AMERICAN JOURNAL OF PHARMTECH RESEARCH

Journal home page: http://www.ajptr.com/

Periodontitis and Diabetes Mellitus-A Short Review

Anitha Roy[1*], Sosa George[2]

1.Faculty of Pharmacology, Saveetha Dental College,Chennai, India

2.Saveetha Dental College, Chennai, India

ABSTRACT

Diabetes Mellitus is a chronic metabolic disorder caused by the deficiency of the pancreatic hormone insulin (Type 1 DM) or due to the resistance of the peripheral cells to the insulin secreted by pancreatic β cells(Type 2 DM). It is characterized by chronic hyperglycaemia. The patients are associated with symptoms like polyuria, polydipsia and polyphagia.Type I Diabetes is normally controlled by diet restriction, exercise and insulin therapy. Type II Diabetes is treated with various oral hypoglycaemic agents in addition to dietary restriction and exercise. In severe cases exogenous supply of insulin is also used for therapy. Periodontitis is considered to be the 6th complication of diabetes mellitus. It is a group of inflammatory diseases affecting the supporting structures that surround the tooth. It causes inflammation of gum, loss of alveolar bone and destruction of periodontal ligament. Maintaining oral hygiene is the first step in controlling periodontitis. Chlorhexidine or listerine mouthwash is used commonly. The antibiotic of choice for the treatment is Doxycycline. Diabetes promotes periodontal infection and causes periodontitis. The proinflammatory cytokines produced in response to periodontal infection increase the insulin resistance and aggravate Diabetes. Thus diabetes and periodontitis share a bidirectional relationship. The severity of periodontitis is related to the glycaemic control of the patient and not to the duration of diabetes. Control of blood glucose level and maintenance of oral heath are really important in diabetes mellitus. This article reviews the relation between diabetes mellitus and periodontal health.

Keywords: Diabetes mellitus, periodontitis, hyperglycaemia, AGE, cytokines, bidirectional relationship

*Corresponding Author Email: anitharoypeeter@yahoo.co.in

Received 17 December 2013, Accepted 20 January 2014

Please cite this article in press as: Roy A *et al* Periodontitis and Diabetes Mellitus-A Short Review. American Journal of PharmTech Research 2014.

INTRODUCTION

Diabetes Mellitus is a chronic metabolic disorder caused by the deficiency of the pancreatic hormone insulin (Type 1 DM) or due to the resistance of the peripheral cells to the insulin secreted by pancreatic β cells(Type 2 DM). This is a condition which is characterized by chronic hyperglycaemia. Diabetes has many systemic manifestations. Uncontrolled diabetes can lead to cardio-vascular damage, neuropathy, nephropathy, retinopathy etc. In most of the patients with diabetes mellitus, oral hypoglycaemic drugs in combination with diet control and exercise aids in controlling blood sugar level; but, in severe cases, exogenous insulin therapy is used. Periodontitis is considered to be the 6th complication of Diabetes mellitus. Periodontitis is an inflammatory condition affecting the supporting structures that surround the tooth(periodontium). It causes inflammation of gum, loss of alveolar bone and destruction of periodontal ligament. It is caused by the microorganisms that attaches themselves to the tooth structure and multiplies there. Compromised immunity and exaggerated immune responses also can contribute to periodontitis. Periodontitis if left untreated, can lead to loosening and ultimately loss of the affected tooth. Clinically, it can be defined as the loss of connective tissue attachment between teeth and the alveolar bone. Loss of attachment is diagnosed by probing around the tooth structure; whereas, radiographical examination aids in evaluating the extend of bone loss. Diabetes and periodontal diseases share a bidirectional relationship.[1]

Statistics of the bidirectional relationship

The world-wide prevalence of diabetes was found to be around 2.8% in 2000. It is anticipated that this rate may increase to 4.4% of the population by 2030.[2] Whereas the prevalence of periodontitis is about 10-15% of the world population. In India, periodontitis is considered to be the commonest oral infection. Its prevalence rate in India is about 66.2% among people of the age 15yrs and about 89.2% among the age group of 35-44 years. A study conducted among the diabetic patients in North India showed 25.3% prevalence of periodontal disease.[3] Among diabetics, the risk for periodontal disease increases with the age; but, it does not show any sexual predilection.[4] A study conducted among children between the ages of 6-18yrs in New York showed significant correlation between diabetes and periodontal health even at the age of 6-11 years. This relationship became more remarkable after the age of 12.[5] Another study conducted among Pirna Indians in Arizona showed an increased risk for destructive periodontal disease among diabetics than the non-diabetic population.[6] Study conducted among Pima Indians showed that the death rate due to ischemic heart disease and neuropathy is higher among diabetics with

periodontal disease than among the diabetics without or with mild periodontal disease. The diabetics with periodontal disease are more susceptible to micro and macro vascular damage. This is the major cause of morbidity and death in diabetes.[7] A study conducted on the relationship between diabetes and gingival bleeding showed that there is increased bleeding tendency among diabetics than non-diabetics. Among diabetics, those with poor glycaemic control were more susceptible to gingival bleeding.[8] The relationship between diabetes and periodontal disease is more pronounced in certain populations. This is suggestive of a possible genetic involvement.[9]

Role of Dentist

Periodontal pocket formation is the first sign of periodontitis. Pockets provide excellent environment for bacterial multiplication and growth. Diabetes can predispose to periodontitis and the severity of it is dependent on the degree of hyperglycaemia. Some studies have shown that there is an increase in the number of microbial flora in the periodontal pocket of an individual with poor glycaemic control. Even the severity of gingivitis and periodontal infection increases with poor glycaemic control. Diabetes enhances periodontal bone loss as well as attachment loss. Periodontitis can enhance the chronic state of insulin resistance of the peripheral cells by various mechanisms. The signs of periodontitis can be easily detected by a dentist through clinical examination. Hence, a dental clinic can serve as an optimal screening centre for undiagnosed or progressed diabetes mellitus.[10-13]

Advanced Glycation End product(AGE)

In a patient with diabetes, the polymorphonuclear leukocytes become less functional. Chemotaxis, adhesion and phagocytosis of neutrophils are affected. Though neutrophils are hypo-functional in diabetes, monocytes and macrophages are hyper-functional. Hyperglycaemia causes the non-enzymatic glycosylation of proteins. This leads to the formation of Advanced Glycation Endproducts (AGE). Chronic hyperglycaemia as in diabetes mellitus causes the accumulation of AGE in a much higher level than normal. Macrophages, monocytes and endothelial cells, all of which have increased affinity to AGE, bind to it and create a hyper-responsive cellular state. AGE bound macrophages and monocytes can secrete more TNF-α, IL-1, Insulin like growth factor and prostaglandin E2. The elevated level of all these factors can be detected in the gingival crevicular fluid of diabetic patients. AGE bound endothelial cells causes procoagulatory changes leading to focal thrombosis and vasoconstriction. These changes may have significant role in tissue changes within the periodontium. The altered functioning of phagocytes causes compromised host resistance and creates a suitable environment for the

growth of more sub gingival flora. The bacteria present in the periodontal pockets enhance periodontal destruction. AGE promote the formation of reactive oxygen metabolites. Neutrophils in a diabetic patient produce more oxygen metabolites than in a normal individual. Increased oxidative stress can lead to vascular damage.[11,14,15]

Chronic hyperglycaemia along with AGE deposition causes increased expression of genes associated with transcription factor nuclear factor kB(NFkB). Chronic impairment in the expression of this gene can lead to infections such as periodontitis.[16]

AGE can also bind to fibroblasts. This adversely affects collagen formation. Hyperglycaemia also reduces the synthesis of glycosamino glycans(GAG).As collagen and glycosaminoglycans are important components of periodontal tissue, any impairment to its synthesis and maturation can alter its wound healing capacity and can make the periodontal tissue susceptible to bacterial attack. In addition, AGE increases the activity of collagenases and other lytic enzymes in the connective tissue and thus promote periodontal destruction.[11,14,17]

Diabetes mellitus cytokine and periodontitis

Bacterial products like endotoxins and lipopolysaccharides can promote inflammatory cascade. This is mediated through Toll-Like Receptors. Oral microbes and their products can gain systemic access through inflamed or destructed periodontium. Cytokines which are produced as a result of infection can enhance insulin resistance. These proinflammatory cytokines can gain access to circulation through microcirculation at periodontal level. By serine phosphorylation it can modify insulin receptor substrate1. They can also alter adipocyte function as well as decrease endothelial nitric acid production. Cytokine production can cause alteration in the functioning of pancreatic cells by direct action or indirectly by enhancing free fatty acid production.[16] It was shown that anti-infective treatment has positive impact on metabolic glucose control in diabetes. This effect may be due to decreased level of serum TNF-α, which decreases the insulin resistance and thus the glycated haemoglobin level. Cytokines are also capable of altering lipid metabolism and can cause hyperlipidaemia[18-21]

Management of Periodontitis in Diabetes

The principles of treatment for periodontitis is the same for diabetics and non-diabetics.[22] Few studies have shown that diabetes patients with poor oral hygiene habits had poorer periodontal health when compared to those with good oral hygiene habits.[23] Each person should take efforts to minimise plaque accumulation and calculus formation around the tooth. Brushing and flossing twice daily, rinsing the mouth after each meal, and usage of any good antibacterial mouthwash like listerine or chlorhexidine should be part of the daily routine of any diabetes patient. Regular

dental check up helps in the early detection of periodontitis and prevention of its progress. In advanced periodontitis cases, more aggressive treatment may be necessary. It can range from anti microbial therapy to surgery or to a combination of both.[16]Doxycycline is a common drug of choice for treating periodontitis. In addition, it should be ensured that the patient's blood glucose level is also maintained under control by appropriate therapy and diet restrictions.

CONCLUSION

There exists a bidirectional relationship between diabetes and periodontitis. Maintaining good oral hygiene as well as keeping the blood sugar level under control with proper anti diabetic agent are very important in diabetes mellitus as well as periodontitis. Regular dental check-up is always advised and it is very helpful in the early diagnosis and treatment of periodontitis.

REFERENCES

1. G. Rutger Persson. Diabetes and Periodontal Disease: An Update for Health Care Providers. Diabetes Spectrum 2011;24:195-198
2. Sarah Wild, Gojka Roglic, Anders Green, Richard Sicree, Hilary King. Global Prevalence of Diabetes-Estimates for the year 2000 and projections for 2030.Diabetes Care 2004;27:1047-1053
3. Anjani Kumar Pathak, Vijay Kumar Shakya, Anil Chandra, Kopal Goel. Association between diabetes mellitus and periodontal status in north Indian adults. Eur J Gen Dent 2013;2:58-61
4. Harald Loe. Periodontal Disease-The sixth complication of diabetes mellitus. Diabetes Care 1993;16:329-334
5. Evanthia Lalla, Bin Cheng, Shantanu Lal, Sid Tucker, Ellen Greenberg, Robin Goland, Ira B. Lamster. Periodontal Changes in Children and Adolescents With Diabetes. DiabetesCare 2006;29:295-299
6. Emrich LJ, Shlossman M, Genco RJ. Periodontal disease in non-insulin-dependent diabetes mellitus. J Periodontol 1991;62:123-131
7. Aramesh Saremi, Robert G. Nelson, Marshall Tulloch-Reid, Robert L. Hanson, Maurice L. Sievers, George W. Taylor, Marc Shlossman, Peter H. Bennett, Robert Genco, William C. Knowler. Periodontal Disease and Mortality in Type2 Diabetes. Diabetes Care 2005;28:27–32
8. Ervasti T, Knuuttila M, Pohjamo L, Haukipuro K. Relation between control of diabetes and gingival bleeding. J Periodontol 1985;56:154-7.

9. Debora C. Matthews. The Relationship Between Diabetes and Periodontal Disease. Journal of the Canadian Dental Association 2002;68:161-164
10. MT Rosedale, SM Strauss. Diabetes screening at the periodontal visit: patient and provider experiences with two screening approaches. Int J Dent Hygiene 2012;10:250-258.
11. Brianl. Mealey, Glorial. Ocampo. Diabetes Mellitus and periodontal disease. Periodontology 2007;44:127–153
12. Choi YH, McKeown RE, Mayer-Davis EJ, Liese AD, Song KB, Merchant AT. Association between periodontitis and impaired fasting glucose and diabetes. Diabetes Care. 2011 Feb;34(2):381-6
13. Mealey BL. Periodontal disease and diabetes. A two-way street. J Am Dent Assoc. 2008 Mar;139(3): 26S-31S.
14. The Research, Science and Therapy Committee of The American Academy of Periodontology. Position Paper; Diabetes and Periodontal Diseases. J Periodontol 1999;70:935-949
15. M. Karima, A. Kantarci, T. Ohira, H. Hasturk, V.L. Jones, B-H. Nam, A. Malabanan, P.C. Trackman, J.A. Badwey, T.E. VanDyke. Enhanced superoxide release and elevated protein kinase C activity in neutrophils from diabetic patients: association with periodontitis. Journal of Leukocyte Biology 2005;78:862-870
16. Janet H. Southerland, George W. Taylor, Steven Offenbacher.Diabetes and Periodontal Infection: Making the Connection.Clinical Diabetes 2005;23:171-178
17. Antonio Bascones-Martinez, Paula Matesanz-Perez, Marta Escribano-Bermejo, Miguel-Ángel GonzálezMoles, Jaime Bascones-Ilundain, Jukka-H Meurman. Periodontal disease and diabetes-Review of the literature.Med Oral Patol Oral Cir Bucal 2011;16:e722-729
18. Iwamoto Y, Nishimura F, Nakagawa M, Sugimoto H, Shikata K, Makino H, Fukuda T, Tsuji T, Iwamoto M, Murayama Y. The effect of antimicrobial periodontal treatment on circulating tumor necrosis factor-alpha and glycated hemoglobin level in patients with type 2 diabetes. J Periodontol 2001;72:774-8.
19. Grossi SG, Skrepcinski FB, DeCaro T, Zambon JJ, Cummins D, Genco RJ. Response to periodontal therapy in diabetics and smokers. J Periodontol 1996;67:1094-1102.
20. Grossi SG, Skrepcinski FB, DeCaro T, Robertson DC, Ho AW, Dunford RG, Genco RJ. Treatment of periodontal disease in diabetics reduces glycated hemoglobin. J Periodontol 1997;68:713-719.

21. Iacopino AM. Periodontitis and diabetes interrelationships: role of inflammation. Ann Periodontol 2001;6:125-137.
22. Soskolne WA. Epidemiological and clinical aspects of periodontal diseases in diabetics. Ann Periodontol 1998;3:3-12.
23. Preetha P. Kanjirath, BDS, MDS, MS; Seung Eun Kim, DDS; Marita Rohr Inglehart. Diabetes and Oral Health: The Importance of Oral Health–Related Behavior. The Journal of Dental Hygiene 2011;85:264-272