

Original Research

Dyslipidemia and Diabetes Mellitus as Risk Factors for Chronic Periodontitis : A Cross Sectional Study

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ABSTRACT

Introduction- Periodontal disease is an infectious disease characterized by loss of attachment and bone loss. It is determined by the presence of bacteria biofilm, however, a host of immune responses also play an essential role in its pathogenesis. Thus, systemic conditions that could alter host response should be considered risk factors for periodontal disease. Periodontal disease is closely related to systemic conditions like diabetes mellitus type 2 and dyslipidemia. Type 2 diabetes results from insulin resistance and dyslipidemia is characterized by increased level of lipoproteins in blood.

Aims and Objective- To evaluate periodontal conditions of subjects with diabetes mellitus type 2 or with dyslipidemia or with both diabetes mellitus type 2 and dyslipidemia.

Materials and Method- A total 60 subjects recruited were divided into four groups. Group 1 subjects were systemically healthy, group 2 with diabetes mellitus type 2, group 3 with dyslipidemia and group 4 with both diabetes mellitus type 2 and dyslipidemia. Clinical parameters measured were plaque index, bleeding index, periodontal probing depth and clinical attachment level.

Results- Groups 2 (DM2) and 4 (DM2 and Dyslipidemia) showed positive association with periodontal disease.

Conclusion- Dyslipidemia did not influence periodontal status while diabetes type 2 was significantly associated with gingivitis and periodontitis. Our study indicated that DM2 + dyslipidemia and isolated DM2 were associated with loss of CAL. However, DM2 is still an important

factor to determine the periodontal destruction, especially with signs of severe periodontitis.

Keywords ; Diabetes, Dyslipidemia, periodontitis.

INTRODUCTION

Periodontitis is a chronic infection characterized by an exaggerated gingival inflammatory response to pathogen microbiota, which results in the loss of dental support tissue and, eventually, in the loss of teeth.^[1] It is determined by the presence of bacterial biofilm, however, a host of immune responses also play an essential role in its pathogenesis.² Thus, systemic conditions that could alter host response should be considered risk factors for periodontal disease.^[3,4]

Diabetes mellitus (DM) is a highly prevalent metabolic disorder; with 150 million cases estimated worldwide, it constitutes a global public health burden.^[5] Diabetes is divided into two main forms: type 1 diabetes mellitus (DM1) (formerly insulin-dependent diabetes mellitus) and type 2 diabetes mellitus (DM2) (formerly non-insulin-dependent diabetes mellitus). Type 1 diabetes is caused by immune-mediated destruction of the insulin-producing pancreatic β cells and accounts for 10% to 15% of all diabetes cases. The more common form, type 2 diabetes, results from a combination of impaired insulin production and insulin resistance. Both forms of the disease are associated with a range of complications that increases the morbidity and mortality of affected individuals.^[5]

Periodontitis, which is the most common oral infection in humans and the major cause of tooth loss in adults, has been considered the sixth complication of diabetes.^[3]

Most clinical investigators agree with the evidence that diabetes acts as a modifying and probably an accelerating factor in periodontitis, although less evidence is available on the underlying mechanisms.^[6]

The entrance of microorganisms and/or their products in the systemic circulation and the host inflammatory response are believed to play a role in this process.^[5]

It has been shown that DM2 occurs synergically and/or

concomitantly to other systemic diseases, jeopardizing the health status of affected individuals. A recent population study proved that DM2 is closely associated with dyslipidemia.^[7]

Dyslipidemia is characterized by a metabolic dysfunction resulting from an increased level of lipoproteins in blood.^[8] The characteristic features of diabetic dyslipidemia are a high plasma triglyceride concentration, low HDL cholesterol concentration and increased concentration of small dense LDL-cholesterol particles. The lipid changes associated with diabetes mellitus are attributed to increased free fatty acid flux secondary to insulin resistance.^[9] Despite this relationship with DM2 and cardiovascular disease, recent studies indicate an association between elevation in blood lipoproteins and alterations in periodontal conditions.^[10] Fentoğlu O et al, in his study concluded that patients with mild or moderate hyperlipidemia manifested higher values of periodontal parameters compared with individuals who are normolipidemic.^[11]

Thus, considering that diabetic dyslipidemia could result from metabolic derangement, and that both systemic conditions (DM 2 and dyslipidemia) could occur as comorbidities in the population, it has been hypothesized that dyslipidemia associated with DM2 could promote a synergistic effect on periodontal breakdown. Hence, the purpose of this study was to evaluate the periodontal conditions of patients presenting with diabetes mellitus type 2 or with dyslipidemia or with both diabetes mellitus type2 and dyslipidemia.

MATERIALS AND METHOD

The study was conducted from October 2013 to December 2013 following protocol approved by ethical committee of Swami Devi Dyal Hospital and Dental College, Barwala (Panchkula), Haryana. Patients with diabetes mellitus type 2 and dyslipidemia or with either diabetes mellitus type 2 or dyslipidemia were recruited

at Out Patient Department of Swami Devi Dyal Hospital. Subjects who were systemically healthy were recruited at Out Patient Department of Periodontology and Oral Implantology of above mentioned hospital and dental college. Each patient was given a detailed verbal and written description of the study and all the selected patients were required to sign an informed consent form prior to commencement of the study. For inclusion in this population assessment, the participants were 30-60 years old, had ≥ 14 teeth, and had a diagnosis of DM2 ≥ 3 years ago. Participants who had been treated for periodontitis in the last 6 months, used systemic or topical antimicrobials, and/or presented any conditions not allowing clinical examination were excluded. Patients on immunosuppressive therapy, pregnant or lactating mothers, and patients with a history of smoking were also excluded from the study.

Metabolic Parameters- Venous blood samples were obtained after a 12-hour fasting period from antecubital vein; plasma lipids were determined using routine laboratory methods. DM2 diagnosis was based on fasting plasma glucose (FPG) >126 mg/dL, in two repeated tests. Blood samples were screened for plasma triglycerides (TGs), total cholesterol (TC), low-density lipoprotein (LDL), and high-density lipoprotein (HDL). To be considered to have dyslipidemia, the patient should present with ≥ 1 lipidic marker above threshold. The following threshold levels were used according to the laboratory's recommendation: TGs >150 mg/dL; TC >200 mg/dL; LDL >100 mg/dL, or HDL <40 mg/dL in males and 50 mg/dL for females.

A total of 60 subjects who fulfilled above mentioned criteria were selected and divided into four groups of 15 each. Group 1 consisted of systemically healthy subjects (n=15 subjects); Group 2 of patients diagnosed

with DM2 (n=15 patients); Group 3, patients diagnosed with dyslipidemia (n=15 patients) and Group 4, patients diagnosed with both DM2 and dyslipidemia (n=15 patients). All participants underwent a full-mouth examination and following measurements were made: plaque Index (PI),¹² bleeding index (BI),¹³ periodontal probing depth (PD) using a UNC-15 probe[‡], and Clinical Attachment Level (CAL) at six sites per tooth. Measurements were made in millimeters and rounded to the nearest whole millimeter. The result was subjected to statistical analysis using SPSS Version 20.0. (Armonk, NY: IBM Corp.).

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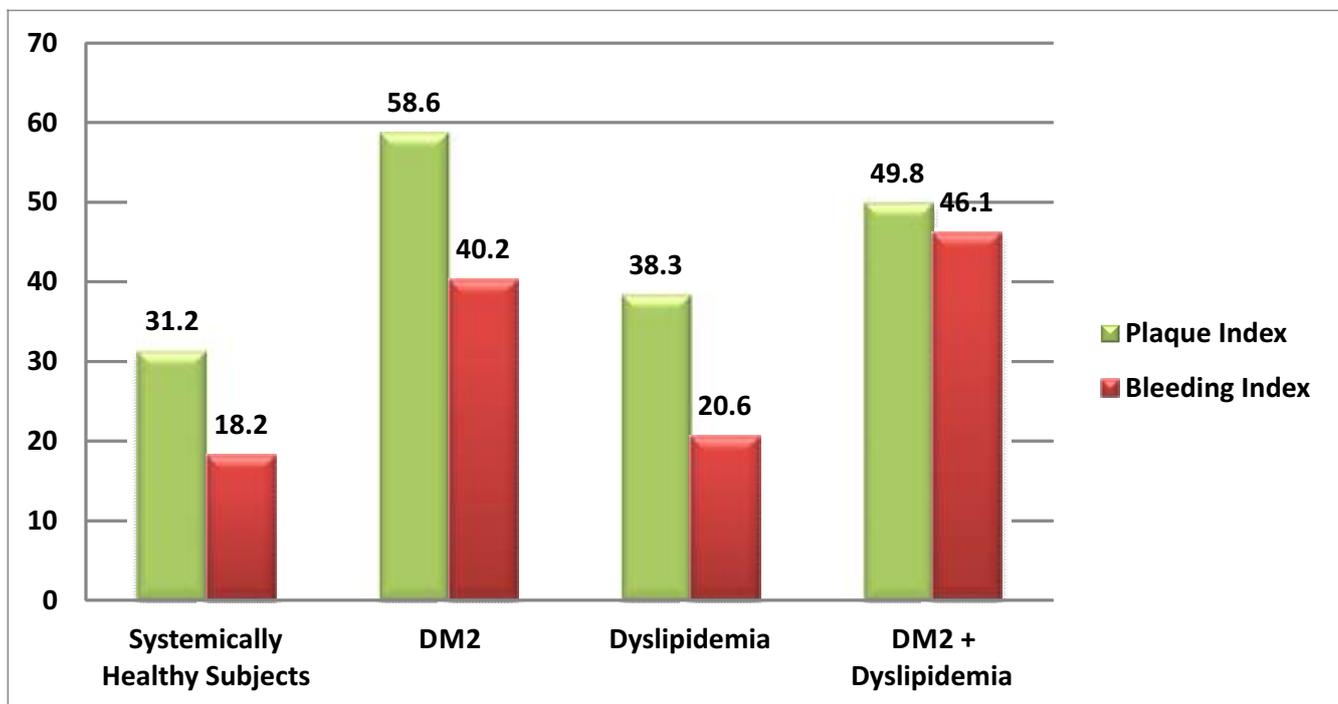
RESULTS

A total 60 subjects were selected and 15 patients were selected for each group fulfilling the criteria.. Group 1 consisted of systemically healthy subjects (n= 15 subjects); Group 2 of patients diagnosed with DM2 (n= 15 patients); Group 3, patients diagnosed with dyslipidemia (n= 15 patients) and Group 4, patients diagnosed with both DM2 and dyslipidemia (n= 15 patients). Statistical analysis using SPSS Version 20.0. (Armonk, NY: IBM Corp.).

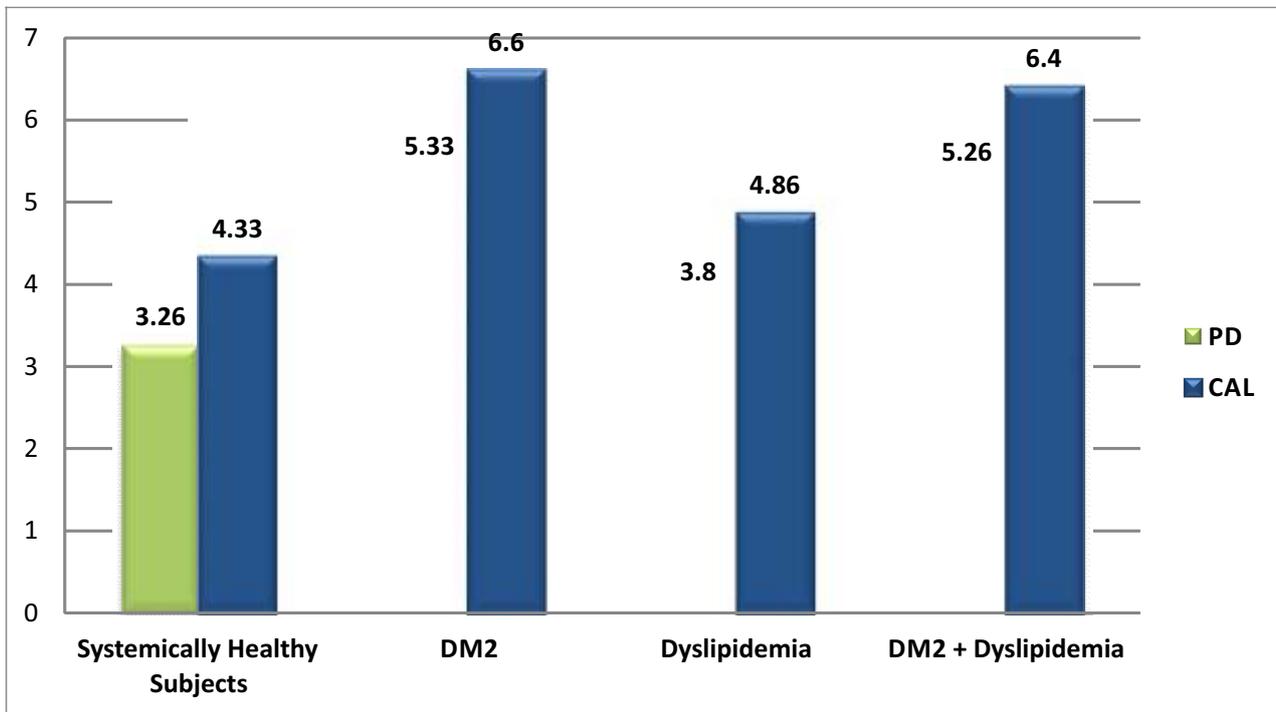
Plaque index for Group II i.e DM2 was the highest (mean 58.6 ± 30.2) followed by Group IV i.e DM2+ Dyslipidemia. Bleeding Index was highest for Group IV (DM2 + Dyslipidemia) (mean 46.1 ± 29.4). Probing depth was the highest for DM2 (mean 5.33 ± 0.976) followed by DM2 + Dyslipidemia (mean 5.26 ± 0.79) , Dyslipidemia and Systemically healthy subjects. Similarly, CAL was the highest for DM2 (mean 6.6 ± 0.91) followed by DM2 + Dyslipidemia (mean 6.4 ± 0.83) , Dyslipidemia and Systemically healthy subjects.

TABLE 1: INTERGROUP COMPARISON BETWEEN FOUR GROUPS

PERIODONTAL CONDITON (mean±SD)	GROUP I (SYSTEMICALLY HEALTHY) (N=15)	GROUP II (DM 2) (N=15)	GROUP III (DYSLIPIDEMIA) (N=15)	GROUP IV (DM 2+ DYSLIPIDEMIA) (N=15)
PI	31.2 ±22.1	58.6±30.2	38.3±24.6	49.8±32.8
BI	18.2±18.6	40.2±30.9	20.6±21	46.1±29.4
PD	3.26±1.28	5.33±0.976	3.8±0.77	5.26±0.79
CAL	4.33±1.49	6.6±0.91	4.86±0.73	6.4±0.83



Graph 1: Plaque Index and Bleeding Index of Healthy controls with DM2 and/or Dyslipidemia



Graph 2: Probing Depth and CAL of Healthy controls with DM2 and/or Dyslipidemia

DISCUSSION

Periodontal disease may act as risk factors for development and progression of destruction of periodontal tissues. Within several systemic conditions, DM2 is highly associated with periodontal breakdown.^[14] However, studies have reported other systemic conditions that could also be disease indicators such as alteration in blood lipid levels correlating with periodontitis occurrence and severity.^[11,15] These conditions usually occur as comorbidities, and have a synergic effect leading to higher risk for periodontal disease. Thus, the present study investigated if dyslipidemia could be associated with severity of periodontal disease in individuals who are healthy and/or have DM2. Little literature is available on diabetic dyslipidemia and chronic periodontitis. Our study indicated that DM2 + dyslipidemia and isolated DM2 were associated with loss of CAL. However, DM2 is still an important factor to determine the periodontal destruction, especially with signs of severe

periodontitis.

Diabetes and periodontal disease are two chronic disorders considered to be biologically related. The prevalence of periodontitis in patients with diabetes is estimated to be double or triple as compared to the normal population,^[14] and a bidirectional relationship appears to exist between both the diseases. Hyperglycemia and the resulting advanced glycation end product formation is one of several pathways that are thought to lead to the higher amounts of interleukin IL-17, IL-23, interferon- γ , IL-1 β , and osteoregulators associated with bone resorption.^[16,17] Thus, DM2 is strongly and positively correlated with periodontal destruction.^[14]

Dyslipidemia is defined as high blood concentration of lipids (especially LDL and TGs). It can arise from metabolic disorders, such as DM2, and also from a high-fat diet.^[8] In a recent study, it was associated with destructive periodontal disease.^[11] Lipids may interact directly with cellular membranes of macrophages,

inducing expression of genes of growth factors and proinflammatory cytokines, such as tumor necrosis factor- α (TNF- α) and IL-1 β .^[18] Fentoğlu O et al while analyzing different inflammatory markers in gingival crevicular fluid in participants who had hyperlipidemia and those who were healthy, indicated that serum lipoprotein associated phospholipase A2 and high-sensitivity C-reactive protein (hs-CRP), as well as proinflammatory cytokine (TNF- α , IL-6) gingival crevicular fluid levels, may play an important role in the association between periodontal disease and hyperlipidemia.^[19,20]

In another study by Ramirez-Tortosa et al an association was observed between periodontitis and altered plasma fatty acids and the levels were directly related to periodontal PD and CAL.^[21] Similarly, Fentoğlu O evaluated periodontal conditions of patients with normal lipid levels and those with hyperlipidemia, and confirmed that mild or moderate hyperlipidemia manifested higher values of periodontal parameters compared with individuals with normal lipid levels.^[11]

Our present study also showed a possible association between blood lipid levels and periodontal condition but diabetes mellitus 2 was still highly associated with periodontal disease.

Another study by Lim et al included multivariate analyses of periodontal parameters (percentage sites with PD >5 mm) and several systemic markers (HDL, LDL, TG, hs-CRP, and hemoglobin A1c [HbA1c]). Using adjustments for several parameters, only HbA1C, a glycemic control marker, remained as a significant variable,^[22] corroborating with present study by showing DM2's primary role in periodontal disease pathophysiology, overlapping with any cellular disarrangement caused by blood lipids. On the contrary, Machado AC et al, in a clinical trial enrolling Brazilian individuals, concluded that there was no significant relationship between periodontal disease, regardless of

its intensity, and blood lipid levels.^[23]

CONCLUSION

To conclude, patients who were systemically healthy, had DM2, had dyslipidemia, and had DM2 plus dyslipidemia, it appears that DM2 plus dyslipidemia and DM2 alone are strong predictors for periodontal disease, DM2 being more important as a risk factor for chronic periodontitis. However, there are some limitations to the present study as well such as the small sample size, which does not allow generalization of the outcomes. Also, different degrees of glycemic control were not included in this study. Thus, within the limits of this study, it could be concluded that dyslipidemia associated with diabetes and isolated diabetes did influence periodontal conditions in patients and further investigation evaluating cellular or microbiologic and also clinical aspects of periodontal disease needs to be done to fully evaluate this relationship and identify real risk factors for periodontal disease.

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