International Journal of Research in Medical Sciences
Chandran N et al. Int J Res Med Sci. 2024 Sep;12(9):3517-3521
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20242640

Review Article

Diabetes mellitus and periodontitis-a conundrum resolved

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Received: 12 June 2024
Revised: 24 June 2024
Accepted: 25 June 2024

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ABSTRACT

Periodontitis is an inflammatory and infectious disease affecting the supporting structures of the tooth resulting in alveolar bone loss and tooth loss. Systemic diseases like diabetes have an intimate relation with periodontitis as they share common mechanisms in pathogenesis. Advanced Glycation Endproducts (AGEs) seen in diabetes patients binds with collagen and decreases the turnover. In the presence of preexisting periodontal inflammation, this collagen breaks down leading to periodontitis. On the other hand, inflammatory mediators in periodontitis can lead to tissue resistance to insulin, eventually increasing the blood glucose level, increasing the susceptibility to diabetes. Understanding the exact etiology of both diabetes and periodontitis helps clinician to educate and motivate their patients in managing their glycemic levels as well as to take proper precautions in treating and managing the periodontitis.

Keywords: AGEs, Diabetes, Periodontitis

INTRODUCTION

A common condition affecting a vast majority of population is dental disorders. This vastness of the disease can be attributed to factors like poor oral hygiene, age, adverse habits, etc. Periodontal diseases are one such group of diseases affecting the oral cavity. This inflammatory condition is found to affect the periodontium of the body.[1]Periodontitis is the chronic inflammation of soft and hard tissues surrounding the teeth in response to plaque.[2]

There has been ongoing research and conflicts regarding the relationship between periodontitis and diabetes, which is a multi-organ disease, for over several years.[3]Periodontitis is considered to be a complication of this chronic disease.[4]

Non-surgical treatment of periodontitis is shown to have significant impact on glycemic control in patients with and without diabetes. Management of Diabetes mellitus has also shown to be of significance in periodontitis with lessening of severity of its symptoms.[1] This correlation between periodontitis and diabetes is effectively studied in the following sections.

PERIODONTITIS

Periodontitis is a disease affecting the periodontal ligament and the alveolar bone resulting in their destruction and loss.[5] The periodontal diseases include gingivitis, which is the reversible inflammation of soft tissues surrounding the teeth in response to dental plaque.[1]

When left untreated, gingivitis may lead to its severe form, periodontitis. Gingivitis is a condition that can be reversed by introducing good oral hygiene practices, whereas periodontitis is a chronic, irreversible and destructive condition.[6]

RISK FACTORS

Poor oral hygiene

Poor oral hygiene can cause the build-up of plaque and pathogenic organisms leading to gingivitis and periodontitis.

Tobacco smoking

Tobacco smokers are at risk of increased loss of bone, loss of attachment and tooth loss than non-smokers.

Pregnancy

Fluctuation of hormones which are frequently observed in pregnancy can cause inflammatory changes in the periodontium.

Diabetes mellitus

Diabetes mellitus causes various pathologic events such as delayed wound healing which can result in inflammatory response of the periodontium.

Age

Elderly people are at high risk for developing periodontal diseases than the younger individuals due to increased inflammatory response, decreased dexterity leading to poor oral hygiene, etc.

Genetics

Certain syndromes such as down syndrome, Crohn's disease etc, are associated with the development of periodontitis

DIABETES MELLITUS

According to WHO, diabetes is defined as the chronic disease that occurs when either the pancreas does not produce enough insulin or when the body cannot effectively use the insulin.

Classification

Type 1 Diabetes mellitus, Type 2 Diabetes mellitus and Other specific types like Genetic defects of β-cell, Genetic defects in insulin action, Diseases of the exocrine pancreas, Endocrinopathies, Drug- or chemical-induced diabetes, Infections, Uncommon forms of immune mediated diabetes, Other genetic syndromes associated with diabetes, Gestational diabetes.[7]

Systemic complications

Dyslipidemia, Hyperglycemia, Nephropathy, Neuropathy, Retinopathy, Diabetic foot, Coronary heart disease, Peripheral arterial disease.[8,9]

Oral manifestations

Periodontitis, Xerostomia, Caries, Oral mucosal lesion, Poor wound healing, Alteration in taste, Burning mouth.[8,9]

Periodontal manifestations

Oedamatous gingiva-soggy and puffy, Stippling may be absent, Bleeding gums, Alveolar bone loss radiographically, Tooth loss, Osteoporosis.[6,10]

INVESTIGATIONS IN DIABETIC PATIENTS

Oral glucose tolerance test

Fasting plasma glucose

Two FPG ≥126 mg/dl (7.0 mmol/l) is one of the diagnostic indicators for diabetes mellitus. This is the preferred test. A normal FPG is less than 110 mg/dl (6.1mmol/l). FPG levels ranging from 110-126 mg/dl (6.1-7.0 mmol/l) are called impaired fasting glucose. Such patients are at an increased risk of developing type 2 diabetes mellitus.

2-hour postprandial plasma glucose of ≥200 mg/dl after a glucose load of 75 g

A normal 2 hours PPG levels are less than 140mg/dl (7.75 mmol/l). A 2 hours PPG level ranging from 140-200 mg/dl (7.75-11.1 mmol/l) are called impaired glucose tolerance. Such patients are at an increased risk of developing type 2 diabetes mellitus.

HbA1c

HbA1C is now considered as the standard biomarker for the diagnosis of diabetes.[11] The average blood sugar levels for the past two to three months is well indicated by HbA1c.[8]

Advantages of A1c over FPG

Greater convenience since fasting is not required. Greater pre-analytical stability.[11]

Disadvantages

Expensive, less availability of A1c testing in certain places, not accurate in patients with certain forms.[11]

Table 1: Assessment of HbA1c level[12]

Category	HbA1c level
Non- diabetic	<5.7 %
Pre-diabetic	5.7%-6.4 %
Diabetic	>6.5 %

Bidirectional relationship between diabetes and periodontitis

Diabetes is one of the most major risk factors for periodontitis. There is threefold increase in chance for periodontitis in a diabetic patient.[13] Diabetes and periodontitis are chronic diseases that are highly interactive that is diabetes can promote the occurrence as well as progression of periodontitis on the other hand periodontitis affect the glycemic control and promote the complications of diabetes. Inflammatory cytokines released in association with periodontitis, increase tissue resistance to insulin, reduce the uptake of glucose by cells and thus increase the glucose concentration in blood.[10]

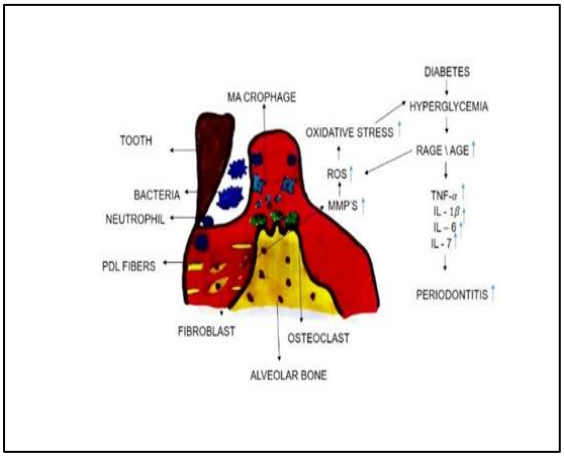

Figure 1: Represents bidirectional relationship between diabetes and periodontitis.

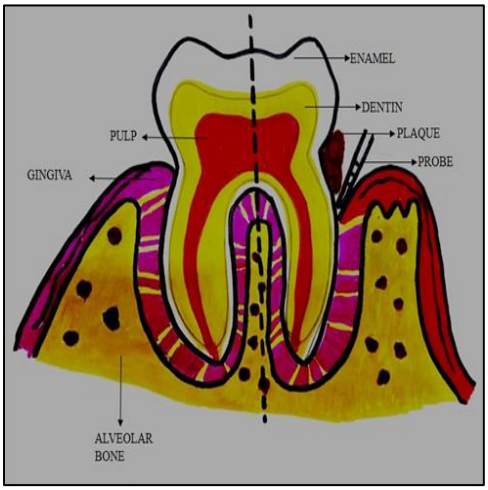

Figure 2: Comparison between health and periodontal disease condition.

Bacterial pathogens

The increased level of glucose in the gingival crevicular fluid and the blood cause alteration in the normal oral microbiota which favors bacterial growth that further increases the severity of the periodontal disease.[15] Capnocytophaga, anaerobic vibrios and actinomyces species are commonly seen in the subgingival flora of the patients with type 1 Diabetes mellitus. Prophyromonasgingivalis, prevotella intermedia, aggregatibacteractinomycetocommitans are predominately seen in subgingival flora of patients with type 2 Diabetes mellitus.

Polymorphonuclear leukocyte function

Patients with diabetes mellitus are more prone to infections due to the deficiency of PMN's where their functions such as chemotaxis and phagocytosis are seen altered. The altered function of PMN's, macrophages and monocytes lead to impairment of normal defense response that paves a way for increased bacteria proliferation.[15]

Altered collagen metabolism

In patients with poorly controlled diabetes mellitus the synthesis, maturation and maintenance of collagen is impaired. Increased level of AGEs is seen due with carbohydrate, protein and fat molecules are seen altered. Crosslinking between collagen and AGEs make the collagen less soluble that decreases the tissue repair. When the damaged collagen remains in the tissues the tissue integrity is lost and the susceptibility to periodontal destruction is increased along with increased accumulation of AGEs.[15]

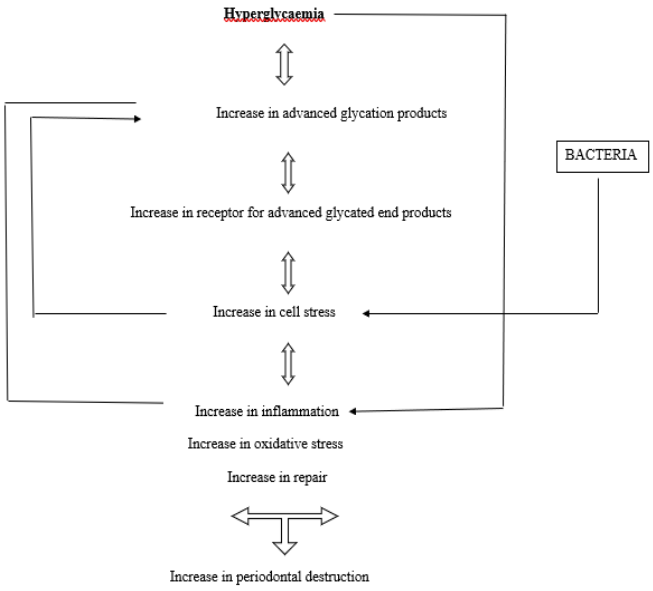

Figure 3: Potential mechanism in pathogenesis of diabetes associated periodontitis.

MANAGEMENT

Most of the diabetic patients are unaware of the interlink between diabetes and periodontitis. Hence, they often tend to neglect oral health, leading to worsening of glycemic control as well as periodontitis. Therefore, it is

very much crucial to educate the patients about the link between the two conditions and encouraging them to have proper glycemic control as well as good oral hygiene.[14] There are five important things that a dentist should keep in mind when a diabetic patient walks into the clinic. They are the dentist should emphasize on taking a detailed medical history of the patient to evaluate the metabolic status of the patient. It is preferred to have a good communication with the patient's physician to validate complete safety of the patient. A complete and careful examination of the mouth is to be carried out ensuring no finding is missed. The dentist should also evaluate the presence of other risk factors for the development of periodontitis. The presence of other co-morbidities should also be adequately taken into account.

Diabetic patients with gingivitis, an early and reversible symptom of periodontal disease, should get oral hygiene education and preventive care from their dentist. They should also be examined routinely for any subsequent periodontal tissue changes. If Patients with diabetes have an acute oral/periodontal infection, should seek immediate care. Nonsurgical periodontal therapy (NSPT) can enhance glycemic management, regardless of the patient's diabetes condition. Dentists should use clinical discretion when treating patients with poorly or weakly managed diabetes. Delaying elective dental treatment can help patients achieve stable or optimum glycemic control. For patients with poorly or moderately managed diabetes, surgical periodontal and implant therapy is not recommended. The outcomes of surgical intervention are comparable in patients with well-controlled diabetes to those without the disease. Patients with poorly controlled diabetes who are more likely to experience postoperative infections should be given special attention. To lower the risk of intraoperative hypoglycemia in patients receiving insulin or sulfonylureas, the doctor should be contacted regarding the timing of a scheduled procedure and any necessary adjustments to medication dosage. To ascertain the patient's health status and whether scheduled dental treatment can be carried out safely and effectively, coordination with the patient's physician or treating medical professional may be required. Individuals with diabetes may generally have procedures planned in the morning when endogenous cortisol levels are greater, which reduces the risk of hypoglycemia in these individuals. In order to lower the risk of hypoglycemia, it is crucial to time procedures for patients receiving short- or long-acting insulin therapy such that the outcomes do not overlap with peak insulin activity. It is crucial to verify that the patient took all recommended prescriptions and had a regular diet before to the visit. Diabetes medication may be changed by speaking with the patient's doctor or treating physician if the treatment (such as conscious sedation) is scheduled with the understanding that the patient will change regular eating habits beforehand. For the majority of surgical operations, patients with well-controlled diabetes may be treated normally. An advance strategy should be devised to balance food intake and antidiabetic drugs in case the patient's oral intake is impaired following oral or dental surgery. It is important to encourage patients who have diabetes and significant tooth loss to seek dental rehabilitation in order to regain sufficient mastication for the best possible nutrition. Diabetes patients should also be assessed for further oral health issues, such as dental caries, candidal infection, burning feeling in the mouth, mouth ulcers, and dry mouth. It is advised to undertake an annual oral screening for dental caries and early indications of periodontal involvement in children and adolescents with diabetes as soon as feasible.[15] Ensure that the patient follows all maintenance treatments and follow-up consultations with the physician as well as periodontitis.[14]

CONCLUSION

There is a significant association between diabetes and periodontitis. Improvement in glycemic control in diabetic patients is seen to have improved their periodontal health also. Surgical and non-surgical periodontal therapies are known to bring about better glycemic control in such comorbidities. Therefore, both of these conditions have to be taken to account in diagnosis and treatment planning. Physician and dental professional should be able to work together to eliminate this comorbidity.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Chandran N, Melath A, Raman AM, Khader MA, Krishnamoorthy M. Diabetes mellitus and periodontitis-a conundrum resolved. Int J Res Med Sci 2024;12:3517-21.