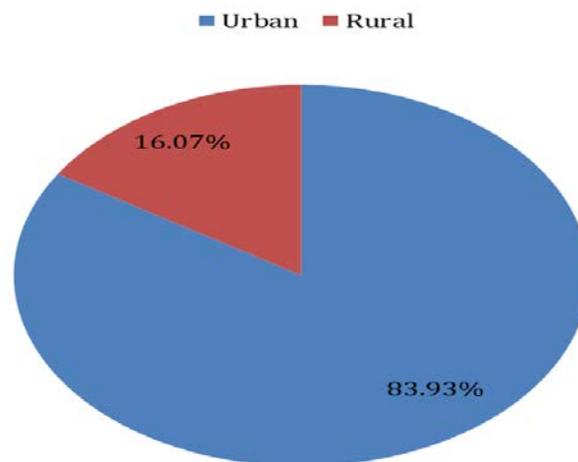
The youngest patient included in the study was 22 years old, and the oldest 78, the average age was 57.3 years. The highest incidence of the disease was in the 6th decade of life (**Figure 1**).

Distribution by gender was almost equal, with a slightly bigger number of males (51.78%).

Most of the patients live in the city; only 16.07% coming from rural communities (**Figure 2**).



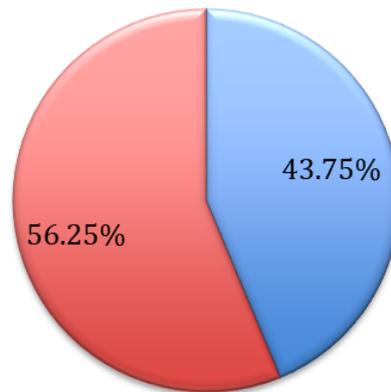
**Figure 1:** number of patients distributed by age



**Figure 2:** patients distribution by living environment

The glycated hemoglobin limit value has been settled at 7.5%; values equal or under indicating a good compensated diabetes, while values over indicating a not compensated diabetes. Unfortunately over 56.25% of our patients had HbA1c values over 7.5% (**Figure 3**).

- Compensated diabetes (HbA1c  $\leq$  7.5)
- Uncompensated diabetes (HbA1c  $\geq$  7.5)

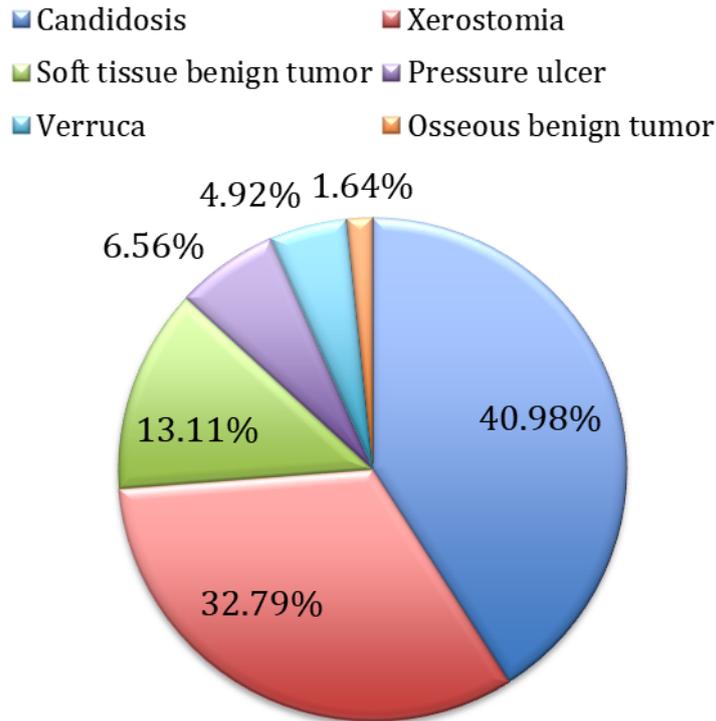


**Figure 3:** patient distribution by diabetes status

Besides the marginal inflammatory disease, two patients had also maxillary sinusitis (**Figure 4**), and 5 presented residual soft tissue after extractions prior the beginning of the study. The clinical and radiological examinations revealed some non odontogenic lesions in 51 patients. The most frequent one was candidosis (**Figure 5**).



**Figure 4:** CBCT image showing a swollen Schneiderian membrane of a left maxillary sinus at a patient with type 2 diabetes



**Figure 5:** detected non-odontogenic lesions

Periodontal disease was present at all patients, but in different stages of advancement. Some patients had only gingivitis, others severe periodontitis. The extent of periodontal disease decided the treatment plan for each patient. Only 53 patients (47.32%) presented mild to moderate forms of periodontitis that made saving the teeth possible, while 59 (52.27%) had severe forms that required a radical treatment.

#### 4. Discussion

The selected subgroup for this study consisted of almost 90% of the total number of patients, all of them having marginal inflammatory disease. Several epidemiological studies documented and confirmed the a link between type 2 diabetes and periodontitis and gingivitis, showing that the risk of periodontitis is 3 to 4 times higher in diabetic patients compared to systematically healthy individuals [13-15]. Besides this, these patients presented also a high risk in developing dental caries, heavy plaque, candidosis and xerostomia [16].

Hyperglycemia affects periodontal outcomes and chronic inflammation derived from periodontitis also adversely affects blood glucose levels and worsens diabetes control (HbA1c values) and complications [12]. The inadequate values of HbA1c at the majority of patients in our study could be an explanation for the oral complications found during the periodical clinical examinations. Also, older patients may had this diabetes for a longer period of time, in consequence may have been exposed to periodontopathogens for a longer period of time, explaining the high values of glycate hemoglobin and large number of oral complications.

Lifestyle and physical activity are capable to improve the metabolic state of type 2 diabetes patients, and lower the levels of HbA1c, having a positive effect on cardiovascular mortality, life quality and blood pressure [17,18]. Studies suggested that regular physical exercise is associated with a low prevalence of periodontitis [19, 20], lower plaque and gingival indices, and lower clinical attachment loss compared to sedentary subjects [21].

The mechanisms linking diabetes with periodontitis are not completely understood, but is assumed that some aspects of inflammation and immune function are involved [10]. Patients with type 2 diabetes are having higher serum levels of inflammatory mediators (interleukin-1 $\beta$  and tumor necrosis factor- $\alpha$ ) [22] and the increased local production of these cytokines plays an important role to alveolar bone destruction in periodontitis [23].

Most of the patients were unaware of the link between diabetes and their oral health, therefore almost all of the patients presented poor oral care, with various complications. The perceived need and importance for oral health care among people with diabetes is found to be very poor [24, 25], oral health being not as important as general health for these patients [26, 27].

Oral health behavior may be also influenced by socio-economic factors (living in a rural community or having a low income), may explain some unhealthy habits, poor attitude and knowledge to oral health and low addressability to dental services [28]. This is in concordance with data from studies conducted in the US and Finland, that showed that 49% of participants acknowledged that taking care of their oral health was as important as their general health, and only a third (33%) considered plaque or tartar build up as a problem, respectively more than a third (37%) of diabetic patients did not visit a dentist [29].

The limitation of our study would be the number of the patients. Our sample was limited to patients with diabetes type 2 treated in Maxilomed Clinic in Oradea, Romania.

## **5. Conclusion**

Periodontal disease can be found in patients with type 2 diabetes regardless of their glycemic control, suggesting a pronounced local metabolic alteration and increasing the risk of inflammatory lesions.

Early identification and treatment of any marginal inflammatory disease is particularly important for these patients as it could potentially improve their diabetes control and be more cost effective than delaying dental treatment until severe oral complications have developed.

## **6. Recommendations**

Looking at the age interval and living environment of the selected patients we can presume that stress and lack of physical exercise also had a contribution to diabetes and its complications.

Type 2 diabetes patients should improve their lifestyle and give greater importance to physical activity in order to improve the metabolic state and lower the levels of HbA1c, having a positive effect on cardiovascular mortality, life quality and blood pressure.

We recommend early identification and treatment of any marginal inflammatory disease as it could potentially improve their diabetes control.

### Acknowledgement

This study was supported through the Competitiveness Operational Program within the project entitled “Odontogenic infection in the patient with type 2 diabetes mellitus, an effective therapeutical approach”, through contract no. 99/09.09.2016 ID P\_38\_632 Cod SMIS 2014+

Acest studiu a fost realizat prin Programul Operațional Competitivitate în cadrul proiectului intitulat: ”Infecția de origine odontogene la pacientul cu diabet zaharat tip II, o abordare terapeutică eficientă”, prin contractual nr 99/09.09.2016 ID P\_38\_632 Cod SMIS 2014+

### References

- [1]. Wernicke K, Zeissler S, Mooren FC, Frech T, Hellmann S, Stiesch M, Grischke J, Linnenweber S, Schmidt B, Menne J, Melk A, Bauer P, Hillebrecht A, Eberhard J. - Probing depth is an independent risk factor for HbA1c levels in diabetic patients under physical training: a cross-sectional pilot-study. *BMC Oral Health*. 2018 Mar 16;18(1):46.
- [2]. International Federation of Diabetes. The global picture In: International Diabetes Federation Diabetes Atlas, 2015:47–66.
- [3]. American Diabetes Association 2. Classification and diagnosis of diabetes. *Diabetes Care*. 2017;40(Suppl 1):S11–S24.
- [4]. World Health Organization (WHO). Global report on diabetes. World Health Organization. 2016. [http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf). Accessed 26 Dec 2017.
- [5]. Taylor GW, Borgnakke WS. Periodontal disease: associations with diabetes, glycemic control and complications. *Oral Dis*. 2008;14:191–203
- [6]. Cohen DW, Friedman LA, Shapiro J, Kyle GC, Franklin S. Diabetes mellitus and periodontal disease: two-year longitudinal observations part I. *J Periodontol*. 1970;41(12):709–712
- [7]. Taylor JJ, Preshaw PM, Lalla EA. Review of the evidence for pathogenic mechanisms that may link periodontitis and diabetes. *J Clin Periodontol*. 2013;40(Suppl 14):S113–S134.
- [8]. Marcenes W, Kassebaum NJ, Bernabé E, et al. Global burden of oral conditions in 1990-2010: a systematic analysis. *J Dent Res* 2013;92:592–7.
- [9]. Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. *Lancet*. 2005;366:1809–1820
- [10]. Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, et al. Periodontitis and diabetes: a two-way relationship. *Diabetologia*. 2012;55:21–31.
- [11]. Loesche WJ, Lopatin DE. Interactions between periodontal disease, medical diseases and immunity in the older individual. *Periodontology 2000*. 1998;16:80–105.
- [12]. Watts A, Crimmins EM, Gatz M. Inflammation as a potential mediator for the association between periodontal disease and Alzheimer’s disease. *Neuropsychiatr Dis Treat*. 2008;4:865.
- [13]. Artese HPC, Foz AM, de Sousa RM, Gomes GH, Orlandi M, Suvan J, D’Aiuto F, Romito GA.

- Periodontal therapy and systemic inflammation in type 2 diabetes mellitus: a meta-analysis. *PLoS One*. 2015;10(5):e0128344.
- [14]. Borgnakke WS, Yi-Ostalo PV, Taylor GW, Genco RJ. Effect of periodontal disease on diabetes: systematic review of epidemiologic observational evidence. *J Periodontol*. 2013;84(4-s):S135–S152.
- [15]. Watanabe K. Periodontitis in diabetics: is collaboration between physicians and dentists needed? *Dis Mon*. 2011;57(4):206–213.
- [16]. Almusawi MA, Gosadi I, Abidia R, Almasawi M, Khan HA. - Potential risk factors for dental caries in Type 2 diabetic patients. *Int J Dent Hyg*. 2018 May 11
- [17]. Pai L, Li T, Hwu Y, Chang S, Chen L, Chang P. The effectiveness of regular leisure-time physical activities on long-term glycemic control in people with type 2 diabetes: a systematic review and meta-analysis. *Diabetes Res Clin Pract*. 2016;113:77–85.
- [18]. Umpierre D, Ribeiro PA, Kramer CK, Leitão CB, Zucatti AT, Azevedo MJ, Gross JL, Ribeiro JP, Scaaan BD. Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: a systematic review and meta-analysis. *JAMA*. 2011;305(17):1790–1799.
- [19]. Al-Zahrani MS, Borawski EA, Bissada NF. Increased physical activity reduces prevalence of periodontitis. *J Dent*. 2005;33(9):703–710.
- [20]. Eberhard J, Stiesch M, Kerling A, Bara C, Eulert C, Hilfiker-Kleiner D, Hilfiker A, Budde E, Bauersachs J, Kück M. Moderate and severe periodontitis are independent risk factors associated with low cardiorespiratory fitness in sedentary non-smoking men aged between 45 and 65 years. *J Clin Periodontol*. 2014;41(1):31–37.
- [21]. Bawadi H, Khader Y, Haroun T, Al-Omari M, Tayyem R. The association between periodontal disease, physical activity and healthy diet among adults in Jordan. *J Periodont Res*. 2011;46(1):74–81.
- [22]. Dandona P, Aljada A, Bandyopadhyay A. Inflammation: the link between insulin resistance, obesity and diabetes. *Trends Immunol*. 2004;25(1):4–7.
- [23]. Graves D, Cochran D. The contribution of interleukin-1 and tumor necrosis factor to periodontal tissue destruction. *J Periodontol*. 2003;74(3):391–401.
- [24]. Allen EM, Ziada HM, O'Halloran D, Clerehugh V, Allen PF. Attitudes, awareness and oral health-related quality of life in patients with diabetes. *J Oral Rehabil*. 2008;35(3):218–223.
- [25]. Bowyer V, Sutcliffe P, Ireland R, Lindenmeyer A, Gadsby R, Graveney M, et al. Oral health awareness in adult patients with diabetes: a questionnaire study. *Br Dent J*. 2011;211:E12.
- [26]. Orlando VA, Johnson LR, Wilson AR, Maahs DM, Wadwa RP, Bishop FK, et al. Oral health knowledge and behaviors among adolescents with type 1 diabetes. *Int J Dent*. 2010;2010:942124
- [27]. Sahril N, Aris T, Asari AS, Yaw SL, Saleh NC, Omar MA, et al. Oral health seeking behaviour among Malaysians with type II diabetes. *J Public Health Aspects*. 2014;1(1):1–8.
- [28]. Petersen PE, Kwan S. Equity, Social determinants and public health programmes—the case of oral health. *Community dentistry and oral epidemiology*. *Community Dent Oral Epidemiol*. 2011;39:481–487
- [29]. Karikoski A, Ilanne-Parikka P, Murtomaa H. Oral self care among adults with diabetes in Finland. *Community Dent Oral Epidemiol*. 2002;30:216–223