

Review Article

Diabetes and Periodontal disease

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ABSTRACT:

Periodontal disease is a high prevalent disease. It is a chronic infectious disease characterized by destruction and loss of supporting tissues of teeth. Tremendous advances in modern medicine strongly postulated periodontal health as an indication of systemic health. Thus, periodontal diseases are closely linked with set of systemic manifestations, such as cardiovascular disease, diabetes mellitus, osteoporosis, respiratory illness and adverse pregnancy outcomes. Periodontitis and diabetes are common, complex, chronic diseases with an established bidirectional relationship.

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INTRODUCTION

Periodontitis and diabetes are both highly prevalent conditions, and the association between these two common diseases has been recognized by dental professionals for many years. Epidemiological studies have clearly identified that diabetes is a major risk factor for periodontitis, increasing the risk approximately three-fold compared to non-diabetic individuals, particularly if glycemic control is poor.¹ Periodontitis is defined as an inflammatory disease of supporting tissues of teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with periodontal pocket formation, gingival recession or both.²

Diabetes mellitus is a term applied to a heterogeneous group of disorders that share the characteristic of altered glucose tolerance or impaired lipid and carbohydrate metabolism. It develops as a result of either deficient production of insulin or impaired use of insulin. It can be divided into two types; Type I or insulin dependent diabetes mellitus and Type II or non-insulin dependent DM. Type I is caused by a cell mediated autoimmune destruction of insulin producing beta-cells of the islets of Langerhans in the

pancreas. Type II is due to impaired insulin function rather than deficiency.³

Type 1 diabetes accounts for 5%-10% of all cases of diabetes and most often occur in children and young adults. Type II diabetes mellitus is the most common form of diabetes, accounting for 90-95% of all cases and usually has an adult onset. The general signs and symptoms of diabetes are a direct result of hyperglycemia, and the signs and symptoms are polyuria, polydipsia, and polyphagia also weakness and fatigue with pruritus.

RELATIONSHIP OF DIABETES AND PERIODONTITIS

Periodontitis is stated to be sixth complication of diabetes.⁴ Prevalence of severe periodontitis in diabetics as compared to non-diabetics has been found to 59.6%:39%.⁵ Diabetes mellitus is a chronic metabolic disease characterized by persistent high blood glucose levels or hyperglycemia. In diabetic individual, progression of periodontal disease does not follow any peculiar pattern. Diabetic patient with poor oral hygiene often present with gingival inflammation, periodontal pockets, rapid bone loss and periodontal abscesses. Though diabetes does not directly contribute to gingivitis or periodontal pockets but it

can modify the response of the periodontal tissues to local factors. This hastens the bone loss and retard postsurgical healing of periodontal tissues.⁶

In longitudinal study of patients with type 2 diabetes, severe periodontitis was associated with significant worsening of glycemic control over time.⁷ Individuals with severe periodontitis at the baseline examination had a greater incidence of worsening glycemic control over a 2-4 year period than did those without periodontitis at baseline. In this study periodontitis is known to have preceded the worsening of glycemic control.

Periodontitis has also been associated with the classic complications of diabetes. Diabetic adult with severe periodontitis at baseline had significantly greater incidence of kidney and macrovascular complications over the subsequent 1 to 11 years than did diabetic adults with only gingivitis and mild periodontitis.⁸ This was true despite both groups have similar glycemic control. One or more cardiovascular complications occurred in 82% of patients with severe periodontitis versus 21% of patients without severe periodontitis.

Although it is difficult to make definitive conclusions about the specific effects of diabetes on periodontium, a variety of changes have been described, including a tendency toward enlarged gingiva, sessile or pedunculated gingival polyps, polypoid gingival proliferations, abscess formation, periodontitis and loosened teeth.⁹ Perhaps the most striking changes in uncontrolled diabetes are the reduction in defense mechanisms and the increased susceptibility to infections, leading to destructive periodontal disease.

EFFECT OF DIABETES MELLITUS ON PERIODONTIUM BACTERIAL PATHOGENS

Patients with type 1 diabetes mellitus and periodontitis have been reported to have a subgingival flora composed mainly of capnocytophaga, anaerobic vibrios and Actinomyces species. Porphyromonas gingivalis, Prevotella intermedia and Aggregatibacter actinomycetemcomitans, which are common in periodontal lesions of individuals without diabetes, are present in low numbers in those with the disease.¹⁰

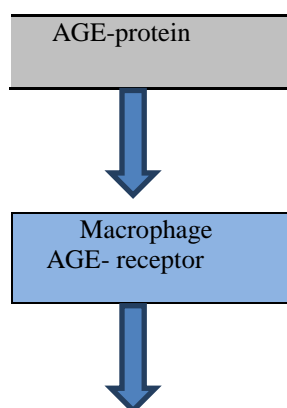
Other studies, however, found scarce Capnocytophaga and abundant A. actinomycetemcomitans and black pigmented Bacteroides, as well as P. intermedia, P. melaninogenica and campylobacter rectus.¹¹ Black-pigmented species, especially P. gingivalis, P. intermedia and C. rectus, are prominent in severe periodontal lesions of Pima Indians with type 2 diabetes.¹²

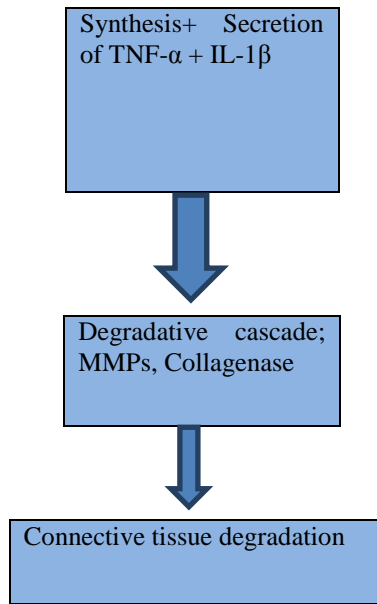
POLYMORPHONUCLEAR LEUKOCYTE FUNCTION

The increased susceptibility of diabetic patients to infection has been hypothesized as being caused by polymorphonuclear leukocyte (PMN) deficiencies resulting in impaired chemotaxis, defective phagocytosis, or impaired adherence.¹³ In patients with poorly controlled diabetes, the function of PMNs and monocyte/macrophage is impaired.¹⁴ As a result, the primary defense (PMNs) against periodontal pathogens is diminished and bacterial proliferation is more likely.

ALTERED COLLAGEN METABOLISM

Chronic hyperglycemia impairs collagen structure and function, which may directly impact the integrity of the periodontium. Decreased collagen synthesis, osteoporosis, as well as a reduction in alveolar bone height has been demonstrated in diabetic animals.¹⁵ In hyperglycemic state, numerous proteins and matrix molecules undergo a nonenzymatic glycosylation, resulting in accumulated glycation end-products (AGEs). Collagen is cross linked by AGE formation, making it less soluble and less likely to be normally repaired or replaced. Cellular migration through cross-linked collagen is impeded, and perhaps more importantly, tissue integrity is impaired as a result of damaged collagen remaining in the tissues for longer periods. (i.e collagen is not renewed at normal rate).¹⁶ AGEs play a central role in the classic complications of diabetes¹⁷ and may play a significant role in the progression of periodontal disease as well. Poor glycemic control, with the associated increase in AGEs, renders the periodontal tissues more susceptible to destruction.¹⁸





Flowchart; AGE-mediated tissue destruction in diabetes mellitus

ABBREVIATIONS

TNF- α - Tumor necrosis factor alpha; AGE- advanced glycation end product; IL-1 β - interleukin-1 β ; MMPs- matrix metalloproteinase

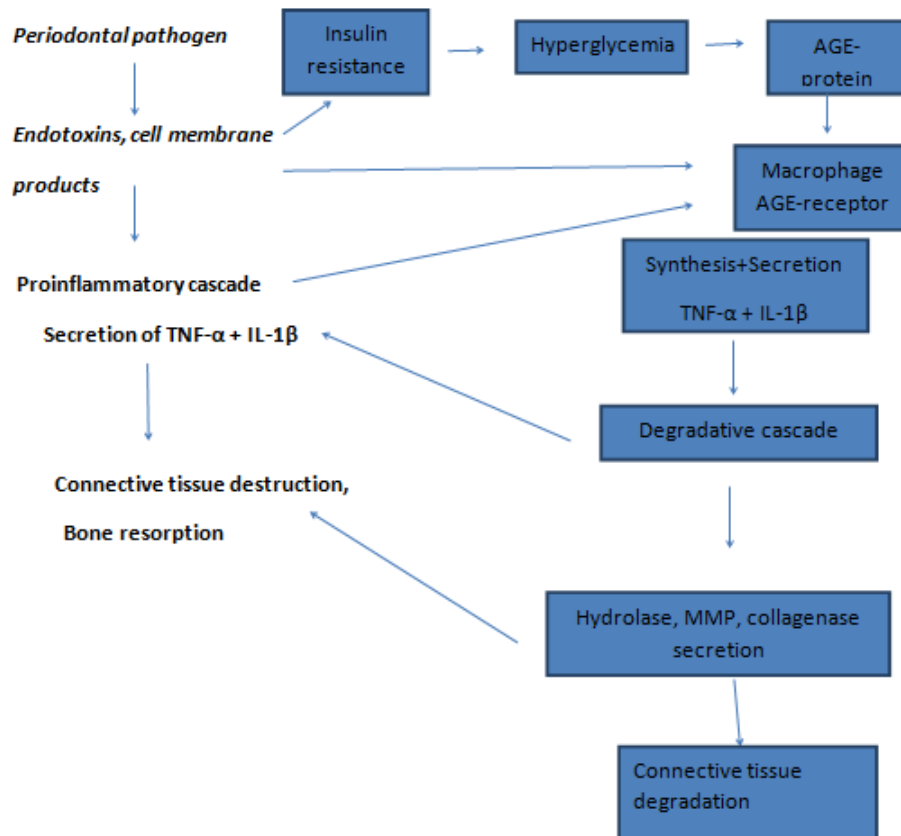
The preponderance of evidence suggests a two way relationship between periodontal disease and diabetes.¹⁹ Periodontitis is recognized as potential aggravator of hyperglycemic state of diabetes

mellitus. Periodontal infections increase tissue resistance to insulin, preventing glucose from entering target cells, causes elevated blood glucose levels and requiring increased pancreatic insulin production to maintain normal glucose level. In diabetes where there is significant insulin resistance, further tissue resistance to insulin induced by periodontal infection exacerbates poor glycemic control.²⁰

Flowchart; A two way relationship between periodontal disease and diabetes mellitus

PERIODONTAL DISEASE

DIABETES MELLITUS



ABBREVIATIONS

AGE

Advanced glycation end product; IL-1: interleukin-1; TNF- α : tumor necrosis factor- α ; MMPs: matrix metalloproteinase

CONCLUSION

Epidemiological studies confirm that diabetes is a significant risk factor for periodontitis, and the risk of periodontitis is greater if glycemic control is poor; people with poorly controlled diabetes are at an increased risk of periodontitis and alveolar bone loss. Diabetes has been associated to different oral diseases such as; xerostomia, neuro-sensory disorders, several oral mucosa diseases, tooth decay and periodontal disease. It is well documented in the literature that periodontal disease is more prevalent and severe in diabetic individuals than in healthy subjects. However, it has to be kept in mind that level of metabolic control and duration of diabetes appear to influence the risk for periodontal disease, with a significant heterogeneity among diabetic individuals.

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