DE GRUYTER OPEN

http://www.jrdiabet.ro
Rom J Diabetes Nutr Metab Dis. **23**(3):247-254
doi: 10.1515/rjdnmd-2016-0029

ORAL DISEASE IN DIABETIC PATIENTS – A PILOT STUDY

Raluca-Iulia Juncar [1,2], ***Mihai Juncar*** [2,3,✉], ***Amorin-Remus Popa*** [4]

[1] Department of Prosthodontics, University Hospital Cluj Napoca, Cluj Napoca, Romania
[2] SC Juncar Med SRL, Oradea, România
[3] Dental Medicine Department, Faculty of Medicine and Pharmacy, University of Oradea, Oradea, Romania
[4] 2nd Medical Clinic Diabetes, Faculty of Medicine and Pharmacy, University of Oradea, Oradea, Romania

received: June 21, 2016 *accepted*: August 26, 2016
available online: September 15, 2016

Abstract

Background and Aims. *Diabetes mellitus is one of the most frequent systemic diseases found in the human adult population. However, the impact of diabetes mellitus, particularly type 2, on oral health is a controversial subject that is far from being clarified. The aim of this study was to prospectively assess the oral health of patients with type 2 diabetes mellitus (T2DM) in order to detect the main oral pathological changes occurring in these patients.* ***Material and method.*** *For this study, 328 patients who presented for dental treatments in the period May 2015 – May 2016 were available. Of these, 33 patients with T2DM, who made up the diabetes group, and 79 patients who formed the control group were selected. Diabetes group was selected from patients that presented no other systemic disorders that could determine the appearance of oral lesions except for T2DM. The control group was selected in order to have general characteristics similar to the diabetes group.* ***Results.*** *Patients in the diabetes group had a mean tooth loss value of 12.69±7.47 compared to patients in the non-diabetic group, who had a mean value of 6.29±4.62. Non-odontogenic oral pathology such as chronic candidiasis, salivary disorders and lichen planus was present in 51.52% of all patients with T2DM, while in the control group this was absent.* ***Conclusions.*** *The presence of diabetes mellitus favors tooth loss and the development of non-diabetic oral lesions.*

key words: *oral disease, T2DM, glycemic control, oral status*

Background and aims

Diabetes mellitus has a high prevalence among the adult population worldwide, with an estimated number of 350 million patients affected globally [1]. Diabetic disease mainly affects economically developed countries; for example, in USA it is estimated that by 2050, 33% of the adult population will suffer from diabetes mellitus, particularly type 2 [2].

A number of systemic diseases have oral manifestations, diabetes mellitus being one of the most important [3]. Diabetes mellitus is responsible for the development of periodontal disease, an alteration of the quality of oral tissues, changes in salivary secretion and even

✉ Țepeș Vodă 23A, 410513 Oradea, România. tel: 0744438874
corresponding author e-mail: mihaijuncar@gmail.com

the development of dental caries [3]. In order to obtain control of diabetes mellitus and its complications, it is essential to have adequate glycemic control [4]. This is not possible without correct dietary management [5,6], for which oral health status is important. Regarding the evaluation of oral health in diabetic patients, attention has so far focused on periodontal disease, which has been proposed to be included in the category of diabetes mellitus complications [7,8].

The results of research on the relationship between type 2 diabetes mellitus (T2DM) and oral health status are contradictory. Some studies support the negative influence of T2DM on the health of oral cavity tissues [7,9], while other studies found no correlation between the increased incidence of oral pathological changes in diabetic patients and the presence of diabetes as such [3]. These studies have a number of limitations regarding the methodology used; thus, in the majority of cases, the characteristics of T2DM are not analyzed, whereas in other situations, only punctual changes of the oral status are analyzed. The contradictory results reported by the literature indicate the fact that the influence of T2DM on oral health is far from being understood. For these reasons, the presence of a prospective case-control clinical study establishing an oral health status profile of patients with T2DM according to the characteristics of this systemic disorder is important. In this way, the impact of T2DM on oral health can be quantified.

The aim of this study was to prospectively assess the oral health of patients with T2DM in order to detect the main oral pathological changes occurring in these patients.

Material and method

For this study, the patients of the Juncar Md SRL dental practice in Oradea, treated in the period May 2015 – May 2016, were available. Over the studied period, a number of 328 patients were available. Of these, 112 patients were selected to be included in the study. Patients were divided into two groups, a diabetes group consisting of 33 diabetic patients and a control group of 79 non-diabetic patients. The patients included in the diabetes group had to meet the following criteria: adult patient, patient having signed an informed consent to be included in the study, patient with adequate imaging investigations for the evaluation of general oral health (at least panoramic X-ray). The patients included in the control group had to meet similar criteria to those of the diabetes group, except that the absence of associated systemic disease was a mandatory prerequisite. They were selected in such a manner so that their age would be included in the same interval as the diabetes group. Data gathering was realized for all patients and those who did not fulfill the age criteria were eliminated from the data base.

The study data were prospectively collected. In the case of each patient, the following variables were recorded: general data (age, sex, environment of origin, education level), data related to T2DM (disease duration, type of treatment, medication used, glycated hemoglobin (HbA1c) value), presence of associated pathology, data related to oral health status (edentulism, prosthetic restoration, carious lesions, endodontic pathology, periapical pathology, marginal periodontal pathology), other pathological non-odontogenic oral lesions like disorders of salivary secretion, tumors of oral mucosa, chronic infections of the oral mucosa and oral degenerative lesions.

Statistical analysis The data obtained were recorded in the individual chart of each patient, they were centralized in an electronic form and statistically interpreted using the Microsoft

Excel program. Data gathering was realized separately for each group. Afterwards, descriptive statistics for the two groups was completed and the results were compared.

Results

The results obtained following analysis of general features in the two groups of patients evidenced a mean age of patients in the diabetes group of 56.78±8.5 years, with a minimum age of 35 years and a maximum age of 74 years. In the control group, the patients' age ranged between 35 and 61 years, with a mean of 44.93±6.91 years. Regarding the environment of origin, the majority of patients in both groups were from urban areas, with a value of 75.76% for the diabetes group and 91.25% for the control group. Male patients were predominant in the diabetes group, representing 57.58% of patients and balanced in the control group (50.63% of patients). Regarding the education level of patients in the two groups, almost half of them had higher education level, with a value of 48.48% for the diabetes group and 45.57% for the control group.

The characteristics of diabetic disease in the diabetes group evidenced that this was diagnosed 1 to 15 years before inclusion in the study, the mean duration of T2DM in the diabetes group being 6.27 years. The treatment of diabetic patients consisted in most cases of oral antidiabetic drugs (66.67%), followed by antidiabetics associated with insulin (12.12%) and diet only in equal proportion (12.12%). Treatment with insulin alone was used by 9.09% of diabetic patients. Regarding the type of oral medication used by diabetic patients, in most of the cases these had metformin treatment (80% of cases), followed by glimepiride and sitagliptin in 20% of patients, and gliclazide in 16.67% of cases. The degree of control of T2DM, assessed by HbA1c, indicated values between 6.2% and 10.5%, with a mean of 7.86%±0.84 (Figure 1).

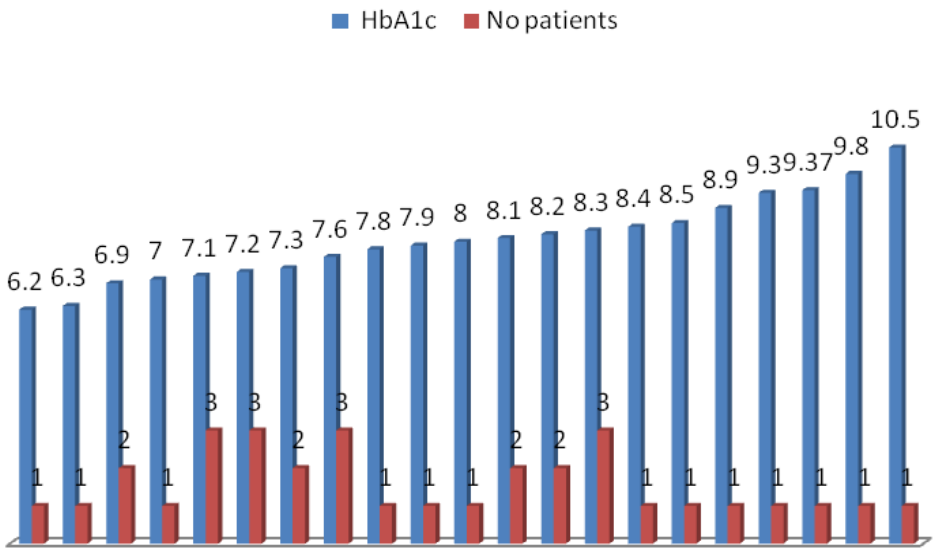

Figure 1. *Distribution of patients in the diabetes group depending on the HbA1c value.*

In addition to T2DM, the patients of the diabetes group had other systemic disorders. Obesity was the most frequently found, in 81.25% of cases, followed by essential arterial hypertension in 42.42% of cases, and chronic heart failure in 15.15% of cases.

The assessment of oral health status in patients of the two groups evidenced a higher tooth loss rate in patients of the diabetes group

compared to the control group. No patient in the diabetes group had intact dental arches, while 3 such patients were identified in the control group. In the diabetes group, between 3 and 28 teeth were absent, with a mean of 12.69±7.47 lost teeth, while tooth loss in the control group ranged between 0 and 23 absent teeth, with a mean of 6.29±4.62 absent teeth.

Regarding the presence of carious lesions, these were found in the majority of patients in the two groups. However, they were more frequent in the diabetes group, being present in 81.82% of patients compared to the control group, with 71.15% of patients. Among endodontic complications, pulp gangrene was found in the group of patients with T2DM who had endodontic disease in a proportion of 84.64% of cases, and in the control group, in 93.88% of cases with endodontic disease. Inflammatory periapical disease was much more frequent in the control group (75.79%) compared to the diabetes group, in which it affected less than half of the patients (48.48%). On the other hand, chronic marginal periodontal disease more frequently affected patients with T2DM (84.85%) compared to control patients (67.09%). Regarding the mean number of teeth affected by periodontal disease, (loss of attachement level, periodontal pockets and bone loss) this was higher in control patients (17.9±7.28 teeth) compared to the diabetes group (11.39 teeth). Figure 2 shows the distribution of patients in the two groups depending on the number of teeth affected by periodontitis.

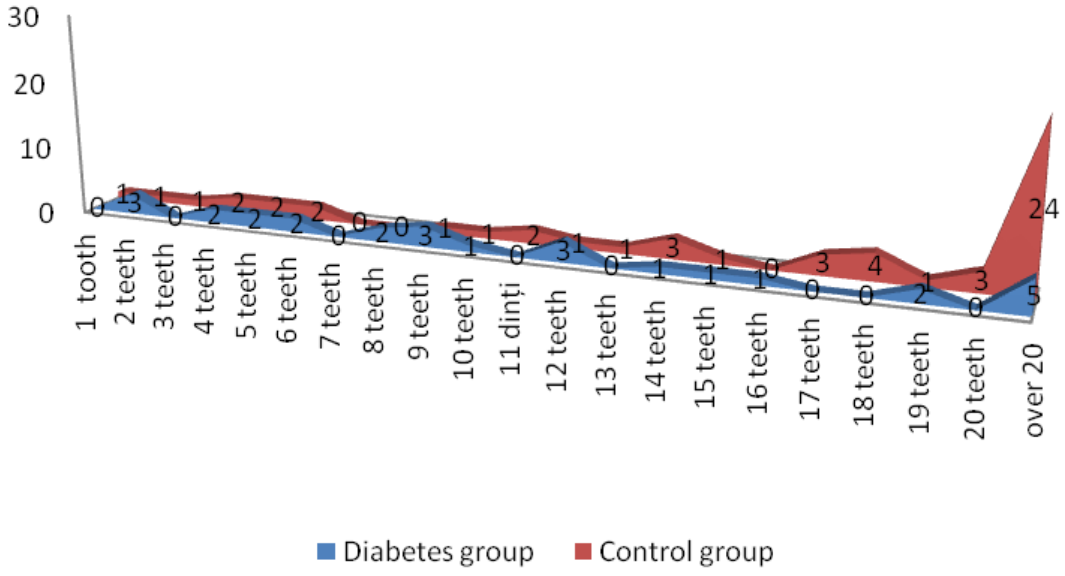

Figure 2. *Distribution of patients depending on the number of teeth affected by periodontal disease*

Table 1. Distribution of patients with T2DM depending on the duration of systemic disease and the presence or absence of non-diabetic oral disease.

Duration of T2DM (years from the time of diagnosis)	Non-diabetic oral lesions		Total cases
	Present	Absent	
1 – 5 years	0	10	10
5 – 10 years	10	6	16
Over 10 years	7	0	7

Table 2. Distribution of patients with T2DM depending on HbA1c values and the type of non-diabetic oral disease

HbA1c value	Number of patients (%)	Candidiasis	Hyposialia	Lichen planus	Incidence of oral disease
<7.5	13 (39.39%)	0	4	1	38.46%
7.5-9	16 (48.48%)	4	6	1	50%
>9	4 (12.13%)	0	3	0	75%

In patients with T2DM, pathological changes other than odontogenic ones were identified in the oral cavity. Unlike patients in the control group, those with T2DM presented hyposialia, chronic candidiasis and lichen planus, which affected 51.52% of all diabetes group patients, while no case was detected in the control group. Hyposialia accounted for 70% of pathological non-odontogenic oral changes, followed by chronic candidiasis (20%) and lichen planus (10%). The incidence of pathological non-odontogenic oral changes in the group of patients with T2DM depending on the duration of diabetes (Table 1) and the HbA1c value (Table 2) was analyzed.

Discussions

The aim of this study was reached: an oral disease profile of patients with T2DM can be defined compared to patients without this disease. An analysis of the general features in the two groups shows the fact that the mean age of patients in the diabetes group is higher compared to that of control patients, although an inclusion criterion for patients of the control group was an age range identical to that of the diabetes group. This criterion was introduced precisely to limit the influence of patient age on oral health, as it is obvious that an elderly patient will be more likely to have a poorer oral health status than a young patient. Studies in cohorts of patients have revealed that T2DM more frequently manifests after 50 years of age [10], which could be main reason why the mean age of patients in the diabetes group is higher compared to that of control patients.

Although male patients were predominant in the diabetes group, we do not believe that male sex is a factor predisposing to the development of pathological oral lesions among diabetic patients. This rationale is based on the fact that the difference between the two sexes is small. The majority of the patients in both groups came from an urban environment, and almost half of them had higher education level. These characteristics can be rather explained by the fact that data were collected in institutions from urban areas, as well as by the easier access to dental care services for these patients compared to patients from rural areas.

The analysis of the characteristics of T2DM evidenced a diverse picture of the disease. Thus, the duration of the disease, from the time of diagnosis to the inclusion of patients in the study, was extremely varied. It cannot be stated with certainty that the recorded values are real ones, because between pre-diabetic condition and diabetes mellitus there is a limit that is not always clearly established [11]. Nevertheless, this remains the only modality to quantify the duration of the disease and most importantly, its influence on the human body. Regarding the treatment used by patients in the diabetes group for glycemic control, oral antidiabetic medication was the most frequent, similar with other studies reporting that more than 50% of patients with T2DM use this type of treatment, followed in order of frequency by an association of oral antidiabetics and insulin [12,13]. Metformin is the most frequently used oral antidiabetic drug as a single therapy or more commonly, associated with other oral antidiabetics. The wide administration of this

drug has been reported by other authors in a number of studies on the long-term effects of this drug [14].

The evaluation of glycemic control, based on the HbA1c value at the time of patient inclusion in the study, showed that most of the patients had moderate glycemic control, with HbA1c values between 7% and 9%. In patients of the diabetes group, a number of cardiac diseases associated with T2DM were also detected. This is not surprising, taking into consideration that this type of comorbidities is frequently associated with T2DM [12,15]. However, it should not be overlooked that cardiac disease significantly influences the treatment of odontogenic lesions, including in diabetic patients [16].

The analysis of oral health in diabetic patients compared to controls showed a poorer oral health status of patients in the diabetes group compared to those of the control group. Oral health deterioration in diabetic patients is obvious both in terms of dental lesions and tooth loss, and associated oral pathology. The more extensive tooth loss is not surprising given that inflammatory dental disease, affecting the marginal periodontium in particular, is more frequent in diabetic patients [7,8,17]. Carious lesions and their complications have an increased incidence in both groups, but their septic complications are more severe in T2DM patients compared to non-diabetic patients [18,19]. The main cause of tooth loss and dental status deterioration in diabetic patients is most probably periodontal disease. This is supported by the fact that the incidence of periodontal disease was higher in the diabetes group compared to the control group.

The analysis of non-diabetic oral disease in the two groups evidenced surprising discrepancies. The main non-odontogenic changes present in diabetic patients are salivary gland disorders manifesting as hyposialia. This type of changes was found in other similar studies, which reported a significant diminution of salivary secretion [7]. Some authors analyzed in detail the pathological changes in the salivary glands of diabetic patients, and even proposed the idea of assessing T2DM depending on the level of glucose excreted by these [20]. Although the aim of this study was not to analyze salivary gland health in T2DM patients, the correlation between this type of systemic disease and the alteration of salivary function is obvious. Other pathological non-odontogenic oral changes detected in the diabetes group were candidiasis infection and lichen planus. These were reported by other authors to have a higher incidence in diabetic patients, but this increased incidence was not attributed to the presence of T2DM [3]. We cannot share this opinion in the context in which these disorders have a clearly higher incidence in the diabetes group compared to the control group. In addition, a clear correlation can be seen between the duration of T2DM and HbA1c values and the increased incidence of these non-odontogenic oral disorders. The data of this study suggest the fact that poor glycemic control associated with long-duration disease favors the development of these non-odontogenic oral disorders.

The relatively small number of patients in the diabetes group does not allow a thorough investigation of all non-odontogenic oral changes occurring in diabetic patients. This is why we consider that further studies are necessary in this regard, and particularly for detecting the mechanisms by which T2DM favors the development of these oral diseases.

The advantages of this study can be defined as finding the most recurrent odontogenic and non odontogenic oral lesions in patients with T2DM which may be useful in managing this type of pathology in terms of prevention and

treatment. The present study has several limitations arising from the small number of patients and the fact that this was the only practice in the geographic area that was screening for this pathology without the possibility of extrapolating the result to the entire geographic area from which the patients were selected.

Conclusions

T2DM has a negative effect on the dental-periodontal status of diabetic patients, particularly through the development of inflammatory lesions of the marginal periodontium. Inadequate glycemic control associated with a long history of T2DM is an important factor that favors the development of non-odontogenic lesions in the oral cavity, the salivary glands being mainly involved.

Acknowledgements & Duality of interest. None.

REFERENCES

1. Danaei G, Finucane MM, Lu Y et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet* 378(9785): 31–40, 2011.

2. Boyle JP, Thompson TJ, Gregg EW, Barker LE, Williamson DF. Projection of the year 2050 burden of diabetes in the US adult population: Dynamic modeling of incidence, mortality, and prediabetes prevalence. *Popul Health Metr* 22: 8-29, 2010.

3. de Menezes Sousa MG, de Lisboa Lopes Costa A, Roncalli AG. Clinical study of the oral manifestations and related factors in type 2 diabetics patients. *Braz J Otorhinolaryngol* 77: 145-152, 2011.

4. Boltri JM, Okosun IS, Davis-Smith M, Vogel RL. Hemoglobin A1c levels in diagnosed and undiagnosed black, Hispanic, and white persons with diabetes: Results from NHANES 1999–2000. *Ethn Dis* 15: 562–567, 2005.

5. Peek ME, Cargill A, Huang ES. Diabetes health disparities: A systematic review of health care interventions. *Med Care Res Rev* 64: 101S–156S, 2007.

6. Oikarinen K, Raustia AM, Hartikainen M. General and local contraindications for endosseal implants -- an epidemiological panoramic radiograph study in 65-year-old subjects. *Community Dent Oral Epidemiol* 23: 114–118, 1995.

7. Al-Maskari AY, Al-Maskari MY, Al-Sudairy S. Oral manifestations and complications of diabetes mellitus. *Sultan Qaboos Univ Med J* 11: 179–186, 2011.

8. Masayuki U, Susumu T, Akiko O, Kayoko S, Satoko O, Yoko K. Association between Diabetes Mellitus and Oral Health Status in Japanese Adults. *Int J Oral Sci* 2: 82–89, 2010.

9. Gondivkar SM, Indurkar A, Degwekar S, Bhowate R. Evaluation of gustatory function in patients with diabetes mellitus type 2. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 108: 876-880, 2009.

10. Wang A, Chen G, Su Z et al. Risk scores for predicting incidence of type 2 diabetes in the Chinese population: the Kailuan prospective study. *Sci Rep* 25: 6: 26548, 2016.

11. Liu Y, Xiao X, Sun C et al. Ideal glycated hemoglobin cut-off points for screening diabetes and prediabetes in a Chinese population. *J Diabetes Investig* 2016 Feb 13. doi: 10.1111/jdi.12498. [Epub ahead of print]

12. Davari M, Boroumand Z, Amini M, Aslani A, Hosseini M. The direct medical costs of outpatient cares of type 2 diabetes in iran: a retrospective study. *Int J Prev Med* 7: 72-75, 2016.

13. Yotsapon T, Sirinate K, Ekgaluck W et al. Clinical characteristics and outcomes of the oldest old people with type 2 diabetes - perspective from a tertiary diabetes center in Thailand. *BMC Endocr Disord*. 16: 30, 2016.

14. Winkler G. Metformin - new data of an "old", but efficient, safe and reliable antidiabetic drug. *Orv Hetil* 157: 882-891, 2016.

15. Karetnikova V, Gruzdeva O, Uchasova E, Osokina A, Barbarash A. Glucose levels as a prognostic

marker in patients with ST-segment elevation myocardial infarction: a case–control study. *BMC Endocr Disord* 16: 31, 2016

16. Juncar M, Lung T, Onișor F. Atitudinea terapeutică față de pacienţii cu patologie cronică periapicală și afecțiuni cardio-vasculare. Studiu pe o perioadă de un an. *Revista Română de Stomatologie*, 56: 175 – 180, 2010

17. Kapellas K, Mejia G, Bartold PM et al. Periodontal therapy and glycaemic control among individuals with type 2 diabetes: reflections from the PerioCardio study. *Int J Dent Hyg* 2016 Jun 1. doi: 10.1111/idh.12234. [Epub ahead of print]

18. Juncar M, Popa A, Fritsch R, Lung T. The necrotizing cervical fasciitis – case presentation. *Rom J Diab Nutr Metab Dis* 17: 165-171, 2010.

19. Juncar M, Popa A, Lung T, Georgios P. The evolution of the diffuse effusions of the cephalic extremity in patients suffering from diabetes mellitus. *Rom J Diab Nutr Metab Dis* 17: 187-195, 2010

20. Shanbhag VK. Salivary glucose estimation in T2DM patients. *Indian J Dent Res*. 27: 108, 2016.