

Comparison of TNF- α levels before and after treatment in patients with periodontitis with and without type 2 diabetes mellitus

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ABSTRACT

Background: Periodontitis is an inflammatory reaction triggered by the pathogenic microorganisms present in a chronic dental biofilm, which leads to progressive harm to the structures that support teeth. The present study was conducted to compare TNF- α levels before and after treatment in patients with periodontitis with and without type 2 diabetes mellitus.

Materials & Methods: 80 patients were divided into 2 groups of 40 each. Group I were periodontitis and group II were periodontitis+ type 2 diabetes mellitus patients. Group I were further subdivided into group A who underwent scaling and root planing alone and group B who underwent scaling and root planing+ low level laser therapy. Group II were further subdivided into group C who underwent scaling and root planing alone and group D who underwent scaling and root planing+ low level laser therapy. In both groups, saliva was collected in a test tube for the assessment of TNF- α levels at baseline and at 8 weeks.

Results: Group A had 1 male and 9 females, group B had 10 males and 10 females, group C had 8 males and 12 females and group D had 9 males and 11 females. The mean age was 45.2 ± 5.2 years, 47.4 ± 5.8 years, 46.3 ± 5.1 years and 45.8 ± 3.8 years in group A, B, C and D respectively. The mean BMI was 24.2 ± 3.6 Kg/m², 23.2 ± 4.1 Kg/m², 23.1 ± 4.3 Kg/m² and 22.5 ± 6.1 Kg/m² in group A, B, C and D respectively. At baseline and 8 weeks, in group A, PI was 1.71, 0.67, BI was 1.92 and 0.48, PD was 6.2 and 2.9 and CAL was 6.5 and 2.5 respectively. In group B, PI was 1.72 and 0.68, BI was 2.1 and 1.4, PD was 5.4 and 2.9 and CAL was 2.8 and 2.7 respectively. In group C, PI was 2.1 and 0.37, BI was 1.94 and 0.41, PD was 5.8 and 3.2 and CAL was 6.1 and 3.1 respectively. In group D, PI was 2.1 and 0.4, BI was 1.7 and 0.42, PD was 5.7 and 2.7 and CAL was 5.8 and 2.6 respectively. The difference was significant ($P < 0.05$). TNF- α at baseline and at 8 weeks in group A was 14.2 ± 2.3 and 9.1 ± 1.1 , in group B was 14.9 ± 5.3 and 10.5 ± 4.2 , in group C was 22.3 ± 7.1 and 14.8 ± 7.2 and in group D was 22.1 ± 8.4 and 12.4 ± 3.1 respectively. The difference was significant ($P < 0.05$).

Conclusion: Salivary TNF- α levels in periodontitis are associated with T2DM. There was a notable improvement in both clinical and salivary TNF- α levels with SRP and SRP adjunct to LLLT.

Keywords: Periodontitis, TNF- α , Laser, salivary, diabetes mellitus

1. INTRODUCTION

Periodontitis is an inflammatory reaction triggered by the pathogenic microorganisms present in a chronic dental biofilm, which leads to progressive harm to the structures that support teeth. In periodontitis, rapid phases of destruction occur, primarily driven by systemic or environmental factors stemming from interactions between the host and bacteria, which compromise the host's defense mechanisms.¹ A complicated two-way connection between type 2 diabetes mellitus (T2DM) and periodontitis forms a vicious cycle that worsens both conditions when they coexist in the same person. Tumor necrosis factor-alpha (TNF- α) is a prototypical ligand of the TNF superfamily and a pro-inflammatory cytokine released by macrophages. It is among the factors that promote inflammation. It is a pleiotropic molecule that is crucial for inflammation, immune system development, apoptosis, and lipid metabolism.²

Different treatment methods for periodontitis encompass scaling and root planing (SRP), disinfectants, antibiotics, and surgical approaches. There have been only a handful of recent studies that indicated that TNF- α levels in periodontitis decrease after SRP. Numerous studies have focused on periodontal treatment concerning metabolic control and TNF- α levels in individuals with T2DM, as measured in serum and gingival crevicular fluid (GCF). Nevertheless, SRP has specific physical constraints, including its inability to reach interproximal and furcation areas as well as deep periodontal pockets.^{3,4}

Laser therapy (LT) has been suggested as a treatment option for periodontitis in order to overcome the limitations of SRP and to decrease the bacterial load. Different laser wavelengths that are accessible are utilized in dentistry as a supplement to SRP.⁵ Low-level laser therapy (LLLT) exhibits bio-stimulatory, anti-infective, and anti-ablation effects. Research on the use of LLLT alongside SRP has demonstrated a reduction in TNF- α levels in the GCF and gingival tissue of periodontitis patients.⁶ This reduction is achieved by suppressing bacterial presence and biostimulating healing tissue through anti-inflammatory effects. Recently, there has been a growing connection between salivary cytokines and both periodontal status and oral inflammatory burden. Since systemic inflammation affects salivary inflammatory burden, it serves as an easy, rapid, and non-invasive salivary biomarker.⁷ The present study was conducted to compare TNF- α levels before and after non-surgical periodontal treatment in patients with periodontitis with and without type 2 diabetes mellitus

2. MATERIALS & METHODS

The study was carried out on 80 patients with periodontitis of both genders. All gave their written consent to participate in the study. The study was conducted within 1 year. Inclusion criteria consisted of; body mass index (BMI) normal (18.5–24.9) based on WHO criteria. Periodontitis with a probing depth (PD) of ≥ 5 mm, clinical attachment level (CAL) of ≥ 2 mm. Periodontitis and well-controlled T2DM. patients who underwent laser therapy in the past 3 months, surgical or nonsurgical therapy within 6 months, Pregnancy, lactating women. Autoimmune disorders such as rheumatoid arthritis etc. and tobacco habit were excluded.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups of 40 each. Group I were periodontitis and group II were periodontitis+ type 2 diabetes mellitus patients. Group I were further subdivided into group A who underwent scaling and root planing alone and group B who underwent scaling and root planing+ low level laser therapy. Group II were further subdivided into group C who underwent scaling and root planing alone and group D who underwent scaling and root planing+ low level laser therapy. In both groups, saliva was collected in a test tube for the assessment of TNF- α levels at baseline and at 8 weeks. Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

3. RESULTS

Table: I Demographic data

Parameters	Group I (40)		Group II (40)	
	Group A (20)	Group B (20)	Group C (20)	Group D (20)
M:F	11:9	10:10	8:12	9:11
Age (years)	45.2 \pm 5.2	47.4 \pm 5.8	46.3 \pm 5.1	45.8 \pm 3.8
BMI (Kg/m ²)	24.2 \pm 3.6	23.2 \pm 4.1	23.1 \pm 4.3	22.5 \pm 6.1

Table I shows that group A had 1 male and 9 females, group B had 10 males and 10 females, group C had 8 males and 12 females and group D had 9 males and 11 females. The mean age was 45.2 \pm 5.2 years, 47.4 \pm 5.8 years, 46.3 \pm 5.1 years and 45.8 \pm 3.8 years in group A, B, C and D respectively. The mean BMI was 24.2 \pm 3.6Kg/m², 23.2 \pm 4.1Kg/m², 23.1 \pm 4.3Kg/m² and 22.5 \pm 6.1Kg/m² in group A, B, C and D respectively.

Table: II Comparison of clinical parameters from baseline and 8 weeks after treatment

Groups	Parameters	Baseline	8 weeks	P value
Group A	PI	1.71	0.67	0.01
	BI	1.92	0.48	0.04
	PD	6.2	2.9	0.03

	CAL	6.5	2.5	0.05
Group B	PI	1.72	0.68	0.02
	BI	2.1	1.4	0.01
	PD	5.4	2.9	0.01
	CAL	2.8	2.7	0.05
Group C	PI	2.1	0.37	0.01
	BI	1.94	0.41	0.01
	PD	5.8	3.2	0.01
	CAL	6.1	3.1	0.01
Group D	PI	2.1	0.4	0.01
	BI	1.7	0.42	0.02
	PD	5.7	2.7	0.01
	CAL	5.8	2.6	0.03

Table II, graph I shows that at baseline and 8 weeks, in group A, PI was 1.71, 0.67, BI was 1.92 and 0.48, PD was 6.2 and 2.9 and CAL was 6.5 and 2.5 respectively. In group B, PI was 1.72 and 0.68, BI was 2.1 and 1.4, PD was 5.4 and 2.9 and CAL was 2.8 and 2.7 respectively. In group C, PI was 2.1 and 0.37, BI was 1.94 and 0.41, PD was 5.8 and 3.2 and CAL was 6.1 and 3.1 respectively. In group D, PI was 2.1 and 0.4, BI was 1.7 and 0.42, PD was 5.7 and 2.7 and CAL was 5.8 and 2.6 respectively. The difference was significant ($P < 0.05$).

Graph: I Comparison of clinical parameters from baseline and 8 weeks after treatment

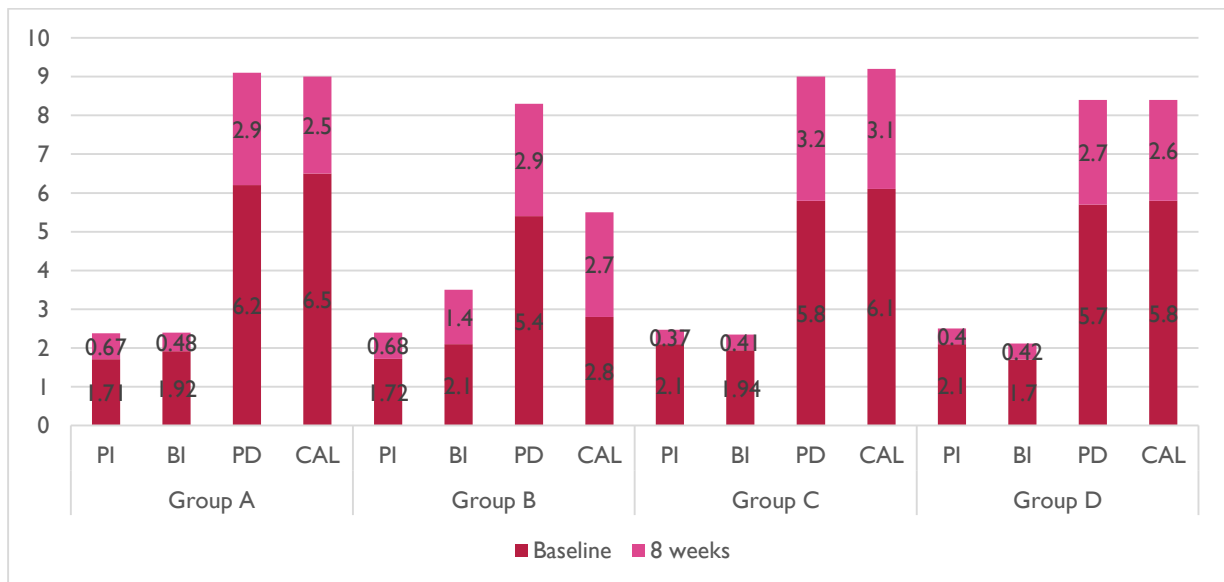


Table III Comparison of salivary tumor necrosis factor-alpha levels from baseline and 8 weeks after treatment

Groups	Baseline	8 weeks	P value
Group A	14.2 ±2.3	9.1±1.1	0.01

Group B	14.9±5.3	10.5±4.2	0.04
Group C	22.3±7.1	14.8±7.2	0.02
Group D	22.1±8.4	12.4±3.1	0.01

Table III shows that TNF- α at baseline and at 8 weeks in group A was 14.2 \pm 2.3 and 9.1 \pm 1.1, in group B was 14.9 \pm 5.3 and 10.5 \pm 4.2, in group C was 22.3 \pm 7.1 and 14.8 \pm 7.2 and in group D was 22.1 \pm 8.4 and 12.4 \pm 3.1 respectively. The difference was significant ($P < 0.05$).

4. DISCUSSION

Both diabetes and periodontitis have a shared pathogenesis characterized by heightened inflammatory responses both locally and systemically.⁸ Patients suffering from inflammatory periodontal diseases frequently exhibit heightened serum levels of proinflammatory cytokines.⁹ In contrast, individuals with diabetes possess hyperinflammatory immune cells that can aggravate the increased production of these cytokines. This exacerbation can lead to a rise in insulin resistance and complicate diabetes management for the patient.¹⁰ The present study was conducted to compare TNF- α levels before and after treatment in patients with periodontitis with and without type 2 diabetes mellitus.

In present study, the demographic characteristics (age, gender, BMI) showed no significant difference between all the study groups indicating the proper random assignment. Pulivarthy et al¹¹ evaluated and compared the alteration in TNF- α levels before and after treatment in patients with periodontitis with and without type 2 diabetes mellitus (T2DM). Sixty-four participants were divided into groups A (periodontitis) and B (periodontitis associated with T2DM), based on probing depth ≥ 5 mm, clinical attachment level ≥ 2 mm, and history of T2DM. Later were subdivided into A1, A2, B1, B2, based on assigned treatments. Clinical periodontal parameters and salivary TNF- α levels were evaluated and compared at baseline to 8 weeks. Comparison of periodontal parameters and salivary TNF- α levels from baseline to 8 weeks showed statistically significant difference ($P < 0.05$) in all groups, indicating a positive effect of scaling and root planing (SRP) and adjunctive LLLT.

The comparisons of PI and BI from baseline to 8 weeks after treatment in all groups showed significant difference. This result can be attributed to reducing local factors like plaque and calculus by SRP and improving inflammatory conditions by SRP adjunct to LLLT. This was in accordance with the studies conducted by Calderín et al.¹², Giannopoulou et al.¹³, Badersten et al.¹⁴ Dag A et al¹⁵ who determined the effect of non-surgical periodontal therapy on serum TNF-alpha and HbA1c levels in poorly and well-controlled type 2 diabetic patients. The plaque index, gingival index, probing depth, clinical attachment loss, gingival bleeding index, HbA1c value, and circulating TNF-alpha concentration were measured at baseline and three months after the non-surgical periodontal therapy. All periodontal parameters and serum TNF-alpha levels were significantly decreased three months after the non-surgical periodontal therapy compared to the baseline values in all groups. The HbA1c values were significantly decreased only in well-controlled diabetic patients.

In our study, comparison of PD and CAL from baseline to 8 weeks after treatment, all groups showed significant difference. This change can be due to reduced inflammation and the formation of reattachment following SRP and removal of pocket lining, hemostasis, and coagulation of periodontal inflamed soft tissues by SRP adjunct to LLLT. The results are in agreement with studies conducted by Dukić et al., Calderín et al.¹²

We found no significant differences in the periodontal parameters or TNF-alpha levels at baseline and after three months between the two groups. This change may be due to mechanical therapy, and the anti-inflammatory effect of LLLT reduced the clinical inflammation. Giannopoulou et al.¹³, Calderín et al¹² have observed similar results.

5. CONCLUSION

Authors found that Salivary TNF- α levels in periodontitis are associated with T2DM. There was a notable enhancement in both clinical and salivary TNF- α levels with SRP and SRP adjunct to LLLT with no significant difference between the two modalities

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