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Influence of Diabetes on the Periodontal Tissues

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ABSTRACT

Diabetes and periodontitis are common chronic diseases in the world, and abundant epidemiological evidence implies a bidirectional relationship between the two diseases. It appears that diabetes is a risk factor for greater periodontal destruction, whereas managing periodontitis can also contribute to better glycemic control. The underlying regulatory mechanisms are also bidirectional. The hyperglycemic status may directly alter subgingival microbial compositions, impair cellular function, and change collagen metabolism. The formation of advanced glycation end-products (AGEs) can further modify the extracellular matrix, and establishment of cellular receptor binding can amplify inflammation. Moreover, periodontitis also induces hyperlipidemia and insulin resistance. This cyclical relationship converges via overproduction of proinflammatory cytokines, such as tumor necrosis factor-a and interleukin-1β. From a systemic aspect, targeting proinflammatory cytokines or receptors of AGEs could be a potential modality for treating periodontitis, treating periodontitis.

Introduction

Periodontitis is a biofilm-induced chronic inflammatory disorder of teeth and supporting structures that affects over 740 million people world wide in its severe form . Diabetes mellitus is a group of chronic metabolic disorders characterized by irregular glucose metabolism caused by defects in insulin production . The International Diabetes Federation estimates that approximately 382 million people have diabetes and a 55% increase in its prevalence is expected by the year 2035 . Several clinical studies have established the relationship between diabetes and periodontitis. This relationship appears to be bidirectional, with diabetes being a risk factor for periodontitis and the severity of periodontitis a factor influencing glycemic control and the development of complications in diabetic patients . In addition, periodontal treatment may have a positive effect on glycemic control in diabetic patients . Clinically, patients suffer from gradual loss of tooth attachment in the alveolar bone leading to periodontal pockets, receding gums, loose teeth, and eventually tooth exfoliation, which may result in changes in diversity of food uptake, possibly affecting general health . Often gums are red and swollen, bleed easily, and patients with periodontitis suffer from bad breath.

Diabetes and periodontal disease are two chronic diseases that have long been considered to be biologically linked. The prevalence of periodontitis in diabetic subjects is estimated to be double or even triple the number in the normal population . It has been suggested that hyper glycemia and resultant advanced glycation end product formation, which is one of the several pathways that is thought to lead to the classic microvascular and macrovascular complications of diabetes, are also involved in the pathophysiology of periodontitis in diabetic subjects .

There is a growing body of evidence supporting the fact that the periodontal infection with gram-negative microorganisms adversely affects Glycemic control . Thus, it is now acknowledged that due to untreated or inadequately controlled moderate-to-severe periodontitis, the systemic inflammatory burden may be increased. For example, in periodontitis patients without other apparent diseases, C-reactive protein (CRP) levels are higher compared to subjects without periodontitis . Similarly, it has been suggested that a microbiological imbalance in the gut may increase the gram-negative bacterial load, which, through lipopolysaccharides leakage into the circulation, also increases the systematic inflammatory burden. The increased inflammation eventually triggers insulin resistance.

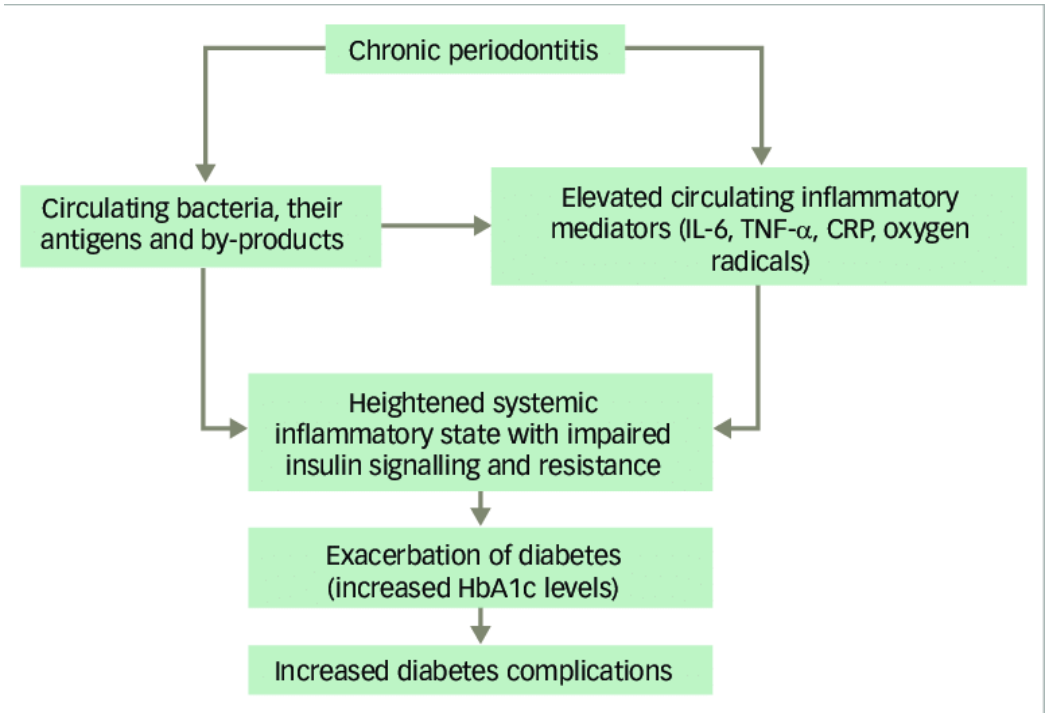
Effects Of Diabetes on The Response to Periodontal Therapy

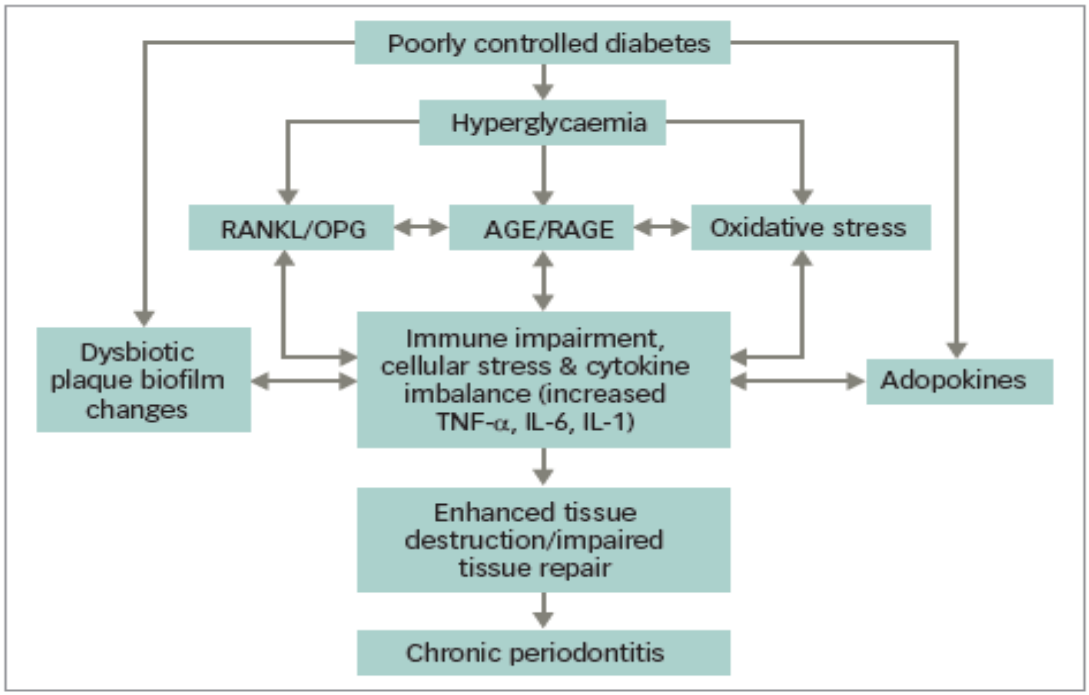
Several studies revealed that the degree of glycemic control is an important variable in relationship between diabetes and periodontitis. A large scale analysis showed that individuals with type 1 diabetes manifested advanced periodontal diseases with a higher prevalence and severity of gingival inflammation and periodontal destruction being seen in those with a higher glycemic index. Significantly more

periodontal attachment loss and alveolar bone was lost in type 1 diabetic patients who had poor glycemic control than those who were well controlled or non-diabetic patients. Only limited evidence is available to evaluate the comparative response to periodontal therapy in diabetic and non-diabetic patients with periodontitis. In well-controlled diabetic subjects, the clinical and microbiologic response to scaling and root planing appears similar to that in non-diabetic individuals. Although many diabetic patients show improvement in clinical parameters of disease immediately after therapy, patients with poorer glycemic control may have a more rapid recurrence of deep pockets and a less favorable long-term response.

Alterations of periodontal tissues with diabetes

Morphological changes in periodontal tissues under experimental diabetes were reported that revealed mild inflammation limited to the lamina propria and perivascular region, with gingival epithelial hyperplasia and moderate-to-severe angiitis 90 days after inducing diabetes. With the presence of plaque retentive factors (i.e., subgingival ligature placement), Silva and co-workers demonstrated a thickening of the gingival epithelium, with elongated dermal papilla, and the collagen alignment in connective tissue was loose and disorganized, with more prominent inflammatory cell infiltration in diabetic animals. Furthermore, in our current investigation, we also demonstrated that a diabetic condition can prolong the period of periodontal breakdown and delay mitogenesis. Healing of periodontal destruction in diabetic animals was investigated by Liu and co-workers. They reported that a diabetic condition can induce greater bone loss with ligature placement and may impair new bone formation after ligature removal. They also found that recovery from inflammation was delayed, apoptotic bone-lining cells exhibited prolonged expression, and the numbers of osteoblasts and periodontal ligament fibroblasts decreased in diabetic animals. Devlin and co-workers also evaluated the pattern of alveolar bone after tooth extraction . They showed extensive necrosis of alveolar bone after extraction, and that reepithelization, mineralization, and tissue remodelling were delayed in diabetic animals. Desta and co-workers also suggested that the delayed healing of gingival wounds may have originated from decreased numbers of fibroblasts, due to increased apoptosis and reduced proliferation.Taken together, preclinical studies confirmed that a diabetic status can augment and prolong periodontal destruction, while at the same time, impairing repair capabilities.





AGE = advanced glycation end-products; IL = interleukin; RAGE = receptor for advanced glycation end-products; RANKL/OPG = receptor activator of nuclear factor kappa-B ligand/osteoprotegerin; TNF = tumor necrosis factor.
Adapted from Taylor et al., 2013.[13]

Figure 02; Potential mechanisms explain the impact of diabetes of Periodontists

Alveolar Bone Levels Are Normal, With the Crest Oof the Alveolar bone being in close proximity to the Cemento – Enamel Junction (The Boundry between the enamel Crown and the root). Constract with appearance in **Figure 03a**

3a A 42-year-old man with type 2 diabetes and generalised severe periodontitis. There is extensive alveolar bone loss (generally 50–75% of the root length) affecting the entire dentition, with an irregular (uneven) pattern of bone loss. Some of the teeth have lost nearly all their supporting alveolar bone as a result of periodontitis progression, e.g., the upper molars (both right and left), and the four lower incisors, all of which are grossly mobile and which are retained in the oral cavity only by the soft tissue attachment (having lost 100% of their bone support)

3b A 21-year-old man with no periodontitis.

Conclusion

Patients with diabetes are usually poorly informed about the relationship between periodontitis and diabetes. Therefore, health care providers of patients with diabetes should be aware of this link and inform their patients about the need for good oral health. Referral of patients with uncontrolled diabetes for dental evaluation and periodontal treatment may result in better control of blood glucose levels. Although a survey of the oral cavity should be included in a thorough medical examination, health care providers other than those within the dental team usually are not aware of what clinical signs of periodontitis to consider. An increased redness of the gum tissues along the teeth is a classic sign of

gingivitis, a condition that indicates that there is an active inflammatory response to bacterial infection. The use of a toothbrush or a toothpick to gently touch the gums of diabetic patients with inflammation will provoke bleeding that will cease within minutes. Health care providers should suggest a thorough dental examination if such bleeding is common throughout a patient's mouth. Also, the presence of white or grey deposits on teeth suggests that dental treatment may be necessary. Spacing between upper front teeth and mobile teeth are other signs of periodontitis. Likewise, dentists and dental hygienists should refer their patients who respond poorly to initial periodontal therapy or have advanced periodontitis without obvious signs of poor oral hygiene for diabetes screening. In fact, it might be advantageous for dental offices to monitor the blood glucose levels of patients considered to be at risk for diabetes.

In Summary: • Diabetes and periodontitis are both common chronic diseases in adults and specifically in older individuals. • There is substantial evidence of the impact of periodontitis on systemic inflammatory markers. • Periodontal treatment of patients with diabetes may have limited effects on slightly elevated A1C levels, but in patients with more severe diabetes, such treatment may reduce A1C levels significantly if coordinated with blood glucose control. • Signs of periodontal inflammation, including gingivitis, can be assessed easily by all medical health care providers. • Patients with periodontitis with severe gingival inflammation who do not respond to routine periodontal therapy should be screened for diabetes.

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