

Special Article

The Interaction between Diabetes and Periodontal Disease

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Abstract

During the last decades, there has been an increasing interest in the relationship between diabetes mellitus (DM) and periodontal disease (PD), two chronic diseases that affect a quite large proportion of the world's population. Since the mid-1960s, several studies have been published in the world literature to clarify their bidirectional relationship. Epidemiological data verify that diabetes is a major risk factor for periodontal disease; susceptibility to periodontitis is increased almost three times in patients with diabetes. On the other hand, there is emerging evidence to support that periodontal inflammation can lead to poor glycaemic control. The prevalence of diabetes in periodontal patients was reported to be about 4%. The mechanisms that link these two conditions are not completely understood and require further research, but they involve the presence of advanced glycation end - products (AGEs), neutrophil activity, and cytokine biology. Furthermore, several meta-analyses have reported a significant reduction in HbA1c of 0.4%, 3-6 months after conventional periodontal therapy.

Key words: diabetes mellitus, periodontitis, inflammation, oral hygiene.

Introduction to Periodontal Disease

Periodontal disease is a common chronic inflammatory disease characterized by destruction of the supporting structures of the teeth and includes gingivitis and periodontitis.

The symptoms of gingivitis (gingival inflammation) are rather ambiguous and manifest in the gum tissue as the classic signs of inflammation: edematous, bleeding, bright red or purple gums which are tender or painful to the touch. It is a reversible situation provided that the patient receives the proper treatment and maintains a good oral hygiene.

If the inflammation of the gums is left untreated it will, in all likelihood, expand to the rest supporting tissues and will destroy the alveolar bone. This new situation is known as periodontitis and is non-reversible. Periodontitis is characterized by intense inflammation, halitosis, development of periodontal pockets and gingival recession with simultaneous exposure of

the root of the tooth. In advanced stages it will lead to loosening and mobility of the teeth and eventually their loss.

It is estimated that the early stages of PD affects 90% of the world's population, while severe PD affects about 5-15% of adults globally. (Dye, 2012)



Figure 1. Gingival inflammation. Gums are bright-red, edematous and bleeding (Clinica Dental Agustinas)



Figure 2. Aggressive generalized periodontitis with severe bone loss and loosening of teeth. Male patient 30 years old. Source: photo of our private dental clinic.

On the other hand, diabetes is a metabolic syndrome whose prevalence is growing rapidly. It is known to be accompanied by serious complications such as blindness, gangrene, nephropathy, healing disorders, cardiovascular disease, and even death.

Periodontal disease is the sixth most common complication of diabetes, as the risk of periodontitis increases about three times in diabetic patients compared to non-diabetics. (Saini, Saini, & Sugandha, 2011)

The relationship between diabetes mellitus and periodontitis

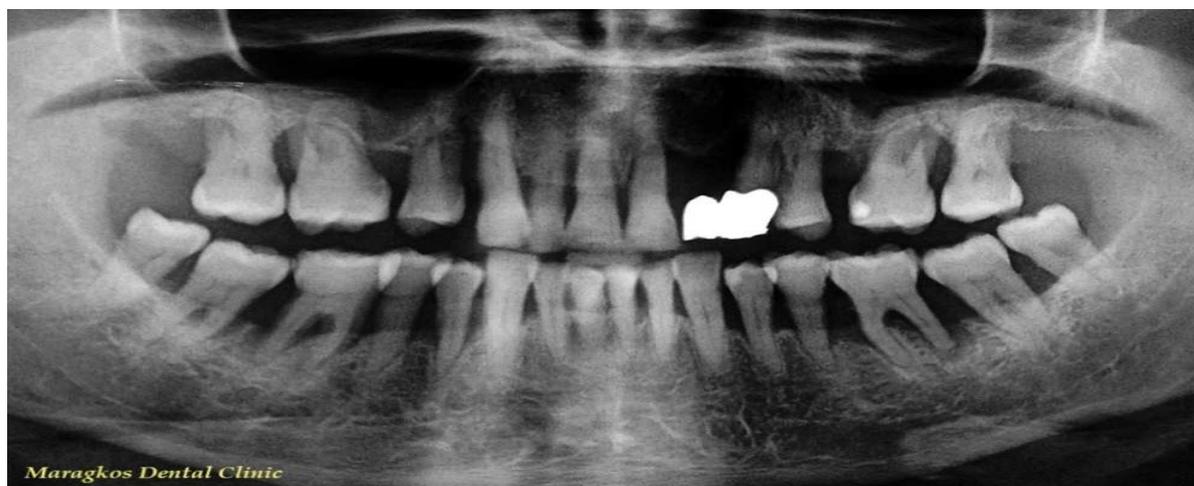
How, however, does the PD deteriorate on the presence of the DM? The following mechanisms are discussed below. High glucose concentration leads to the formation of advanced glycation end – products (AGEs), which play a key role in the periodontium. They cause changes and reduced collagen synthesis, apoptosis of periodontal fibroblasts and osteoblasts, conditions leading to reduced bone reconstruction and osteopenia. They also interact with endothelial cells by increasing oxidative stress in mucosal tissues of diabetic patients. Also, AGEs increase the concentration of interleukin (IL 1 β , 6) and tumor necrosis factor (TNF- α), which contributes to the deterioration of PD. (Graves, Liu, Alikhani, Al-Mashat, & Trackman, 2006) Finally, advanced glycation end – products affect neutrophil polymorphonuclear leukocytes (PMN), contributing to decreased chemotaxis, adhesion and phagocytic ability of the latter.

A first documentation of the relationship between PD and DM was derived from a long-term study of PIMA Indians (North American Indian population with the highest incidence of type 2 diabetes worldwide) where at least 60% of diabetics were initially present with periodontal disease, while for healthy individuals the percentage was 36%. After 2.5 years of follow-up, a higher incidence of PD ($\times 2.6$) was reported in diabetic than in non-diabetic patients, with no differentiation between males and females. (Shlossman, Knowler, Pettitt, & Genco, 1990)

Table 1. Etiological factors of the Periodontal Disease.

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| 1. Microbial factor |
| <ul style="list-style-type: none"> ❖ Porphyromonasgingivalis (anaerobe, gram negative), which is found in 87.75% in subgingival calculus of patients with chronic periodontitis. ❖ Aggregatibacteractinomycetemcomitans (facultative anaerobe, gram negative), found in 97% of patients with aggressive juvenile periodontitis. ❖ Others: Prevotella intermedia, Fusobacterium nucleatum, Capnocytophaga species, Spirochaetes. (Lang & Lindhe, 2015) |
| 2. Poor oral hygiene |
| 3. Smoking |
| 4. Heredity |
| 5. Medications |
| <ul style="list-style-type: none"> ❖ Anti-depressants ❖ Anti-epileptics ❖ Contraceptives |
| 6. Stress |
| 7. Hormonal imbalance |
| <ul style="list-style-type: none"> ❖ Pregnancy ❖ Menopause |
| 8. Other diseases |
| <ul style="list-style-type: none"> ❖ HIV ❖ Leukemia ❖ Cardiovascular disease ❖ Rheumatoid disease ❖ Diabetes Mellitus (Lagervall, Jansson, & Bergstrom, 2003) |

Figure 3. Panoramic dental X-ray. Female patient, 53 years old, with advanced periodontitis. Excessive horizontal bone loss can be seen. Source: photo of our private dental clinic.



In another study of NHANES III (1988-1994), in the US, data on 4343 persons ages 45–90 years were analyzed using weighted multivariable logistic regression. Severe periodontal disease was defined as 2+ sites with 6+ mm loss of attachment and at least one site with probing pocket depth of 5+ mm. Individuals with fasting plasma glucose >126 mg/dL were classified as having diabetes; those with poorly controlled diabetes (PCDM) had glycosylated hemoglobin >9% and those with better-controlled diabetes (BCDM) had glycosylated hemoglobin ≤9%. Additional variables evaluated in multivariable modeling included age, ethnicity, education, gender, smoking status, and other factors derived from the interview, medical and dental examination, and laboratory assays. Results show that individuals with PCDM had a significantly higher prevalence of severe periodontitis than those without diabetes (odds ratio = 2.90; 95% CI: 1.40, 6.03), after controlling for age, education, smoking status, and calculus. For the BCDM subjects, there was a tendency for a higher prevalence of severe periodontitis (odds ratio = 1.56; 95% CI: 0.90, 2.68). (Tsai, Hayes, & Taylor, 2002)

In one other research in a population of 80 patients, Taylor et al. (1996) found that patients with type 2 diabetes and advanced PD were 6 times more likely to develop difficulties in glycemic control than diabetic patients without advanced periodontitis. In addition, in a relatively

recent prospective study, the effect of PD on non-diabetic subjects was studied for 5 years. It was observed that people with severe PD had a 5-fold increased risk of HbA1c increase compared to those without PD at onset. An interesting conclusion has also been drawn from studies conducted in patients with type 1 diabetes mellitus. The researchers stated that the periodontal tissue destruction in children and patients suffering from DM was higher than in those of the same age without DM (Lalla, et al., 2006).

In the question of whether the treatment of PD in diabetic patients would lead to a better glycemic control, the answer was given by Sara Grossi et al. where it has been demonstrated that treatment of PD with doxycycline and the use of topical antiseptics (such as chlorhexidine) resulted in a reduction of glycosylated hemoglobin by 0.4% after 3-6 months of treatment (Grossi, et al., 1997).

Treatment of the Periodontal Disease

- ✓ **Professional dental cleaning.** The dental hygienist is removing the plaque and calculus supra- and subgingivally of all teeth, with the use of ultrasonic scalers.
- ✓ **Deep scaling and root planning.** It is a non-surgical procedure, done under local anesthesia, where plaque and calculus from deep periodontal pockets are scraped away (scaling) and rough spots on the root of the

tooth are made smooth (planning) and free of bacteria.

- ✓ **Surgical treatments**, like flap surgery, bone and soft tissue grafts and GTR (guided tissue regeneration).

Conclusion

It is obvious, therefore, from the above-mentioned clinical studies that the prevalence, incidence and risk for the occurrence of periodontal disease is higher in individuals with diabetes mellitus compared to healthy subjects. It has also been documented that the level of glycemic control of diabetic patients is the main regulator of the above relationship. Finally, one concludes that preserving the health of the periodontium helps to better regulate blood sugar. Concluding, one could say that good collaboration between diabetic doctors and dentists is required to avoid or address possible complications of DM in the oral cavity.

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