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Effect of Laser as An Adjunct to Nonsurgical Periodontal Treatment on Serum Inflammatory Markers in Patients with Chronic Periodontitis: A Clinico Biochemical Study

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Abstract

Background: The most common oral disease in response to the chronic infection caused by different periodontopathogenic bacteria is periodontitis resulting from inflammation of supporting structures of teeth. It has been shown that nonsurgical periodontal treatment (SRP) result in significant clinical improvements, but they do not completely remove periodontopathogens, especially in deep periodontal Adjunctive therapies improve tissue healing through detoxification and bactericidal effects. In recent years, adjunctive use of lasers has shown to be a promising modality to increase the effectiveness of nonsurgical periodontal treatment. The objective of the study is to evaluate the efficacy of diode laser in addition to scaling and root planning on periodontal parameters and CRP levels in chronic periodontitis. Materials and Methods: 24 chronic periodontitis patients were grouped as group 1(n=12) and group2(n=12) where in group 1 scaling and root planing was done and group 2 scaling and root planning with subgingival debridement using diode laser was done. The probing pocket depth, gingival index, plaque index, C-reactive protein, total leucocyte counts and erythrocyte sedimentation rate was recorded at baseline and after 1 month. Results: There was statistically significant reduction in probing pocket depth, CRP, ESR and TLC in both groups from baseline to 1 month. Conclusion: Both treatment groups showed reduction in the periodontal parameters and biomarkers. Adjunctive use of laser had same clinical benefits as to scaling and root planing alone.

Keywords: *Chronic periodontitis, C-reactive protein, Lasers, non-surgical periodontal therapy*

1. Introduction

Periodontitis is characterized by multifactorial etiology with pathogenic bacteria being a primary etiologic agent that resides in subgingival area and initiates a localized inflammatory response that further leads to the destruction of tooth supporting tissues (Singh et al., 2016; Gani et al., 2012). The periodontal pathogens affect local and systemic immune and inflammatory response. These local inflammatory response to pathogenic bacteria or bacterial products is characterized by infiltration of the periodontal tissues by inflammatory cells including polymorphonuclear neutrophils, macrophages, lymphocytes, and plasma cells.

The systemic consequences of periodontal disease are due to bacteraemia caused by damaged periodontal tissue and the resulting inflammatory response. It is exhibited in blood as an increase in total leukocyte count (TLC), erythrocyte sedimentation rate (ESR) values, PMNs and lymphocyte count (Kalsi et al., 2017). The activated macrophages releases cytokines. These cytokines lead to destruction

of periodontal tissues, which can also initiate systemic inflammatory response such as elevated levels of CRP, erythrocyte sedimentation rate (Noacj et al., 2001).

CRP is an extremely sensitive and non-specific acute-phase marker for inflammation that is produced in response to many forms of injury other than periodontitis, such as other infections, trauma, and hypoxia. and it is regulated by cytokines interleukin [IL- 6] and [IL-1] and tumor necrosis factor-alpha [TNF-α] (Saito et al., 2003). CRP is primarily synthesised in the liver. Some studies show that human gingiva is able to produce CRP in situ. Research has shown that individuals with periodontitis have higher CRP levels compared to those without the condition. In addition, studies have found that treating periodontitis with non-surgical periodontal therapy can lead to reduction in CRP levels (Marcaccni et al., 2009). Normal CRP levels vary among populations, with mean values between 2.5 and 5.0 mg/L (Correia & Burini, 2000).

The main goal in the treatment of these diseases was the elimination of supragingival and subgingival microbial biofilm which can be achieved by scaling and root planing. In this regard, nonsurgical periodontal treatment is the primary therapy, and its effectiveness has been documented by numerous studies (Qadri et al., 2005). However, in some cases more comprehensive therapies are needed. Studies are being conducted to enhance the efficacy of non-surgical periodontal treatment and to reduce patient compliance requirements following treatment with adjunctive modalities such as the use of chemotherapy or lasers.

In recent years, various studies were done to increase the effectiveness of nonsurgical periodontal treatment; one such promising modality is the use of lasers (Makhlouf et al., 2012). Reduction in the bacterial load utilising laser systems can be an effective tool when used as an adjunct to conventional treatment (Adriaens, 2004). The diode laser is a soft tissue laser having a wavelength of 810 nm or 910–980 nm, which aids in soft tissue curettage, sulcular debridement, has a bactericidal effect and has no interaction with dental hard tissues. During the time of irradiation, a part of the laser energy scatters and penetrates into periodontal pockets, stimulating the cells of surrounding tissues which results in reduction of the inflammatory conditions, increased in cell proliferation, flow of lymph, thereby improving the periodontal tissue attachment (Gupta et al.,2016). Studies have shown that use of diode laser in adjunct to non-surgical periodontal therapy led to reduction of CRP levels in the GCF (Dembowska et al.,2022).

There is better efficacy of adjunctive diode laser treatment resulting in both clinical as well as microbial reduction in the oral environment. Therefore, it is safe to use as a coadjuvant for non-surgical treatment for chronic periodontitis. Thus, the aim of this study was to evaluate the efficacy of diode laser in addition to scaling and root planing on periodontal parameters and CRP levels in chronic periodontitis patients.

2. Materials and Methods

The present study was conducted in Rajarajeswari dental college after obtaining due clearance from the Ethical Committee of Rajarajeswari dental college and informed consent was obtained from the participants selected for the study. 13 males and 11 females systemically healthy with no history of periodontal treatment in past 3months in the age group of 25 to 55 years but diagnosed moderate to severe chronic generalised periodontitis with pocket depth ≤ 5mm were selected from the Department of periodontology Rajarajeswari dental college and hospital, Bangalore Patients on any anti-inflammatory or antibiotics taken within the last 6 months, Chronic smokers and alcoholics were excluded from the study. Pregnant and lactating females were also excluded from the study.

The probing pocket depth (PPD), gingival index (GI) by Loe H and Silness P 1963 and Plaque index (PI) by Silness P and Loe H, 1964 were measured. PPD was measured using UNC 15 probe. Results were recorded at the baseline and after 1 month post treatment. CRP levels of the selected patients was assessed at baseline and after 1 month post treatment.

Treatment Protocol:

The selected patients were allocated into group-1(n=12) and group-2(n=12) using coin flip randomisation method.

Group-1: scaling and root planing

Group-2: scaling and root planing with subgingival laser treatment under local anaesthesia

These procedures were carried out with ultrasonic devices and curettes (Gracey curettes). Diode laser (BIOLASE) with wavelength of 980nm was used for sulcular debridement with non-contact mode with tip tissue distance of approximately 1 cm at 1.2W and with an application tip 1 cm in diameter was applied on every tooth in group-2 for 15s in the continuous mode.

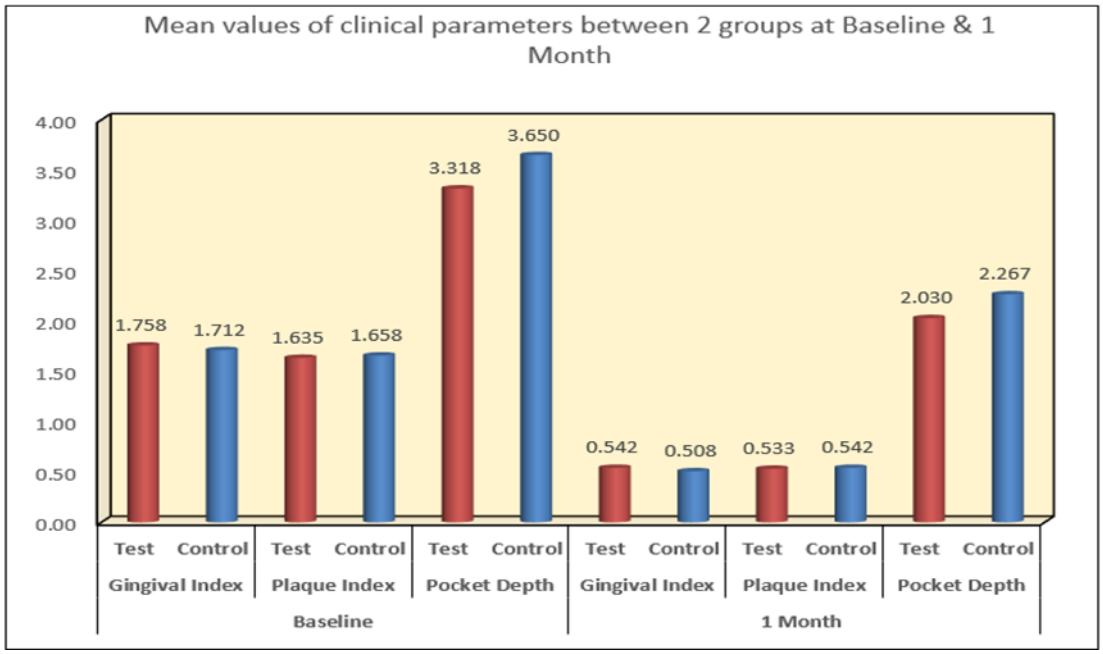
3. Results and Discussion

The data for 24 patients is tabulated in table 1 which shows the various clinical parameters, their averages and change in pre and post-treatment values. The mean Gingival & Plaque Index scores and mean Pocket depth at baseline period between 2 groups showed no significant differences. At 1 Month period, the mean plaque index scores and Pocket depth showed relatively lesser scores in the test group as compared to control group, but however the differences between 2 groups were not statistically significant. Contrastingly, the mean Gingival index scores in the control group showed relatively lesser scores as compared to Test group, but the difference was not statistically significant, Graph 1 is the pictorial representation of the same.

The mean CRP & TLC values at baseline period showed no significance between 2 groups. The mean ESR values were significantly higher in Test group as compared to Control group at baseline and the difference was statistically significant at p=0.008. At 1 Month period, the mean CRP and TLC levels in test group showed relatively lesser values as compared to control group. However, the mean difference in CRP & TLC levels between test and control group showed no significant differences. The mean ESR levels showed significantly lesser levels in Test group as compared to Control group and the mean difference between 2 groups was statistically significant at p=0.02, which is explained in Table 2, Graph-2 and Graph-3 are the pictorial representation of the same.

Table:1

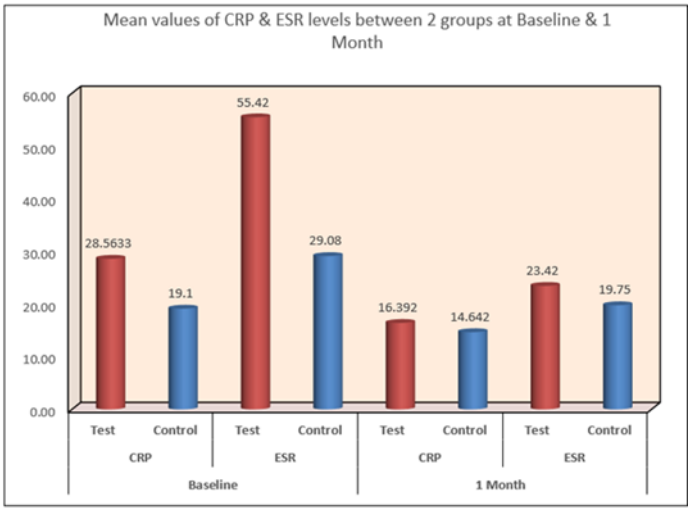
Comparison of mean values of clinical parameters between 2 groups at Baseline & 1 Month using Independent Student t Test						
Time	Parameter	Group	N	Mean	SD	p
Baseline	Gingival Index	Test	12	1.758	0.424	0.781
		Control	12	1.712	0.371	
	Plaque Index	Test	12	1.635	0.305	0.848
		Control	12	1.658	0.284	
	Pocket Depth	Test	12	3.3183	0.924	0.305
		Control	12	3.6500	0.583	
1 Month	Gingival Index	Test	12	0.542	0.124	0.459
		Control	12	0.508	0.090	
	Plaque Index	Test	12	0.533	0.098	0.846
		Control	12	0.542	0.108	
	Pocket Depth	Test	12	2.030	0.393	0.101
		Control	12	2.267	0.274	



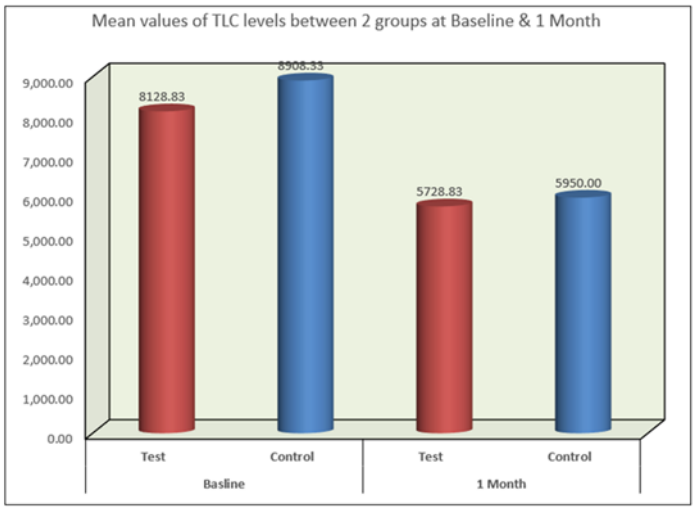
Graph:1

Table: 2

Comparison of mean values of Laboratory parameters between 2 groups at Baseline & 1 Month using Independent Student t Test						
Time	Parameter	Group	N	Mean	SD	p
Baseline	CRP	Test	12	28.5633	33.264	0.361
		Control	12	19.1000	11.425	
	TLC	Test	12	8128.83	2083.455	0.313
		Control	12	8908.33	1576.220	
	ESR	Test	12	55.42	30.345	0.008*
		Control	12	29.08	7.525	
1 Month	CRP	Test	12	16.392	25.580	0.825
		Control	12	14.642	8.740	
	TLC	Test	12	5728.83	1466.106	0.711
		Control	12	5950.00	1422.226	
	ESR	Test	12	23.42	4.680	0.023*
		Control	12	19.75	2.261	



Graph: 2



Graph: 3

Periodontal disease is considered to be a polymicrobial infection wherein pathogens act directly or indirectly to cause destruction of tooth-supporting structures. The accumulation of microbial plaque in the dentogingival area is the primary etiological factor. The assessed parameters (CRP, ESR, TLC) are commonly evaluated indicators of systemic health and disease and can show alterations due to Chronic periodontitis.

Nonsurgical periodontal therapy, with adjunctive treatment options such as laser is a well-established treatment modality for chronic periodontitis. The present study evaluates the laser effects as an adjunct to nonsurgical treatment of chronic periodontitis on CRP levels.

The results of the present study demonstrate that the adjunct use of laser promotes clinical improvements as well as improvement in blood parameters. There was improvement in terms of GI, PI, PPD and CRP levels in both the groups from baseline to 1 month. In terms of intergroup comparison there was no statistically significant difference, indicating that laser has no additional effects when used as adjunct to nonsurgical periodontal therapy.

Previous studies on the adjunct use of laser and nonsurgical periodontal therapy in treating chronic periodontitis are few and have discrete results. In accordance with our study D'Aiuto Fet al. (2005) showed that there was decrease in the CRP levels and differential counts measured at 7 and 30 days. But a split mouth study stated no statistical difference between laser and control group in plaque index, GI levels and PPD levels. another parallel study reported that laser results in a statistically significant decrease in PPD and CAL levels in 6 months (Aykol et al., 2011).

These discrepancies in previous literature can be attributed to the type of lasers (e.g., penetration depth), study design, and laser duration. However, due to a lack of studies, selecting the right laser and parameters can be challenging. In the present situation lasers are used and studied both in combination with pocket disinfection methods and for fastening up wound recovery and anti-inflammatory effects. The data from our clinical trial indicate that lasers adjunct to SRP improves clinical and blood parameters but there is no statistically significant difference when compared to SRP alone. The result from clinical trial suggests that lasers in combination with SRP improve clinical and blood measurements, but statistically no significant differences were observed when compared with SRP alone.

4. Conclusion

The present study was aimed at evaluating the efficacy of diode laser as an adjunct to SRP in chronic periodontitis patients. The study shows that both treatment groups showed decrease in the periodontal parameters and the biomarkers. However, the adjunctive use of laser did not show any significant benefits compared to SRP.

Prior publication: nil

Support: nil

Conflicts of interest: nil

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