Evaluation of Effect of SRP on the Levels of HbA1c in Prediabetic and Diabetes Mellitus type 2 Patients with Periodontitis

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Abstract: _Introduction_: *Effect of scaling and root planing (SRP) in controlling glycemic index in pre-diabetic individuals with chronic periodontitis has been evaluated in a very limited number of studies. _Objective_: This study is aimed to evaluate HbA1c levels after SRP in chronic periodontitis in 3 groups i.e., non diabetic patients, pre-diabetic patients and established controlled type 2 diabetes mellitus patients. _Methodology_: This comparative study was done on non diabetics and diabetic individuals who were 35 to 70 years old. Group A consisted of 15 non diabetic patients with periodontitis, Group B consisted of 15 pre-diabetic patients with periodontitis and Group C consisted of 15 diabetic patients with chronic periodontits. Gingival index (GI), Plaque index (PI), Pocket depth (PD), Clinical attachment loss (CAL), Fasting blood glucose (FG) and HbA1c levels of all the participants was recorded. All participants were given SRP and oral hygiene instructions. Clinical & laboratory evaluations were made at baseline, at 1st month and at the end of 3rd month. _Result_: The primary observation was statistically significant reduction in HbA1c parameter from 8.1±0.84 (baseline) to 7±0.50 (at 3rd month) in diabetics and 5.93±0.24 (baseline) to 5.52±0.38 (at 3rd month) in prediabetics. Secondary outcomes observed are reduced mean GI, mean PI, mean PD and mean CAL which indicates a improved periodontal status in patients. _Conclusion_: This study was able to established "bidirectional relationship". Improving one disease can alter the nature and progression of these chronic diseases. This study was able to highlight relationship of periodontitis and progression of prediabetes. There can be a marked improvement in diabetic status of prediabetics if periodontal health in kept under check. Though longitudinal studies with greater sample size are required to completely elucidate this relationship.*

Keywords: Prediabetes, Diabetes Mellitus, Periodontitis, HbA1c

1. Introduction

Chronic periodontitis is a long standing inflammatory disease affecting hard and soft tissues around teeth. It is considered as most common disease of oral cavity. [1] Various risk factors have been suggested which can modify the nature of progression of chronic periodontitis. These include biological risk factors like high blood pressure, high blood cholesterol, diabetes, genetic factors, and obesity. Behavioral risk factors like an unhealthy diet, physical inactivity, and tobacco use have been well documented. [2] Diabetes has been recognized to influence the prevalence and severity of periodontitis and is now accepted as sixth complication of diabetes mellitus. [3]

Diabetes Mellitus (DM) is a chronic hyperglycemic state characterized by high blood glucose levels, reduced peripheral absorption of glucose by cells and an increased risk of microvascular diseases. [4] Type 1 DM is 'insulin dependent' due to inability of β cells of pancreas to synthesize insulin whereas type 2 diabetes is 'non insulin dependent' which is characterized by reduced peripheral absorption of glucose by the cells. [4]

The prevalence of type 1 DM is 3 - 5% with a young age predilection whereas type 2 DM is 95% prevalent with an older age group predilection. [5] International Diabetic Federation in 2017 reported the prevalence of type 2 DM is way above 422 million individuals which accounts for a 8% of total world population. [6] Interestingly 1 in every 2 person is unaware of the condition which increase the complications associated with diabetes. [7]

Type 2 DM may be preceded by a buffer period which is termed as "Prediabetes", where the blood glucose is higher than the normal but lower than the diagnostic criteria for type 2 DM. The proposed pathological pathways associated with prediabetes are impaired β - cell function and increased insulin resistance. [7] Continued insulin resistance with a decrease in β - cell function, glucose levels in the blood become unregulated and prediabetes then evolves into full - blown diabetes. [7]

Type 1 DM appears to have a similar role in severity of periodontitis [8, 9] but it is less investigated. [10] The probable reason could be lesser prevalence of type 1 in comparison to type 2 DM and age of the individual affecting periodontitis.

A fascinating relationship between DM and periodontitis is its ''bidirectional relationship''. Both DM and periodontitis potentiate a chronic release of pro - inflammatory cytokines that in turn have a deleterious effect on the health of periodontal tissues, conversely, chronic systemic elevation of pro - inflammatory cytokines caused by periodontitis can predispose an individual with chronic periodontitis to develop type 2 DM. [11] Mechanical treatment like Scaling and Root Planing (SRP) along with therapeutic

antimicrobials have been proven to improve glycemic control in diabetic patients with periodontitis. [11]

2. Aim & Objective

This study is aimed to evaluate HbA1c levels after SRP in chronic periodontitis in 3 groups i. e. non - diabetic patients, prediabetic patients and established controlled type 2 DM patients.

3. Methodology

A comparative single blinded study was conducted in the Department of Periodontology, Shree Bankey Bihari Dental College, Ghaziabad on 45 patients. The patients were divided in 3 groups of 15 patients each.

Inclusion Criteria:
1) Patient's age between 30 and 70 years.
2) Glycemic status was defined by the diagnostic criteria laid by Ameriacan Diabetic Association, 2019 i. e. HbA1c (Normal <5.7%, Prediabetes 5.7 - 6.4%, Diabetes >6.5%), Fasting Plasma Glucose (Normal <100mg/dl, Prediabetes 100 - 126mg/dl, Diabetes >126mg/dl), Random Plasma Glucose (Diabetes >/=200mg/dl)
3) Periodontitis criteria: Generalized Moderate to Severe Stage II/ III Periodontitis as per Classification system of periodontal and peri - implant diseases and conditions 2017

4) Presence of ≥10 teeth per dental arch, excluding third molars.
5) No previous periodontal treatment taken.
6) Signing informed consent, and commitment to post - treatment follow up visits.
7) No modification in medication for 2 months, before or during the study.

**Exclusion Criteria:**
1) Presence of systemic disease that could influence the course of periodontal disease or hemoglobin levels in the blood
2) Intake of NSAIDs/ Antibiotics for 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.
5) Periodontal abscess or any other periodontal condition that may require adjunctive use of antibiotics locally or systemically.

Group A: 15 Non - diabetic patients with Periodontitis who received SRP (scaling and root planning).

Group B: 15 Prediabetic patients with Periodontitis who received SRP.

Group C: 15 Diabetic patients with Periodontitis who received SRP.
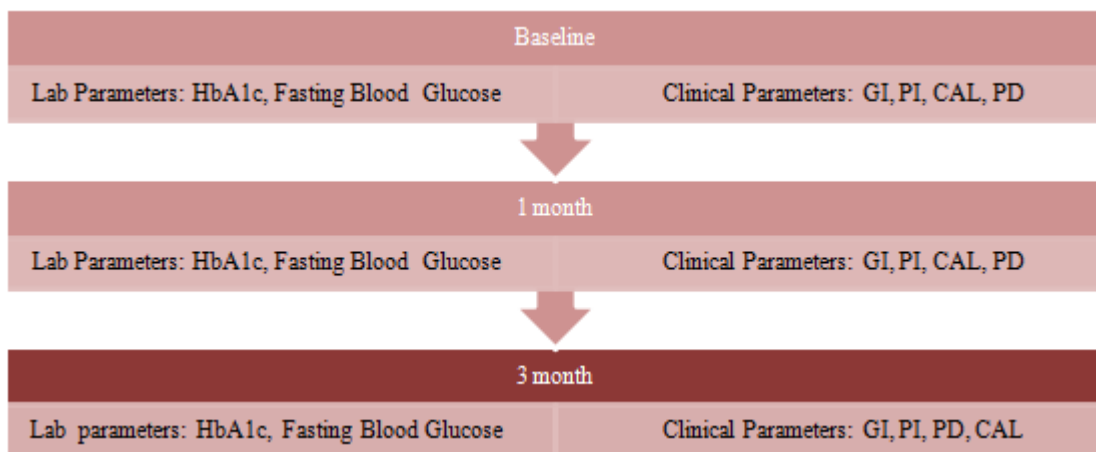
Clinical parameters like Gingival Index (GI), Plaque Index (PI), Pocket Depth (PD), Clinical Attachment Level (CAL) and laboratory parameters Fasting Blood Sugar, and HbA1c are recorded at baseline, at 1st month and at the end of 3rd month.

Statistical Analysis

ANOVA test was applied to study the parameters.

4. Results

Multivariate ANOVA test was applied to study the variance in mean HbA1c value intergroup and intragroup. The mean reduction in HbA1c (Table 1) was found to be statically significant (p <0.05) in Group B and C, whereas the

reduction in HbA1c observed was not statistically significant.

Table 1: Mean change in HbA1c between 3 groups (Primary Outcome)

HbA1c (in %)	Baseline	1 month	3 month	
Group A	5.1±0.27	5.0±0.28	5.1±0.6	p >0.05
Group B	5.9±0.24	5.7±0.29	5.5±0.38	P <0.05
Group C	8.1±0.84	7.4±0.66	7.0±0.50	p <0.05

Table 2: Mean periodontal parameters (Secondary Outcome)

Table 2.1: Group A

Other Parameters	Baseline	1month	3 month
mean GI	2.26	1.83	1.99
mean PI	2.42	1.91	2.1
mean PD	3.8	3.34	3.24
mean CAL	3.91	3.67	3.61
mean FG	86	82	84

Table 2.2: Group B

Other Parameters	Baseline	1month	3 month
mean GI	2.36	1.87	2.0
mean PI	2.22	1.86	1.97
mean PD	3.6	3.19	3.07
mean CAL	3.98	3.59	3.52
mean FG	118	108	109

Table 2.3: Group C

Other Parameters	Baseline	1month	3 month
mean GI	2.41	1.96	2.07
mean PI	2.52	2.13	2.19
mean PD	3.92	3.44	3.31
mean CAL	4.23	3.81	3.72
mean FG	184	163	151

5. Discussion

A low grade inflammation is associated with pathogenesis of type 2 DM and periodontal diseases. Cytokines play a central role in the pathogenesis. These pro - inflammatory cytokines are raised significantly in type 2 DM and Periodontitis. The raised level of cytokines associated with Periodontitis can potentiate the susceptibility and severity of type 2 DM whereas a chronic hyperglycemic state raises pro - inflammatory cytokines predisposing an individual to Periodontitis. Sun WL et al. [18] studied the levels of pro - inflammatory cytokines in a 3 month study in patients with periodontitis. They concluded that the patients who received periodontal therapy had found to have decreased pro - inflammatory markers like IL - 6, TNF - α and CRP. They also observed an improved glycemic control establishing a common inflammatory pathogenesis of type 2 DM and Periodontitis.

The present study was conducted with the prime objective to study non - surgical and non - pharmacological management of periodontitis in non - diabetics, prediabetics and diabetic patients. The study has able to demonstrate significant improvement in diabetes laboratory parameters and clinical periodontal parameters in prediabetics and diabetic patients. The primary observation was statistically significant reduction in HbA1c parameter from 8.1 ± 0.84 (baseline) to 7 ± 0.50 (at 3rd month) in diabetics and 5.93 ± 0.24 (baseline) to 5.52 ± 0.38 (at 3rd month) in prediabetics. Similar results have been observed in a RCT done by Elisabet Mauri - Obradors et al. [12] who conducted a 6 month follow up after SRP v/s supragingival scaling in type 2 DM. They observed improved glycemic parameters like HbA1c and fasting plasma glucose in accordance to our observations in Group 3. Similar results were observed by Mizuno H et al. [13] who observed a statistical change in levels of HbA1c in

periodontitis in non surgical SRP group v/s no treatment group at the end of 3rd month.

The 15 patients allocated in diabetes group (Group 3) our study had HbA1c in range of 6.8% to 9.2% with mean value of 8.1 ± 0.84 (%). A striking observation was in our study was intragroup lesser % reduction in HbA1c levels was observed in diabetic patients with less HbA1c levels prior to intervention, whereas a greater percentage reduction of HbA1c level was observed in patients with excessively raised HbA1c level above 7%. Antonio J Quintero et al. [14] observed a greater impact of periodontal therapy on HbA1c level > 9% irrespective type of periodontal therapy however they reported a minor increase in HbA1c level ranging between 7 to 9% which is contradictory to our observations.

Jones JA et al. [16] observed no change in value of HbA1c in 4 month study however they reported improvement in clinical parameters in favour of periodontal therapy. Janket SJ et al [17] conducted a meta - analysis and studied periodontal treatment as predictor and actual change in HbA1c level as outcome. They observed an average decrease of 0.38% in actual HBA1c level. The reduction of HbA1c of 0.66% in type 2 diabetes patients and 0.71% reduction with use of adjunctive antibiotic therapy. However, none of the results were reported statistically significant. These results are contradictory to our study, in which we observed 13.5% reduction in mean HbA1c level 3 months postoperative. The biggest limitation of our study is small sample size and shorter follow up duration which can influence our findings. Oral hypoglycemic agents can influence the outcomes of HbA1c levels, which may have resulted an over extrapolated 13.5% reduction of HbA1c levels in our study. In our study known type 2 diabetic patients were under oral hypoglycemic and those who were diagnosed in our out - patient department were referred to diabetologists for further treatment of diabetes. Hence, oral hypoglycemics may have resulted in an increased mean reduction of HbA1c.

Secondary outcomes observed were reduced mean GI, mean PI, mean PD and mean CAL which indicated an improved periodontal status in patients. Mauri - Obradors E et al. [19] observed improved clinical parameters like PD, PI, GI at 3rd and 6th month as compared to baseline together with determinations of fasting plasma glucose, HbA1c, and bacterial counts alike our results. We observed an initial improvement in all clinical parameters between baseline and 1st month, however there was slight increase in severity in clinical parameters like mean GI amd mean PI at the end of 3rd month in comparison to 1st month. This could be to due to lack of motivation from the patients to observe oral hygiene instructions religiously. The baseline high mean GI and PI value indicates the poor oral hygiene of the patients prior to the study, since majority of participants in the study belonged to a poor socio - economical background.

A very few studies have been conducted in past to study the relation of prediabetes and periodontitis which could be due to the fact that most prediabetic individuals are not aware of their glycemic status unless they are regularly monitored. In our study we observed a statistical reduction in mean HbA1c level ($p<0.05$), mean PI, mean GI, mean PD, mean CAL.

These results are accordance to a similar study done by Giblin LJ [15] who observed a reduction in PD, CAL and HbA1c at the end of 3 months. A striking observation was 8 out 15 prediabetic individual reported a HbA1c level of less than 5.6% at the end of 3 months, hence this can be concluded that improvement and maintenance of periodontal health can help in reversal of diabetic status of an prediabetic individual. The results must be carefully evaluated and authors suggest a greater sample size and long term follow up.

6. Conclusion

There has been a proven bidirectional relationship between periodontitis and Type 2 DM. This study was able to established the same bidirectional relationship. Improving one disease can alter the nature and progression of these chronic diseases. This study was able to highlight relationship of periodontitis and progression of prediabetes. There can be a marked improvement in diabetic status of prediabetics if periodontal health in kept under check. Though longitudinal studies with greater sample size are required to completely elucidate this relationship.

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Conflict of Interest

Nil

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