Research Article

AHB Advances in Human Biology

Adv Hum Biol 2013; 3(1):21-28.

The Effect of Improved Periodontal Health On Metabolic Control In Type 2 Diabetes Mellitus

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ABSTRACT

Objectives: The aim of the present study was to investigate the effect of improved periodontal health on metabolic control in type 2 diabetes mellitus (DM) patients.

Material and Methods: Fifty (50) patients with type 2 DM were selected. Subjects were randomly assigned into two groups. Data collection: Plaque index (PI), gingival index (GI), probing pocket depth (PPD) and bleeding on probing (BOP) were recorded at baseline and after 3 months. Glycosylated haemoglobin (HbA1c), were analysed at baseline, 3 months following the periodontal therapy. The treatment group received full-mouth scaling and root planing whereas the control group received no periodontal treatment.

Results: A statistically significant effect could be demonstrated for PI, GI, PPD, CAL and BOP for the treatment group. HbA1c levels in the treatment group decreased significantly whereas the control group showed a slight but insignificant decrease for this parameter.

Conclusions: The results of this study showed that non-surgical periodontal treatment is associated with improved glycaemic control in type 2 patients and could be undertaken along with the standard measures for the diabetic patient care.

Keywords: Type 2 diabetes mellitus, glycosylated hemoglobin, chronic periodontitis

INTRODUCTION

The stability and integrity of the periodontal tissue are influenced by an ever-changing balance within the conditions in the mouth which constitute the environment of tooth. The balance is such that change in one environment is likely to influence the other.[1]Periodontal disease is an inflammatory process, in which the primary etiologic factor may be microbiologic, systemic, or physical injury. It is a condition that affects and destroys the attachment apparatus. The sign and symptoms are gingival bleeding, increase in probing depth, pain, destruction of periodontal attachment and tooth loss.[2] Recently, much emphasis has been laid down to potentiate the impact of systemic disease on the oral health. Many systemic diseases and disorders have been impacted as risk indicator or risk factor in periodontal disease. One such example is diabetes mellitus.[3]

Diabetes mellitus is complex and globally evolving chronic health problem faced by the world today. The Indian task force on diabetes care have reported a crude prevalence rate of 9% in urban and 3% in rural population. The studies reported there is at least 2-fold increase in risk of periodontal disease in diabetic when compared with healthy controls.[4,5,6] The systemic manifestation of diabetes include artherosclerosis, microangiopathy,

Received: Dec. 01, 2012: **Accepted**: Dec. 15, 2012
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pISSN 2321-8568
eISSN 2348-4691

ocularretinopathy, and artherosclerotic heart disease. However Loe (1993) has declared periodontal disease as the "sixth" complication of diabetes mellitus.

Intervention trials have assessed the potential effect of periodontal therapy on glycemic control in diabetic subjects. However, they did not produce enough evidence to establish the fact that periodontal therapy is effective in improving the metabolic control in same group. On the other hand, several studies of diabetic subject with chronic periodontitis showed improvement in glycemic control following scaling and root planing. This was followed by short term reduction in level of glycated hemoglobin(HbA1c).[7]

The aims of present study are:

1. To compare clinical changes (by Plaque index, Gingival index, Probing depth, Sulcus bleeding index) in response to conventional periodontal treatment– scaling and root planing, of type-2 diabetic population as a test group with moderate Generalized Chronic Periodontitis at baseline and at 3 months.

2. To compare metabolic status of type-2 diabetic with HbA1c at baseline and at 3 months.

MATERIALS AND METHOD

Present study is a prospective, interventional, comparative, clinical study and carried out on a population of diabetic individuals with moderate generalized chronic periodontitis. The study aimed at comparing a single group of subjects with pre-treatment and post-treatment evaluations. This comparative Clinical study was carried out in the Dept. of Periodontics, Karnavati School of Dentistry, Uvarsad, Gujarat. The study protocol was explained to each potential subject, and written informed consent was obtained prior to the commencement of any treatment. This study was approved by the research review board committee of Karnavati school of Dentistry.

Study design

50 subjects with type 2 diabetes mellitus with moderate generalized chronic periodontitis were recruited for the study from the outpatient department of the Periodontics, Karnavati School of Dentistry, Uvarsad, Gujarat. Their daily routine, attitude and responsiveness were evaluated by asking routine questions. The aims and objectives of the study along with the duration and method were elaborated and explained to the subjects. Each patient was divided into two groups as under as

1. Treatment (test) group.
2. Non-treatment (control) group.

The inclusion criteria were:

1. Age group: 35-70 years
2. Presence of moderately controlled type 2 diabetes mellitus with HbA1c 6-8%
3. Clinical diagnosis of moderate generalized chronic periodontitis (one site with probing pocket depth ≥5mm).
4. No major diabetic complications like retinopathy, nephropathy, cardiopathy and cerebrovascular changes.
5. No history of systemic antibiotic administration within last four months.
6. No periodontal treatment four months prior to the study.

The exclusion criteria's were:

1. Presence of any systemic disease that could influence the course of periodontal disease like leukemia, febrile conditions, chronic respiratory diseases etc.
2. Intake of antibiotics or anti-inflammatory drugs in the last four months.
3. Current smokers or ex-smokers for four to six months.
4. Pregnancy.
5. Patients on anticoagulation therapy.
6. Radiographs showing any periapical pathology.
7. Inability of the persons to cooperate because of their physical or mental status or daily routine.

The study group underwent an initial examination consisting of

1. History
2. Complete clinical periodontal examination
3. Blood investigations.

The patients were examined at baseline and after three months of periodontal therapy. The participants were instructed to continue with their medical management of diabetes mellitus (oral

hypoglycemic agents, diet, and life style) without any modifications during the study period.

Data collection

Clinical periodontal examination: the periodontal parameters were recorded at baseline (day 0) and 3 months following the periodontal treatment.

The parameters recorded were:

1. Plaque index (PI) (Silness P and Loe H 1964).
2. Gingival index (Loe H and Silness J 1963).
3. Sulcus bleeding index (SBI) (Muhlemann HR and Son S 1971).
4. Pocket probing depth.
5. HbA1c test.

Treatment Regimen

Conventional periodontal treatment, scaling and root planing under local anesthesia (if necessary) was carried out. Follow up examination done at 3 months including all elements of initial examination [Determination of HbA1cand, Periodontal examination by clinical variable assessment with Plaque Index, Gingival Index, sulcus bleeding index (SBI), PPD (Probing Depth).

STATISTICAL ANALYSIS

All the descriptive data for each of the groups which included mean, standard deviation were determined. The data derived for each of the groups was analyzed by Paired Samples T-Test. For all tests, a P-value of <0.0001 was considered statistically significant.

RESULTS

This study was being conducted on 50 patients. 25 diabetics as test group and 25 diabetics as control group with chronic generalized periodontitis were enrolled.

In test group out of 25 patients 12 patients (48%) were male and 13 patients (52%) were female. Mean age in test group were 44.04 years. In control group, 15(60%) were males and 10(40%) were females, with mean age of 45.00 years.

Periodontal parameters

Plaque Index-The mean plaque index score was 1.96±0.444 at baseline which declined to 1.26±0.194, at 3 months after the periodontal therapy in test group and in control group mean plaque score is 1.63±0.3999 at base line and 1.62±0.4222 at 3 months. The mean difference of test group was 0.69. It was statistically significant (p<0.0001).

Gingival Index-Following the treatment, the GI dropped from 1.92±0.492 at baseline to 1.25± 0.141 after 3 months in test group, and in control group GI from 1.51±0.312 at baseline to 1.52±0.311 after 3 months in control group. Reduction in the gingival index was statistically significant (p<0.0001) in test group at baseline to 3 months.

Probing Pocket Depth- Following the non-surgical periodontal treatment PPD decreases from 3.19±0.577 baseline to 2.41±0.335 after 3months in test group. While in control group 3.23±0.507 at baseline to 3.61±0.493 after 3 months.Reduction in the PPD was statistically significant (p<0.0001) in test groups at baseline to 3 months, and increase significantly in control group (p<0.0001).

Sulcus Bleeding Index- The mean SBI was 2.68±0.872 at baseline, which declined to 1.54±0.509 at 3 months after the periodontal therapy in test group. In control group SBI which was 2.28±0.681 increased to 2.54±0.758 at 3 month. Mean reduction in SBI at baseline to 3 months after periodontal therapy was statistically significant (p<0.0001) in test group.

Metabolic parameter

Glycated Hemoglobin- The mean HbA1c value at baseline was 7.14±0.697 which reduced to 6.55±0.740 after 3 months after the periodontal therapy in test group which was statistically significant (p<0.0001). While HbA1c reduced between baseline to 3 months of interval in control group but reduction was not statistically significant (p=687).

DISCUSSION

Periodontitis is a complex multi factorial disease. Similarly diabetes mellitus is a complex metabolic syndrome. It is the complexity of both of these processes which has contributed to the controversies and their probable interrelationship in the literature.[8]Type 2 diabetes mellitus has shown a spectacular increase in the past few

decades.[9] It is generally perceived that subjects with diabetes mellitus are at a great risk of having periodontitis. Additionally periodontitis has also been found to modify the effect of diabetes mellitus.[10]

Our aim of present study was to evaluate metabolic control of diabetes, after periodontal treatment by means of improvement in blood HbA1c level after 3 months in patients with moderate periodontitis. Primary methods used to diagnose Diabetes Mellitus and monitor blood glucose level have been Fasting Blood Glucose, glucose assay, and HbA1c assay (glycated Hb assay) has been developed which does not require fasting, doesn't rely on patient compliance and gives indication of blood glucose level over an extended period of time of past 3 to 4 months.

The second aim of present study was to compare clinical variables (plaque index, bleeding index, gingival index, probing depth) in response to conventional periodontal treatment – scaling and root planing of type 2 diabetic individuals with moderate Generalized Chronic Periodontitis.

The metabolic assessment was based on the assessment of blood HbA1c levels. Blood glucose measurements show the level of glucose in blood at a given moment of time. In contrast, HbA1c measurements predict the level of glucose in blood over a period of time (30-90 days). The glycosylated hemoglobin assay is a relatively new test used in the diagnosis and monitoring of the diabetic patient. This assay is of interest as it offers advantages over traditional blood glucose monitoring methods.[11] Numerous proteins in the body are capable of being glycated. Glycated hemoglobin is formed continuously in erythrocytes as a product of the non-enzymatic reaction between the hemoglobin protein, which carries oxygen molecules, and glucose. Binding of glucose to hemoglobin is highly stable; thus hemoglobin remains glycated for the life-span of erythrocyte is approximately 123±23 days.[12]

One of the hemoglobin fractions resulting from the glycosylation reaction is hemoglobin A1c. It is the fraction which is elevated in the diabetic and which is measured by the assay. There are principally three methods of HbA1c examination: flow cytometry, high performance liquid chromatography and turbidimetric inhibition immunoassay (TINIA). The method used in this study is by turbidimetric inhibition immunoassay (TINIA) by COBAS e411 auto analyzer. This method is easily accessible and widely applied in routine practice of Medicine.[13]

The influence of diabetes on periodontal health and vice versa has been discussed widely in the dental literature.[14,15] More direct evidence regarding the effects of periodontal infection on glycemic control in diabetes comes from treatment studies. There is evidence to support that periodontal infection has adverse effect on glycemic control.[6,16,8,17] However, not all investigations report about improvement in glycemic control after periodontal treatment.

A number of studies reported a high incidence and severity of periodontal disease in diabetic patients as compared with the non-diabetic controls.[14] Considering that patients with diabetes have a higher risk for infection that is due to vascular alterations and poor healing responses, one stage periodontal therapy was adopted to minimize, the risk for re-infections and to reduce the repeated trauma and edema that are responsible for the continued maintenance of high levels of pro-inflammatory cytokines. After treatment, there were improvements in all of the monitored clinical parameters. These improvements were reflected at the systemic level by alterations in serum inflammatory markers and as verified in previous studies, a reduction in HbA1c.[6]The findings of the present study are in support of the above studies.

A number of different surgical and non-surgical therapies have been successful in achieving this goal. The primary non-surgical approach involves mechanical scaling and root planing. If a patient suffering from periodontitis is able to establish and maintain effective individual oral hygiene, subgingival scaling and root planing may result in resolution of inflammation, reduced probing pocket depth and clinical attachment gain (Kahldahl et al 1996).[18] The current study, utilizing non-surgical periodontal therapy, showed a significant reduction in infection and periodontal inflammation, in test, as well as reduced HbA1c levels after 3 months in test group.

Significant improvement in plaque control was seen throughout in the present study, in agreement with study of Ricardo Faria-Almeida, -Ana Navarro, and Antonio Bascones (2006)[19],Debora C. Rodrigues (2003)[20], Grossi et al (1997)[22,]In present study, test group plaque score reduction from baseline to 3 months, at all examinations p<0.0001, suggested of highly significant improvement.

Significant changes (p<0.0001) in bleeding index and gingival index were also evident in the study in test group. Other studies by Christgau M et al[17], Patricia AA et al, Ricardo FA et al[19], Kiran M et al[23], also showed similar results. PI reductions were 30% to 34%, GI reductions were 19% to 25% and the reductions in BOP were 63% to 65% and 60% in diabetics in the studies done by Rodrigues DC et al[20], Kiran M et al[23].

Statistically significant differences (P<0.0001) in mean probing depth, were found in test groups. However, test groups showed significant improvements (P<0.0001) at baseline to 3 months.Probing depth observed in our study are in agreement with Grossi et al.(1997)[21] who, using doxycycline, showed reductions of 17% at 3 months 23% at 6 months in type 2 diabetic patients. The reduction in probing depth observed in study of Débora C. Rodrigues (2003)[20] was 25% after 3 months. Whereas pocket probing depth is significantly increased in control group with mean difference of -0.38 (p<0.0001). This data support the data of Kiran M et al[23].

In the present study reduction in HbA1c level in test group was from baseline to 3 month 9.10%. These results suggested that non-surgical periodontal therapy leads to reduction in HbA1c levels, especially in patients with an elevated degree of diabetes mellitus severity and periodontal disease. Thus it is possible that, treatment of chronic periodontitis improve glycemic status of diabetics. And this status is measured by HbA1clevels, which is an accurate, specific (specificity of HbA1cassay is 83 to 89%) and sensitive (sensitivity of HbA1cassay is 45 to 90%) marker of long term metabolic control (30 to 60 days) in diabetic population. Reduction in HbA1clevel of present study confirms results of prior studies. In the study of Débora C. Rodrigues (2003)[20]both groups showed reductions in HbA1c levels. Although for Group 1 (one stage full mouth scaling and root planing plus amoxicillin/ clavulanic acid 875 mg) it was not statistically significant, and fasting glucose levels were minimally altered. The change in HbA1c levels was 4% in G1 and 11% in Group 2 (one stage full mouth scaling and root planing alone), with a statistically significant difference between groups by ANNOVA. Stewart et al.(2001)[22] in a retrospective study, evaluated patients who received scaling and root planing without antibiotics; after 10 months, glycated hemoglobin examinations were performed and revealed an average reduction of 17% from baseline HbA1c levels. HbA1c level in control group was at baseline 6.83±0.682, and after 3 months it was 6.81±0.698. This also showed that control group has reduced HbA1c but results were not significant.

Hence, there is a two-way relationship between diabetes mellitus and periodontitis, with the former producing a greater severity of periodontal disease and the latter compromising blood glucose control in diabetic patients. Treatment of periodontitis in diabetic patients would lead to a reduction in the soluble mediators responsible for periodontal tissue destruction and would lessen the insulin resistance of the tissues. The findings of this study showed that effective periodontal treatment resulted in lower glycemic levels, which can be measured with the help of HbA1c assay – a reliable long term marker of glycemic control and in the reduction of clinical parameters of periodontal infection, confirming the existing interrelationship between diabetes mellitus type-2 and periodontitis. Therefore, periodontal treatment should be included in diabetes preventive measures.

CONCLUSION

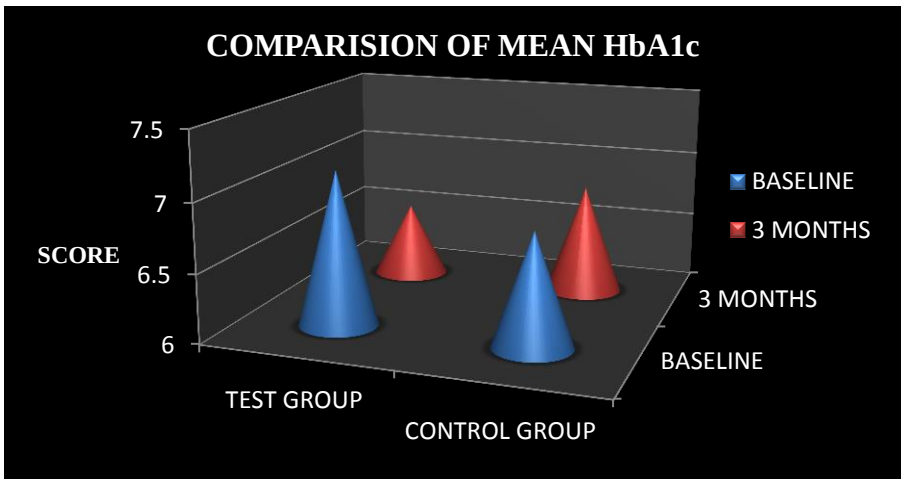
The clinical and the metabolic improvements following periodontal therapy is a strong indicator of the correlation between type 2 diabetes mellitus and periodontitis. Effective control of the inflammatory process by the reduction of pathogenic bacteria and of the diabetic condition provides a favorable periodontal tissue environment that leads to clinical improvements as observed in this study.

Table 1: Clinical and Metabolic parameters in test group at Baseline, and 3 months in response to conventional periodontal treatment

CLINICAL PARAMETERS			
S.No	Parameters	Mean±SD At Baseline (N=25)	Mean±SD At 3 months (N=25)
1.	Plaque index (PI)	1.96±0.444	1.26±0.194
2.	Gingival index (GI)	1.92±0.492	1.25±0.141
3.	Probing Pocket depth (PPD)	3.19±0.577	2.42±0.335
4.	Sulcus bleeding index (SBI)	2.68±0.872	1.54±0.509
METABOLIC PARAMETERS			
S.No	Parameters	Mean±SD At Baseline (N=25)	Mean±SD At 3 months (N=25)
1.	HbA1c	7.14±0.697	6.55±0.740

Table 2: Clinical and Metabolic parameters in Control group at Baseline and 3 months.

CLINICAL PARAMETERS			
S.No	Parameters	Mean±SD At Baseline (N=25)	Mean±SD At 3 months (N=25)
1.	Plaque index (PI)	1.63±0.3999	1.62±0.4222
2.	Gingival index (GI)	1.51±0.312	1.52±0.3111
3.	Probing Pocket depth (PPD)	3.23±0.507	3.61±0.493
4.	Sulcus Bleeding index (SBI)	2.28±0.681	2.54±0.758
METABOLIC PARAMETERS			
S.N0	Parameters	Mean±SD At Baseline (N=25)	Mean±SD At 3 months (N=25)
1.	HbA1c	6.83±0.682	6.81±0.698



Graph 1: Comparison of mean HbA1c

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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