Evaluation of periodontal status in young patients with insulin-dependent diabetes mellitus (type 1)

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Abstract

Purpose: **The aim of the study was to value periodontal status in young persons with well-controlled insulin-dependent diabetes mellitus (IDDM).**

Material and methods: **We examined 50 young people with IDDM (25 girls and 25 boys) and 50 healthy subjects (25 girls and 25 boys). Mean age of examined persons was about 14 years. We investigated gingival indexes: GI (Gingival Index) and PBI (Papillary Bleeding Index) and periodontal indexes: PI (Periodontal Index) and PDI (Periodontal Disease Index).**

The results were statistically analysed, and significant differences we observed for $p<0.05$.

Results: **The mean scores of Gingival Index and Papillary Bleeding Index were lower in healthy subjects but differences were not statistically significant. Only maximum scores of these indexes were significantly higher in diabetics.**

The mean and maximum values of Periodontal Index were significantly higher in patients with IDDM.

We did not notice differences between mean scores of PDI in both examined groups. Analysis of maximum values of Periodontal Disease Index reveals higher level in diabetic girls than in female controls.

Conclusions: **IDDM patients may be at risk of periodontal diseases. Well-controlling insulin-dependent diabetes mellitus may be important for periodontal tissues status and prophylaxis of periodontal diseases.**

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Introduction

Diabetes mellitus is a pathological syndrome of varied etiology and diverse clinical course. World Health Organization has distinguished three types of this ailment: insulin-dependent (type 1), insulin-independent (type 2) and associated with other diseases and syndromes (type 3). Children and adolescents almost exclusively develop type 1 diabetes. Type 1 diabetic patients account for approximately 10% of all diabetics, of which 2% are under 18 years old. Epidemiological data of 1995 demonstrate that 8000 children were treated for diabetes in Poland [1]. According to the most recent surveys, 421 young patients were registered in the north-eastern region of Poland in the years 1988-1999. In other European countries, the incidence rate also shows a growing tendency [2].

Etiology of this ailment is not fully known. It is assumed that diabetes is most frequently caused by viral infection in genetically predisposed subjects and by autoimmunization directed against β cells of the pancreas that leads to their destruction (1). Viruses showing affinity to the pancreas are, e.g. viruses of hepatitis B, influenza, parainfluenza, cytomegaly and rubella. Other pathogens include many chemical substances as well as the mode of nutrition [1,3,4].

Diabetes can be diagnosed on the basis of such symptoms as excessive thirst and appetite, polyuria, body weight reduction, glucosuria and hyperglycaemia, confirmed by laboratory tests. In type 1 diabetes, when clinical symptoms appear, examination reveals damage to β islet cells with a resulting insulin deficiency [1,3].

High sensitivity to insulin usually makes insulin therapy indispensable. However, typical of the disease course in young patients is metabolic instability due to changeable demand for

Figure 1. **Mean and maximum values of Gingival Index (GI) and Papillary Bleeding Index (PBI) in diabetic and non-diabetic patients**

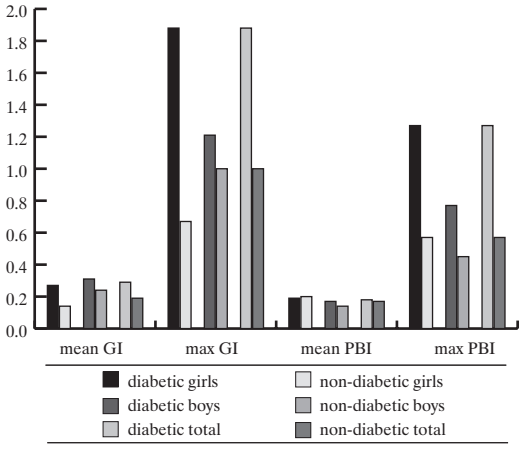
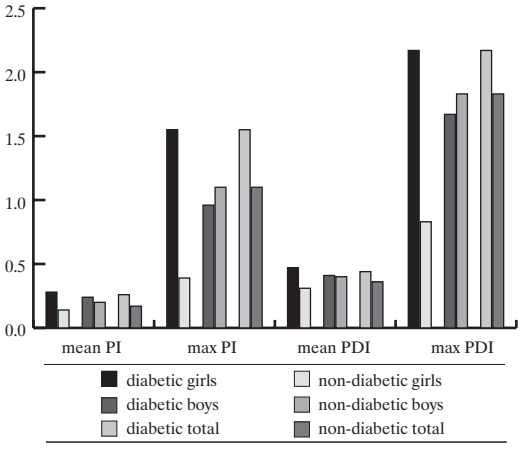


Figure 2. **Mean and maximum values of Periodontal Index (PI) and Periodontal Disease Index (PDI) in diabetics and non-diabetics**



insulin. Children and adolescents with well-controlled diabetes show normal physical and mental development [1].

However, some acute complications may develop in the course of diabetes, such as emergency conditions of deep metabolic disorders. The others are chronic, caused by changes in vessels, nerves and many organs, including the oral cavity [1].

Before insulin discovery, diabetes-related complications were common and markedly intensified. The periodontal status was characterized by inflammatory-atrophic changes, often with alveolar process necrosis and pyorrhoea. Nowadays, in well-controlled diabetes, oral lesions are milder and usually appear as gingivitis, which in case of metabolic instability can be severe [1,3-7].

The aim of the study was to assess periodontal status in children, adolescents and young adults with well-controlled type 1 diabetes.

Material and methods

The study involved 50 patients (25 female and 25 male subjects) with insulin-dependent diabetes treated in the Diabetic Outpatient Department Children's University Hospital in Białystok and 50 healthy individuals (25 female and 25 male subjects) treated at the Department of Pedodontics, Medical University of Białystok. The mean age of the study subjects was about 14 years. Examinations were performed in the dental surgery.

Periodontal status was determined based on:

- Gingival Index (GI) according to Löe and Silness (GI) [8],
- Papillary Bleeding Index (PBI) according to Saxers and Mühlemann [8],
- Periodontal Index (PI) according to Russel [8],
- Periodontal Disease Index (PDI) according to Ramfjord [8].

Test χ^2, Mann-Whitney test and t-Student test were used for statistical analysis of the results. Statistically significant differences were observed for $p<0.05$.

Results

Fig. 1 presents the mean and maximum scores of the gingival index. The mean GI score was lower in healthy subjects (0.19) than in diabetic patients (0.29). A similar correlation was noted in girls (diabetic 0.27, healthy 0.14) and boys (diabetic 0.31, healthy 0.24). The differences found were not statistically significant. The maximum GI level was significantly higher in diabetic patients (1.88) as compared to non-diabetic controls (0.67) ($p<0.05$). The correlation was similar for gender.

The mean Papillary Bleeding Index (PBI) did not differ significantly between the groups. The difference was only noted in the maximum PBI score, which was higher in diabetics (1.27) than healthy subjects (0.57), and significantly higher in diabetic girls compared to diabetic boys.

Damage to periodontal tissues was established based on PI and PDI. The mean and maximum scores are shown in *Fig. 2*. A significantly lower PI score was observed in healthy subjects (0.17) in comparison with diabetic population (0.26), and in the group of girls (healthy 0.14, diabetic 0.14). The maximum PI score was significantly higher in diabetic patients (1.55) as compared to healthy individuals (1.10).

The PDI score reflects the advancement stages of periodontal disease. The mean value did not differ significantly between diabetic patients (0.44) and non-diabetic controls (0.36). No statistically significant differences were noted in the mean PDI scores with reference to gender. The analysis of the maximum scores of PDI reveals higher level in diabetic girls (2.17) than in female controls (0.83) ($p<0.05$).

Discussion

Pathological changes in the periodontal tissue are late diabetic complications markedly determined by vascular lesions [9,10]. Capillaroscopy of the marginal gum vessels in diabetic patients revealed irregular distribution of loops, various length and thickness of blood vessels and degenerative changes in the pericapillary connective tissue. The basement membrane of periodontal capillaries was thickened, probably due to glycoproteid substance deposits. The above disorders hamper both oxygen diffusion and elimination of waste metabolites, thus disturbing physiologic equilibrium and increasing periodontium susceptibility to damage. A hyperglycaemia-induced increase in colagenase activity was also noted. Changes in collagen metabolism in the gum have an effect on the progression of periodontal destruction. Complications in periodontal tissues in the course of diabetes are also due to susceptibility to infection, delayed healing and immunity disorders, i.e. neutrophilic leukocyte dysfunction [11].

The GI is commonly used to define the status of the marginal periodontium. According to most researchers, diabetic patients have higher GI score compared to healthy population [12-20]. Only Andronikaki-Faldami et al. found similar GI values in young diabetics and non-diabetic controls [21]. Also in our study, the gingival index was only insignificantly higher in diabetic patients. However, the maximum GI score was significantly higher in diabetics, thus indicating that there were patients with more advanced gingivitis in the study group.

The Papillary Bleeding Index (PBI) reflects the condition of the marginal periodontium, especially in children and adolescents. However, it has not been yet assessed in young type 1 diabetics. We found a significant difference in the PBI maximum score, unfavourable for diabetic patients, which may suggest that a pathological process took place within the vessels of the marginal gum.

Literature data concerning the advancement of periodontal disease suggest more pronounced periodontal damage in diabetic children and adolescents as compared to healthy population [19,22]. In the studies carried out by Italian and Russian researchers [19,22], the mean PI and PDI scores in young diabetics were higher than in their healthy peers, which is in agreement with our findings, although in our study the differences were not statistically significant. Only for the maximum values, the PI and PDI levels were statistically significantly different, being higher in diabetic patients. However, no literature data have been available to compare with our results.

The present assessment of periodontal status as well as data reported by other authors allow the assumption that children, adolescents and young adults suffering from type 1 diabetes mellitus can be at risk of periodontal diseases [23]. Although Pinson et al. [15] claim that periodontal indices are not associated with the course of diabetes and periodontal diseases do not result from abnormal glucose metabolism, a vast majority of researchers emphasize a great role of proper diabetes monitoring [24-26]. It is believed that both hyper- and hypoglycaemia may induce the development of diabetic angiopathy and thus cause periodontal tissue dysfunction. Slight differences found in the present study in the periodontal status of diabetic patients, as compared to the control group, may be due to the fact that diabetes was systematically monitored and at the time of dental examination it was well-controlled.

It leaves no doubts, however, that in children and adolescents with type 1 diabetes, proper management of the primary disease should be accompanied by prevention, early detection and treatment of periodontal diseases.

Conclusions

1. Young type 1 diabetes mellitus patients may be at risk of periodontal diseases.
2. Properly-controlled diabetes may play an important role in periodontal tissues status and in the prophylaxis of periodontal diseases.

Refferences

1. Ławecka-Symonides A. Diabetes in children. Warsaw, PZWL; 1995. In Polish.
2. Peczyńska J, Urban M, Florys B. The epidemiology of type 1 diabetes in children and adolescents in north-east Poland in the period 1988-1999. Endokrynologia, Diabetologia i Choroby Przemiany Materii Wieku Rozwojowego, 2001; 7, 1: 17-20. In Polish.
3. Czyżyk A. Patophysiology and clinics of diabetes. Warsaw, PZWL; 1987. In Polish.
4. Knychalska-Karwan Z. Conservative stomatology of developing age. Cracow, Collegium medicum UJ; 1996. In Polish.
5. Smosarska H. Diseases of oral mucosa. Warsaw, PZWL; 1975. In Polish.
6. Szpringer-Nodzak M. Dentistry of developing age. Warsaw: PZWL; 1987. In Polish.
7. Wierzbicka M. Clinical periodontology. Part 1. Warsaw, Sanmedia Med. Tour Press International; 1992. In Polish.
8. Ketterel W. Periodontology. In: Lange DE. Periodontal status indexes. Wrocław, Urban and Partner; 1995, p. 67-80. In Polish.
9. Petrou-Amerikanou C, Markopoulos AK, Belazi M, Karamitsos D, Papanayotou P. Prevalence of oral lichen planus in diabetes mellitus according to the type of diabetes. Oral Diseases, 1998; 4: 37-40.
10. Van Dis ML, Parks ET. Prevalence of oral lichen planus in patients with diabetes mellitus. Oral Surg Oral Med. Oral Pathol Oral Radiol Endod, 1995; 79: 696-700.
11. Emeryk B, Emeryk A. Vascular reaction of periodontium in children with insulin-dependent diabetes mellitus. Czas Stomat, 1990; 43, 8: 453-8.
12. Akyuz S, Octay C. The relationship between periodontitis and tooth decay in juvenile diabetes mellitus cases and in healthy children. J Marmara Univ Dent Fac, 1990; 1, 1: 58-65.
13. Novaes AB Jr, Silva MA, Batista EL Jr, dos Anjos BA, Novaes AB, Pereira L. Manifestations of insulin-dependent diabetes mellitus in the periodontium in young Brasilian patients. J Periodontol, 1991; 62, 2: 116-22.
14. Pinducciu G, Micheletti L, Piras V, Songini C, Serra C, Pompei R, Pintas L. Periodontal disease, oral microbial flora and salivary antibacterial factors in diabetes mellitus type 1 patients. Eur J Epidemiol, 1996; 12, 6: 631-6.
15. Pinson M, Hoffman WH, Garnick JJ, Litaker MS. Periodontal disease and type I diabetes mellitus in children and adolescents. J Clin Periodontol, 1995; 22, 2: 118-23.
16. Pommereau de V, Dargent-Pare C, Robert JJ, Brion M. Periodontal status in insulin-dependent diabetic adolescents. J Clin Periodontol, 1992; 19, 9Pt1: 628-32.
17. Rosenthal IM, Abrams H, Kopczyk A. The relationship of inflamatory periodontal disease to diabetic status in insulin-dependent diabetes mellitus patients. J Clin Periodontol, 1988; 15, 7: 425-9.
18. Sandholm L, Swanljung O, Rytomaa I, Kaprio EA, Maenpaa J. Periodontal status of Finnish adolescents with insulin-dependent diabetes mellitus. J Clin Periodontol, 1989; 16, 10: 617-20.
19. Smoliar NJ, Godovaniec LV. Dental and periodontal status in children with diabetes mellitus. Stomatologia Mosk, 1988; 67, 6: 57-9. In Russian.

20. Willershausen B, Barth S, Preac-Mursic V, Halsbeck M. Periodontal status and microbial flora in insulin-dependent (type-I) diabetics. Schweiz Monatsschr Zahnmed, 1991; 101, 11: 1399-404. In German.

21. Andronikaki-Faldami A, Asimakopoulou G, Diamantikipioti A, Papadopoulou-Markopoulou K, Thalassinos N. Diabetes mellitus and periodontium. 1. Prevalence of periodontal disease in young insulin-dependent diabetics. Stomatologia Athenai, 1990; 47, 2: 73-86. In Greek.

22. Piatelli A, Sabatino G, Chiarelli V, Verrotti A, Trisi P. Periodontal disease and insulin-dependent diabetes. Clinical study. Dent Cadmos, 1990; 58, 9: 72-83. In Italian.

23. Dominguez Rojas V, Callatrava Larraga L, Ortega Molina P, Astasio Arbiza P, Perez Bravo L, de Pereda Garcia A, Garcia Munez JA. Periodontal disease in juvenile diabetics and non-diabetics. Rev Sanid Hig Publica Madr, 1993; 67, 6: 475-83. In Spanish.

24. Iughetti L, Marino R, Bertolani MF, Bernasconi S. Oral Health in children and adolescents with IDDM – a review. J Pediatr Endocrinol Metab, 1999; 12, 5: 603-10.

25. Aldridge JP, Lester V, Watts TL, Collins A, Vibreti G, Wilson RF. Single-blind studies of the effects of improved periodontal health on metabolic control in type 1 diabetes mellitus. J Clin Periodontol, 1995; 22, 4: 271-5.

26. Nishimura F, Takahasi K, Kurihara M, Takashiba S, Murayama Y. Periodontal disease as a complication of diabetes mellitus. Ann Periodontol, 1998; 3, 1: 20-9.