IJPSR (2020), Volume 11, Issue 10 (Research Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 19 October 2019; received in revised form, 18 February 2020; accepted, 12 March 2020; published 01 October 2020

A COMPARATIVE EVALUATION OF LASER ASSISTED & CONVENTIONAL OPEN FLAP SURGICAL DEBRIDEMENT PROCEDURE IN PATIENTS WITH CHRONIC PERIODONTITIS – A CLINICAL AND MICROBIOLOGICAL STUDY- A PILOT PROJECT

Shreya Shetty [*1], Karunakar Shetty [1], Saad Alghamdi [1], Nouf Almehmadi [1] and Tanya Mukherjee [2]

Dentistry Program [1], IBN Sina National College of Medical Sciences, Jeddah, KSA.
Government Hospital [2], Kakching - 795103, Manipur, India.

Keywords:

Laser-assisted flap surgery, Conventional flap surgery, Healing, Bacterial pathogens, Original research

Correspondence to Author:
Dr. Shreya Shetty

Associate Professor,
Dentistry Program, IBN Sina National College of Medical Sciences, Jeddah, KSA.

E-mail: drshreyak@gmail.com

ABSTRACT: Background and Objectives: Current research suggests several advantages of the adjunctive use of lasers in periodontal therapy. The aim of this study was to assess and evaluate the comparative therapeutic effects of laser-assisted and conventional open flap debridement procedures. **Materials and Methods:** 30 sites in 15 patients (9 males and 6 females), age range (25-50 yrs) with chronic periodontitis having probing depth ≥5 mm after phase I therapy were randomly assigned to test group (laser-assisted flap debridement) & control group (conventional open flap debridement) in a split-mouth design. Clinical and microbial parameters were analyzed at baseline, 3 months, and 6 months. In addition, Soft tissue healing was also assessed using the healing index at 1 week, 2 weeks, 1 month, 3 months & 6 months. **Results:** The change in clinical parameters in the test and control groups was not statistically significant at the various time intervals ($p<0.05$). However, the microbiological analysis showed a significant reduction in the CFU counts of periodontal pathogens in the test sites when compared to the control sites at immediate post-op and 6 months ($p>0.05$). **Conclusion:** Laser assisted flap procedures showed better therapeutic outcomes when compared to the conventional open flap debridement with respect to microbial parameters; however, future long term RCTs (randomized clinical trials) with larger sample sizes need to be carried out to ascertain their benefits.

INTRODUCTION: Periodontitis is the result of complex interrelationships between infectious agents such as bacteria and host factors. It is universally accepted that periodontal disease is the result of mixed bacterial infections that require the participation of a very limited number of the members of the anaerobic microbiota inhabiting the subgingival region, and results in the destruction of the supporting structures of the teeth [1, 2].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.11(10).4957-65

This article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.11(10).4957-65

Most conventional methods used to treat the disease involve disruption of the biofilm by the mechanical removal of subgingival plaque and, sometimes, the adjuvant use of antimicrobial agents and mechanical surgical debridement of pocket and root surfaces damaged as a result of periodontal disease. An alternative (ecological) approach would be to alter the environment of the pocket to prevent the growth of the putative pathogens, as suggested by Marsh (ecological plaque hypothesis) [3].

Nonsurgical therapy leads to resolution of inflammation, reduction in bacterial load, and reduction in probing pocket depth. However, the complete removal of bacterial toxins from the root surfaces in the deep periodontal pockets is not always achieved with nonsurgical therapy [4].

Instrumentation is not possible in inaccessible areas such as furcation, grooves and concavities [4]. In addition, it has also been suggested that sonic and ultrasonic instrumentation does not result in the killing of periodontopathogens [5]. These instruments merely help to reduce the bacterial load by the mechanical removal of plaque and calculus.

Surgical therapy performed in cases with persistent inflammation, deep pockets, class II and III furcation defects, and intrabony defects provides better accessibility to root surfaces as well as osseous defects. However, periodontopathogens persist in the mixed-species plaque biofilm on tooth surfaces, adhere to and enter the epithelial cells, and are tissue invasive in nature [6]. These are the major sources for re-colonization and reinfection. Therefore, the above methods may prove ineffective unless supplemented by concomitant use of systemic antibiotics, which again have their own share of adverse effects.

LASERS - an acronym for Light Amplification by Stimulated Emission of Radiation; have been used in periodontology to reduce periodontopathogenic bacteria, [7, 8, 9] remove the pocket epithelium, and retard epithelial migration into the pocket. If the wavelength is appropriate, it is also possible to remove the hard deposits (*i.e.,* calculus) and to perform root planning [10]. A significant reduction of periodontopathogenic bacteria has also been demonstrated, regardless of laser wavelength [7, 11, 12].

Diode laser with a wavelength of 810 nm or 910–980 nm, does not interact with dental hard tissues and therefore, is an excellent soft tissue surgical laser, indicated for cutting and coagulating gingiva and oral mucosa, and for soft tissue curettage or sulcular debridement with an additional bactericidal effect [11].

The principal goal of periodontal therapy is the elimination of bacterial plaque and also prevention of its accumulation. Conventional open flap surgery in conjunction with mechanical debridement has been shown to effectively achieve this goal. However, incomplete removal of pathogens from the base of deep pockets & tissue penetrating organisms along with other inherent drawbacks such as lack of hemostasis, intraoperative and postoperative pain & discomfort with this technique have led to the popularity of laser-assisted procedures [13] which have claimed to overcome the above shortcomings and effectively achieve the goal of plaque elimination by completely sterilizing the periodontal pocket.

The purpose of this study was, therefore, to comparatively assess and evaluate clinically and microbiologically the treatment outcomes following laser-assisted and conventional open flap surgical procedures.

MATERIALS AND METHODS: Following an initial screening, 15 patients (9 males and 6 females) with chronic periodontitis involving two or more quadrants in the mouth were selected from the outpatient department of a dental institute for the study based on the following criteria:

Inclusion Criteria:

1. Patients willing to sign on a written consent form.
2. Male and female patients aged between 25-50 years.
3. Patients with suprabony pockets with probing pocket depth ≥ 5mm in 1 or more teeth in two or more quadrants evidenced clinically and radiographically.
4. Number of teeth present ≥ 20.

Exclusion Criteria:

1. Presence of any systemic or debilitating diseases.
2. Pregnant or lactating women.
3. A recent history or presence of any acute or chronic infections.
4. Patients with history of any drug intake including antibiotics, analgesics or any other drugs three months prior to study.
5. Patients who have undergone periodontal therapy in the last six months.
6. Patients who are smokers/paan/tobacco/ betelnut users.
7. Patients who are physically or mentally challenged.

After obtaining the required permissions and consent from the institutional Ethical Committee, (IEC NO - VEF/14112013), the selected patients

were randomly divided into two groups following the split-mouth/arch study design thereby comprising of 15 patients in each group- Test (n=15) & Control (n =15).

The following clinical parameters where recorded at baseline, 3 months & 6 months in both the groups:

1. Gingival index (GI) by Loe and Sillness (1963) [14].
2. Plaque index (PI) by Turesky-Gilmore-Glickman modification of the Quigley Hein Plaque index (1970).
3. Probing pocket depth (PPD).
4. Relative attachment level (RAL) (using an acrylic stent).
5. Soft tissue healing using healing index [15] was assessed at day 1, 1 week, 2 weeks, 1 month, 3 month, and 6 months following therapy.

Treatment Procedure: All periodontal surgical procedures were performed on an outpatient basis under aseptic conditions. Standardized surgical procedures for the test and control sites were performed as follows

The surgical area was anesthetized using local anesthetic 2% lignocaine with adrenaline 1:80,000 (Lignox 2%)[α]. Intracrevicular incisions were made and full-thickness mucoperiosteal flaps were elevated, granulation tissue was collected in an Eppendorf tube, and refrigerated at- 20 °C till microbial analysis was performed. Following flap reflection, the hard tissue deposits were debrided using an ultrasonic scaler and Gracey curettes.

In the test sites, granulation tissue debridement using soft tissue diode (980nm) laser* was done by lasing the tissue for 3 min at 2.5 watts, and at the end of all possible debridement, the residual granulation tissue was collected and stored in a seperate Eppendorf tube till microbial analysis was performed. In the control sites, following flap reflection, the granulation tissue and hard tissue deposits were debrided using an ultrasonic scaler and Gracey curettes. At the end of all the possible debridement, the residual granulation tissue was collected and stored in another separate Eppendorf tube for microbial analysis.

In both the sites, surgical flaps were repositioned to the presurgical level and sutured with 3-0 silk suture utilizing an interdental, direct suturing technique achieving primary closure. No periodontal dressing was given as healing had to be assessed.

One week following surgery, sutures were removed, and the area was irrigated thoroughly with saline. Recall appointments were made at the scheduled time intervals, as mentioned earlier, and at each visit, clinical parameters were recorded, oral hygiene instructions were reinforced, and scaling was done whenever necessary.

The granulation tissue collected and stored in the Eppendorf tubes, and the plaque samples were sent for microbial culture (anerobic) in both test and control groups at said time intervals.

Statistical Analysis: The clinical and microbiological parameters in both the groups were statistically analyzed by Student's 't' test using SPSS V13 software. Paired 't' tests were used to compare the intragroup and intergroup variations. A 'p' value of 0.05 or less was considered significant.

RESULTS: A significant improvement in clinical parameters *viz*, gingival index, plaque index, probing pocket depth and relative attachment level within both the test and control groups at all the time intervals throughout the study was observed ($p<0.001$) **Table 1A** and **B**. However, the difference between the 2 groups was not statistically significant ($p\geq0.05$) **Table 1C**. Similarly, the healing index scores showed significant changes within both groups ($p<0.001$) in **Table 2A** and **2B** but did not show any significant differences between the groups ($p>0.05$) **Table 2C**.

The assessment of the microbial parameters, *viz*., *P. gingivalis*, *P. intermedia*, and *A. comitans* CFU counts showed statistically significant changes ($p<0.001$) within both the groups **Table 3A** and **B**. However, a significant reduction in the CFU counts of periodontal pathogens were found in the test group when compared to the control group at immediate post-op and 6 months ($p<0.001$) but not at the other time intervals ($p\geq0.05$) **Table 3C**.

TABLE 1: COMPARISON OF CLINICAL PARAMETERS (GINGIVAL INDEX, PLAQUE INDEX, PROBING POCKET DEPTH AND ATTACHMENT LEVEL)

A. TEST GROUP

Parameters	Gingival index				Plaque index			
Time Interval	**Mean**	**Std Dev**	**t**	**P-Value**	**Mean**	**Std Dev**	**t**	**P-Value**
Baseline	3.12	1.68	6.288	<0.001*	1.17	0.50	8.353	<0.001*
3 months	1.93	1.05			0.79	0.37		
Baseline	3.12	1.68	6.973	<0.001*	1.17	0.50	9.423	<0.001*
6 months	1.22	0.68			0.51	0.26		
3 months	1.93	1.05	6.317	<0.001*	0.79	0.37	8.771	<0.001*
6 months	1.22	0.68			0.51	0.26		
Parameters	**Probing pocket depth**				**Relative attachment level**			
Time Interval	**Mean**	**Std Dev**	**t**	**P-Value**	**Mean**	**Std Dev**	**t**	**P-Value**
Baseline	2.98	0.80			7.00	1.05		
3 months	1.78	0.49	11.272	<0.001*	5.79	1.01	13.827	<0.001*
Baseline	2.98	0.80			7.00	1.05		
6 months	1.53	0.49	11.764	<0.001*	4.97	0.89	19.242	<0.001*
3 months	1.78	0.49			5.79	1.01		
6 months	1.53	0.49	8.488	<0.001*	4.97	0.89	11.709	<0.001*

B. CONTROL GROUP

Parameters	Gingival index				Plaque index			
Time Interval	**Mean**	**Std Dev**	**t**	**P-Value**	**Mean**	**Std Dev**	**t**	**P-Value**
Baseline	3.31	1.71	7.488	<0.001*	1.14	0.46	9.739	<0.001*
3 months	2.13	1.17			0.63	0.31		
Baseline	3.31	1.71	8.282	<0.001*	1.14	0.46	11.927	<0.001*
6 months	1.46	0.93			0.45	0.29		
3 months	2.13	1.17	8.014	<0.001*	0.63	0.31	15.783	<0.001*
6 months	1.46	0.93			0.45	0.29		
Parameters	**Probing pocket depth**				**Relative attachment level**			
Time Interval	**Mean**	**Std Dev**	**t**	**P-Value**	**Mean**	**Std Dev**	**t**	**P-Value**
Baseline	2.94	0.67			7.57	1.38	19.138	<0.001*
3 months	1.93	0.58	15.808	<0.001*	5.81	1.38		
Baseline	2.94	0.67			7.57	1.38	34.755	<0.001*
6 months	1.41	0.54	18.558	<0.001*	4.73	1.37		
3 months	1.93	0.58			5.81	1.38	27.725	<0.001*
6 months	1.41	0.54	15.502	<0.001*	4.73	1.37		

C. INTER-GROUP COMPARISON

Parameters		Gingival index				Plaque index			
Time Interval	**Group**	**Mean**	**Std Dev**	**t**	**P-Value**	**Mean**	**Std Dev**	**t**	**P-Value**
Baseline	Test group	3.12	1.68	-0.293	0.771	1.17	0.50	0.164	0.871
	Control group	3.31	1.71			1.14	0.46		
3 months	Test group	1.93	1.05	-0.499	0.622	0.79	0.37	1.302	0.203
	Control group	2.13	1.17			0.63	0.31		
6 months	Test group	1.22	0.68	-0.803	0.429	0.51	0.26	0.663	0.513
	Control group	1.46	0.93			0.45	0.29		
Parameters		**Probing depths**				**RAL**			
Time Interval	**Group**	**Mean**	**Std Dev**	**t**	**P-Value**	**Mean**	**Std Dev**	**t**	**P-Value**
Baseline	Test group	2.98	0.80	0.144	0.886	7.00	1.05	-1.280	0.211
	Control group	2.94	0.67			7.57	1.38		
3 months	Test group	1.78	0.49	-0.785	0.439	5.79	1.01	-0.041	0.968
	Control group	1.93	0.58			5.81	1.38		
6 months	Test group	1.53	0.49	0.655	0.518	4.97	0.89	0.557	0.582
	Control group	1.41	0.54			4.73	1.37		

TABLE 2: COMPARISON OF HEALING INDEX BETWEEN THE TWO GROUPS FOR DIFFERENT TIME INTERVALS

Time Interval	Group	Mean	Std Dev	SE of Mean	Mean Diff	t	P-Value
1 day	Test group	2.40	0.51	0.13	0.000	0.000	1.000
	Control group	2.40	0.51	0.13			
1 week	Test group	2.66	0.44	0.11	-0.012	-0.071	0.944
	Control group	2.68	0.48	0.12			
2 week	Test group	2.91	0.18	0.05	0.039	0.520	0.607
	Control group	2.87	0.23	0.06			
1month	Test group	2.68	0.40	0.10	0.093	0.635	0.531
	Control group	2.59	0.40	0.10			
3 month	Test group	2.32	0.59	0.15	-0.123	-0.636	0.530
	Control group	2.44	0.45	0.12			
6 month	Test group	2.43	0.50	0.13	0.017	0.095	0.925
	Control group	2.42	0.47	0.12			

TABLE 3: COMPARISON OF MICROBIOLOGIC PARAMETERS

A. TEST GROUP

Micro-organisms	*P. intermedia*				*A. comitans*				*P. gingivalis*			
Time Interval	Mean	Std Dev	Z	P-Value	Mean	Std Dev	Z	P-Value	Mean	Std Dev	Z	P-Value
Pre Op	21000.00	7367.88	-1.144	0.253	18666.67	4418.58	0.000	1.000	21000.00	7367.88		
Post Op	18333.33	4498.68			18666.67	4418.58			19666.67	4805.75	-0.570	0.569
Pre Op	21000.00	7367.88	-2.897	0.004*	18666.67	4418.58	-3.304	0.001*	21000.00	7367.88		
1 month	13800.00	2932.58			14466.67	3136.57			15533.33	5139.02	-3.442	0.001*
Pre Op	21000.00	7367.88	-3.091	0.002*	18666.67	4418.58	-3.458	0.001*	21000.00	7367.88		
3 month	11800.00	3144.16			12133.33	3204.16			12200.00	3839.64	-3.461	0.001*
Pre Op	21000.00	7367.88	-3.422	0.001*	18666.67	4418.58	-3.442	0.001*	21000.00	7367.88		
6 month	6800.00	3405.88			7200.00	4522.96			6333.33	4418.58	-3.474	0.001*
Post Op	18333.33	4498.68	-3.439	0.001*	18666.67	4418.58	-3.304	0.001*	19666.67	4805.75		
1 month	13800.00	2932.58			14466.67	3136.57			15533.33	5139.02	-1.914	0.056
Post Op	18333.33	4498.68	-3.458	0.001*	18666.67	4418.58	-3.458	0.001*	19666.67	4805.75		
3 month	11800.00	3144.16			12133.33	3204.16			12200.00	3839.64	-3.104	0.002*
Post Op	18333.33	4498.68	-3.425	0.001*	18666.67	4418.58	-3.442	0.001*	19666.67	4805.75		
6 month	6800.00	3405.88			7200.00	4522.96			6333.33	4418.58	-3.438	0.001*
1 month	13800.00	2932.58	-2.456	0.014*	14466.67	3136.57	-2.636	0.008*	15533.33	5139.02		
3 month	11800.00	3144.16			12133.33	3204.16			12200.00	3839.64	-2.530	0.011*
1 month	13800.00	2932.58	-3.431	0.001*	14466.67	3136.57	-3.454	0.001*	15533.33	5139.02		
6 month	6800.00	3405.88			7200.00	4522.96			6333.33	4418.58	-3.471	0.001*
3 month	11800.00	3144.16	-3.470	0.001*	12133.33	3204.16	-3.240	0.001*	12200.00	3839.64		
6 month	6800.00	3405.88			7200.00	4522.96			6333.33	4418.58	-3.275	0.001*

B. CONTROL GROUP

Micro-organisms	*P. intermedia*				*A. comitans*				*P. gingivalis*			
Time Interval	Mean	Std Dev	Z	P-Value	Mean	Std Dev	Z	P-Value	Mean	Std Dev	Z	P-Value
Pre Op	18000.00	4551.29	-2.842	0.004*	18333.33	4498.68	-2.966	0.003*	20333.33	5814.60	-2.807	0.005*
Post Op	14866.67	3563.04			15066.67	3654.09			16333.33	3518.66		
Pre Op	18000.00	4551.29	-3.530	<0.001*	18333.33	4498.68	-3.530	<0.001*	20333.33	5814.60	-3.501	<0.001*
1 month	12333.33	3287.78			12666.67	3287.78			13533.33	3700.71		
Pre Op	18000.00	4551.29	-3.436	0.001*	18333.33	4498.68	-3.455	0.001*	20333.33	5814.60	-3.450	0.001*
3 month	9933.33	3594.97			10333.33	4303.93			10800.00	2569.05		
Pre Op	18000.00	4551.29	-3.086	0.002*	18333.33	4498.68	-3.341	0.001*	20333.33	5814.60	-2.640	0.008*
6 month	12466.67	2825.06			10933.33	1791.51			15066.67	3654.09		
Post Op	14866.67	3563.04	-2.716	0.007*	15066.67	3654.09	-2.692	0.007*	16333.33	3518.66	-2.887	0.004*
1 month	12333.33	3287.78			12666.67	3287.78			13533.33	3700.71		
Post Op	14866.67	3563.04	-3.317	0.001*	15066.67	3654.09	-3.205	0.001*	16333.33	3518.66	-3.497	<0.001*
3 month	9933.33	3594.97			10333.33	4303.93			10800.00	2569.05		
Post Op	14866.67	3563.04	-1.740	0.082	15066.67	3654.09	-2.914	0.004*	16333.33	3518.66	-1.273	0.203
6 month	12466.67	2825.06			10933.33	1791.51			15066.67	3654.09		
1 month	12333.33	3287.78	-2.680	0.007*	12666.67	3287.78	-2.419	0.016*	13533.33	3700.71	-2.911	0.004*
3 month	9933.33	3594.97			10333.33	4303.93			10800.00	2569.05		
1 month	12333.33	3287.78	-0.299	0.765	12666.67	3287.78	-1.709	0.088	13533.33	3700.71	-1.299	0.194
6 month	12466.67	2825.06			10933.33	1791.51			15066.67	3654.09		
3 month	9933.33	3594.97	-2.157	0.031*	10333.33	4303.93	-0.339	0.734	10800.00	2569.05	-3.075	0.002*
6 month	12466.67	2825.06			10933.33	1791.51			15066.67	3654.09	-2.807	0.005*

C. INTER-GROUP COMPARISON

Parameters		*P. gingivalis*				*P. intermedia*				*A. comitans*			
Time Interval	**Group**	**Mean**	**Std Dev**	**Z**	**P-Value**	**Mean**	**Std Dev**	**Z**	**P-Value**	**Mean**	**Std Dev**	**Z**	**P-Value**
Pre Op	Test site	21000.00	7367.88	-	0.946	21000.00	7367.88	-1.261	0.207	18666.67	4418.58	-	0.762
	Control site	20333.33	5814.60	0.068		18000.00	4551.29			18333.33	4498.68	0.303	
Post Op	Test site	19666.67	4805.75	-	0.030*	18333.33	4498.68	-2.150	0.032*	18666.67	4418.58	-	0.020*
	Control site	16333.33	3518.66	2.167		14866.67	3563.04			15066.67	3654.09	2.320	
1 month	Test site	15533.33	5139.02	-	0.286	13800.00	2932.58	-1.422	0.155	14466.67	3136.57	-	0.118
	Control site	13533.33	3700.71	1.067		12333.33	3287.78			12666.67	3287.78	1.565	
3 month	Test site	12200.00	3839.64	-	0.278	11800.00	3144.16	-1.337	0.181	12133.33	3204.16	-	0.240
	Control site	10800.00	2569.05	1.086		9933.33	3594.97			10333.33	4303.93	1.174	
6 month	Test site	6333.33	4418.58	-	<0.001*	6800.00	3405.88	-3.738	<0.001 *	7200.00	4522.96	-	0.005*
	Control site	15066.67	3654.09	4.134		12466.67	2825.06			10933.33	1791.51	2.787	

DISCUSSION: Successful periodontal therapy depends on anti-infective procedures aimed at eliminating or suppressing pathogenic organisms found in dental plaque associated with the tooth surface and within other niches in the oral cavity. Laser-assisted periodontal therapy has attracted attention recently as a potential alternative or adjunct to conventional mechanical debridement [16-18]. Carbon dioxide (CO_2) laser, neodymium-doped: yttrium-aluminum-garnet (Nd:YAG) laser, and diode and erbium-doped: yttrium-aluminum-garnet (Er:YAG) laser have been used in the therapy of periodontal pocket for hard tissue as well as soft tissue management [7, 10].

It has been suggested that a part of the laser energy scatters and penetrates during irradiation into periodontal pockets. The attenuated laser at a low energy level might then stimulate the cells of surrounding tissue resulting in a reduction of the inflammatory conditions, in cell proliferation, and an increased flow of lymph, improving the periodontal tissue attachment and possibly reducing postoperative pain [19-21].

Soft tissue lasers such as diode and Nd: YAG have the potential for curettage of the pocket wall and disinfection of periodontal pockets [16, 17]. A search of literature reviews revealed very few reports of the use of CO_2 and Er:-YAG lasers in surgical pocket therapy. To the knowledge of the authors, there are few reports of the use of diode laser as an adjunct to mechanical debridement in access flap surgery, although it is the most commonly used laser [16, 17, 22,] and some provide mixed reports [23]. Most reports focus on the use of laser for non-surgical periodontal therapy [21, 24].

In the present study, it was therefore decided to evaluate the adjunctive effects of a soft tissue diode laser in open flap debridement on the clinical and microbiological parameters.

Systemically, healthy patients with chronic periodontitis and presenting pockets on contralateral sites were recruited in this split-mouth designed study and randomly assigned to test and control groups to avoid bias. The clinical study was designed to compare the clinical treatment outcomes of laser-assisted flap debridement and conventional open flap procedures. A split-mouth design was used as this excludes the influence of individual patient characteristics and helps to obtain a more powerful estimate of treatment effect with a smaller sample size [25]. The sample size in this study was arrived at on consultation with the statistician, which was in accordance with a vast majority of clinical periodontal studies carried out in humans [26]. The gold standard for recording changes in periodontal status is the longitudinal measurements with clinical attachment level (CAL) from CEJ to the base of the pocket.

Due to the relative inconsistencies in determining CEJ accurately at the selected sites, it was decided to use a customized acrylic stent and use the base of the stent as the fixed reference point and evaluate relative attachment level (RAL) and PPD.

To evaluate the antibacterial effect of lasers, it was decided to assess the debrided tissues and the plaque samples at regular intervals post- operatively by anaerobic culture. This was essentially carried out to ascertain whether reduced microbial counts enhanced clinical outcomes.

There was a significant improvement in clinical parameters (gingival index, plaque index and probing pocket depth and attachment levels) within both, the laser and conventional open flap treated groups from baseline to 3 months and up to 6 months which is line with various evidence [16, 17, 22] concluding similar findings.

On the contrary, no significant differences were observed at the various time intervals between the laser-assisted open flap debridement and open flap debridement procedure in accordance with Gokhale *et al*., 2012 [22] who also observed similar findings.

Interestingly, significant improvement in healing within both the laser-assisted open flap debridement & open flap debridement procedure was observed in this study, as evidenced by the healing index scores, thus suggesting that both the procedures lead to effective healing outcomes [27-29]. Additionally, healing outcomes may be better with laser because of enhanced reduction in inflammatory mediators [30].

However, no significant differences were observed at the various time intervals between the laser-assisted open flap debridement surgery versus open flap surgery. This was in accordance with some evidence [31, 32,] and in contrast to the findings of Grzech *et al*., [33] and Kripal *et al*., [34] who reported delayed healing.

Although the reliability and reproducibility of the index used for assessing healing in this study is not aptly justified, there is convincing evidence suggesting this index has been reliable to evaluate clinical soft tissue healing in periodontal studies [35].

The soft tissue diode laser has been widely suggested to be safe to use as it does not react or adversely affect the dental hard tissues *i.e.* the tooth as well as the root surfaces [31, 34, 36]. In the present study, too, no untoward effects were reported.

With regard to the microbiological parameters, open flap debridement procedures have also shown to significantly reduce microbial counts of periodontal pathogens [37, 38,] which was also observed in our study. Similarly, there was also a significant reduction in CFU counts of *P. gingivalis, P. intermedia* & *A. actinomycetem-comitans* within the laser-assisted open flap debridement group at the various time intervals. This is in accordance with the findings of various investigators [39-41] wherein; they observed that a laser facilitates bacterial elimination from periodontal pockets, resulting in better healing.

An interesting finding in this study was a significantly greater reduction in the CFU counts of *P. gingivalis, P. Intermedia* & A. Actino-mycetemcomitans, observed in the laser assisted open flap debridement compared to the open flap debridement procedure at immediate post-op and 6 months time intervals. This is in accordance with the findings of Gokhale SR *et al*., 2012 [22] where the greater reduction was found in CFU of obligate anaerobes in the laser group compared to the open flap debridement group. As concluded by various investigators, this could possibly be due to the direct cytopathic effects of the lasers on the periodontal pathogens [18, 41]. However, there were no significant differences observed in the various other time intervals, which was in accordance with the findings of Ren *et al*., [21] wherein they found no advantage was achieved with the additional use of laser.

CONCLUSION: Laser-assisted flap procedures have potentially better therapeutic outcomes when compared to the conventional open flap debridement, which is evident from the enhanced reduction in periodontal pathogens.

Limitations:

1. More sophisticated and sensitive healing assessment methods like fluorescein angiogram, flow cytometry using markers for various cells and cytokines, and also immunohistochemistry evaluation of healing using various MMPs as markers could also be done.
2. For more accurate microbiological assessment, an advanced diagnostic tool like PCR or ELISA kits could have been used, although they would have proved very expensive.
3. Larger sample size involving a larger cross-section of the population needs to be carried out.

ACKNOWLEDGEMENT: The services of Mr. Murthy, who performed the statistical analysis of the results of the study.

CONFLICTS OF INTEREST: The authors report no conflict of interest in this study.

REFERENCES:

1. Haffajee AD and Socransky SS: Microbial etiological agents of destructive periodontal diseases. Periodontol 1994; 5: 78-111.
2. Darveau RP, Tanner A and Page RC: The microbial challenge in periodontitis. Periodontol 1997; 14: 12-32.
3. Marsh PD: Sugar, fluoride, pH and microbial homeostasis in dental plaque. Proc Finn Dent Soc 1991; 87: 515-25.
4. Latheef P, Sirajuddin S, Gundapaneni V, Mn K and Apine A: Iatrogenic damage to the periodontium caused by periodontal treatment procedures. Open Dent J. 2015; 9: 203-07.
5. Schenk G, Flemmig TF, Lob S, Ruckdeschel G and Hickel R: Lack of antimicrobial effect on periodontopathic bacteria by ultrasonic and sonic scalers *in-vitro*. J Clin Periodontol 2000; 27: 116-19.
6. Ji S, Choi YS and Choi Y: Bacterial invasion and persistence: critical events in the pathogenesis of periodontitis? J Periodont Res 2015; 50: 570-85.
7. Rao NR and More CB: "Application of lasers in periodontal therapy: A review of literature with International Journal of Current Research 2016; 8(09): 38985-94.
8. Jha A, Gupta V and Adinarayan R: LANAP, Periodontics and Beyond: A Review. J Lasers Med Sci 2018; 9(2): 76-81.
9. Katuri KK, Bollepalli AC, Sunkireddy HKR, Chilakalapudi HCB, Kurapati S and Vinnakota NR: Clinical effectiveness of laser assisted new attachment procedure as an adjunct to nonsurgical periodontal treatment: a randomized clinical study. J Int Oral Health 2015; 7(11): 57-62.
10. Abdulsamee N: "Soft and Hard Dental Tissues Laser Er: YAG Laser: From Fundamentals to Clinical Applications. Review Article". EC Dental Science 2017; 11(4): 149-67.
11. Shah NK, Rai JJ, Dave DH and Patel JK: Deploying diode laser in periodontics: An evidence-based review. Adv Hum Biol 2018; 8: 64-9.
12. McCawley TK, McCawley MN and Rams TE: Immediate Effects of Laser-Assisted New Attachment Procedure (LANAP) on Human Periodontitis Microbiota. J Int Acad Periodontol. 2018; 20(4): 163-7.
13. Cobb CM: Lasers and the treatment of periodontitis: The essence and the noise. Periodontol 2017; 75: 205-95.
14. Loe H: The Gingival Index, the Plaque Index and the Retention Index Systems, J Periodontol 1967; 38(6) Part II : 610-16.
15. Marini L, Rojas MA, Sahrmann P, Aghazada R and Pilloni A: Early Wound Healing Score: a system to evaluate the early healing of periodontal soft tissue wounds. J Periodontal Implant Sci 2018; 48(5): 274-83.
16. Lobo TM and Pol DG: Evaluation of the use of a 940 nm diode laser as an adjunct in flap surgery for treatment of chronic periodontitis. J Indian Soc Periodontol 2015; 19: 43-8.
17. Aena PJ, Parul A, Siddharth P, Pravesh G, Vikas D and Vandita A: The clinical efficacy of laser assisted modified widman flap: A randomized split mouth clinical trial. Indian J Dent Res 2015; 26: 384-9.
18. Sumra N, Kulshrestha R, Umale V and Chandurkar K: Lasers in non-surgical periodontal treatment – a review, Journal of Cosmetic and Laser Therapy 2019; 21(5): 255-61.
19. Suresh S, Merugu S, Mithradas N and Sivasankari: Low-level laser therapy: A biostimulation therapy in periodontics. SRM J Res Dent Sci 2015; 6: 53-6.
20. Sudhakar U, Satyanarayana, Thilagar S and Suresh S: Clinical efficacy of low-level laser therapy as an adjunct to nonsurgical treatment of chronic periodontitis. J Dent Lasers 2015; 9: 31-7.
21. Ren C, McGrath C, Jin L, Zhang C and Yang Y: The effectiveness of low-level laser therapy as an adjunct to non-surgical periodontal treatment: A meta-analysis. J Periodontal Res 2017; 52: 8-20.
22. Gokhale SR, Padhye AM and Byakod G: A comparative evaluation of the efficacy of diode laser as an adjunct to mechanical debridement versus conventional mechanical debridement in periodontal flap surgery: a clinical and microbiological study. Photomedicine and Laser Surgery 2012; 30(10): 598-03.
23. Mills MP, Rosen PS, Chambrone L, Greenwell H, Kao RT, Klokkevold PR, McAllister BS, Reynolds MA, Romanos GE and Wang HL: American Academy of Periodontology best evidence consensus statement on the efficacy of laser therapy used alone or as an adjunct to non-surgical and surgical treatment of periodontitis and peri-implant diseases. J Periodontol 2018; 89: 737-42.
24. Slot DE, Jorritsma KH, Cobb CM and Van der Weijden FA: The effect of the thermal diode laser (wavelength 808- 980 nm) in non- surgical periodontal therapy: a systematic review and meta- analysis. J Clin Periodontol 2014; 41: 681-92.
25. Hujoel PP and DeRouen TA: Validity issues in split-mouth trials. J Clin Periodontol 1992; 19: 625-7.
26. Antezaks AA, Tulloch JFC and Berkey CS: Split mouth and cross over designs in dental research. J Clin Periodontotol 1990; 17: 446-53.
27. Soares DM, Ginani F, Henriques ÁG and Barboza CA: Effects of laser therapy on the proliferation of human periodontal ligament stem cells. Lasers Med Sci 2015; 30: 1171-74.
28. Wang Y, Li W, Shi L, Zhang F and Zheng S: Comparison of clinical parameters, microbiological effects and calprotectin counts in gingival crevicular fluid between Er: YAG laser and conventional periodontal therapies: A split-mouth, single-blinded, randomized controlled trial. Medicine (Baltimore) 2017; 96(51): e9367.
29. Sağlam M, Köseoğlu S, Taşdemir İ, Erbak-Yılmaz H, Savran L and Sütçü R: Combined application of Er: YAG and Nd: YAG lasers in treatment of chronic periodontitis. A split- mouth, single- blind, randomized controlled trial. J Periodont Res 2017; 52: 853-62.
30. Abduljabbar T, Vohra F, Kellesarian SV and Javed F: Efficacy of scaling and root planning with and without adjunct Nd: YAG laser therapy on clinical periodontal parameters and gingival crevicular fluid interleukin 1-beta and tumor necrosis factor-alpha levels among patients with periodontal disease: a prospective randomized split-mouth clinical study. J Photochem Photobiol B 2017; 169: 70-74.
31. Cheng Y, Chen JW, Ge MK, Zhou ZY, Yin X and Zou SJ: Efficacy of adjunctive laser in non-surgical periodontal treatment: a systematic review and meta-analysis. Lasers Med Sci 2016; 31(1): 151-63.
32. Zhao Y, Yin Y, Tao L, Nie P, Tang Y and Zhu ME: YAG laser versus scaling and root planing as alternative or adjuvant for chronic periodontitis treatment: a systematic review. J Clin Periodontol 2014; 41(11): 1069-79.
33. Grzech-Leśniak K, Sculean A and Gašpirc B: Laser reduction of specific microorganisms in the periodontal pocket using Er: YAG and Nd: YAG lasers: a randomized

controlled clinical study. Lasers Med Sci 2018; 33(7): 1461-70.
34. Kripal K, Sirajuddin S, Rafiuddin S, Mp R and Chungkham S: Iatrogenic damage to the periodontium caused by laser: an overview. Open Den J 2015; 9: 210-13.
35. Marini L, Sahrmann P and Rojas MA: Early Wound Healing Score (EHS): An Intra- and Inter-Examiner Reliability Study. Dent J (Basel). 2019; 7(3): 86.
36. Jonnalagadda BD, Gottumukkala SNVS, Dwarakanath CD and Koneru S: Effect of Diode Laser-assisted Flap Surgery on Postoperative Healing and Clinical Parameters: A Randomized Controlled Clinical Trial. Contemp Clin Dent 2018; 9(2): 205-12.
37. Renvert S, Nilveus R, Dahlen G, Slots J and Egelberg J: 5 year follow up of periodontal intraosseous defects treated by root planning or flap surgery. J Clin Periodontal 1990; 17: 356-63.
38. Levy RM, Giannobile WV, Feres M, Haffajee AD, Smith C and Socransky SS: The effect of apically repositioned flap surgery on clinical parameters and the composition of the subgingival microbiota: 12-month data. Int J Periodontics Restorative Dent 2002; 22(3): 209-19.
39. Harris DM and Reinisch L: Selective photoantisepsis. Lasers Surg Med 2016; 48(8): 763-73.
40. Eick S, Meier I, Spoerle F, Bender P, Aoki A, Izumi Y, Salvi GE and Sculean A: *In-vitro*-activity of Er: YAG laser in comparison with other treatment modalities on biofilm ablation from implant and tooth surfaces. PLoS One 2017; 12(1): e0171086.
41. Everett JD, Rossmann JA, Kerns DG and Al-Hashimi I: Laser assisted non-surgical periodontal therapy: a double blind, randomized clinical trial. Open Dent J 2017; 11: 79-90.

How to cite this article:
Shetty S, Shetty K, Alghamdi S, Almehmadi N and Mukherjee T: A comparative evaluation of laser assisted & conventional open flap surgical debridement procedure in patients with chronic periodontitis – a clinical and microbiological study- a pilot project. Int J Pharm Sci & Res 2020; 11(10): 4957-65. doi: 10.13040/IJPSR.0975-8232.11(10).4957-65.