



DIABETES MELLITUS AND PERIODONTITIS: BIDIRECTIONAL RELATIONSHIP

Anjani Kumar Pathak	MDS (Periodontology) Associate professor, FODS, King George's Medical University Lucknow.
Virendra Kumar	MDS (Periodontology), Assistant Professor, Department of dentistry, Sarojini Naidu Medical College Agra.
Kopal Goel*	MDS (prosthodontics), Reader, Sardar Patel Post Graduate Institute of Dental And Medical Sciences.*Corresponding author
Manisha Verma	Junior Resident, (Periodontology) FODS, King George's Medical University Lucknow.

ABSTRACT Periodontitis is an inflammatory disease which is characterized by progressive destruction of the tooth supporting structures and ultimately, resulting in tooth loss. Diabetes is a complex metabolic disorder with numerous pathophysiological abnormalities resulting in sustained hyperglycemia. It increases the risk of micro- and macro-vascular diseases when left uncontrolled. Scientific evidence has shown for some time that diabetes is a risk factor for the development of periodontitis. Recent revisions confirm that type 2 diabetes can be considered a risk factor for periodontitis. The aim of this review is to summarize epidemiological evidence of the relationship between periodontitis and diabetes, based on available literature. Article searching was done using electronic database (MEDLINE, EMBASE). Non interventional studies that permit to determine the relationship were included in the study.

KEYWORDS : Periodontitis, Diabetes mellitus, Inflammation.

INTRODUCTION

Periodontitis is one of the main oral health problems, which is predominantly a Gram-negative infection resulting in severe inflammation, with potential for vascular dissemination (*via* the sulcular epithelium) of microorganisms and their products such as Lipopolysaccharides (LPS) throughout the body.¹ The American Academy of Periodontology (AAP) consensus concluded that periodontitis may be associated with systemic conditions such as diabetes, HIV infection and cardiovascular disease.²

Chronic Periodontitis negatively affects mastication and thereby nutrition, it is a source of social inequality, and impairs quality of life. Globally, Chronic Periodontitis is the sixth most prevalent disease, affecting 11.2% of the population (95% uncertainty interval: 10.5–12.0%).³

Diabetes is a complex metabolic disorder with numerous pathophysiological abnormalities resulting in sustained hyperglycemia. It increases the risk of micro- and macro-vascular diseases when left uncontrolled. It is estimated that 346 million people have diabetes worldwide (World Health Organization, 2011) with the prediction of 439 million by the year 2030, representing an increase of 54% in 20 years to encompass almost one tenth of adults 20 years and older.⁴

Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individuals currently diagnosed with the disease. In 2000, India (31.7 million) topped the world with the highest number of people with diabetes mellitus followed by China (20.8 million) with the United States (17.7 million) in second and third place respectively.⁵ A study by the American Diabetes Association reports that India will see the greatest increase in people diagnosed with diabetes by 2030. The high incidence is attributed to a combination of genetic susceptibility plus adoption of a high-calorie, low-active lifestyle of India's growing middle class.⁶

The association between diabetes and periodontal diseases has been recognized in dental literature for many years. Periodontitis is considered one of the main, oral health problems encountered in patients with diabetes. With the increase in the incidence of diabetes worldwide, its negative impact on oral health should be considered. Scientific evidence has shown for some time that diabetes is a risk factor for the development of periodontitis. Recent revisions confirm that type 2 diabetes can be considered a risk factor for periodontitis.^{7,8}

The aim of this review is to summarize the epidemiological evidence of the relationship between CP and diabetes, based on available literature.

Effect of diabetes mellitus on periodontitis

The effect of diabetes on periodontium has been thoroughly investigated and confirmed as a major risk factor for periodontitis.⁹ The risk of periodontitis is increased by approximately threefold in diabetic individuals compared with non-diabetic individuals.¹⁰ A variety of changes in diabetics have been described, including enlarged gingiva, gingival polyps, abscess formation, periodontitis and loosened teeth.¹¹ The overall impression of the clinicians indicates that periodontal disease in diabetics follows no distinct pattern. Severe gingival inflammation, deep periodontal pockets, rapid bone loss, and periodontal abscesses often occur in diabetic patients with poor oral hygiene.¹² The most striking changes in uncontrolled diabetes are the reduction in defense mechanisms and increased susceptibility to infections leading to destructive periodontal diseases. In fact, periodontitis was referred to as the sixth complication of diabetes¹³ and in 2003 the ADA acknowledged that periodontal disease is often found in people with diabetes.¹⁴

The relationship between diabetes and periodontitis is not clearly understood. The pathophysiology considered to be associated with altered host response, inflammation, altered collagen metabolism and insulin resistance. Inflammation is a basic feature of the pathogenesis of diabetes and periodontitis. Both type 1 and type 2 diabetes mellitus are associated with elevated levels of systemic markers of inflammation.¹⁵

The inflammatory response in periodontitis is characterized by increased levels of host-derived inflammatory mediators and tissue breakdown products. The most extensively studied include IL-1 β , IL-6, prostaglandin E2 (PGE2), TNF- α , receptor activator of nuclear factor κ B ligand (RANKL), and the matrix metalloproteinases (MMPs; particularly MMP-8, MMP-9, and MMP-13).¹⁶ Hyperglycemia can result in the activation of pathways that increase inflammation, oxidative stress and apoptosis. The hyperglycaemic state also results in deposition of AGEs in the periodontal tissues and binding of the receptor for AGE (RAGE) results in the local cytokine release and altered inflammatory responses.¹⁷

Neutrophil function is also altered in the diabetic state, resulting in the enhancement of the respiratory burst and delayed apoptosis leading to increased periodontal tissue destruction. The increased susceptibility to infection in diabetic patients is caused by neutrophil deficiencies resulting in impaired chemotaxis, defective phagocytosis or impaired adherence. As a result, the primary defense against periodontal pathogens is diminished.¹⁸

The cumulative effects of altered host response, impaired tissue integrity, and an altered collagen metabolism play a significant role in the susceptibility of diabetic patients to destructive periodontitis.

Effect of periodontitis on diabetes mellitus

Periodontitis is a bacterial infection of the Periodontium, which is caused by gram-negative anaerobic microorganisms that adhere to teeth as a bacterial plaque resulting in severe inflammation.

Many studies showed that diabetes mellitus is one of the risk factors for the severity and progression of periodontitis.¹⁰⁻¹³ On the other hand, periodontal disease may be a possible risk factor for poor glycemic control and promote the existence of diabetic complications.^{5,19} In a study of patients with type 2 diabetes, severe periodontitis was associated with significant worsening of glycemic control over time.²⁰ In this study, individuals with severe periodontitis at the baseline examination had a greater incidence of worsening glycemic control over 2 to 4 year period than did those without periodontitis at baseline.

Bacterial and viral infections have been shown to increase insulin resistance and worsen the glycemic control.²¹ Systemic infections increase tissue resistance to insulin, preventing glucose from entering target cells, causing elevated blood glucose levels, and requiring increased pancreatic insulin production to maintain normal blood glucose level. It is possible that gram-negative periodontal infections may also result in increased insulin resistance and poor glycemic control.²²

Some literatures supported the hypothesis of periodontal therapy has a positive effect on glycemic control, which in turn reduces the incidence of diabetic related complications.^{23,24} Periodontal therapies have a beneficiary effect on the healing process of the periodontal tissue in healthy individuals. The Proposed mechanism is that the periodontal treatment tends to decrease the bacterial insult and reducing the inflammation (reduced serum level mediators such as TNF- α and IL-6) thus restores insulin sensitivity. However, the healing process of the periodontium in diabetic patients depends on the level of glycemic control. The presence of a positive association between periodontal therapy and glycemic control has a significant clinical impact because every 1% reduction in HbA1c significantly reduces the risk of diabetic complications.²⁵

Several studies have confirmed that periodontal therapy can result in reduced HbA1c. In 2008, a meta-analysis of nine studies involving 485 patients reported a significant reduction of HbA1c of 0.46% following periodontal treatment.²⁶ The Cochrane Collaboration has reported one study that investigated the relationship between periodontal treatment and glycemic control in people with diabetes. Three studies were included in this meta-analysis which reported a significant reduction in HbA1c of 0.40% 3–4 months after conventional periodontal therapy.²³

CONCLUSION

The association between diabetes mellitus has been studied extensively. Diabetes is associated with an increased risk of periodontitis with the level of glycemic control being the important determining factor. On the reverse evidence supported that periodontitis may adversely affect glycemic control in diabetic subjects. The relationship between these two appears to be bidirectional. The rationale coupling the periodontitis and diabetes is the inflammation. Improving the glycemic control is likely to reduce the risk and severity of periodontitis. Furthermore, evidence also supported that periodontal therapy in patients with diabetes also associated with improvements in glycemic control.

Individuals with diabetes must be considered at risk for periodontitis and should be informed of this. Oral hygiene reinforcement must be promoted in patients with diabetes and should be included as an integral component of their overall management.

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