

## Oral Health Problems among Diabetic Patients – Part of Dental Professionals in Diagnostic and Therapy

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### Abstract

Diabetes mellitus is a metabolic disease characterized by hyperglycemia. This is the result of a deficiency in insulin secretion or an increased cellular resistance to the actions of insulin, leading to a variety of metabolic abnormalities. Persistent hyperglycemia has been associated with the incidence and progression in diabetes-related complications, including oral health problems such as oral mucosal diseases, dental caries, salivary dysfunction, oral infections, taste and other neurosensory disorders. Dentists play a major role as part of an allied health team in providing oral care to patients with diabetes. Screening for diabetes and prediabetes in the dental office may provide an important benefit to patients. Several studies have demonstrated the beneficial effect of periodontal treatment on metabolic control of diabetic patients.

The aim of this article is to present an overview of opinions contained in the contemporary literature and presentation of the results of clinical trials performed in oral health problems among diabetic patients.

**Keywords:** Diabetes mellitus; Mucosal diseases; Salivary dysfunction; Periodontal disease; Dental caries

### Introduction

Sickness-changes within the oral cavity are to be considering both as the complication of the diabetes as well as the reason of the difficulty in the metabolic compensation of the illness [1-3]. Every chronic hyperglycaemia, aside from its reasons, leads to the activation of the process of not enzymatic glycation of proteins, poliolic route and the oxidative stress.

The chronic hyperglycaemia and related inflammation leads to the disturbances in the balance between the metalloproteinase system and their inhibitors (MMP/TIMP), what becomes a reason of the pathological reconstruction of the vascular wall, the proliferation of the endothelium and arteriogenesis [4-6].

Inflammatory focus in the human body, including the oral cavity, can on one hand be the reason of disturbances of the metabolic control of the diabetes, from the second hand – can accelerate the development hyperglycaemia related vascular complications [7-13]. Many authors think that fundamental role in the occurrence of complications plays the insufficient degree of the metabolic compensation. Other authors pay attention that also chronic changes within the oral cavity can unfavourably influence on the compensation of the diabetes [14-16]. To finally evaluate described above interactions further studies are indicated [17].

This issue is also highlighted in the publication presented by Teeuw and co-authors [18]. On the basis of extensive literature analysis Spanish authors formulated the conclusion that periodontal disease control can improve DM type 2 patient's glycaemia control; on the other hand glycaemia control improvement can influence better periodontal diseases control [10]. Lately American authors presented the results of multicentre trials on the influence of inflammatory

changes of the paradontium on the degree of the metabolic compensation of the diabetes [19,20].

At the evaluation of oral cavity changes in diabetic patients usually the attention is paid mainly to the type 1 diabetes. These are usually younger patients at who more easily is to set the relation between these changes and the diabetes. In the diabetes mellitus type 2, concerning usually older people with different sickness-changes related to the age, the arteriosclerosis etc, the settlement whether changes found within the oral cavity have a relationship with the diabetes or else with other morbid conditions is difficult [7,21,22].

However lately more and more researches are dedicated also to patients with the type 2 diabetes [23-25]. In case of this group of patients the meaning of the bad metabolic control as the risk factor for the development of sickness-changes within the oral cavity is particularly underlined [26-34].

Lithuanian authors who explored comparative trials confirmed that the course of paradontium morbid conditions at patients with the diabetes mellitus type 2 it is particularly heavy [35]. This type of the diabetes develops usually slowly and its diagnosis and the commencement of the treatment are usually very late. Still very often diagnosis of this type of the diabetes it comes only in the moment of the appearance of heavy vascular complications.

The necessity of tightening of the criteria for earlier diagnostics of glucose homeostasis disturbances before the appearance of the clinically overt diabetes is discussed. Such pointers are metabolic syndrome features. This issue is discussed in the publication describing cause-effect relationships of the metabolic syndrome with changes in the paradontium [36].

Also other authors dealt with the issue of the coexistence of peridontosis at patients with metabolic syndrome [37,38]. Lately large number of articles representing results of trials on mechanisms binding the obesity with illnesses of the paradontium appeared [39]. In

the context of this observations of Spanish authors who paid attention on the usefulness of the dentists' evaluation of the occurrence of paradontal pockets of the depth  $\geq 5$  mms, and numbers of lacking teeth are very interesting. Authors determined that the presence 4 or more lacking teeth and pockets about the depth 5 or more the mm, signals the necessity of the diagnosis, among other things towards the glucose metabolism dysregulation [40].

Similar observations were made by American authors who underlined the meaning of the presence  $\geq$  of 26% teeth with deep pockets or  $\geq 4$  lacking teeth detection during the dental investigation for the further detection of the pre-diabetic status [41,42]. The chronic hyperglycaemia and related inflammation leads to triggering the processes lying at complications of the diabetes grassroots, including changes within the oral cavity, where different sickness-processes can exist - one of them are inflammatory disorders of the mucous membrane [43,44].

Inflammatory disorders of the oral cavity mucous membrane are often one of first symptoms of the newly revealed diabetes, so always at their statement careful interview of the concerning occurrence of other diabetes symptoms is indicated. The parallel occurrence of changes on the mucous membrane and within external urogenital tract should engage the diagnosis towards the presence of the glycosuria [45]. The issue of the occurrence of illnesses of the oral cavity in patients with diabetes and mutual dependence among the degree of the metabolic compensation, and an occurrence of these changes it is not new. Already in the year 1973 results of Polish research carried out in the group juvenile patients was published [46].

In 50% cases inflammation of gums was observed. In 1985 Gusberti and co-authors presented the results of their research in the group 77 juvenile patients [47]. Later researches confirmed the significantly greater frequency of the occurrence of changes in the paradontium at juvenile patients with the diabetes into comparisons to the group of healthy population [48]. Orbaket and co-authors introduced results of their research in the group 100 children patients, whereof 50 were children with the type 1 diabetes [49]. Authors evaluated the large number of health status indicators within the oral cavity. There found statistically significant differences of indicators: PI (*plaque index*), GI (*gingival index*), CI (*calculus index*) and their increase in the group of children with the diabetes.

Researches aiming to fix the factors participating in the pathogenesis of inflammatory changes of the paradontium in the diabetes are conducted [50,51].

## Periodontal Disease

Paradontium diseases, relatively often appearing in the diabetes, are connected not only with the presence of infectious (bacteria, viruses, fungus) factors, but also with the presence of diabetic changes in vessels as the as result of the chronic hyperglycaemia which leads to the disturbance of the blood supply and the vulnerability to infections [13,52]. Relationships of paradontium diseases with the diabetes have the large representation in the literature [12,53].

Results of research over the pathogenesis of inflammatory changes of the paradontium at children with the diabetes of the type 1 were presented by Swedish authors [50]. They evaluated both the clinical state of gums (the tendency to bleeding) and the saliva IgG level in the group of 48 children with the diabetes. Both these indicators were increased, especially in the group of children with the badly controlled

diabetes. Gümüş et al. found the decreased level of the reduced glutathione in the group of patients with the type 1 diabetes [54].

The reduced glutathione is an antioxidant involved into many cellular functions – its reduced level can be involved in the destruction of tissues through the oxidative stress vulnerability increase. The investigation carried out in Poland in the occurrence of paradontium illnesses in the group of juvenile patients with type 1 diabetes showed the presence of the higher PDI indicator (*periodontal disease index*) at these patients [55]. Authors think that the type 1 diabetes can be a risk factor for the development of periodontal diseases.

Afterwards also other authors presented results of their own investigations over the occurrence of paradontium inflammable status at juvenile diabetic patients, finding the greater vulnerability to inflammation occurrence comparatively with healthy juvenile population [56-59].

Lalla and co-authors in the group 182 juvenile diabetic patient research confirmed the significantly greater frequency of the occurrence paradontium changes in comparisons with the group of healthy juvenile population [60]. It was stated in consideration with increased risk of paradontium changes occurrence the specialized programmes for the prophylaxis and the treatment of diabetes juvenile patients are necessary [61]. Also the reports that the risk of the paradontium illness development during the pregnancy at diabetic women is significantly higher than in the control group [62]. Xiong et al. presented the relationship of the paradontium illness occurrence with the development of diabetes at women with gestational diabetes (GDM) [63]. Despite many research decisive factors about the occurrence of paradontium changes at patients with the diabetes, were still not fully identified [29,64-69].

Preferansow and co-authors used the Russel index for the paradontium condition at diabetic patients. It's value in the group of patients with the diabetes was 2,14 in comparison with 0,99 ascertained in the healthy group [70]. Authors found that a reason of paradontium changes in diabetes patients was improper metabolic control. Limas et al. also underlined the meaning of the insufficient diabetes metabolic compensation as the risk factor for the occurrence of the paradontium diseases; they also paid attention and explored in the group of adult diabetic patients some parameters indicative of the insufficient degree of the metabolic compensation [71].

## Salivary Dysfunction

Patients with diabetes often complaint for the oral cavity dryness. This can be the result, among other reasons, of an autonomic neuropathy. The investigations are conducted to explain the mechanisms of these changes [72-76]. Zalewska et al. introduced the results of the saliva glands function evaluation at diabetes 1 juvenile patients [77]. They found the changes are more expressed at younger children in comparison with adolescents group.

Waszkiel et al. found differences in the PH value and buffer capacity of saliva at children with type 1 diabetes in comparison with the group of healthy children [78]. Arene et al. investigating the group of children with newly diagnosed diabetes and with the long lasting diabetes found the essential relationship of the diabetes compensation degree with the paradontium state, buffer capacity of saliva, and also with peroxidase activity [79].

Siudikiene et al. presented their own investigations results carried out in the group of 63 diabetic children [80]. Significantly lower degree

of the saliva flow, the higher IgA, proteins and glucose concentration in the saliva of diabetic children was disclosed, what can be a factor favouring to the cariogenesis.

Gümüş et al. signalled decrease of the reduced glutathione level, what, according to their opinion can play role in the destruction of paradontium tissues [54]. The influence of the diabetes on the activity of saliva glands was also confirmed by other authors [81-86] Also interesting observations of Polish authors concerning salivary glands function changes at patients with the gestational diabetes were presented [87].

## Dental Caries

Results obtained by different authors concerning occurrences of the caries at patients with the diabetes they are differentiated [88]. Main factor of the cariogenesis is considered reduced salivary secretion and the reduction of its pH and the growth of the density of the saliva in comparison with healthy persons.

The intensity of the caries process can be tied with the glucose concentration growth in the saliva and in the fluid of gingival pockets at patients with the improperly controlled diabetes. Miralles et al. found the significant increase of caries occurrence frequency at type 1 diabetes patients [89]. According to the authors, the degrees of the metabolic compensation, the length of the duration of the illness and the presence of complications of the diabetes had influence on the cariogenesis of teeth.

Miko et al. made a survey in 259 groups of adolescents [90]. The teeth caries was evaluated according to DMFT index. In the investigated group this indicator was higher than in the control group ( $p < 0.001$ ). Tagelsir et al. pay attention that the diabetes can indeed increase the risk of caries occurrence, however worse state of teeth at diabetic children authors bind mainly with the insufficient dental care [91].

## Conclusion

Large number of clinical research appeared lately; their authors paid attention on the occurrence of oral cavity changes which can suggest the diagnosis of the diabetes at patients still not diagnosed as diabetic [92,93]. The extensive discussion of this issue presented the group of American researchers [94]. Based on carried out analyses, the authors indicate the necessity of screening tests broad applications, also at dentists' offices. Other authors also confirm this opinion [95-98].

Albert and co-authors [99] presented the results of the conference dedicated to the discussion about the national diabetes educative programme to promote the cooperation between dentists and doctors of different specialities as well as pharmacists, for the purpose of the improvement of methods for the early diabetes diagnosis and treatment. Also other authors dedicate much attention for the necessity of such interdisciplinary actions [100]. In conclusion there is a need to remind that every chronic hyperglycaemia, independently from its reason, leads to the activation of not enzymatic protein glycation process, poliolic route and the oxidative stress, what can lie at the base of many pathological processes going on within the oral cavity [4,101]. Changes within the oral cavity are considering both as the complication of the diabetes as well as the reason of the difficulty in metabolic disease compensation. Apart from the aspirations to the maximum metabolic compensation, what are the basis of the prevention and the treatment of diabetes complications, it's very

important to provide to the patients maximally effective education and the dental care.

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