

Relationship between diabetes mellitus and periodontal disease - A clinical study.

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Abstract:

Introduction: The relation between diabetes mellitus and periodontal disease is not clear. From the available data, it seemed reasonable to believe that diabetics were more susceptible to periodontal disease than non diabetics. **Aim:** The present study was to clinically evaluate the relationship of diabetes mellitus with periodontal disease along with various parameters. **Materials and Methods:** 200 patients with diabetes mellitus were examined. A thorough oral examination was carried out and relevant history was recorded for all the patients. **Results:** The prevalence of periodontal disease in diabetic patients was 88.4% (gingivitis 26.3% and periodontitis 62%) and complete edentulousness was 9.8%. Remaining 1.9% of patients were periodontally healthy. **Conclusion:** It can be concluded that poorer the glycemic control and longer the duration of diabetes, the greater will be the prevalence and severity of periodontal disease.

Keywords: Glycemic control, Periodontal disease, Prevalence, Severity.

Introduction:

Diabetes mellitus (DM) is a chronic, non-communicable disease and also one of the major global public health issues. It is defined as a clinical syndrome characterized by hyperglycemia due to absolute or relative deficiency of insulin.

The global prevalence of T2DM has reached 382 million people in 2013 and by 2035 this will rise to 592 million's adult inhabitants. Diabetes has caused 5.1 million deaths in 2013. Every six seconds a person dies from diabetes.^[1]

An elevation of blood glucose level (hyperglycemia) is the primary feature of DM and results from a defect in insulin secretion by pancreatic β cells, a decrease in insulin sensitivity, or a combination of both.^[2]

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Type 2 diabetes mellitus (T2DM) is a highly prevalent metabolic disorder and accounts for about 85-90% of all cases of diabetes in the world and



could be an overwhelming health pressure on society in both the developed and developing countries.^[3]

Periodontal disease is a common chronic, which accounts for 80-85% of cases with diabetes, is an inflammatory response to bacteria that exist in the gum tissue (periodontal ligament) that causes an irreversible loss of the supporting tooth structures, and may lead to eventual loss of teeth.^[4]

Hyperglycemia has been found to modify periodontal expression, by interfering with the host response and causing an excessive inflammatory response to infection,^[5] as well as by the interaction of the receptor for advanced glycation end products (RAGE) with its ligands in gingival.^[6] Inflammatory periodontal diseases are the most common chronic inflammatory conditions of humans worldwide.

Periodontal disease has been labeled as the “Sixth Complication” of diabetes^[7]. However, there is no unanimity about the exact relationship between diabetes mellitus and occurrence of periodontal disease.

Cianciola et al^[8] reported the prevalence of periodontitis to be 39% in individuals aged 19 years and older, while in patients above 35 years of age, Rylander et al^[9], reported the prevalence of periodontitis to be 87%; Bacic et al^[10] reported the prevalence to be 50%; Neelima S. Rajhans et al^[11] reported the prevalence of periodontitis to be 86.8%.

Objectives:

The study was undertaken in diabetic patients with the following objectives.

1. To find out prevalence and severity of periodontal disease.
2. To evaluate the relationship between the diabetes mellitus and periodontal disease in terms of plaque and calculus.
3. To evaluate the relationship between duration of diabetes and prevalence and severity of periodontal disease.
4. To investigate the association between glycemic status of diabetics and prevalence and severity of periodontal disease.
5. To find out effect of diabetes mellitus on loss of teeth.
6. To study the effect of glycemic status of diabetics on tooth mobility.

Materials and Methods:

The study was carried out at AMC Dental College & Hospital, Khokhara, Ahmedabad. A total 200 patients were selected from outpatient Department of Periodontology, AMC Dental College & Hospital. These patients were diagnosed as having diabetes mellitus and were under treatment.

The patients were selected by the following *inclusion criteria*:

1. Under treatment or had diabetes mellitus diagnosed for at least last one year or more.
2. Not having any other systemic diseases.

3. Not having any history of diabetic complications like neuropathy, nephropathy, retinopathy etc.
4. Not using drugs such as phenytoin, nifedipine etc.
5. Not undergone any periodontal treatment since last one year.
6. Willingness to participate in the study

The relevant history was recorded for all the patients. A careful oral examination was carried out with the help of mouth mirror and graduated periodontal probe. Ramfjord periodontal disease index having components for plaque, calculus and disease severity and Miller's mobility index were recorded for each patient.

Determination of blood glucose levels

In all the patients, venous blood was collected under strict aseptic conditions, after an overnight fast and one and half hour after meal. The fasting and postprandial blood glucose levels were determined by autoanalyzer.

Results:

Out of the 200 patients, 1.2% of Patients had insulin-dependent diabetes mellitus (IDDM) and 98.8% had non-insulin-dependent diabetes mellitus (NIDDM).

The collected data was analyzed statistically. Karl Pearson correlation coefficient analysis was used to investigate the relationship between prevalence and severity of periodontal disease and various other factors such as age, sex, glycemic status, and duration of diabetes mellitus.

Out of 200 patients, 108(54%) were male and 92(46%) were female. The age range of the patients was 15 years to 76 years with a mean age of 53.24±11.91 years. The patients were classified into five groups. (Table 1).

Table 1: Distribution of patients according to age and sex

Group	Age groups	No. of patients	Percentage
Males			
Group I	15-24	4	2
Group II	25-34	12	6
Group III	35-44	18	9
Group IV	45-54	22	11
Group V	55 & Above	52	26
Total		108	54
Females			
Group I	15-24	2	1
Group II	25-34	8	4
Group III	35-44	10	5
Group IV	45-54	24	12
Group V	55 & Above	48	24
Total		92	46

Prevalence and severity of periodontal disease:

The prevalence of periodontal disease in diabetic patients was 88.4% (gingivitis 26.3% and periodontitis 62%) and complete edentulousness was 9.8% . Remaining 1.9% of patients were periodontally healthy. (Image 1)

Plaque and calculus index:

The mean plaque and calculus index scores were 1.23±0.50 and 1.26±0.60, respectively. There was a statistically significant correlation (P<0.01) of plaque and calculus index with severity, but not with the prevalence of periodontal disease.

Duration of diabetes mellitus:

The mean duration of diabetes mellitus was 7.98±4.64 years. The duration of diabetes mellitus was statistically correlated (P<0.01) with the prevalence and severity of periodontal disease. (Table 2)

Table 2 Mean duration (in years) of diabetes mellitus and periodontal status

Periodontal status	Duration of diabetes mellitus
Healthy	2.78 ± 1.18
Localized gingivitis	3.28 ± 1.74
Generalized gingivitis	4.80 ± 2.36
Localized periodontitis	8.86 ± 3.22
Generalized periodontitis	9.48 ± 4.36
Complete edentulous	11.98 ± 5.00
Total population	7.98 ± 4.64

Missing teeth:

Out of 200 patients, 80 patients (40%) were complete dentulous, 100 patients (50%) were partially and 20 patients (9.8%) were completely edentulous. 42 patients (21%) were lost their teeth before the diagnosis of diabetes mellitus and 78 patients (39%) were lost their teeth after the diagnosis of diabetes mellitus.

Image 1 Periodontal status of Diabetes mellitus patients (%)

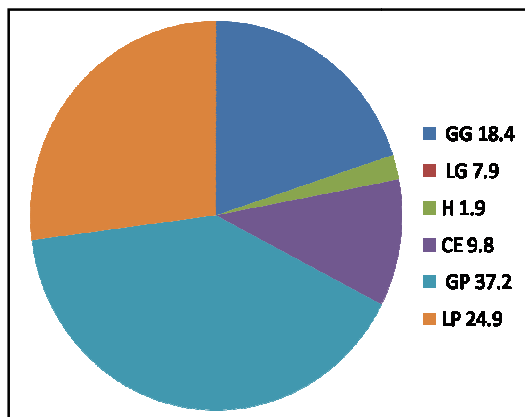
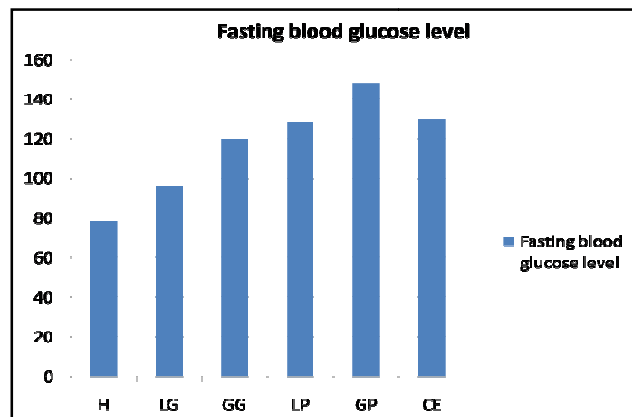


Image 2 Mean blood glucose level (mg%) and Periodontal status



H = Healthy , LG = Localized gingivitis, GG = Generalized gingivitis, LP = Localized periodontitis, GP = Generalized periodontitis, CE = Complete Edentulous

Glycemic status of diabetes mellitus:

The mean fasting blood glucose level was 123.00 ± 34.56 . In healthy periodontium group, it was 78.26 ± 2.38 and was found to be maximum in generalized periodontitis group i.e. 148.73 ± 36.81 .

Miller's mobility index:

84 patients (42%) and a total 252 teeth exhibited pathologic tooth mobility. At the level of significance $P < 0.01$, there was a statistically significant correlation of tooth mobility with glycemic status of diabetics.

Discussion:

The systemic disorders exert the effect in a generalized manner and so also affect the occurrence and management of the periodontal conditions. One of such systemic conditions playing an important role in the etiology of periodontal disease is diabetes mellitus.

Periodontal disease is a common chronic, which accounts for 80-85% of cases with diabetes, is an inflammatory response to bacteria that exist in the gum tissue (periodontal ligament) that causes an irreversible loss of the supporting tooth structures, and may lead to eventual loss of teeth. Hyperglycemia has been found to modify periodontal expression, by interfering with the host response and causing an excessive inflammatory response to infection, as well as by the interaction of the receptor for advanced glycation end products (RAGE) with its ligands in gingiva.

Cianciola et al.^[8] reported the prevalence of periodontitis to be 39% in individuals aged 19 years and older, while in patients above 35 years of age, Rylander et al.^[9], reported the prevalence of periodontitis to be 87%; Bacic et al.^[10] reported the prevalence to be 50%; Neelima S. Rajhans et al.^[11] reported the prevalence of periodontitis to be 86.8%. Consistent with these findings, the prevalence of periodontitis and gingivitis was 62% and 26.3% respectively, in the present study.

The mean plaque and calculus index values were minimum in patients having healthy periodontium, but increased gradually with the progress of periodontal disease except for localized periodontitis. This may be account of the absence of or scanty amount of plaque or calculus on the remaining teeth in localized periodontitis patients.

Cerda et al.^[11] and Firatli et al.^[12] had concluded that the duration of diabetes was a significant factor for the severity of periodontal disease. Emrich et al.^[13] stated that the diabetic status was significantly and strongly related to both prevalence and severity of periodontal disease. From the present study also, it can be speculated that poorer the control and longer the duration of diabetes, the greater will be the prevalence and severity of periodontal disease. Karjalainen and Kunuttila^[14] had suggested that hyperglycemia impairs overall cell function, as insulin is required for glucose to enter cells to provide a source of energy. It also decreases PMN cell chemotaxis, phagocytosis and intracellular killing of bacteria. The ability of glycosylated haemoglobin to carry oxygen would be impaired, thereby decreasing tissue oxygenation. Hyperglycemia induces blood flow abnormalities including increased blood viscosity, reduced erythrocyte deformability, and increased platelet

aggregation, which further enhance tissue hypoxia. All these factors result in increased periodontal destruction.

It was also noticed that the mean duration of diabetes and mean blood glucose levels were significantly correlated with periodontal disease. However, in complete edentulous patients, even though the mean duration was highest, the mean blood glucose levels were very less when compared to patients with localized/generalized periodontitis.

The mechanisms may be:

1. The predominant cultivable organisms at the base of the active periodontal pockets are gram negative and thus produce endotoxin which has been shown to cause hyperglycemia and depletion of liver glycogen (Schluger et al.)
2. The tumor necrosis factor alpha and cytokines found in destructive periodontitis interferes with the action of insulin and lead to metabolic alterations during infection. The relationship between insulin resistance and inflammatory connective tissue diseases have also been reported for severe periodontitis as a risk factor for poor glycemic control. It is, thus, expected that there is an increase in blood glucose levels in diabetics with the increasing severity of periodontal disease.

The role that diabetes plays in the initiation and progression of periodontal disease involves multiple factors. Particularly poor metabolic control as well as extended duration of diabetes is a risk factor periodontitis when extensive local irritants are present on teeth.

The dentist can play an important role in diabetic patients overall health care through recognition and treatment of their periodontal needs understanding the “Sixth Complication of diabetes mellitus.”

Conclusion:

1. The prevalence of periodontal disease in diabetic patients was 88.4%.
2. Plaque and calculus index were significantly correlated with increase in age, but not with the prevalence of periodontal disease.
3. Duration of diabetes mellitus was significantly correlated to the prevalence and severity of periodontal disease.
4. Glycemic status had a significant effect on the prevalence and severity of periodontal disease.
5. The number of missing teeth increased with increase in age of the patient and duration of diabetes mellitus, and had the direct correlation with the severity of periodontal disease.

References:

1. IDF Diabetes Atlas, 6th edition. International Diabetes Federation, 2013.
2. Vaibhav Tandon, Pradeep Tangade, Ravishankar Telgi Lingesha, Amit Tirth, Sumit Kumar Pal, Vipul Yadav. Glycemic control and periodontal disease in type 2 diabetes

- mellitus patients: A cross-sectional study. *Journal of Indian Association of Public Health Dentistry* Vol. 13, Issue 3, July-September 2015
3. Pushparani D.S. Serum Zinc and Iron Level in Type 2 Diabetes Mellitus with Periodontitis. *International Journal of PharmTech Research* 2014-2015, 7(1), Vol.7, No.1, pp 165-171.
 4. Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. *Lancet*. 2005; 366:1809-1820.
 5. Nishihara R, Sugano N, Takano M, Shimada T, Tanka H, Oka S et al. The effect of *Porohyromonas gingivalis* infection on cytokine levels in type 2 diabetic mice. *J Periodontal Res*. 2009; 44:305-10.
 6. Mealey BL. Periodontal disease and diabetes. A two-way street. *J Am Dent Assoc*. 2006; 137 (Suppl): 26S-31S.
 7. Grossi SG, Skrepanwki FB, Caro TD, Zambon JJ, Cummins D, Genco RJ. Response to periodontal therapy in diabetics and smokers. *J Periodontal* 1996; 67:1094-102.
 8. Cianciola LJ, Park BH, Bruck E, Monsonvich L, Genco RJ. Prevalence of periodontal disease in insulin dependent diabetes mellitus (juvenile diabetes) *J Am Dent Asso*.1982; 104:653-60.
 9. Rylander H, Ramberg P, Blohme G, Lind he J. Prevalence of periodontal disease in young diabetics. *J Clin periodontal*.1986; 14:38-43.
 10. Bacic M, Plancak D, Granic M. CPITN assessment of periodontal disease in diabetic patients. *J Periodontal*. 1988; 59:816-22.
 11. Neelima S. Rajhans, Ramesh M. Kohad, Viren G. Chaudhari, Nilkanth H. Mhaske. A clinical study of the relationship between diabetes mellitus and periodontal disease. *J Indian Soc Periodontal* 2011 Oct-Dec; 15(4): 388-392.
 12. Cerda JG, Dela Torre CV, Malacara JM, Nova LE. Periodonatl disease in non-insulin dependent diabetes mellitus (NIDDM).The effect of age and time since diagnosis. *J Periodontal* 1994; 65:991-5.
 13. Firatli E, Yilmaz O, Onan V. The relationship between clinical attachment loss and the duration of insulin dependent diabetes mellitus (IDDM) in children and adolescents. *J Clin Periodontal*. 1996; 23:362-6. [PubMed:8739168]
 14. Emrich LJ, Shlossman M, Genco RJ. Periodontal disease in non-insulin dependent diabetes mellitus. *J Periodontal*. 1991; 62:123-30.
 15. Karjalainen KM, Knuutila ML. The onset of diabetes and poor metabolic control increases gingival bleeding in children and adolescents with insulin dependent diabetes mellitus. *J Clin Periodontal* 1996; 23:1060-7.