

The assessment of periodontium in patients with uncontrolled diabetes

Preferansow E^{1*}, Gołbiewska M¹, Kulikowska-Bielaczyc E¹, Górska M²

¹ Department of Prosthodontics, Medical University of Białystok, Poland

² Department of Endocrinology, Diabetology and Internal Medicine, Medical University of Białystok, Poland

Abstract

Purpose: Uncontrolled diabetes leads to disturbances of carbohydrate, protein, and lipid balance as well as morphological changes in many organs. It can be assumed that the changes can also regard the masticatory organ and thus, periodontal tissues.

The aim of the study was the assessment of periodontium in patients with uncontrolled diabetes ($HbA_{1C} > 7\%$) and the comparison of the results with data obtained in the group of healthy individuals – depending on sex.

Material and methods: The study was carried out in the group of 275 subjects: 155 hospitalized patients with uncontrolled diabetes (the examined group) and 120 healthy individuals comprising the control group. Russell's index was used for the evaluation of the periodontal condition.

Results: The mean level of glycated hemoglobin HbA_{1C} in patients was 9.43% in women and 9.57% in men. The mean value of Russell's index was 2.14 in the examined group and 0.99 – in the controls. The difference was statistically significant ($p < 0.001$).

Discussion: Although other authors' results are ambiguous and controversial, the theory that there is the connection between uncontrolled diabetes and periodontitis and the consequences of the coexistence of these diseases are very serious, is still maintained.

Conclusions: Uncontrolled diabetes was the crucial cause of periodontal changes and, to a large extent, influenced the function of the masticatory organ in patients.

Key words: uncontrolled diabetes, periodontium.

Introduction

Diabetes mellitus, specifically uncontrolled diabetes, is the disease most frequently mentioned as the systemic metabolic disease affecting the condition of the masticatory organ, and thus periodontium [1].

Diabetes mellitus is considered to be a social disease. According to the epidemiological data, there are 3% to 6% of the society suffering from the disease. Diabetes can markedly influence general indices of morbidity and mortality and lead to life shortening by about 30% [2,3].

The disease can be defined as the systemic disorder characterized by hyperglycemia, which is a result of insulin secretion or action defects [3].

The following types of diabetes mellitus are distinguished: type 1 diabetes (autoimmunologically conditioned or idiopathic), type 2 diabetes, other specific forms of diabetes (occurring, e.g. in the course of infectious diseases, chronic pancreatitis, endocrinopathy, genetic diseases, connected with drug taking), and diabetes in pregnancy [3-5].

The ailment is characterized by the risk of complication occurrence, both acute and chronic [4,6]. All chronic diabetes complications are probably due to vascular disorders, which can be divided into non-specific macroangiopathy and specific microangiopathy. It seems that the influence of vascular lesions in the course of diabetes mellitus on periodontal tissues is unquestionable: capillary and precapillary angiostenosis hinders the transport of nutritional components. Oxygen diffusion and waste products elimination impairment leads to physiological imbalance and increases periodontal sensitivity to injury [7]. According to Matthews [8], chronic diabetes complications are connected with persistent hyperglycemia, which results in the formation of end products of advanced glycation (AGEs). They sensitize endothelial cells and monocytes to stimuli inducing inflammatory mediators. As plasma and tissue AGEs accumu-

* CORRESPONDING AUTHOR:

Ewa Preferansow
ul. M. Skłodowskiej-Curie 24a
15-267 Białystok, Poland
Tel./fax: +48 085 744 70 30
e-mail: protetyk@amb.edu.pl

Table 1. Mean glycated hemoglobin HbA_{1c} in examined group (depending on the sex)

HbA _{1c}	Subgroup I			Subgroup II			Examined group (total)		
	M	F	Total	M	F	total	M	F	total
Number	34	36	70	46	39	85	80	75	155
Standard deviation	1.15	1.58	1.38	1.86	1.3	1.63	1.49	1.44	1.52
Medium value	9.7	9.8	9.8	9.7	9.6	9.6	9.7	9.6	9.6
Mean value	9.43	9.51	9.47	9.68	9.36	9.53	9.57	9.43	9.5

Table 2. Mean Russell's index value in examined and control groups

Russell's index	Subgroup I			Subgroup II			Control group			Examined group (total)		
	M	F	total	M	F	total	M	F	total	M	F	total
Number	24	28	52	30	29	59	51	54	105	54	57	111
Standard deviation	1.01	1.27	1.18	0.87	0.94	1.05	0.85	0.78	0.81	1.18	1.11	1.15
Medium value	1.57	1.8	1.72	3.01	2.02	2.5	0.7	0.8	0.8	2.55	2.0	2.02
Mean value	1.5	2.05	1.79	2.97	1.89	2.44	0.96	1.02	0.99	2.32	1.97	2.14
Statistical analysis	0.095		0.001		0.708		0.108					
	0.001			0.001			0.001					
	0.018											
	0.001											
	0.595			0.001			0.001					
	0.001											
	0.001											
	0.003			0.001			0.001					
	0.001											
	0.001											

lation occurs due to uncontrolled diabetes, it can be assumed that periodontal tissues with large amount of AGEs content are characterized by higher vascular permeability, elevated collagen fiber atrophy, and reveal accelerated damage of non-mineralized connective tissues and bones.

The aim of the study was the assessment of periodontium in patients with uncontrolled diabetes mellitus (HbA_{1c} >7%) and the comparison of the results with those obtained in the group of generally healthy individuals – depending on sex.

Material and methods

The study was performed in the group of 275 patients: 155 hospitalized patients with type 1 (subgroup I) or type 2 uncontrolled diabetes (subgroup II) – the examined group, and the control group of 10 healthy subjects. The examination was carried out at a dental surgery, in artificial light, with the use of a dental set and a calibrated periodontological probe. The results were included into prepared examination charts. Russell's index was used to evaluate periodontal condition.

The results were transferred into electronic data base, which enabled the statistical analysis. The hypotheses of the study were verified with t-Student test for two means and "u" test for two frequencies. Differences at $p < 0.05$ were considered statistically significant.

Results

The mean glycated hemoglobin HbA_{1c} level in patients of the examined group was 9.43% in women and 9.57% in men (Tab. 1). The subgroup 1 revealed the mean value of 9.47% and was slightly higher in women – 9.51% than in men – 9.43% while in the subgroup II it was 9.53% (9.36% in women and 9.68% in men, respectively).

The mean value of Russell's index (Tab. 2) was 2.14 in the whole group while in the control group it was 0.99. The difference was statistically significant ($p < 0.001$). The Russell's index in the subgroup I was on average 1.79 and in the subgroup II it was markedly higher and constituted 2.44. As far as the subgroups are concerned, the difference was statistically significant ($p < 0.003$). It points to more advanced periodontal lesions in patients with uncontrolled diabetes of both types.

Men in the whole examined group revealed a slightly higher Russell's index than women (2.32 and 1.97, respectively) whereas the difference between mean values of the index (men – 2.97 and women – 1.89) in patients of subgroup II was statistically significant ($p < 0.001$) in favor of women.

Discussion

There are many reports in the literature concerning the influence of uncontrolled diabetes on periodontal condition. However, the spectrum of examinations was very narrow and the

choice of indices – diverse in character. Other authors' results are ambiguous and controversial. According to Soskolne et al. [9], the dynamics of pathological processes in periodontium in the course of diabetes mellitus depends on numerous factors, like compensating the disease and the presence of vascular complications. Firatli [10] claimed that vascular microangiopathies of gingivae lead to disturbances in oxygen distribution and waste products elimination as well as leukocyte migration defect. Thus, it can be assumed that these factors decrease the ability of periodontal tissues to repair and regenerate in patients with diabetes mellitus. Grossi et al. [11], who studied microbiological indices of periodontal diseases in 1426 patients, showed that the risk of periodontitis occurrence in patients with diabetes was 2-3 times higher than in healthy subjects. Løe [12] observed a sixfold increase in the rate of periodontal diseases in diabetics than in healthy. The studies of Hallman and Mealey [13] and, independently Szymańska and Fetkowska [14], revealed more frequent occurrence of oral mucositis in patients as compared to the healthy. A marked elevation of periodontal diseases was observed in patients with type 1 diabetes than in those with type 2 [15], despite the fact that Saito et al. [16] claimed that type 2 diabetes is the higher risk factor in these diseases.

Thus, other authors' results are in accordance with ours. However, some scientists do not seem to notice the differences between periodontal tissue condition in patients and healthy subjects. Hayden and Buckley from Ireland [17], and independently Vechis-Bon from France [18], calculating periodontal indices and assessing the depths of gingival pockets and glycated hemoglobin level in patients with diabetes did not show any significant correlation between diabetes and periodontal diseases.

Despite those controversial results, the theory of the connection between the two diseases and the consequences of their coexistence are very serious, is maintained [19,20].

Conclusions

Uncontrolled diabetes constituted the significant cause of periodontal tissue changes and the marked loss of the masticatory organ functioning in patients. Thus, the effect of this ailment on periodontal tissues, and the masticatory organ itself, comprises a serious problem and should become the scope of intensified preventive and therapeutic activities of diabetologists and dentists.

References

1. Dorocka-Bobkowska B, Jaśkowiak E, Pietkiewicz K, Włoch S. Wpływ cukrzycy na stopień adhezji *Candida albicans* do komórek błony śluzowej podłoża protetycznego. *Prot Stom*, 1994; XLIV, 1: 42-4.
2. Atlas powikłań naczyniowych cukrzycy, Servier.
3. Czech A, Tatoń J, Bernas M. *Kompendium diabetologii*. Via Medica, Gdańsk 2000; 3: 10-1, 193.
4. Herold G, et al. *Medycyna wewnętrzna*, Wyd Lek PZWL, Warszawa 2000: 770-95.
5. Mealey B. Diabetes and periodontal diseases. *J Periodontol*, 1999; 70(8): 935-49.
6. Tutak M, Ciechanowski K. Pacjent z cukrzycą w praktyce stomatologicznej. *Stom Współ*, 1996; 3(2): 146-8.
7. Orkiszewska M. Objawy w jamie ustnej u chorych z nierozpoznaną cukrzycą insulino niezależną. *Przegląd piśmiennictwa*. *Poznańska Stom*, 1992: 125-7.
8. Soskolne WA, Klinger A. The relationship between periodontal diseases and diabetes: an overview. *Ann Periodontol*, 2001; 6(1): 91-8.
9. Matthews DC. The relationship between diabetes and periodontal disease. *J Can Dent Assoc*, 2002; 68(3): 161-4.
10. Firatli E. The relationship between clinical periodontal status and insulin – dependent diabetes mellitus. Results after 5 years. *J Periodontol*, 1997; 68(2): 136-140.
11. Grossi SG, Skrepicinski FB, DeCaro T, Robertson DC, Ho AW, Dunford RG, and others. Treatment of periodontal disease in diabetics reduces glycated hemoglobin. *J Periodontol*, 1997; 68(8): 713-9.
12. Løe H. The sixth complication of diabetes mellitus. *Diab Care*, 1993; 16(1): 329-34.
13. Hallman WW, Mealey BL. Implications of diabetes mellitus and periodontal disease. *Diabetes Educ*, 1992; 18(4): 310-5.
14. Szymańska J, Fetkowska-Mielnik K. Ocena stanu błony śluzowej jamy ustnej u dzieci i młodzieży z cukrzycą insulinozależną. *Przegląd Pediatr*, 1993; 4: 441-5.
15. Banach J, Czuryżkiewicz-Cyrana J. Zmiany histopatologiczne tkanek przyzębia w przebiegu cukrzycy – przegląd piśmiennictwa. *Czas Stom*, 2003; LVI, 3: 179-83.
16. Saito T, Shimazaki Y, Kiyohara Y, Kato J, Kubo M, Iida M, Koga T. The severity of periodontal disease is associated with the development of glucose intolerance in non-diabetics: The Hisayama Study. *J Dent Res*, 2004; 83(6): 485-90.
17. Hayden P, Buckley LA. Diabetes mellitus and periodontal disease in an Irish population. *J Periodont Res*, 1989; 24(5): 298-302.
18. Vechis-Bons S. Importance of diabetic equilibrium in periodontal condition. Clinical study. *Actual Odontostomatol*, 1990; 44: 171, 523-34.
19. Sbordone L, Ramaglia L, Barone A, Ciaglia RN, Iacono VJ. Periodontal status and subgingival microbiota of insulin – dependent juvenile diabetics. A 3 – year longitudinal study. *J Periodontol*, 1998; 69: 120-8.
20. Kurnatowska A, Bieniek E. Zmiany w jamie ustnej u chorych na cukrzycę insulinozależną. *Dent Med Probl*, 2004; 41(1): 113-8.