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# Impact of risk factor diabetes mellitus on patients with periodontitis

Tomas Siebert[1]

1 Comenius University in Bratislava

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## Abstract

Periodontal health is defined as a state free from inflammatory periodontal disease that allows an individual to function normally and not suffer any mental or physical consequences as a result of past disease. The elaborate protocol of preventive measures to ensure periodontal health is extremely important. Herein, we describe that periodontal health can serve as a vital common reference point for assessing disease, determining meaningful preventive methods and determining treatment outcomes. Periodontitis patients may benefit from additional risk factor control interventions to improve periodontal treatment outcomes and the maintenance of periodontal stability. In patients with periodontitis, smoking cessation and diabetes control can be effective and thus improve their oral health.

The aim of this scientific article is to provide a comprehensive view of available scientific knowledge and evidence from the systematic evaluation of works in the field of theoretical and clinical research as well as to provide comprehensive conclusions to dentists with regard to the patient. All the knowledge gained from this study can then be used not only in determining preventive methods but also in determining the diagnosis and quality treatment plan of a periodontal patient with a diagnosis of diabetes mellitus.

Key words: periodontal health, periodontitis, diabetes mellitus, risk factors

## Introduction

A healthy periodontal system is a key component of oral health and an important part of general health and subjective well-being at the individual and population levels. In accordance with this definition by the World Health Organization, periodontal health is defined as a state free from inflammatory periodontal disease that allows an individual to function normally and not suffer any mental or physical consequences as a result of past disease.[1]

The pathogenesis of periodontal diseases is influenced by various host factors, including the immune response, anatomical factors, and tissue structural factors. Most of these factors are determined by the genetic profile of the host and may be modified by environmental and host behavioral factors.[2]

Diabetes mellitus has, for many years, been recognized as an important risk factor for periodontal diseases and is associated with a significantly higher prevalence and severity of periodontitis.[3]

Type 1 diabetes mellitus, also known as insulin-dependent diabetes, occurs due to disturbance in sugar (glucose) metabolism.[3] Type 1 diabetes mellitus is the most common type of diabetes mellitus (DM) in children and adolescents in the majority of countries worldwide.[3] However, the incidence and prevalence of type 1 diabetes have changed significantly over the last several decades.[3]

More recent data have confirmed a significant association between chronic hyperglycemia and a high prevalence of severe periodontitis.[2]

Although this evidence focuses particularly on the effects of type 2 DM, the effect appears to be similar, though less investigated, in type 1 DM.[4]

The current global epidemic of type 2 DM has been well documented; World Health Organization data show a 4-fold increase in disease prevalence from 1980 to 2014, with a 2014 prevalence of 422 million people affected, representing an overall prevalence of 8% of the world population.[5] Furthermore, in many diabetic patients, DM is undiagnosed, and the prevalence of these individuals is increasing.[6]

Hence, DM represents a very large public health challenge and is by far the principal systemic disease affecting periodontitis in terms of the extent of the population affected. In addition, there is accumulating evidence that periodontal inflammation may itself contribute to the onset and persistence of hyperglycemia, in that inflammation is associated with poorer glycemic control in individuals with DM and may be associated with an increase in incidence of DM in longitudinal prospective studies.[7]

Periodontitis is characterized by progressive destruction of the tooth-supporting apparatus. Its primary features include the loss of periodontal tissue support manifested through clinical attachment loss (CAL) and radiographically assessed alveolar bone loss and the presence of periodontal pocketing and gingival bleeding.[8]

Periodontal treatment can have a beneficial effect on the systemic health of a patient, but its course must not worsen the patient's underlying disease. Blood glucose control in patients with diabetes mellitus may be facilitated if periodontal therapy is properly provided.

Periodontitis and diabetes mellitus are ultimately part of the modern lifestyle. However, we must explain to a patient with diabetes mellitus that in the case of inadequate individual oral hygiene, this disease is one of the most important risk factors for the onset, development and recurrence of periodontitis.

## Periodontitis and diabetes mellitus

The oral cavity is similar to other habitats within the human body. It has a characteristic and specific community of microorganisms that, in a state of symbiosis, provide the host itself with certain specific advantages. Due to sufficient heat and humidity, they create suitable conditions in the oral cavity for the growth of a wide range of microorganisms, viruses, fungi and protozoa.

In general, however, it is argued that the composition of microorganisms in a structured oral biofilm remains stable over time. If there is a serious disruption of this key environment in terms of dysbiosis, including a change in the immune system, a change in eating habits, etc., the risk of developing disease increases.

Diseases of the periodontal tissues, especially inflammatory tissues, can currently be successfully managed, and we can keep the teeth in patients for a relatively long time. Gingivitis and periodontitis are inflammatory conditions caused by the formation and persistence of an oral microbial biofilm on the surfaces of teeth and mucous membranes of the oral cavity. Gingivitis is the first manifestation of the inflammatory response to a biofilm. Gingivitis is reversible; in the case of therapeutic intervention, we are able to cure gingivitis.

However, in some individuals, gingivitis progresses to periodontitis. In addition to the presence of dysbiotic oral biofilms, these subjects are exposed to other risk factors, such as the body's genetic predisposition, general systemic diseases such as diabetes mellitus, and smoking. Periodontitis is a major public health problem due to its high prevalence, and since it may lead to tooth loss and disability, it negatively affects chewing function and aesthetics, is a source of social inequality, and significantly impairs quality of life.[9]

Periodontitis accounts for a substantial proportion of edentulism and masticatory dysfunction, has a negative impact on general health and results in significant dental care costs.[10]

Periodontitis is the most common chronic inflammatory noncommunicable disease in humans. According to the Global Burden of Disease 2010 study, the global age-standardized prevalence (1990-2010) of severe periodontitis was 11.2%, representing the sixth-most prevalent condition in the world, while in the Global Burden of Disease 2015 study, the prevalence of severe periodontitis was estimated to be 7.4%.[11] The prevalence of milder forms of periodontitis may be as high as 50%.[12]

Furthermore, periodontal infections are associated with a range of systemic diseases leading to premature death, including diabetes, cardiovascular diseases or adverse pregnancy outcomes.[13]

The pathogenic mechanisms responsible for the effects of hyperglycemia on periodontitis have been extensively reviewed

in the literature.[2][14][15]

It should be noted, however, that the interpretation of these findings may be confounded by the effects of comorbidities often seen in individuals with metabolic syndrome, including obesity and hypertension. Studies suggest that in the presence of hyperglycemia, there is a hyperinflammatory response to bacterial challenge, which may give rise to a range of changes in the host, including neutrophil defects, hyperinflammatory responsive monocytes, increased release of proinflammatory cytokines, oxidative stress reactions, and impaired healing responses.[2][16]

Hyperglycemia also leads to the development and accumulation of advanced glycation end products (AGEs), and the interaction between AGEs and their key receptor, receptor for AGEs (RAGE), is thought to play a major role in the development of complications associated with hyperglycemia.[17]

Subsequently, blocking RAGE using soluble receptors for AGEs was shown to reverse these effects independently of the level of hyperglycemia.[18]

The overwhelming evidence for the effects of diabetes on periodontitis comes from epidemiologic data. To date, there is little evidence that the clinical features of periodontitis in patients with DM are distinct from periodontitis in individuals who do not have DM.[2] Dental and periodontal abscesses may be a common complication in DM. A recent study in Saudi Arabia (where the reported prevalence of DM is 23.9%) found that 58.6% of patients who were diagnosed with periodontal abscesses had HbA1c ≥6.5%.[19]

In general, however, an increased prevalence of periodontal abscesses in DM-associated periodontitis compared to periodontitis in individuals who do not have DM is not well documented. This may be partly due to the difficulty of diagnosing a periodontal abscess, particularly when in a chronic stage.[20]

Numerous risk factors associated with periodontitis overlap and intensify each other. Additionally, the proximity of the risk factor may have an impact on causality.[21]

Obesity is a health risk frequently associated with complications such as type 2 DM, dyslipidemia, high blood pressure, abnormal fibrinolysis, cardiovascular disease, and other diseases. Study findings also show that obesity increases susceptibility to bacterial and viral infections, and recent meta-analyses consistently support an epidemiological association between obesity and periodontitis, suggesting a 50% to 80% higher likelihood of periodontitis in individuals who are obese than in individuals who are not.[22][23]

It has been estimated in longitudinal follow-up studies that individuals who are obese have a 35% increased risk of developing periodontitis compared with normal-weight individuals, and the risk may be higher among women who are obese than among men who are obese.[24][25]

However, there are relatively few studies with a longitudinal design, and the overall effect appears to be modest.[24][25]

Current evidence for the efficiency of dietary interventions in periodontitis patients has been moderate when studies were selected to assess one single aspect of the intervention, such as carbohydrate (dietary sugar) reduction alone. Furthermore, counseling intervention studies mainly focusing on weight loss generally included multiple aspects, such as dietary changes or an increase in physical activity (exercise). Similarly, risk factor control interventions in periodontitis patients with type 2 diabetes commonly involved combinations of dietary counseling, physical exercise, and weight loss.[26]

The systemic phase of periodontal treatment should address the general health consequences of periodontal disease on the body and the course of periodontal treatment.
This phase was designed to achieve the greatest possible protection of the patient from the systemic reactions of the body to avoid complications in the overall health of the patient.
Not only in periodontological practice but also in general in the practice of dentists, we encounter patients in whom we find general diseases and, in most cases, serious diseases.

There are several factors to consider when planning periodontal therapy in patients with diabetes mellitus. (Table 1) Any treatment by a dentist must not induce a condition in which the patient's underlying disease may be exacerbated.

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Three publications presented the effect of diabetes control interventions in periodontitis patients.[27][28][29]

The interventions mainly consisted of individual lifestyle counseling, dietary changes and oral health education. The studies lasted either 4 weeks or 6 months. The former two studies are RCTs over 6 months with 77 (Nishihara et al., 2017) and 132 (Saengtipbovorn & Taneepanichskul, 2015) patients, and the latter study was a prospective study over 4 weeks with 8 patients (Holmer et al., 2018). Following the intervention, periodontal parameters such as gingival index or bleeding on probing improved. In one study, PD and CAL improved after six months[29].

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Even if a clearly conservative approach is used, dentists must use surgical procedures. The issue of dental treatment of patients with diabetes mellitus should be handled by every dentist working in an outpatient setting.

The view of the patient's treatment issues is different and is conditioned by the knowledge, possibilities and experience of individual specialists. Each patient, especially for patients with diabetes mellitus, requires an individual approach. It is therefore necessary to evaluate the overall condition, need and possibilities of periodontal treatment on the basis of anamnesis, auxiliary examinations, laboratory tests and possible use of consultation with specialists. Only a few established risk factors for periodontal disease are modifiable.[30]
The association between periodontitis and diabetes mellitus is particularly interesting in this regard, as it has been documented to be bidirectional in nature.[14][15][31]

Within the limitations of the study, the findings of Alshihayb et al. (2021) suggest that the bidirectional associations between periodontitis and diabetes may not be truly bidirectional in regard to causality. Rather, some observed associations may be artifactual due to an unmeasured or unknown common cause. Given that both conditions result from inflammatory processes, it is plausible that each condition shares a common inflammatory cause, or confounder, that is independently associated with both periodontitis and diabetes.[31]

## Conclusion

When we are planning periodontal treatment, we must start from several factors that can act as variables in therapy. As a basis for comprehensive treatment planning, we must understand the needs and ideas of the patient and his or her social and economic backgrounds.

There are many diseases and conditions that can affect periodontal tissues. The main common disease and condition that affect the course of periodontitis are diabetes mellitus.

The magnitude of the effect of DM on the course of periodontitis varies, but effects of DM result in increased occurrence and severity of periodontitis.[32]

There are no characteristic phenotypic features that are unique to periodontitis in patients with diabetes mellitus. Therefore, diabetes-associated periodontitis is not a distinct disease.[32]

Nevertheless, diabetes is an important modifying factor of periodontitis and should be included in a clinical diagnosis of periodontitis as a descriptor. According to the new classification of periodontitis, the level of glycemic control in diabetes influences
the grading of periodontitis.[8][33]

Consequently, in patients with periodontitis, in addition to improving oral hygiene and supporting smokers to quit, the promotion of healthy lifestyles, such as dietary counseling, needs to be adopted in everyday periodontal care.[26]

Thus, the identification of additional modifiable risk factors is important for a better understanding of periodontitis pathology and to enable better cost-effective public health efforts targeting periodontal disease.[34][35]

## Tables

*Table 1. Factors indicating the patient's relationship to diabetes mellitus and periodontitis*

| |
|---|
| Patient |
| Age, Sex |
| Socioeconomic status |
| Smoking, drinking |
| Obesity, diet, physical activity |
| Oral hygiene status |
| Ability to follow medical instructions |
| Unmeasured variable |
| |
| Diabetes mellitus |
| Family history |
| Prediabetes |
| Treatment options |
| Hyperglycemia over time |
| Epidemiology and pathogenesis of diabetic complications |
| Complications and relationship to the dental treatment |
| Unmeasured variable |
| |
| Periodontitis (exposure) |
| Gingivitis as a preexisting factor |
| Inflammation – bleeding on probing (BoP) |
| Probing of pockets depth (PPD) |
| Clinical attachment level (CAL) |
| Tooth loss |
| Nonsurgical therapy |
| Surgical therapy |
| Use of systemic antibiotics |
| Unmeasured variable |

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