Comparative Evaluation of Clinical Changes in Type-2 Diabetic & Non-Diabetic Patients with Chronic Generalized Periodontitis And Metabolic Improvement of Blood HbA$_{1c}$ Level After Conventional Periodontal Treatment

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Abstract:
Aim: *India leads the world today with largest number of diabetic patients in any given country. One forth of total diabetic population of world is in India, majority of them are of type-2 diabetics. Our aim of present study was that after control over periodontal infection by conventional non-surgical periodontal treatment, to evaluate metabolic control of type-2 diabetes by means of improvement in blood HbA1c level after 3 & 6 months.*
Material & Methods: *Present study was carried out for management of periodontal infection by conventional periodontal treatment – scaling & root planing, in experimental group with type 2 diabetics and control group, non diabetics; both groups with moderate generalized chronic periodontitis. Clinical parameters measured were the plaque index, bleeding on probing index, probing depth & level of clinical attachment and metabolic response in tpe-2 diabetic patients by means of HbA1c at 3 & 6 months.*
Results*: An improvement in all clinical variables was observed, with no statistically significant differences between the groups, with the exception of probing depth (p<0.016) which shows significantly better outcomes for the control group. The improvement observed in blood HbA1c levels confirmed a positive metabolic response to periodontal treatment.*
Conclusion*:With this study, we conclude that,,non surgical conventional periodontal therapy can lead to definitive improvement in HbA1c level of type-2 diabetics.*
Key words: *conventional periodontal treatment, diabetes mellitus type 2, HbA1c,moderate Generalized Chronic Periodontitis.*

I. Introduction

Diabetes is a significant illness that is on the rise all over the world. InIndia, the incidence of diabetes is increasing at an alarming rate. There were 24 million diabetics in the year 2000 and this figure is expected to reach 57.2 million by 2025. India leads the world today with largest number of diabetic patients in any given country.[1]

Prevalence, severity and extent of periodontal disease are higher in patient with diabetes mellitus (DM) than in non diabetic control.[2-7] In patients with diabetes mellitus (DM),accumulation of AGEs (Advance Glycated end Products) increases periodontal disease severity [9,37] by upregulation of proinflammatory cytokines from monocytes/polymorphonuclear leukocytes and down regulation of growth factors from macrophages.[9] Periodontal attachment loss increased in diabetic patients because of degradation of collagen fibres by MMPs (MMP-8 & 9), which are elevated in diabetic tissues, including the periodontium. Impaired osseous healing and bone turnover also seen in association with hyperglycemia. [11,12] In individuals with type-2 diabetes, who already has insulin resistance, further tissue resistance to insulin induced by infection like periodontitis may considerably exacerbate poor glycemic control.[8]

Among various methods of measurement of glycemic control,HbA$_{1C}$ assay is a glucose assay, which doesn't require fasting, doesn't rely on patient compliance & gives indication of blood glucose level over an extended period of time. HbA$_{1C}$ assay, is based on the knowledge - blood glucose becomes slowly, nonenzymatically& irreversibly bound to hemoglobin molecules.[14,36] HbA$_{1C}$ is the component resulting from post translational modification of HbA by glucose at the N –terminus of β chain. Glycosylated Hemoglobin (GHb) is a general term for glucose bound nonenzymatically to hemoglobin with a ketoamine structure. Sincethe average life span of RBCs is 120days, the HbA$_{1C}$ assay will reveal patient's glucose status over the

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half-life of RBCs, or approximately 30 to 90 days.[14] As self-monitoring blood glucose gives a snapshot of control at the time of the test, while the HbA1c test gives the big picture of control over the past 3-4 months. So that, HbA_{1C} assay should be of interest to Periodontist.[14,15] Although many studies have examined the effect of diabetes on periodontium, fewer have endeavored to examine the effect of periodontal infection on control of diabetes.[16-19, 33, 34]Data suggest, treatment of chronic periodontitis improve glycemic status of diabetic.[20,21] Present study focuses over the clinical and metabolic status in type-2 diabetics after non-surgical periodontal therapy.

II. Materials And Methods

Present study was a prospective, parallel, comparative, longitudinal clinical study & carried out for management of periodontal infection in experimental group with type 2 diabetics and control group with non diabetics.

2.1 Selection Criteria :
2.1.1 Inclusion Criteria
1. Patient's age between 35-70 years.
2. Presence of type 2 diabetes, criteria for Diagnosis of Diabetes Mellitus are -Symptoms of diabetes plus $HbA_{1c} \geq 6.0$ % , random blood glucose conc. 200mg/dl , Fasting plasma glucose $\geq$ 126mg/dl .Two hour plasma glucose, After 75 g oral glucose taking $\geq$ 200mg/dl (Harrison's 15[th]ed, Principles of Internal Medicine)
3. Clinical diagnosis of moderate Generalized Chronic Periodontitis defined by loss of clinical attachment of 4 to 6 mm in all quadrants. Radiographically assessed bone loss of 30-50%
4. Presence of $\geq$ 10 teeth per dental arch, excluding third molars.
5. No Previous Periodontal Treatment taken.
6. Signing of informed consent and commitment to post treatment follow up visits.
7. No modification in medication in 2 months before or during the study.

2.2.2 Exclusion Criteria
1. Presence of systemic disease that could influence the course of periodontal disease or hemoglobin level of blood .
2. Intake of antibiotics on anti-inflammatories 4 weeks before the study.
3. Current Smokers or Ex-smokers of < 5 years.
4. Pregnancy or intention to be pregnant during the 6 months of study.

2.2 Sample size :
After applying the inclusion and exclusion criteria two groups of patients consecutively selected : 20 patient, with type 2 diabetes visiting diabetes OPD, Department of Medicine Civil Hospital Ahmedabad having periodontal disease were selected as an experimental group and 10 patients, with Moderate Chronic Generalized Periodontitis came to OPD of Dept. of Periodontology, Govt. Dental college & hospital Ahmedabad were selected as a control group.

2.3 Clinical assessment
Clinical assessment had been done by using plaque Index (TURESKY – GILMORE – GLICKMAN MODIFICATION OF THE QUIGLEY-HEIN PLAQUE INDEX), gingival Bleeding Index (GBI) of Ainamo and Bay, probing depth and clinical attachment level in mm measured by UNC 15 probe.

2.4 Blood Investigation
Venous blood samples were collected & assessed for Fasting blood glucose & HbA1c, at baseline and after 3 months & 6months of completion of treatment . Fasting blood sugar done by O – toludin method . Estimation of HbA1c was done by Chromatographic spectrophotometric ion exchange method. Blood investigations were done in Diabetes Research Centre, BJ Medical College Ahmedabad.

2.5 Treatment Regimen
Conventional Periodontal treatment scaling and root planning under local anesthesia (if necessary) in 4 sessions. Maximum time interval between each session of scaling and root planning should be 4 weeks.

III. Results

TABLE-1 Demographics of Study population

GROUP	MEAN AGE	MALE	FEMALE	TOTAL NO. OF CASES
Diabetic CGP patients	50	9	11	20
Nondiabetic CGP control patients	43.3	4	6	10

CGP = Chronic Generalized Periodontitis

TABLE-2 Clinical and Metabolic parameters in Diabetic & Non diabetic CGP group of patients, At Baseline , 3 months & 6 months in response to conventional periodontal treatment

CLINICAL PARAMETERS						
S. NO	PARAMETER	DIABETIC CGP PATIENTS			NONDIABETIC CGP CONTROL PATIENTS		
		MEAN±SD AT BASELIE (N=20)	MEAN±SD AT 3 MONTH (N=20)	MEAN±SD AT 6 MONTHS (N=20)	MEAN±SD AT BASELIE (N=20)	MEAN±SD AT 3 MONTH (N=20)	MEAN±SD AT 6 MONTHS (N=20)
1.	PLAQUE INDEX (PI)	2.36±0.45	1.10±0.35	0.35±0.11	2.09±0.47	1.21±0.46	0.35±0.06
2.	BLEEDING INDEX (BI)	85.34±8.36	27.25±7.22	11.15±4.28	80.50±10.97	21.00±5.18	10.00±5.6
3.	PROBING DEPTH (PD)	3.69±0.41	2.81±0.33	2.35±0.21	3.96±0.40	2.93±0.22	2.25±0.30
4.	CLINICAL ATTACHMENT LEVEL (CAL)	3.87±0.52	3.00±0.47	2.53±0.59	3.98±0.42	3.00±0.47	2.31±0.36
METABOLIC PARAMETERS						
S.NO	PARAMETER	DIABETIC CGP PATIENTS			NONDIABETIC CGP CONTROL PATIENTS		
		MEAN±SD At Baseline (N=20)	MEAN±SD At 3 months (N=20	MEAN±SD At 6 months (N=20)	MEAN±SD At Baseline (N=20)	MEAN±SD At 3 months (N=20	MEAN±SD At 6 months (N=20)
1.	FASTING BLOOD SUGAR (FBS)	178.95±63.45	123.75±35.74	109.20±16.76	96.2±10.22	88.9±6.36	86.8±7.94
2.	HBA$_{1C}$	8.93±0.78	7.91±0.97	6.97±0.65	6.6±0.32	6.4±0.4	6.02±0.23

TABLE-3 Improvement of Clinical and Metabolic parameters in Diabetic group after conventional periodontal treatment

| CLINICAL PARAMETERS							
S.NO	PARAMETER	Reduction From Baseline to 3 months (N=20)		Reduction From 3 months to 6 months (N=20)		Reduction From Baseline to 6 months (N=20)	
		MEAN±SD	P-Value	MEAN±SD	P-Value	MEAN±SD	P-Value
1.	Plaque index (PI)	1.26±0.44	0.00	0.74±0.31	0.00	2.01±0.42	0.00
2.	Bleeding index (BI)	58.09±8.5		16.10±6.0		74.19±7.75	
3.	Probing depth (PD)	0.87±0.32	0.00	0.45±0.21	0.00	1.33±0.36	0.00
4.	Clinical attachment Level (CAL)	0.86±0.32	0.00	0.46±0.22	0.00	1.33±0.37	0.00
METABOLIC PARAMETERS							
S.NO	PARAMETER	From Baseline to 3 months (N=20)		From 3 months to 6 months (N=20)		From Baseline to 6 months (N=20)	
		MEAN±SD	P-Value	MEAN±SD	P-Value	MEAN±SD	P-Value

		MEAN±SD	P-Value	MEAN±SD	P-Value	MEAN±SD	P-Value
1.	Fasting Blood Sugar (FBS)	59.20±49.21	0.00	14.55±38.60	0.108	69.75±60.45	0.00
2.	HbA$_{1c}$	1.01±0.70	0.00	0.94±0.87	0.00	1.95±0.98	0.00

Table-3 ($p < 0.0001$) suggestive of a statistically highly significant decrease in all clinical & metabolic parameters, from baseline to 3 months to 6months & baseline to 6 months in type 2 diabetic patients with Chronic Generalized Periodontitis after conventional periodontal therapy.

TABLE-4 Differences in Clinical & Metabolic parameters in Control group after conventional periodontal treatment

CLINICAL PARAMETERS							
S.NO	PARAMETER	Reduction From Baseline to 3 months (N=20)		Reduction From 3 months to 6 months (N=20)		Reduction From Baseline to 6 months (N=20)	
		MEAN±SD	P-Value	MEAN±SD	P-Value	MEAN±SD	P-Value
1.	Plaque index (PI)	0.87±0.63	0.002	0.85±0.47	0.00	1.73±0.46	0.00
2.	Bleeding index (BI)	59.50±11.78	0.00	11.00±5.01	0.00	70.50±9.05	0.00
3.	Probing depth (PD)	1.02±0.44	0.00	0.68±0.42	0.001	1.71±0.40	0.00
4.	Clinical attachment Level (CAL)	0.93±0.41	0.00	0.73±0.40	0.00	1.66±0.41	0.00
METABOLIC PARAMETERS							
S.NO	PARAMETER	From Baseline to 3 months (N=20)		From 3 months to 6 months (N=20)		From Baseline to 6 months (N=20)	
		MEAN±SD	P-Value	MEAN±SD	P-Value	MEAN±SD	P-Value
1.	Fasting Blood Sugar (FBS)	7.30±12.28	0.093	2.1±3.9	0.123	9.4±12.09	0.036
2.	HbA$_{1c}$	0.21±0.60	0.298	0.41±0.4	0.110	0.62±0.4	0.002

TABLE-5 Comparison of Clinical parameters in between Diabetic & Control group after conventional periodontal treatment

CLINICAL PARAMETERS							
S.NO	PARAMETER	From Baseline to 3 months (N=20)		From 3 months to 6 months (N=20)		MEAN±SD From Baseline to 6 months (N=20)	
		MEAN± SD difference	P-Value	MEAN± SD difference	P-Value	MEAN± SD difference	P-Value
1.	Plaque index (PI)	0.38± 0.19	0.63	-0.11± 0.14	0.447	0.27± 0.16	0.116
2.	Bleeding index (BI)	-1.41± 3.75	0.710	5.10± 2.22	0.099	3.69± 3.17	0.255
3.	Probing depth (PD)	-0.14± 0.14	0.030	-0.23± 0.11	0.057	-0.37± 0.14	0.016
4.	Clinical attachment Level (CAL)	-0.06± 0.13	0.021	-0.26± 0.11	0.027	-0.33± 0.15	0.035

Table-5   p < 0.0001   suggestive of a statistically highly significant & p<0.05 suggestive of a statistically significant decrease in all clinical parameters, but obvious metabolic status remain stable, from baseline to 3 months ,3 months to 6months & baseline to 6 months in nondiabetic patients with Chronic Generalized Periodontitis after conventional periodontal therapy.

Among the clinical variables studied, only probing depth & clinical attachment level showed a statistically significant difference between the control and test group after periodontal treatment. The control group showed a stastistically siginificant   greater reduction in probing depth as well as improvement in cinical attachment level (p<0.05) a result of the periodontal treatment. Test group has shown highly significant(p<0.0001) improvement in HbA1c level after conventional periodontal therapy.
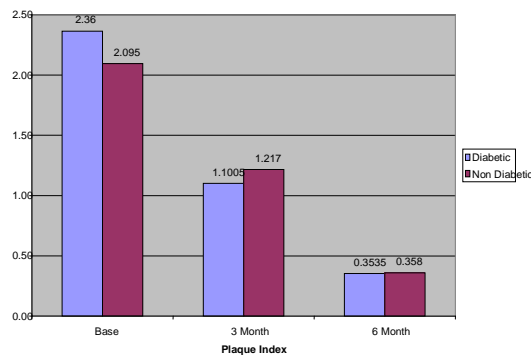
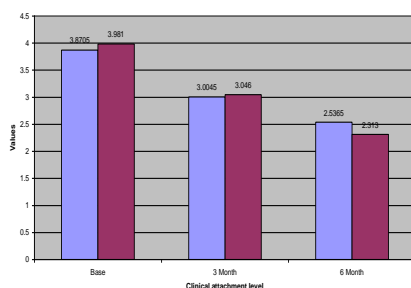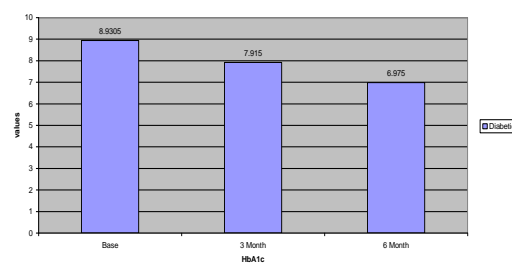**GRAPH-1 :** Plaque index
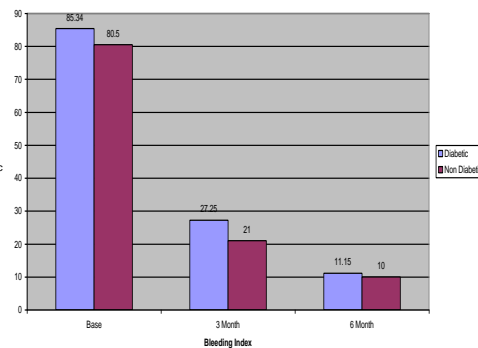
GRAPH-2 : Bleeding index
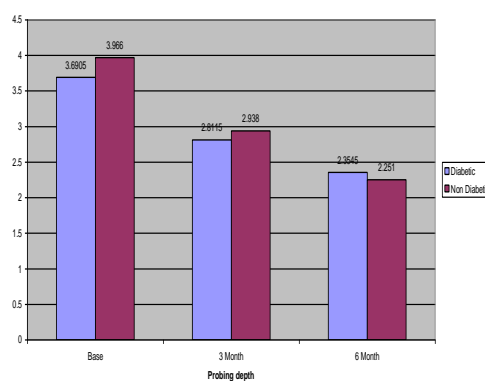
GRAPH 3 : Probing depth

GRAPH 4: Clinical Attachment Level   **GRAPH 5:** HbA$_{1c}$ level in diabetic group

IV. Discussion

Present study was a prospective, parallel, comparative longitudinal clinical study. Very strict inclusion and exclusion criteria were applied to minimize confounding factors. Our aim of present study was that after control over periodontal infection by conventional periodontal treatment – scaling and root planning (without any adjunctive antimicrobials), to evaluate clinical & metabolic status by means of improvement in blood HbA1c level & with clinical variables (plaque index, bleeding index, probing depth, clinical attachment level) in type-2 diabetics in comparison to non diabetics after 3 & 6 months.

HbA$_{1c}$assay, is a glucose assay as a metabolic parameter to check diabetes status of experimental population used worldwide in the field of periodontology.[9,10,20,21] Specificity of HbA$_{1c}$ assay is 83 to 89% & sensitivity of HbA$_{1c}$ assay is 45 to 90%.[14] . The metabolic assessment was based on blood levels of HbA$_{1c}$ andFasting blood glucose. The ADA (American Diabetic Association) recommends fasting Plasma glucose (FPG) as the screening test of choice.[26] In the present study obtained results of HbA1c were converted in to equivalent to a US National Glycohemoglobin Standardization Programme(NGSP) & Diabetes control & trial research group(DCCT), using the following formula:

%HbA1c-NGSP = 0.86 × %HbA1c –Biosystems + 0.24

This formula eliminates the chances of variation & increases accuracy of results in present study. Fructosamine and albumin levels have also been used for this purpose in some previous studies. [23]found that fructosamine assaycorrelated with the degree of gingival bleeding.

Furthermore, comparison of results of present study with published data must take into account the inclusion of a matched control group. The studies by Grossi et al.(1997)[16] and Stewart et al.(2001)[17]did not include a control group of non diabetic patients. At the beginning of present study , no statistically significant difference were observed between the diabetic and control groups in age, gender, number of teeth present.

The current study, utilizing non-surgical periodontal therapy[25-27], showed a significant reduction in infection and periodontal inflammation, in both diabetic& control group, as well as reduced HbA1c levels after 3 & 6 months in diabetic group.

In present study, diabetic group plaque score reduction (Table- 3, Row :1) from baseline to 3 months 54% & from base line to 6 months 76%. In non-diabetic group plaque score reduction (Table- 5, Row :1),at all examinations p<0.0001, suggestive of highly significant improvement in both groups. The diabetic & control groups did not significantly differ in plaque index (P>0.3986) (Table- 6, Row :1). In the study of RicardoFaria-Almeida, Ana Navarro, and Antonio Bascones (2006)[21], statistically significant differences were observed in both groups between baseline and 6 months 68 % reduction in diabetic group & 70 % in non-diabetic group (P<0.0001). Present study also shows similaritis in results with Debora C. Rodrigues (2003)[20]and Grossi et al(1997)[16] in the plaque score reduction.

In present study statistically significant difference observed in reduction of bleeding on probing at each interval in both the groups (p<0.0001) without significantly differ in between two groups (P>0.3546), favors the results in studies by Debora C. Rodrigues (2003)[20], Grossi et al (1997)[16] , Christgau et al.(1998)[25] .

Statistically significant differences (P<0.05) in mean probing depth reduction, were found between the two groups (Diabetic & control groups), with significantly (P<0.0343) better outcomes for the control group (Table- 6, Row :3). However, both groups showed significant improvements (P<0.0001) at each follow-up examination. Baseline and 6 months 37% reduction in diabetic group & 44% in non-diabetic group (P<0.0001) (Table- 3, Row :3 & Table- 5, Row :3). The reduction in probing depth observed in study of Debora C.Rodrigues (2003)[20] was 25% after 3 months.

Statistically significant differences in clinical attachment level were observed between the diabetic and control groups, with significantly (P<0.021) better outcomes for the control group (Table- 5, Row :4).

In present study at baseline Fasting Blood Sugar (FBS) in diabetic patients (Table- 2 & 3 , Metabolic Parameters Row :1 can not be reached up to statistically significant improvement at all examinations. FBS is highly variable with transient fluctuation in blood glucose level at the time of sampling. It can not be consider for long term metabolic control. This can be manipulated by patient (Piche, Swan, Hallmon;1989)[14] In non-diabetic control group (Table- 4 & 5, Metabolic Parameters Row :1, shows non- diabetic status of control group in comparison with diabetic group through out the study.

In present study reduction in HbA$_{1c}$ level in diabetic group (Table- 2 & 3 , MetabolicParameters Row :2) Was From Baseline To 3 Month 11.5%, From 3 To 6 Months 10.5% And From Baseline To 6 months 22%.These results suggestive of non surgical periodontal therapy leads to a reduction in HbA$_{1c}$ levels. Thus it is possible, treatment of chronic periodontitis improve glycemic status of diabetic. Reduction in HbA$_{1c}$ level of present study confirms results of prior studies as described follow: In the study of Debora C.Rodrigues (2003)[20] both groups showed reductions in HbA1c levels. The change in HbA1c levels was 4% in G1 (one stage full mouth scaling & root planning plus amoxicillin/clavulanic acid 875 mg)and 11% in G2 (one stage full mouth scaling &root planning alone), with a statistically significant difference between groups by ANCOVA. *Grossi et al. (1997)* [16] obtained similar numbers after 3 months of a combined non-surgical periodontal therapy

with doxycycline, and found a 10% reduction from the baseline levels of HbA$_{1c}$. *Stewart et al.(2001)* [17] in a retrospective study, evaluated patients who received scaling and root planning without antibiotics; after 10 months, glycated hemoglobin examinations were performed and revealed an average reduction of 17% from baseline HbA1c levels. HbA$_{1c}$ level in non-diabetic control group (Table- 4 & 5 , METABOLIC PARAMETERS Row :2) was at baseline 6.6±0.32, after treatment at 3 months 6.4±0.4,after treatment at 6 months 6.02±0.23. This also shows non- diabetic status of control group in comparison with diabetic group through out the study.

V. Conclusion

In present study, both the groups show statistically significant improvement in all the clinical variables at each follow-up examination, with statistically significant better outcomes for control group in probing depth & clinical attachment level. The diabetic patients showed statistically significant improvement in their metabolic control from baseline to 3 and 6 months as measured by HbA$_{1c}$ levels (p< 0.0001) after conventional periodontal therapy. Therefore, we can conclude, non surgical conventional periodontal treatment can improve glycemic status of type- 2 diabetics with chronic generalized periodontitis.

Acknowledgments & Conflicts of interest

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TABLE-1: Demographics of study population

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