Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: www.saspublishers.com

OPEN ACCESS

Periodontics

Comparative Evaluation of HbA1c and Platelet Markers in Type II Diabetic and Non-Diabetic Patients with Chronic Periodontitis Following Non-Surgical Periodontal Therapy- An Interventional Study

Sheza Shanavas[1*], Hema Seshan[2]

[1]BDS, MDS Periodontics & Implantology, Faculty of Dental Sciences, M.S. Ramaiah University of Applied Sciences, Bangalore – 560054, India
[2]Senior Professor, Department of Periodontics, Faculty of Dental Sciences, M.S. Ramaiah University of Applied Sciences, Bangalore – 560054, India

DOI: 10.36347/sjams.2019.v07i11.008 | **Received:** 30.10.2019 | **Accepted:** 04.11.2019 | **Published:** 08.11.2019

***Corresponding author:** Sheza Shanavas

Abstract **Original Research Article**

Backgroud and Objectives*:** It has been reported in the literature that scaling and root planing (SRP) may help to improve glycemic control in patients with chronic periodontitis and type 2 diabetes mellitus this in turn may have favorable outcome on various independent variables. The aim of this study was to evaluate if Type II Diabetes mellitus (DM) and Non- DM patients, both with chronic periodontal disease, would present changes between timing evaluation, at baseline and at follow up intervals of 3 and 6 months, in periodontal status, HbA1c and Platelet markers (MPV & PDW) after periodontal therapy. ***Materials and Methods*:** This comparative, clinical study was performed between type II diabetics and non-diabetics with chronic periodontitis. The study period was 6 months. Conventional periodontal scaling and root planing were performed, and the response to this treatment was compared between the groups at 3 and 6 months measuring plaque index (PI), gingival index (GI), probing pocket depth (PPD), clinical attachment gain (CAL) and blood parameters such as HbA1c, platelet markers such as mean platelet volume (MPV) and platelet distribution width (PDW) were evaluated and compared to baseline at every follow-up visit. ***Results: An improvement in all clinical variables was observed, with no statistically significant differences between the groups, with the exception of probing depth and clinical attachment level ($P < 0.001^{*}$). The improvement observed in blood HbA1c levels confirmed a positive metabolic response to periodontal treatment, with a lower value for this variable at each measurement time. Furthermore, the results revealed a statistically significant reduction in the platelet volume and a decrease in platelet distribution width at every visit following phase I periodontal therapy ($P < 0.001^{*}$). ***Conclusion:*** Both groups of patients showed a clinical improvement after basic non-surgical periodontal treatment. In addition to that, diabetic and non-diabetic patients showed improved glycemic control and a reduced mean platelet volume and platelet distribution width at 3 and 6 months after periodontal treatment, although the levels in group B never reached the same levels as those of the subjects in group A.

Keywords: HbA1c, MPV, PDW, periodontal disease, SRP, periodontal pocket.

INTRODUCTION

Diabetes mellitus is one of the most frequent metabolic disorders with an estimated prevalence of 7 % in industrialized countries, of which nearly half the cases are undiagnosed [1]. Patients with undiagnosed diabetes mellitus are at significantly increased risk for coronary heart disease, stroke, and peripheral vascular disease [2]. In addition, recent data indicate that the incidence of the most common type of diabetes mellitus, Type II may be increasing by up to 6% per year [3].

Type II DM is a part of metabolic syndrome which comprises dyslipidemia, hypertension, impaired fibrinolysis, and increased procoagulation factors. It is reported that cardiovascular mortality risk is correlated with blood glucose concentration in cases with type II DM. Hyperglycemia is thought to have a harmful effect on the blood vessels [4].

It is found that hyperglycemia causes larger platelets [5]. Larger platelets also release more prothrombotic factors such as thromboxane A2, owing to active platelet release there is variation in platelet size resulting in increased platelet distribution width (PDW)[5, 6]. It is also suggested that the increased

platelet activity enhances vascular complications in these patients [4].

An increase in MPV is one of the risk factors for macro- vascular complications, such as myocardial infarction, ischemic stroke and venous thromboembolism [5]. It has been found that MPV is significantly higher in DM Type II patients having micro-vascular complications than in patients without them [4]. Improved glycemic control decreases MPV and thereby, it can be suggested that reduced platelet activity by proper glycemic control may prevent or delay vascular complications in these patients[7].

The relationship between diabetes mellitus and periodontitis has appeared in the literature for over 70 years; however, with conflicting data. Numerous studies in various populations have demonstrated that individuals with diabetes tend to have a higher prevalence of and more severe periodontitis than non-diabetics [8]. Today, chronic periodontitis has been identified as the sixth complication of diabetes alongside retinopathy, nephropathy, neuropathy, macrovascular disease and poor wound healing [9].

Periodontitis being one of the leading complications of type II DM, may be a risk factor for diabetic complications [9]. A common pathogenesis exist, where in patients with periodontitis have increased serum levels of inflammatory cytokines, while diabetic patients have hyperinflammatory immune cells that can aggravate the increased production of inflammatory cytokines. This exacerbation can increase insulin resistance and make it more difficult for patients to control their diabetes [10].

Intervention trials have suggested an improvement in glycemic levels in type II DM subjects following non-surgical periodontal therapy (NSPT)[11,12]. However no studies have compared the levels of HbA1c with platelet markers in type II DM & non DM subjects with chronic periodontitis following non-surgical periodontal therapy.

Based on these facts, the aim of this study was to evaluate if type II DM and NDM patients, both with chronic periodontal disease, would present changes between timing evaluation, at baseline and at 3 and 6 months follow up, in periodontal status, HbA1c and Platelet markers (MPV & PDW) after periodontal therapy.

MATERIALS AND METHODS

Source of data

Patients reporting to the Department of Periodontics, Faculty of Dental Sciences M.S. Ramaiah University of Applied Sciences, and Bangalore with chronic periodontitis were recruited. Present study is an interventional, comparative, clinical study performed on two populations of individuals with chronic generalized periodontitis. Ethical clearance was obtained for the study.

Sample size

According to the study by Raman *et al*. 2014, a sample size of 15 achieves 91% power to detect a mean of paired differences of 0.9 with a known standard deviation of differences of 1.0 and with a significant level (alpha) of 0.05000 using a two-sided paired Z-test.

Study population

A total of 40 subjects were included in the study based on the inclusion and exclusion criteria. Subjects who met the necessary criteria for inclusion in the study were asked to sign an informed consent form. Subjects were between age group of 30-70 years, patients with a history of type II diabetes mellitus, subjects with atleast 10 teeth present per dental arch with a clinical diagnosis of chronic generalised periodontitis with pocket depth of ≥ 5 mm and clinical attachment levels of ≥ 4 mm, subjects not having received non-surgical periodontal therapy within past 6 months or surgical periodontal treatment within the past 12 months and subjects with no modification in medication in the 2 months before or during the study. Exclusion criteria were presence of systemic diseases other than DM 2 could influence the course of periodontal disease, intake of antibiotics or anti-inflammatory drugs in the 4 weeks before the study, tobacco use, pregnancy or intention to become pregnant during the 6 months of the study, patients on anticoagulant therapy, subjects with systemic complications of DM to be excluded, inability of the persons to cooperate because of their physical or mental status or daily routine.

Study subjects were divided in to 2 groups:

- Group A consisted of 20 Non-Diabetic patients with chronic periodontitis
- Group B consisted of 20 Type II Diabetic patients with chronic periodontitis.

STUDY DESIGN

- The study group underwent an initial examination consisting of detailed medical history, complete clinical periodontal examination and blood investigations to estimate levels of glycated hemoglobin and platelet indices such as mean platelet volume and platelet distribution width as necessary for the study.
- The diabetic group was instructed to continue with their medical treatment of DM (oral hypoglycaemic agents), diet and life style without modifications during the study period.
- At the second visit, the conventional treatment indicated for chronic periodontitis was started which consisted of phase I therapy including non-surgical periodontal treatment, using Gracey curettes and ultrasonic instrumentation at baseline.

- After the periodontal treatment, follow-up examinations at 3 and 6 months included all elements of the initial examination, determination of HbA1c and Platelet indices such as (MPV, PDW) , periodontal examination, provision of information/ instructions on periodontal disease and oral hygiene.

Clinical parameters for comparison

The following clinical parameters were recorded at baseline, 3 and 6 months intervals using UNC-15 probe and customized acrylic occlusal stents grooved to provide reproducible insertion axis. The parameters assessed were plaque index Sillness and Loe, 1964, gingival index Loe and Sillness, 1963 probing pocket depth (PPD) clinical attachment level (CAL).

Analysis of the blood parameters

All the subjects were referred to M.S. Ramaiah Medical Teaching Hospital for blood parameter assessment at baseline after initial examination, at 3 and 6 months following intervention at baseline. 5 ml of venous blood sample was obtained collected in hemogram tubes with dipotassium EDTA and biochemistry tubes, tested within 1 hour of collection to minimize variations due to sample aging. Samples were maintained at room temperature. HbA1c was measured by automated ion-exchange high performance liquid chromatography (Bio-Rad Variant II). Mean platelet volume and platelet distribution width were estimated using Sysmex Automated Hematology Analyser (XT-2000i/XT-1800i).

STATISTICAL ANALYSIS

- The study data was analyzed using SPSS Software Version 22, IBM. Corp.
- The frequency distribution for gender was expressed in terms of number & percentage.
- Mean & SD were derived for all the continuous variables.
- Student Unpaired t test was used to compare the mean values of age & other study parameters at baseline, 3 & 6 months follow-up period.
- Repeated Measures of ANOVA followed by Bonferroni's Post hoc Analysis was used to compare the mean scores within subjects at different time intervals in two groups.
- Pearson Correlation test was used to correlate between HbA1c, MPV & PDW at baseline level.
- The level of Significance [P-Value] was set at P <0.05.

RESULTS

Comparison of demographic & baseline characteristics of study parameters between two groups (table– 1)

The demographic features of the patients are presented in Table 1. The mean age of the patients was 49.8 years in the control group and 50.4 years in the test group, which was not found to be a significant difference (P=0.39). The gender distribution also did not significantly differ between the groups at baseline (P=1.00).

There was no significant difference between the two group at baseline with respect to plaque index and gingival index (P value= 0.77, 0.79). Whereas with respect to probing pocket depth and clinical attachment levels the values were superior for the test group (P <0.001*). The blood parameters such as glycated hemoglobin, mean platelet value and platelet distribution width varied between the two groups. The values being superior for the test group compared to the control group and this difference was statistically significant (P value <0.001*).

Estimation of association between glycated hemoglobin and platelet markers [mpv & pdw] (table– 2)

There was significant association between HbA1 c and mean platelet volume in diabetic group at baseline when compared to non-diabetic group where in no association was noticed for the two parameters (P value 0.55) and this association between the two parameters for diabetic group was statistically significant with a P value of 0.001*.

Also, there was significant association between HbA1 c and platelet distribution width in diabetic group at baseline when compared to non-diabetic group where in no association was noticed for the two parameters (P value 0.13) and this association between the two parameters for diabetic group was statistically significant with a P value of 0.02*.

Intragroup and intergroup comparison of hba1c levels at different time intervals (Table- 3, 10)

There was significant reduction in HbA1c levels in both the groups at 3 and 6 months. The reduction for non-diabetic group was 5.70 ± 0.19 at 3 months and this difference was statistically significant (P value <0.001*). The reduction in HbA1c levels at 6 months follow up was 5.68 ± 0.16 which had statistical significance (P value <0.001*) when compared to baseline however when 3 and 6 months follow up results were compared, The results did not have statistical significance (P value 0.99).

The reduction in the glycated hemoglobin levels for diabetic group was 7.14 ± 0.41 at 3 months and this difference was statistically significant (P value <0.001*). The reduction in HbA1c levels at 6 months follow up was 7.13 ± 0.40 which had statistical significance (P value <0.001*) when compared to baseline however when 3 and 6 months follow up results were compared, the results did not have statistical significance (P value 1.00).

Inter group comparison between diabetic and non-diabetic group for HbA1c had statistical significance with reduction being superior for diabetic group at both 3 and 6 months follow up with a P value of 0.001*.

Intragroup and intergroup comparison of mean platelet volume (mpv) levels at different time intervals (Table- 4, 10)

There was significant reduction in mean platelet volume in diabetic group when compared to baseline at both 3 and 6 months, the reduction being 10.50 ± 0.29 at 3 months and 10.48 ± 0.26 at 6 months and this difference was statistically significant with a P value of <0.001*. When 3 and 6 months follow up levels were compared there was no significant difference with a P value of 0.99.

When inter group comparison was made between diabetic and non-diabetic group, the reduction in mean platelet volume was superior and statistically significant with respect to diabetic group (P value <0.001*).

Intragroup and intergroup comparison of platelet distribution width levels at different time intervals (table- 5, 10)

There was significant reduction in platelet distribution width in both the groups at 3 and 6 months. The reduction in platelet distribution width for non-diabetic group was 10.46 ± 0.66 at 3 months and this difference was statistically significant (P value <0.001*). The reduction in PDW levels at 6 months follow up was 10.38 ± 0.54 which had statistical significance (P value <0.001*) when compared to baseline however when 3 and 6 months follow up results were compared, the results did not have statistical significance (P value 0.71).

The reduction in platelet distribution width for non-diabetic group was 11.24 ± 0.99 at 3 months and this difference was statistically significant (P value <0.001*). The reduction in PDW levels at 6 months follow up was 11.19 ± 0.94 which had statistical significance (P value <0.001*) when compared to baseline however when 3 and 6 months follow up results compared, the results did not have statistical significance (P value 0.14).

Inter group comparison between diabetic and non-diabetic group for HbA1c had statistical significance, the reduction being superior for diabetic group at both 3 and 6 months follow up with a P value of 0.001*.

Intragroup and intergroup comparison of plaque index scores at different time intervals (table- 6, 11)

There was significant reduction in plaque index score in both test and control group. This difference was statistically significant (P value 0.001*).

The inter group comparison between the two groups at both 3 and 6 months did not have statistically significant difference (P value 0.48, 0.57).

Intragroup and intergroup comparison of gingival index scores at different time intervals (table- 7, 11)

There was significant reduction in gingival index score in both test and control group. This difference was statistically significant (P value < 0.001*).

The inter group comparison between the two groups at both 3 and 6 months did not have statistically significant difference (P value 0.38, 0.68).

Intragroup and intergroup comparison of probing depth at different time intervals (Table- 8, 11)

There was significant reduction in probing pocket depth in both the groups at 3 and 6 months. The reduction in probing pocket depth at 6 months was 4.50 ±0 .61 and this was statistically significant (P value <0.001*). However 3 and 6 months results comparison did not show statistical significance (P value 1.00).

The reduction in probing pocket depth for the diabetic group at 6 months was 6.00 ± 1.17 and this difference was statistically significant (P value <0.001*). However 3 and 6 months results comparison did not show statistical significance (P value 0.99).

Intergroup comparison between test and control group showed statistically significant difference with decrease in the measurement being superior for the diabetic group that had a P value of <0.001*.

Intragroup and intergroup comparison of clinical attachment level at different time intervals (Table- 9, 11)

There was significant gain in clinical attachment level in both the groups at 3 and 6 months. The gain in clinical attachment level at 6 months was 4.20 ± 0.70 and this was statistically significant (P value <0.001*). However 3 and 6 months results comparison did not show statistical significance (P value 0.06).

The clinical attachment level for the diabetic group at 6 months was 5.90 ± 1.17 and this difference was statistically significant (P value <0.001*). However 3 and 6 months results comparison did not show statistical significance (P value 0.07).

Intergroup comparison between test and control group showed statistically significant difference with decrease in the measurement being superior for the diabetic group that had a P value of <0.001*.

Table-1: Comparison of demographic & baseline characteristics of study parameters between two groups

Comparison of demographic & baseline characteristics of study parameters between 02 groups						
Variables	Categories	NDM Grp		DM Grp		P-value
		n	%	N	%	
Sex	Males	10	50%	10	50%	1.00[a]
	Females	10	50%	10	50%	
Age	Mean & SD	49.8	2.4	50.4	2.4	0.40
HbA1c	Mean & SD	6.02	0.18	7.69	0.37	<0.001*
MPV	Mean & SD	9.37	0.24	11.03	0.28	<0.001*
PDW	Mean & SD	10.92	0.72	11.65	1.01	0.01*
PI	Mean & SD	2.29	0.24	2.31	0.18	0.77
GI	Mean & SD	2.15	0.14	2.14	0.10	0.79
PPD	Mean & SD	7.70	0.92	10.45	1.76	<0.001*
CAL	Mean & SD	7.05	1.15	9.65	1.46	<0.001*

Table-2: Estimation of association between hba1c and platelet markers in diabetic subjects in comparison to non-diabetic subjects both with chronic periodontitis

Estimation of correlation between HbA1c, MPV & PDW at baseline in 02 groups using Pearson's Correlation test				
Group	Variable	Values	MPV	PDW
NDM Grp	HbA1c	r	-0.14	0.35
		P	0.55	0.13
		N	20	20
DM Grp	HbA1c	r	0.68	0.52
		P	0.001*	0.02*
		N	20	20

Table-3: Intra group comparison of hba1c at different time intervals

Comparison of mean HbA1c scores within subjects at different time intervals in 02 groups using Repeated Measures of ANOVA followed by Bonferroni Post hoc Analysis								
Groups	Time	N	Mean	SD	Greenhouse-Geisser		Diff	P-Value
					F	P-Value		
NDM Grp	BL	20	6.02	0.18	93.040	<0.001*	BL Vs 3m	<0.001*
	3 Months	20	5.70	0.19			BL Vs 6m	<0.001*
	6 Months	20	5.68	0.16			3m Vs 6m	0.99
DM Grp	BL	20	7.69	0.37	312.413	<0.001*	BL Vs 3m	<0.001*
	3 Months	20	7.14	0.41			BL Vs 6m	<0.001*
	6 Months	20	7.13	0.40			3m Vs 6m	1.00

Table-4: Intra group comparison of mpv at different time intervals

Comparison of mean MPV scores within subjects at different time intervals in 02 groups using Repeated Measures of ANOVA followed by Bonferroni Post hoc Analysis								
Groups	Time	N	Mean	SD	Greenhouse-Geisser		Diff	P-Value
					F	P-Value		
NDM Grp	BL	20	9.37	0.24	1.111	0.32	..	..
	3 Months	20	9.34	0.13				
	6 Months	20	9.33	0.13				
DM Grp	BL	20	11.03	0.28	290.372	<0.001*	BL Vs 3m	<0.001*
	3 Months	20	10.50	0.29			BL Vs 6m	<0.001*
	6 Months	20	10.48	0.26			3m Vs 6m	0.99

Table-5: Intra group comparison of pdw at different time intervals

Comparison of mean PDW scores within subjects at different time intervals in 02 groups using Repeated Measures of ANOVA followed by Bonferroni Post hoc Analysis								
Groups	Time	N	Mean	SD	Greenhouse-Geisser		Diff	P-Value
					F	P-Value		
NDM Grp	BL	20	10.92	0.72	46.778	<0.001*	BL Vs 3m	<0.001*
	3 Months	20	10.46	0.66			BL Vs 6m	<0.001*
	6 Months	20	10.38	0.54			3m Vs 6m	0.71
DM Grp	BL	20	11.65	1.01	14.979	0.001*	BL Vs 3m	0.005*
	3 Months	20	11.24	0.99			BL Vs 6m	0.002*
	6 Months	20	11.19	0.94			3m Vs 6m	0.14

Table-6: Intra group comparison of plaque index scores at different time intervals

Comparison of mean Plaque Index scores within subjects at different time intervals in 02 groups using Repeated Measures of ANOVA followed by Bonferroni Post hoc Analysis								
Groups	Time	N	Mean	SD	Greenhouse-Geisser		Diff	P-Value
					F	P-Value		
NDM Grp	BL	20	2.29	0.24	343.514	<0.001*	BL Vs 3m	<0.001*
	3 Months	20	1.09	0.21			BL Vs 6m	<0.001*
	6 Months	20	0.98	0.17			3m Vs 6m	0.01*
DM Grp	BL	20	2.31	0.18	607.549	0.001*	BL Vs 3m	<0.001*
	3 Months	20	1.05	0.18			BL Vs 6m	<0.001*
	6 Months	20	0.95	0.16			3m Vs 6m	0.01*

Table-7: Intra group comparison of gingival index scores at different time intervals

Comparison of mean Gingival Index scores within subjects at different time intervals in 02 groups using Repeated Measures of ANOVA followed by Bonferroni Post hoc Analysis								
Groups	Time	N	Mean	SD	Greenhouse-Geisser		Diff	P-Value
					F	P-Value		
NDM Grp	BL	20	2.15	0.14	319.800	<0.001*	BL Vs 3m	<0.001*
	3 Months	20	1.24	0.22			BL Vs 6m	<0.001*
	6 Months	20	0.89	0.24			3m Vs 6m	<0.001*
DM Grp	BL	20	2.14	0.10	420.717	0.001*	BL Vs 3m	<0.001*
	3 Months	20	1.18	0.16			BL Vs 6m	<0.001*
	6 Months	20	0.86	0.22			3m Vs 6m	<0.001*

Table-8: Intra group comparison of probing depth at different time intervals

Comparison of mean PPD scores within subjects at different time intervals in 02 groups using Repeated Measures of ANOVA followed by Bonferroni Post hoc Analysis								
Groups	Time	N	Mean	SD	Greenhouse-Geisser		Diff	P-Value
					F	P-Value		
NDM Grp	BL	20	7.70	0.92	234.333	<0.001*	BL Vs 3m	<0.001*
	3 Months	20	4.55	0.60			BL Vs 6m	<0.001*
	6 Months	20	4.50	0.61			3m Vs 6m	1.00
DM Grp	BL	20	10.45	1.76	256.881	0.001*	BL Vs 3m	<0.001*
	3 Months	20	6.10	1.33			BL Vs 6m	<0.001*
	6 Months	20	6.00	1.17			3m Vs 6m	0.99

Table-9: Intra group comparison of clinical attachment level at different time intervals

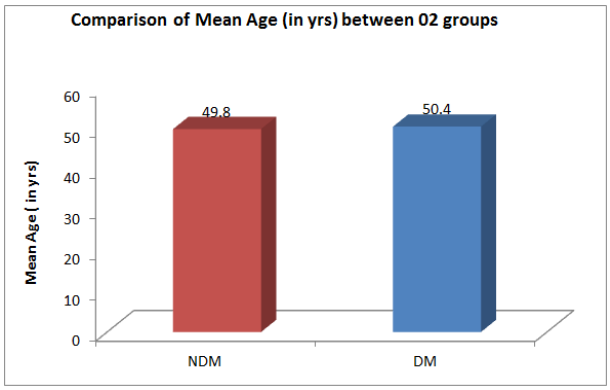
Comparison of mean CAL scores within subjects at different time intervals in 02 groups using Repeated Measures of ANOVA followed by Bonferroni Post hoc Analysis								
Groups	Time	N	Mean	SD	Greenhouse-Geisser		Diff	P-Value
					F	P-Value		
NDM Grp	BL	20	7.05	1.15	138.178	<0.001*	BL Vs 3m	<0.001*
	3 Months	20	4.45	0.69			BL Vs 6m	<0.001*
	6 Months	20	4.20	0.70			3m Vs 6m	0.06
DM Grp	BL	20	9.65	1.46	336.189	0.001*	BL Vs 3m	<0.001*
	3 Months	20	6.25	1.29			BL Vs 6m	<0.001*
	6 Months	20	5.90	1.17			3m Vs 6m	0.01*

Table-10: Inter group comparison of hba1c and platelet markers at 3 & 6 months intervals

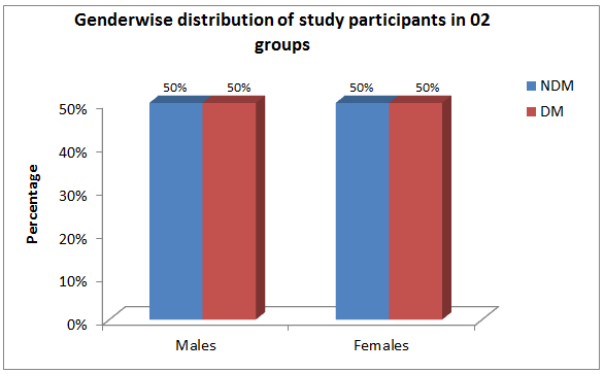
Comparison of Blood Parameters [HbA1c, MPV & PDW] between 02 groups at 3 & 6 Months follow-up periods using Student Unapired t test									
Variables	Time	Group	N	Mean	SD	S.E.M	Mean Diff	t	P-Value
HbA1c	3 Months	NDM Grp	20	5.70	0.19	0.04	-1.45	-14.232	<0.001*
		DM Grp	20	7.14	0.41	0.09			
	6 Months	NDM Grp	20	5.68	0.16	0.04	-1.45	-15.163	<0.001*
		DM Grp	20	7.13	0.40	0.09			
MPV	3 Months	NDM Grp	20	9.34	0.13	0.03	-1.16	-16.285	<0.001*
		DM Grp	20	10.50	0.29	0.07			
	6 Months	NDM Grp	20	9.33	0.13	0.03	-1.16	-17.972	<0.001*
		DM Grp	20	10.48	0.26	0.06			
PDW	3 Months	NDM Grp	20	10.46	0.66	0.15	-0.79	-2.937	0.006*
		DM Grp	20	11.24	0.99	0.22			
	6 Months	NDM Grp	20	10.38	0.54	0.12	-0.81	-3.334	0.002*
		DM Grp	20	11.19	0.94	0.21			

Table-11: Inter group comparison of clinical parameters at 3 & 6 months intervals

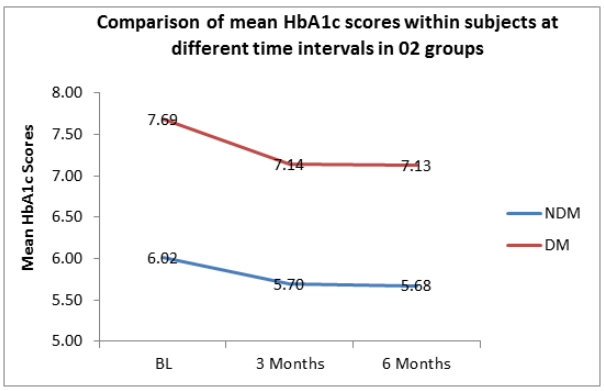
Comparison of Clinical Parameters [PI, GI, PPD & CAL] between 02 groups at 3 & 6 Months follow-up periods using Student Unapired t test									
Variables	Time	Group	N	Mean	SD	S.E.M	Mean Diff	t	P-Value
PI	3 Months	NDM Grp	20	1.09	0.21	0.05	0.05	0.719	0.48
		DM Grp	20	1.05	0.18	0.04			
	6 Months	NDM Grp	20	0.98	0.17	0.04	0.03	0.567	0.57
		DM Grp	20	0.95	0.16	0.04			
GI	3 Months	NDM Grp	20	1.24	0.22	0.05	0.06	0.888	0.38
		DM Grp	20	1.18	0.16	0.04			
	6 Months	NDM Grp	20	0.89	0.24	0.05	0.03	0.412	0.68
		DM Grp	20	0.86	0.22	0.05			
PPD	3 Months	NDM Grp	20	4.55	0.60	0.14	-1.55	-4.733	<0.001*
		DM Grp	20	6.10	1.33	0.30			
	6 Months	NDM Grp	20	4.50	0.61	0.14	-1.50	-5.090	<0.001*
		DM Grp	20	6.00	1.17	0.26			
CAL	3 Months	NDM Grp	20	4.45	0.69	0.15	-1.80	-5.500	<0.001*
		DM Grp	20	6.25	1.29	0.29			
	6 Months	NDM Grp	20	4.20	0.70	0.16	-1.70	-5.602	<0.001*
		DM Grp	20	5.90	1.17	0.26			



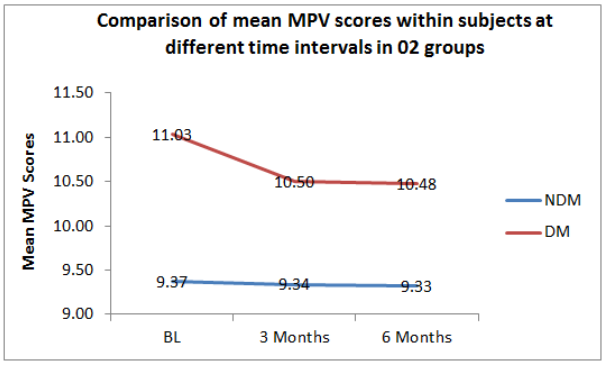
Graph-1: Graphical representation of baseline characteristics comparison of mean age between the two groups



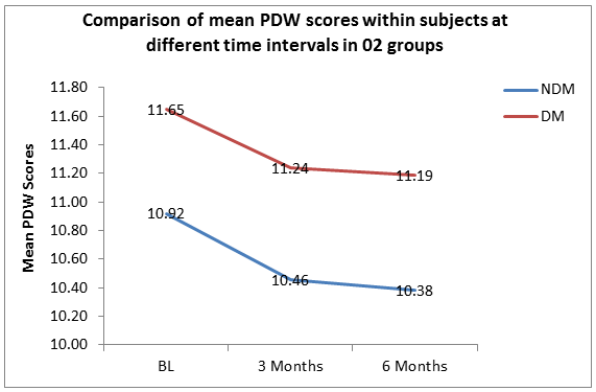
Graph-2: Comparison of gender distribution of the study population



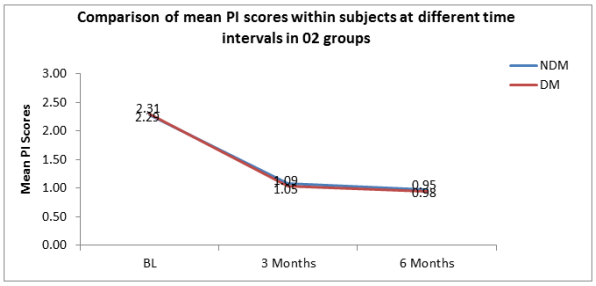
Graph-3: Graphical representation of intra group comparison of hba1c levels at different time interval



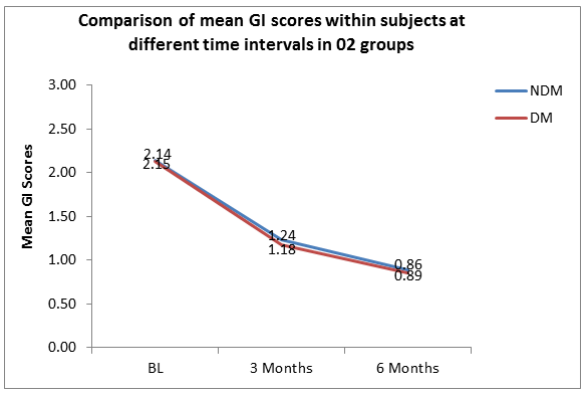
Graph-4: Graphical representation of intra group comparison of mpv at different time intervals



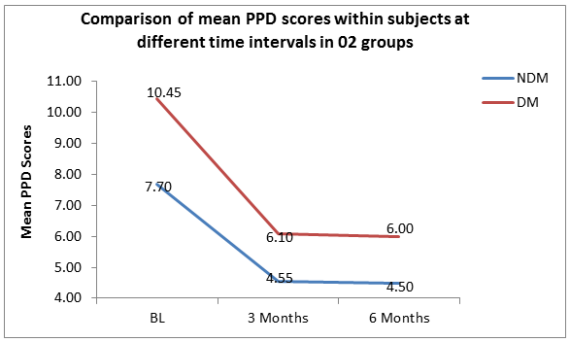
Graph-5: Graphical representation of intra group comparison of pdw levels at different time intervals



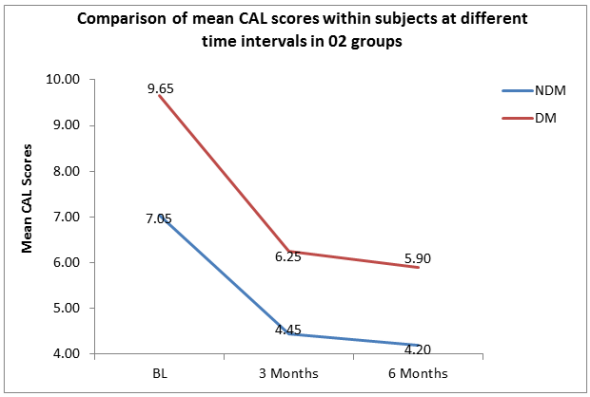
Graph-6: Graphical representation of intra group comparison of plaque index scores at different time intervals



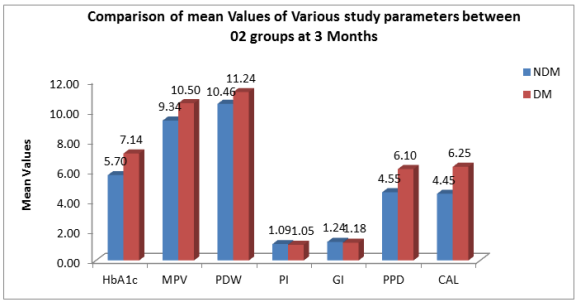
Graph-7: Graphical representation of intra group comparison of gingival index scores at different time intervals



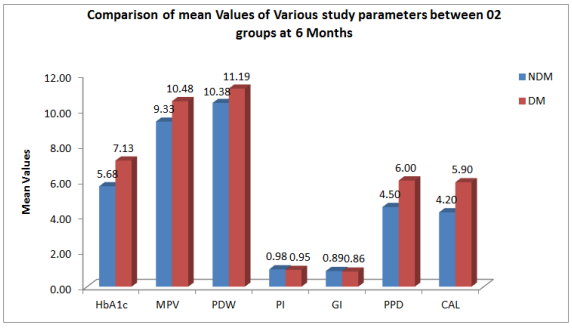
Graph-8: Graphical representation of intra group comparison of probing depth at different time intervals



Graph-9: Graphical representation of intra group comparison of clinical attachment level at different time intervals



Graph-10: Graphical representation of inter group comparison of study parameters at 3 months' time intervals



Graph-11: Graphical representation of inter group comparison of study parameters at 6 months' time intervals

DISCUSSION

In the present study clinical and blood parameters were assessed at baseline, 3 and 6 months. No significant changes were observed with respect to age, gender and clinical parameters such as plaque index and gingival index however clinical parameters such as periodontal pocket and clinical attachment loss was higher for subjects with diabetes and also blood parameters such as HbA1c, mean platelet volume and platelet distribution width demonstrated to have elevated in periodontitis subjects with diabetes mellitus.

In the present study an association was demonstrated between glycated hemoglobin and platelet markers such as MPV and PDW in diabetic patients with chronic periodontitis on comparison to non-diabetic subjects which is in accordance with a study by Kemal Turker *et al.*[4] where in MPV was significantly higher in subjects with diabetes as compared to both

non-diabetic subjects and MPV had a high positive correlation with HbA1c.

The study was also in association with studies by Boos *et al*.[13] suggested that increased HbA1c level was associated with raised MPV. Kakouros N *et al*.[14] suggested that hyperglycemia results in generation of larger platelets. Shimodaira *et al*.[15] confirmed a relationship between MPV and FSG in prediabetic subjects. However present study did not reveal any association between MPV and prediabetes as seen in Group A (non diabetic subjects with periodontal disease) where in mean platelet volume remained within normal range (9.37 ± 0.24 fl), P value 0.32.

The present study found an association between glycated hemoglobin and platelet distribution width in diabetic group on comparison to non-diabetic subjects (P value >0.001). This is in accordance with studies by Maria dalmaga *et al*.[8] MPV and PDW are associated with glycemic indices in diabetic patients but not in diabetic myelodysplastic patients with normal platelet counts. Non-diabetic controls also exhibit FG related changes in platelet morphology. This finding was noticed in our study, the non-diabetic subjects with periodontal disease exhibited higher PDW levels above normal range (10.92 ± 0.72 fl) though lower when compared to diabetic subjects thus this elevation in non-diabetic group was not statistically significant (P value 0.13).

The mean percentage of sites exhibiting pocket ≥ 8 was higher for diabetic subjects when compared to non-diabetic subjects which was in accordance in study by Navarro *et al*.[16] Pocket depth was found to be higher in diabetic subjects when compared to non-diabetic subjects which is in accordance with studies by Sweatha Gurrela *et al*.[17].

The reduction in glycated hemoglobin in diabetic group was followed by an improvement in the MPV the value reduced to 10.48 ± 0.26 fl at 6 months from 11.03 ± 0.28 fl at baseline (P value <0.001) thereby reducing the risk of cardiovascular events in diabetic subjects with chronic periodontitis. This is in accordance with a study by

Sarikaya *et al*.[18] which suggested higher MPV in diabetic patients was independently related to myocardial perfusion defects and may be an indicator of myocardial ischaemia.

In the present study, results showed a positive metabolic response to periodontal treatment, with lowering of HbA1c values at every visit in diabetic subjects. The values decreased from 7.69% ± 0.37% at baseline to 7.13% ± 0.40% at 6 months and this difference was statistically significant (P value <0.001). The change in HbA1c level being 0.5%. This finding is in accordance with various studies.

A systematic review by Fabrizio *et al*. [19] after the study selection process, five randomized clinical trials were included. Results of the meta-analysis indicated that SRP was effective in the reduction of HbA1c (MD = 0.65; 95% CI 0.43 to 0.88; P <0.05).

The present study also revealed elevated levels of glycated hemoglobin in non-diabetic subjects with periodontitis. The mean HbA1c level of group A at baseline was 6.02 ± 0.18 which was in the prediabetes range according to American Diabetes Association. Six months after SRP, the mean HbA1c level of group A was 5.68% ± 0.16% indicated, that periodontal therapy improved their glycemic status. This is in agreement with studies by Zhang *et al.* [20] reported that for HbA1c values of 5.5% to <6.0% and 6.0% to <6.5%, the risks for developing DM were 21% and 44%, respectively.

Jayachandran *et al*.[21] who demonstrated the HbA1c levels of individuals without diabetes and with periodontitis were significantly reduced 3 months after non-surgical periodontal therapy, although they never reached the same levels as those of the individuals without diabetes or periodontitis.

Larger, multi-centred studies are needed to substantiate our findings and confirm that they are generalizable to other populations of patients with type 2 diabetes.

CONCLUSION

Non-Surgical periodontal therapy leads to a reduction in HbA1c and platelet markers such as mean platelet volume and platelet distribution width especially in patients with an elevated degree of DM severity and periodontal disease. However it is not yet possible to precisely establish the clinical relevance of these variations.

The findings of this study showed that effective periodontal treatment resulted in lower glycemic levels which in turn lowers the platelet volume and decreases the size of platelet distribution width. Furthermore, there was reduction in the clinical parameters of periodontal infection, confirming the existing interrelationship between diabetes mellitus and periodontal disease. Therefore periodontal therapy should be included in diabetes preventive measures.

SUMMARY

The results of present study revealed a significant association between HbA1c and platelet markers in type II diabetic subjects. The study further revealed a significant reduction in the variables following periodontal therapy.

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