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ORIGINAL ARTICLE

Effect Of Local Periodontal Treatment Alone And In Combination With Systemic Doxycycline Therapy On Glycaemic Control In Patients With Type-2 Diabetes Mellitus

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ABSTRACT:
Background: Evidence consistently shows that Periodontal infection may adversely affect glycaemic control in people with diabetes. In the light of this background this study aims to examine the effects of non-surgical periodontal treatment alone and incorporating systemic doxycycline on glycaemic control in patients with type 2 diabetes mellitus (type 2 DM) who have generalized periodontitis. **Aim:** The aim of the study was to assess the effect of local periodontal treatment alone and in combination with systemic doxycycline therapy on glycaemic control in patients with type-2 diabetes mellitus. **Materials And Methods:** A total of 30 type 2 DM patients with generalized periodontitis were selected for the study. The selected patients were randomly assigned to three groups (groups A, B, and C) comprising 10 patients each, GroupA and Group B where the (TG) Treatment groups : Group A received treatment with scaling and root planing only. Group B received treatment with scaling and root planing followed by systemic doxycycline. Group C received no treatment (control group). The clinical parameters were recorded like plaque index, gingival index, probing pocket depth, and clinical attachment level, at baseline (day zero), and at the end of 3 months. The Lab investigation for glycated hemoglobin (HbA1c) was recorded at baseline (day zero) and at the end of 3 months. **Results:** Both therapies resulted in a statistically significant improvement for periodontal parameters for both group A and group B (treatment groups) as compared to the control group, whereas, patients in Group B treated with SRP + systemic doxycycline showed enhanced gains in CAL ($p < 0.001$) over a period of 3 months as compared to Group C. HbA1c values showed a statistically significant decrease in treatment groups for both the therapies equally as compared to the control group. **Conclusions:** with this study its concluded that nonsurgical periodontal therapy shows a definite improvement of glycemic control in patients with T2DM, but no statistical difference was observed with adjunctive systemic doxycycline therapy. A further study with a larger sample size is required.
Key words: Glycated hemoglobin, chronic periodontitis, type 2 diabetes mellitus, doxycycline

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Introduction

It Dentists and physicians have restricted themselves to their own respective fields in the past, only treating diseases that are relevant to their own fields of specialization. However, recent findings indicate that oral health may influence systemic health, and that this may be a bi-directional relationship for some conditions. This is particularly true for the relationship between periodontal disease and diabetes mellitus as both are common chronic conditions. Infact, many studies have suggested a two-way relationship between diabetes mellitus and chronic periodontitis.[1,2,3,4,5]

Objectives of the study is to evaluate the effect of periodontal therapy alone on glycaemic control in type-2 diabetes mellitus patients with chronic periodontitis and to evaluate the effect of periodontal therapy plus systemic antibiotic therapy on glycaemic control in type-2 diabetes mellitus patients with chronic periodontitis.

Methodology

A sample of 30 subjects aged 30 – 70 years were recruited from the patients visiting the Department of Periodontology, People's Dental Academy, Bhopal. Subjects were explained about the study and based on their approval, were asked to read carefully and sign the consent form. The design of the study and procedures for obtaining informed consent was approved by the Ethical Committee of People's Dental Academy, Bhopal.

The selected subjects with generalized chronic periodontitis and proven type-2 diabetes mellitus were randomly assigned to three groups (groups A, B, and C) comprising of 10 patients each:

- **Group A** received treatment with full mouth scaling and root planing and plaque control instructions.
- **Group B** received treatment with full mouth scaling and root planing followed by systemic doxycycline.
- **Group C** received no treatment (control group).

INCLUSION CRITERIA

- Patients with diagnosis of type-II Diabetes Mellitus.
- Patients with HbA1c value >7%
- Patient aged between 30-70 years.
- Patient diagnosed with chronic periodontitis (moderate-severe)
- Patient willing to participate in the study.

EXCLUSION CRITERIA

- Patient who has well controlled blood glucose levels.
- Patient who had undergone previous periodontal treatment within previous 6-months.
- Patient who has taken any systemic antibiotics within previous 6-months.
- Patient not willing to participate in the study.

ARMAMENTARIUM

- Mouth mask
- Disposable latex exmanination gloves
- Mouth mirror
- Explorer
- William's graduated periodontal probe
- Dental Explorer
- Tweezer
- Kidney tray
- Sterile cotton

Table 1: Demographic distribution of study subjects according to Gender & Age

Gender	GROUP A N (%)	GROUP B N (%)	GROUP C (Control) N(%)	Total
MALE	4(13.3%)	3(10.0%)	5(16.7%)	12(40.0%)
FEMALE	6(20.0%)	7(23.3%)	5(16.7%)	18(60.0%)
Total	10	10	10	30
Chi Square Value	0.833			
P Value	0.659(NS)			
Mean Age	53.90 year	50.90 year	52.30 year	52.37 year

Table 2: Comparison of Mean Plaque Index (PI) before & after intervention among Group A, Group B & Group C (Control).

Groups	PLAQUE INDEX(PI)				Paired "t" Test	P Value
	Pre Intervention		Post Intervention			
	Mean	SD	Mean	SD		
Group A	2.370	0.3683	1.440	0.3596	27.762	0.001(HS)
Group B	2.470	0.3773	1.480	0.2486	11.000	0.001(HS)
Group C	2.370	0.4270	2.420	0.3736	1.464	0.177(NS)

(p<0.001)

Table 3: Tukeys Post Hoc Analysis for Intergroup Comparison for Mean Plaque Index (PI) before & after intervention among Group A, Group B & Group C (Control).

GROUPS	Pre Intervention Mean Difference	P Value	Post Intervention Mean Difference	P Value
Group A vs Group B	0.1000	0.837(NS)	0.0400	0.961(NS)
Group A vs Group C	0.0000	1.000(NS)	0.9800	0.001(HS)
Group B vs Group C	0.1000	0.837(NS)	0.9400	0.001(HS)

(p<0.001)

Table 4: Comparison of Mean Gingival Index (GI) before & after intervention among Group A, Group B & Group C (Control).

Groups	GINGIVAL INDEX(GI)				Paired "t" Test	P Value
	Pre Intervention		Post Intervention			
	Mean	SD	Mean	SD		
Group A	2.300	0.6018	1.450	0.6241	24.885	0.001(HS)
Group B	2.300	0.3682	1.130	0.3335	19.591	0.001(HS)
Group C	2.470	0.4138	2.460	0.4061	0.287	0.780(NS)

Table 5: Tukeys Post Hoc Analysis for Inter group Comparison for of Mean Gingival Index (GI) before & after intervention among Group A, Group B & Group C (Control).

GROUPS	Pre Intervention Mean Difference	P Value	Post Intervention Mean Difference	P Value
Group A vs Group B	0.0000	1.000(NS)	0.3200	0.298(NS)
Group A vs Group C	0.1700	0.703(NS)	1.0100	0.001(HS)
Group B vs Group C	0.1700	0.703(NS)	1.3300	0.001(HS)

(p<0.001)

Table 6: Comparison of Mean Probing Pocket Depth (PPD) before & after intervention among Group A, Group B & Group C (Control).

Groups	Probing Pocket Depth(PPD)				Paired "t" Test	P Value
	Pre Intervention		Post Intervention			
	Mean	SD	Mean	SD		
Group A	2.910	0.3178	1.870	0.3592	14.807	0.001(HS)
Group B	3.120	0.6179	1.990	0.7593	11.831	0.001(HS)
Group C	3.240	0.5797	3.270	0.6237	1.152	0.279(NS)

(p<0.001)

Table 7: Tukeys Post Hoc Analysis for Inter group Comparison for Mean Probing Pocket Depth (PPD) before & after intervention among Group A, Group B & Group C (Control).

	Pre Intervention Mean Difference	P Value	Post Intervention Mean Difference	P Value
Group A vs Group B	0.2100	0.646(NS)	0.1200	0.897(NS)
Group A vs Group C	0.3300	0.349(NS)	1.4000	0.001(HS)
Group B vs Group C	0.1200	0.865(NS)	1.2800	0.001(HS)

(p<0.001)

Table 8: Mean Clinical Attachment Loss (CAL) before & after intervention among Group A, Group B & Group C (Control).

Groups	Clinical Attachment Loss (CAL)				Paired "t" Test	P Value
	Pre Intervention		Post Intervention			
	Mean	SD	Mean	SD		
Group A	4.450	0.5543	3.62	0.557	22.636	0.001(HS)
Group B	4.350	0.4972	3.19	0.567	23.252	0.001(HS)
Group C	4.120	0.6033	4.18	0.621	2.714	0.024(S)

(p<0.001)

Table 9: Tukeys Post Hoc Analysis for Intergroup Comparison for Clinical Attachment Loss (CAL) before & after intervention among Group A, Group B & Group C (Control).

	Pre Intervention Mean Difference	P Value	Post Intervention Mean Difference	P Value
Group A vs Group B	0.1000	0.914(NS)	0.430	0.242(NS)
Group A vs Group C	0.3300	0.389(NS)	0.560	0.099(NS)
Group B vs Group C	0.2300	0.627(NS)	0.990	0.002(HS)

(p<0.001)

Table 10: Comparison of Mean HbA1c before & after intervention among Group A, Group B & Group C (Control).

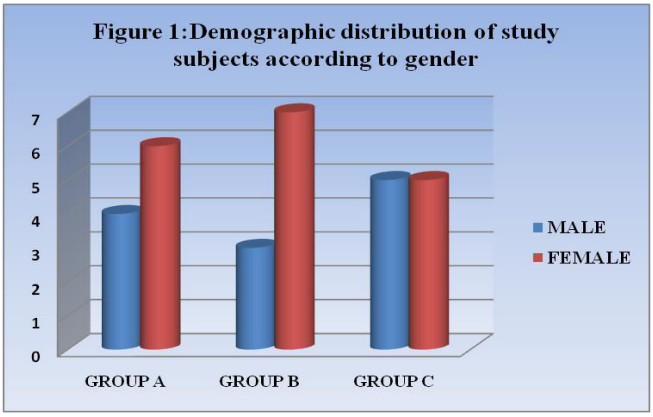
Groups	HBA1c				Paired "t" Test	P Value
	Pre Intervention		Post Intervention			
	Mean	SD	Mean	SD		
Group A	10.220	1.5775	9.560	1.5728	14.597	0.001(HS)
Group B	10.370	1.7069	9.770	1.6800	28.460	0.001(HS)
Group C	10.450	1.3125	10.460	1.2937	0.361	0.726(NS)

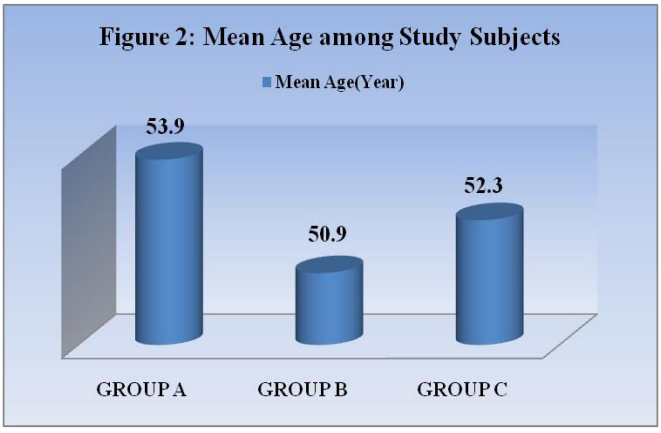
(p<0.001)

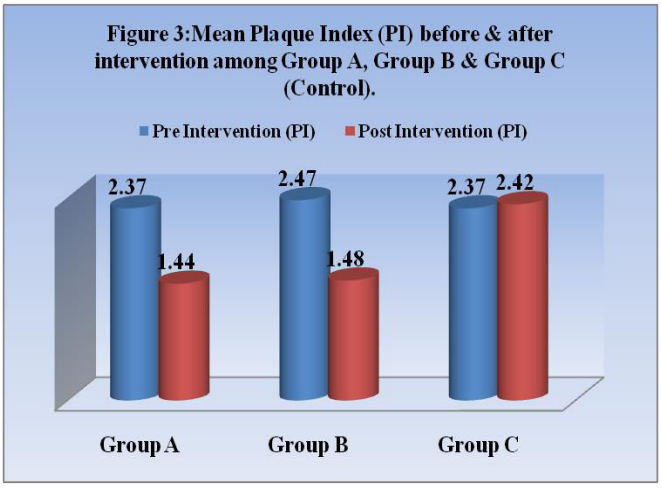
Table 11: Tukeys Post Hoc Analysis for Intergroup Comparison for mean HbA1c before & after intervention among Group A, Group B & Group C (Control).

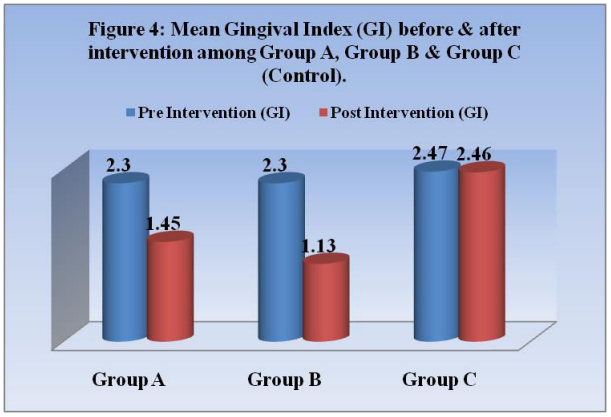
GROUPS	Pre Intervention Mean Difference	P Value	Post Intervention Mean Difference	P Value
Group A vs Group B	0.1500	0.974(NS)	0.2100	0.949(NS)
Group A vs Group C	0.2300	0.941(NS)	0.9000	0.396(NS)
Group B vs Group C	0.0800	0.993(NS)	0.6900	0.576(NS)

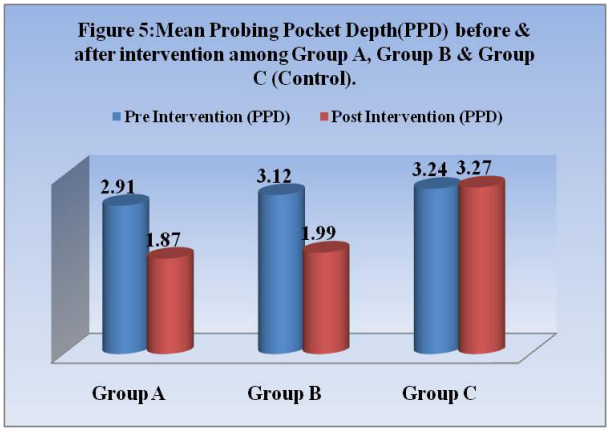
(p<0.001)

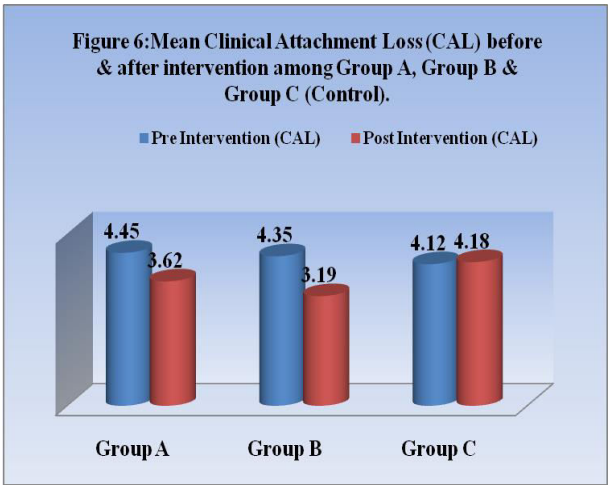


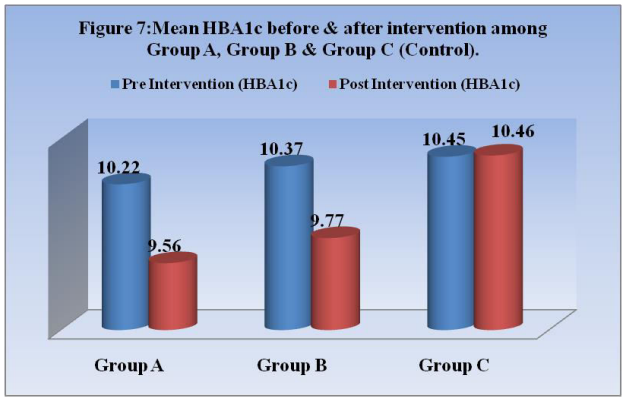












CLINICAL EVALUATION:
For the periodontal status of the three groups, following clinical parameters where evaluated at baseline and after 3 months of intervention :

- Plaque index (PI) by Sillness and Loe (1964)
- Gingival Index (GI) by Loe and Sillness (1963)
- Probing pockect depths (PD) were recorded to their nearest millimeter using a Williams graduated periodontal probe.
- Clinical Attachment Level (CAL)

Plaque index (PI) by Sillness and Loe (1964)
Score Criteria:
0-No plaque
1-A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen only by running a probe across the tooth surface.
2-Moderate accumulation of soft deposits within the gingival pocket, on the gingival margin and/or adjacent tooth surface, which can be seen by the naked eye.
3-Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

Calculation of PI:
PI Score for the individual :
The indices for each of the teeth are added and then divided by the total number of teeth examined. The scores range from 0 to 3.

Interpretation:
Excellent-'0'
Good-0.1-0.9
Fair-1.0-1.9
Poor-2.0-3.0

Gingival Index (GI) by Loe and Sillness (1963)
The gingival index (GI) was developed by Loe H and Silness in 1963, solely for the purpose of assessing the severity of gingivitis and its location in four possible areas by examining only the qualitative changes (i.e., severity of the lesion) of the gingival soft tissue.

This index shows good validity, reliability, and ease of use.
Instruments used:
Mouth mirror, periodontal probe.
Method:
The tissues surrounding each tooth are divided into four gingival scoring units: disto-facial papilla, facial margin, mesio-facial papilla and the entire lingual gingival margin.Unlike the facial surface, the lingual surface is not subdivided in an effort to minimize examiner variability in scoring, since it will most likely be viewed indirectly with a mouth mirror. The teeth and gingival should be dried lightly with a blast of air and/or cotton rolls.

Scoring Criteria:
0-Absence of inflammation/ normal gingiva
1-Mild inflammation, slight change in color, slight edema; no bleeding on probing.
2-Moderate inflammation, moderate glazing, redness, edema and hypertrophy, bleeding on probing.
3-Severe inflammation; marked redness and hypertrophy, ulceration, tendency to spontaneous bleeding.

Calculation:
GI Score for the individual :
The indices for each of the teeth are added and then divided by the total number of teeth examined. The scores ranges from 0 to 3

Interpretation:
Gingival Scores Condition
0.1 – 1.0-Mild Gingivitis
1.1 – 2.0-Moderate Gingivitis

2.1 – 3.0-Severe Gingivitis

Pocket Depth:

Pocket depth was measured by using William's graduated probe. The probe was inserted into the sulcus along the long axis of the tooth at four sites around the tooth – mesial, facial, distal and lingual/palatal. When measuring pocket at the mesial/distal interproximal areas of posterior teeth, the probe was given slight angulation so that it passes below the contact area. The distance from the base of the pocket to the crest of gingival margin was measured and noted to the nearest millimeter.

Clinical Attachment Level :

PD is the depth of the periodontal pocket measured as the distance in millimeters between the free gingival margin (FGM) and the base of the pocket. Gingival recession is the distance in millimeters between the FGM and the line of the cemento-enamel junction (CEJ).

CAL is clinically presented by the total denudation of the root surface of the tooth, and computed as the difference in millimeters between the measure of PD and the gingival recession (CEJ to FGM distance).

Laboratory analysis of blood samples:

Two millimeters of fasting venous blood samples were taken from the anticubital fossa of the patients and subjected to further analyses. All blood investigations were done at a private Laboratory.

Estimation of glycosylated hemoglobin (HbA1c) ;

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 high performance liquid chromatography.

Result

This case – control study was conducted to evaluate the effect of periodontal therapy alone and in combination with systemic doxycycline therapy on glycaemic control in type-2 diabetes mellitus patients with chronic periodontitis.Subjects for this study were selected from the patients visiting the Department of Periodontology, People's Dental Academy Bhopal. The study included 30 subjects aged 30 – 70yrs. The patients were divided into three groups Group A, B & C Blood samples were collected from each subject to evaluate glycosylated haemoglobin levels.

Out of 30 Type -2 DM patients with chronic periodontitis ,male were 12(40%) and female were 18(60%). With mean age of 52.37 years [Table 1] [Figure 1 & 2]

Clinical parameters

Plaque index:

The mean plaque index score for Group A was 2.370 ± 0.3683 at baseline, which declined to 1.440 ± 0.3596 at three months after full mouth scaling and root planning alone, there was a mean difference of 0.93 which was statistically significant ($p<0.001$). And in Group B the mean plaque index score was 2.470 ± 0.3773 at baseline, which declined to 1.480 ± 0.2486 at three months after full mouth scaling and root planning along with systemic doxycycline therapy there was a mean difference of 0.99 which was statistically significant ($p< 0.001$). Whereas in Group C the mean plaque index score was 2.370±0.4270 at baseline, which remained same 2.420±0.3736 following no treatment, with a mean difference of (-) 0.05, which was not statistically significant (P = 0.177).

On comparison in between the groups, for pre intervention the mean PI score 0.217 did not show any statistically significant differences (P = 0.806) between the three groups, whereas post-intervention the mean PI scores 27.907 showed a statistically significant differences (P = 0,001) between the three groups.

And on inter group comparisions there was a statistically significant difference 3 month after the treatment as compared to before treatment, for Group A vs Group C with a mean difference of 0.9800 (P = 0.001) and Group B vs Group C with a mean difference of 0.9400 (P = 0.001), but Group A vs Group B showed a statistically not significant difference with a mean difference of 0.400 (P = 0.961). [Table 2 & 3] [Figure 3].

Gingival index:

Following treatment, the GI score dropped significantly from 2.300 ± 0.6018 at baseline to 1.450 ± 0.6241 (P= 0.001)after treatment and 2.300 ± 0.3862 at baseline to 1.130±0.3335 (P = 0.001) after treatment for Group A and Group B respectively. Whereas the GI score for the control group i.e Group C was not statistically significant (P = 0.780) three months after treatment.

On comparision in between the three groups at baseline the mean GI scores 0.432 did not showed any statistically significant differences (P= 0.654) between the three groups. whereas post intervention i.e after three months, there was a statistically significant difference (P = 0.001) in between these three groups with a mean value of 21.722.

And on inter group comparison there was a statistically significant difference 3 months after treatment as compared to pre intervention for Group A vs Group C with a mean difference of 0.100 (P = 0.001), and Group B vs Group C with a mean difference of 1.3300 (P = 0.001) but Group A vs Group B showed a statistically not significant difference with a mean difference 0.3200 (P = 0.298). [Table 4 & 5] [Figure 4].

Probing pockect depth (PPD):

At the 3-month examination, a statistically significant improvement in probing depth was recorded for both treatment group (P ≤ 0.001).Group A showed a mean probing depth reduction from 2.9 ± 0.3 mm at baseline to 1.9 ± 0.4 mm after 3- months , and Group B from 3.1 ± 0.6 mm at baseline to 1.99 ± 0.8 mm after 3- months . However, in the control group i.e Group C, the decrease in probing depth was not statistically significant (P = 0.297).

On comparision in between the three groups at baseline the mean PPD values 1.022 did not showed any statistically significant differences (P = 0.353) however after three months PPD values showed a statistically significant difference (P = 0.001) in between the groups with a mean difference of 16.504.

And on inter group comparison there was a statistically significant difference 3 months after treatment as compared to pre intervention for Group A vs Group C with a mean difference of 1.4000 (P = 0.001), and Group B vs Group C with a mean difference of 1.2800 (P = 0.001) but Group A vs Group B showed a statistically not significant difference with a mean difference 0.1200 (P = 0.897), Table 6&7] [Figure 5].

Clinical attachment loss (CAL):

For both TGs groups, Group A and Group B there was reduction in mean CAL at baseline and 3 months after treatment from 4.5 ± 0.6 to 3.6 ± 0.6 and 4.4 ± 0.5 to 3.2 ±0.6 respectively, which was statistically significant (P = 0.001). whereas in the control Group C there was no reduction in CALfrom baseline to three months after treatment 4.120 ± 4.18 with a non significant reduction (P = 0.024).

On comparision in between the three groups at baseline the mean CAL values 0.935 did not showed any statistically significant differences (P = 0.405) however Three months after treatment CAL values 7.263 showed a statistically significant difference (P = 0.001) in between the groups with a mean difference of.

And on inter group comparison there was a statistically significant difference 3 months after treatment as compared to pre intervention for Group A vs Group C with a mean difference of 1.4000 (P = 0.001), and Group B vs Group C with a mean difference of 1.2800 (P = 0.001) but Group A vs Group B showed a statistically not significant difference with a mean difference 0.1200 (P = 0.897),

[Table 8&9] [Figure 6].

Metabolic parameter

Glycated hemoglobin:

There was no statistically significant differences between the three groups in the mean HbA1c levels at pre intervention (P = 0.944) and at 3 months post intervention (P = 0.398) .

On inter group comparison between the groups there was no significant differences for any of the pair of groups at baseline or 3 months after intervention.

And on inter group comparison there was no statistically significant difference at baseline and even 3 months after treatment as compared to pre intervention for Group A vs Group B with a mean difference of 0.2100 (P = 0.949), and Group A vs Group C with a mean difference of 0.9000 (P = 0.396), Group B vs Group C with a mean difference of 0.6900 (P = 0.576).

For intra group comparison Group A and Group B showed a decrease in HbA1c value from 10.220 ±1.5775 at baseline to 9.560 ± 1.5728 three month after treatment and 10.370 ± 1.7069 to 9.770 ± 1.6800 three months after treatment, with mean difference of 0.66 and 0.60 respectivily which was statistically significant (P = 0.001). Whereas in Group C there was no decrease in HbA1c values after treatment from 10.450 ± 1.3125 at baseline to 10.460 ± 1.2937 after treatment with a mean difference (-)0.01 which was not statistically significant (P = 0.726) [Table 10 &11] [Figure 7].

Discussion

There is growing evidence that identifies a strong association between diabetes and periodontal diseases and has been explored by many researchers over the years.Extensive studies have shown that incidences of diabetes and periodontal disease share common risk factors and enhance the risk of each other[6,7]

Severe periodontitis often coexists with diabetes and is considered the sixth complication of the disease, as both type 1 and type 2 diabetes patients show a three – to four fold increased risk of periodontitis.70 Therefore we can say that the periodontal disease may be more frequent and severe in diabetic than in non diabetic individuals with more advanced systemic complications. [8]

The monitored periodontal clinical parameters in the present study showed improvements after periodontal treatment and are described below.

In this prospective, observational study T2DM patients responded well to the treatment modality done.

At baseline, T2DM matched patients showed similar levels of oral plaque acummulation (PI), gingival (GI) and periodontal inflammation as well as of periodontal breakdown (PPD), (CAL).

But three months after completion of therapy, both the treatment modalities used in treatment groups i.e Group A and Group B revealed significant reductions of PI and GI scores as well as in PPD and in CAL from baseline to three months after treatment as compared to control group C

Henceforth we can say that the clinical improvements were evident at the 3- month reevaluation, confirming previous studies,conducted by Bridges R et al.,[9]

Promsudthi et al[10] , Mattout C et al.[11], Patricia A.A, and Tervonen T,et al.[12] These reductions in the scores can be attributed to scaling and root planning accompanied diminution of inflammatory infiltrate and laying down of new collagen.

Pocket probing depth (PPD) is considered to be of pathognomic significance of periodontal disease.while periodontal condition was also significantly influenced, as there was reductions in PPD from baseline to three months after treatment in both the treatment groups as compared to control group.

The good healing response and improvements of periodontal status in our study is in accordance to, the reductions in probing depth observed by Grossi et al.[16] who, using doxcycycline, showed reductions of 23% in type 2 diabetic patients, who also found a significant improvement in PPD reductions. Whereas reduction observed in our syudy was 35% in Group A and 36% in Group B. Promsudthi et al.[10] Bridges R, et al,[9] too observed similar results.

On intragroup comparison, within the TGs and CG, the mean CAL showed a significant gain from baseline to 3 month in both the TGs i.e Group A and Group B as compared to Group C.

Whereas on inter-group comparison, for Group B vs Group C there was significantly greater reduction in CAL as compared to Group A vs Group B and Group A vs Group C. Which signifies the added effect of doxcycycline in Group B.The present study is in agreement with Promsudthi et al.[10] , who reported a significant gain in CAL after 3 months. These results are suggestive of the optimal resolution of periodontal lesions with healing in the TG (Group B) receiving doxcycycline, when compared to the control Group C.

This significant gain in CAL can be attributed to doxcycycline's anticollagenase effect and antimicrobial property[13] which has been reported to substantially reduce or eliminate pathogenic species, especially Gram-negative bacilli.[14] Ambrosini P et al. [15] have reported that due to the tissue-invading nature of periodontal pathogens such as Pg and Aa, mechanical therapy alone may not be sufficient to eliminate these pathogens.

In the present study, we selected HbA1c as a parameter for metabolic control instead of urine or plasma glucose because these parameters can show the level at a specific time of sampling but this value can alter within a few minutes due to various factors including diet, physical activity, and medication. Unlike HbA1c measurements, these parameters are not appropriate indicators for long term glycemic control. HbA1c provides an estimate of the average glucose level over the 30 to 90 days preceding the test and it does not account for short term fluctuations in plasma glucose levels and provides an excellent indicator of the long term control of the patient's diabetes.[17]

In our study, there was statistically significant differences observed in terms of metabolic control of T2DM patients.There was a significant reduction in HbA1c levels in both the treatment groups i.e Group A & B as compared to group C, from baseline to three months after treatment.

The change in HbA1c levels was 6.5% in Group A and 5.8% in Group B, the changes were almost similar in both the groups. Indicating lack of any additional benefit from the use of systemic doxycycline in Group B, in corroboration with the hypothesis that by reducing certain species, the equilibrium of the periodontal microbiota may have been altered, allowing previously controlled microorganisms to multiply and exercise their pathogenic potential .

Other authors such as Promsudthi, et al,[10] who likewise used antibiotic treatment, failed to obtain satisfactory results. In contrast, Rodrigues, et al,[18] reported good results but in the group not administered antibiotics.

Thus, the role of antibiotics in reducing HbA1c does not seem quite clear, since similar results appear to be achieved with periodontal treatment in the absence of antibiotics.

Conclusion

Within the scope and limitations of the present study following observations were made:

- There was significant improvements for periodontal status, like there was statistically significant reductions for mean PI and GI scores from baseline to three months after treatment as compared to control group.
- There was statistically significant reductions in PPD scores from baseline to three months after treatment as compared to the Control group.
- There was statistically significant gain in CAL scores from baseline to three months after treatment as compared to the control group.
- There was statistically significant reductions in HbA1c values in treatment groups from baseline to three months after treatment as compared to the control group.
- There were similar effects on reductions of HbA1c values from both the treatment modalities

The results obtained appear to demonstrate a strong, statistically significant, association between clinical improvement in the periodontal condition and improved metabolic control of diabetes.

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