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CLINICAL EVALUATION OF EFFECTIVENESS OF DIODE LASER AS AN ADJUNCT TO OPEN FLAP DEBRIDEMENT AS COMPARED TO OPEN FLAP DEBRIDEMENT ALONE IN THE PERIODONTAL TREATMENT OUTCOME OF PATIENTS WITH CHRONIC PERIODONTITIS – A SYSTEMATIC REVIEW

Dentistry

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ABSTRACT

Objective: The objective of this systematic review is to compare and clinically evaluate the adjunctive benefits of a diode laser (DL) to conventional open flap debridement (OFD) in the treatment of chronic periodontitis. **Background:** DL is an excellent soft tissue surgical laser, indicated for soft tissue curettage or sulcular debridement with an additional bactericidal effect. Studies have been conducted to determine the effect of DL as an adjunct to OFD. There is limited documentation regarding the clinical effectiveness to prove adjunctive effect of OFD in the surgical periodontal therapy. **Methods:** Only randomized controlled trials (RCTs) assessing use of DL only in continuous and contact mode on undersurface of flap post-conventional OFD for treatment of chronic periodontitis in the test group were considered. Studies published only in English language with follow-up periods of 3 and 6 months post-operatively and assessing probing pocket depth (PPD) and clinical attatchment level (CAL) as the outcomes were considered. A total of 6 RCTs were included in this systematic review. Cochrane Risk of Bias tool was used for assessing the risk of bias. **Results:** 3/6 studies concluded that DL significantly led to reduction in PPD or gain in CAL when used as adjunct to OFD. Whereas, other 3/6 studies concluded that DL did not significantly lead to reduction in PPD or gain in CAL when used as adjunct to OFD. **Conclusion:** DL can be used as an adjunct to standard treatments (OFD) of chronic periodontitis i.e; chronic periodontitis rather than as a replacement for standard treatments.

KEYWORDS

Open flap debridement, Periodontal flap surgery, Diode laser

INTRODUCTION:

Periodontitis is an opportunistic infection caused by an imbalance in the virulence factors of pathogenic microorganisms and host defence mechanisms, resulting in an immune-inflammatory response that can cause destruction of the periodontal ligament, alveolar bone with pocket formation and recession.[1] Pathogenic plaque micro-flora, host immune responses, and environmental factors play a major etiologic role and cause both direct as well as host-mediated tissue injury. Elimination or modification of these factors is the basic aspect of treatment, which arrests or controls the disease process. In addition, the aim is to regenerate the tissues and restore function with methods, which are predictable and achieve long-term benefits.[2]

Complete removal of bacterial deposits and their toxins from the root surface cannot be completely achieved by conventional nonsurgical mechanical therapy because of limited access to areas such as furcations, concavities, and developmental grooves and hence necessitating surgical intervention. Thus, flap surgery is an indication for deeper pockets, resulting in greater immediate pocket reduction and attachment gain.[3]

In recent years, various innovative adjunctive treatments have been developed to improve the clinical effectiveness of scaling and root debridement. Among the various new technologies offered, therapeutic diode laser treatment is one.[4] It promotes tissue healing and reduces edema, inflammation, and pain.[5] Laser-enhanced biostimulation has been reported to induce the intracellular metabolic changes, resulting in faster cell division, proliferation rate, migration of fibroblasts, and rapid matrix production. It has also been found to promote fibroblast maturation and proliferation, macrophage phagocytosis and lymphocyte activation.[8]

Light Amplification by Stimulated Emission of Radiation(LASER); have been used in periodontology to reduce periodontopathogenic bacteria,remove the pocket epithelium, and retard epithelial migration into the pocket. A significant reduction of periodontopathogenic bacteria has also been demonstrated, regardless of laser wavelength.[9]

The DL is a solid-state semiconductor laser that typically uses a combination of Gallium (Ga), Arsenide (Ar), and other elements such as Aluminum(Al) and Indium (In) to change electrical energy into light energy. The laser is emitted in continuous-wave and gated-pulsed modes, and is usually operated in a contact method using a flexible fiber optic delivery system. The reliable hemostasis achieved with diode lasers has made them a valuable tool during periodontal surgical procedures.[10]

DL 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]

Rationale :

Studies have been conducted to determine the effect of DL as an adjunct to OFD. Furthermore, various studies have described improved clinical outcomes by employing DL to de-epithelize the underneath lining of the mucoperiosteal flap and also facilitate considerable bacterial reduction.

Although there are studies analyzing the use of DL as an adjunct to OFD in patients with chronic periodontitis, there is limited documentation regarding the clinical effectiveness to prove adjunctive effect of DL in the surgical periodontal therapy.

There are no systematic reviews till date assessing the clinical effectiveness to prove adjunctive effect of DL in the surgical periodontal therapy.

Objective:

The objective of this systematic review is to compare and clinically evaluate the adjunctive benefits of a DL to conventional OFD in the treatment of chronic periodontitis, testing the hypothesis that adjunctive use of DL can improve outcomes of surgical periodontal therapy (OFD) as compared to OFD alone.

Focused Question:
Does DL as an adjunct to OFD has better clinical treatment outcome as compared to OFD alone in treatment of patients with chronic periodontitis in the age group of 20-65 years?

METHODS

Eligibility Criteria:
The PICO (patient, intervention, comparison, and outcome) strategy was followed in this systematic review which are key for designing all stages of an interventional systematic review.

Pico Analysis:
(P) Types of participants: Patients between age group of 20-65 years diagnosed with chronic periodontitis who have completed a cycle of non-surgical periodontal therapy (Phase – I) and present with residual pockets ≥ 5mm in atleast two quadrants.
(I) Types of interventions: DL as an adjunct to OFD as compared to OFD alone.
(C) Comparison between interventions: All possible comparisons between DL as adjunct to OFD with OFD alone in the treatment of chronic periodontitis.
(O) Type of outcomes measures: Clinical attachment level (CAL) gain, Probing Pocket Depth (PPD) reduction
(S) Types of studies: Only randomized controlled clinical trials (RCTs) were considered in the review.

Inclusion Criteria:
RCTs with split-mouth design assessing the clinical parameters- PPD and CAL/RAL, full text articles published in English till April 2023

Exclusion Criteria:
1. Studies assessing patients with habit of tobacco consumption, who are medically compromised or with systemic diseases or pregnant and lactating women, with history of periodontal surgery in past 6 months.
2. Studies assessing the parameters with multiple application of laser at the sites post-operatively

Information Sources:
PubMed, Cochrane Library, Google Scholar and EBSCOhost were employed as electronic databases. All databases were searched from years 2012-2023 with a personal computer.

Last electronic search was carried out on 30 April 2023.

Search Strategy:
Electronically the following search strategies were used in PubMed search builder.

Search terms and Boolean operators used were :
((Diode laser) AND (Open flap debridement)) AND (periodontitis)
Electronic search was carried out without any limits and language restriction to include all the possible clinical trials in the potentially relevant article search phase of the systematic review.

Selection Process:
Titles and abstracts of all relevant articles were screened was then narrowed down manually by the reviewer, When studies met the inclusion criteria or when insufficient data from abstracts for evaluating inclusion criteria were gained, the full article was obtained.

Data Collection Process:
A standardized specifically designed data extraction form was used to record data and a data chart was prepared from each included study, encompassing number of patients, clinical methods (assessment and treatment), follow-up duration and clinical outcomes (Table-2).

Data Items:
To assess the clinical outcomes of the interventions, Probing Pocket Depth (PPD) and Clinical Attachment Level (CAL) / Relative Attachment Level (RAL) were used as variables.

Study Risk Of Bias Assessment:
Cochrane Risk of Bias tool was used for assessing the risk of bias.

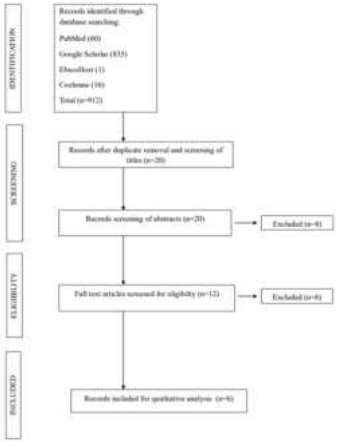
Majorly, seven domains (random sequence generation, allocation concealment, blinding of the outcome assessor, blinding of participants and personnel, incomplete outcome data, selective outcome reporting and other bias) were evaluated and included in a graph. The Risk of bias of the included studies were categorized accordingly:
(A) Low risk of bias if all domains were met.
(B) Unclear risk of bias if one or more domains were partly met.
(C) High risk of bias if one or more domains were not met
Two reviewers independently evaluated risk of bias of included studies. When disagreement between the two reviewers was detected, consensus was achieved by discussion with the third reviewer/statistical advisor.

Effect Measures:
PPD, CAL/RAL had to be expressed as mean difference in millimetres.

Synthesis Methods:
The search strategy provided a total of 912 articles. After assessing for eligibility criteria; 906 studies were excluded. 6 articles published from their earliest records were included in the present systematic review.

The flowchart of article screening and selection process is given in Figure 1

RESULTS



Study Selection: **Figure 1**

Table 1: Table Of Excluded Studies

AUTHORS and YEAR	STUDY DESIGN	REASON FOR EXCLUSION
Misra P, Kalsi R, Anand Arora S, Singh KS, Athar S, Saini A.(2023)[12]	RCT	1. Laser bio-stimulation done in non-contact mode 2. Multiple application of laser at the sites post-operatively
Roy S, Singh DK, Manohar B.(2022)[13]	RCT	1. DL used in non-contact mode 2. No post-operative follow-up at 3months
Shreya M, Harsh M, Surabhi J, Chandni P, Tanvi H, Santosh K.(2022)[14]	RCT	1.No post-operative follow-up at 6 months
Khan F, Chopra R, Sharma N, Agrawal E, Achom M, Sharma P.(2021)[15]	RCT	1. No post-operative follow-up at 6 months
Agarwal A, Saxena A, Gummaluri SS, Chaudhary B, Subramanyam S Sai K, Kumar G.(2021)[23]	RCT	1.No post-operative follow-up at 3 months
Dalvi S, Khetal N, Ansari S, Benedicenti S, Hanna R.(2021)[16]	Case report	1.Case report
Arvind N, Mamatha S, Srikala B. (2020).	RCT	1.PPD, CAL/RAL are not assessed
Shetty S, Shetty K, Alghamdi S, Almehmadi N and Mukherjee T. (2020)[9]	RCT	1.Granulation tissue is debrided using diode laser. 2.No mention of

		diode laser used on undersurface of flap
Karthikeyan J, Vijayalakshmi R, Mahendra J, Kanakamedala AK, Chellathurai BNK, Selvarajan S, Namachi vayam A. (2019)[3]	RCT	1. Multiple application of laser at the sites post-operatively
Heidari M, Fekrazad R, Sobouti F, Moharrami M, Azizi S, Nokhbatol foghahaei H, Khatami M. (2018)[18]	RCT	1.PPD, CAL/RAL are not assessed
Soliman MM, Sabra SM, Al-Shammrani AS, Sorour AA. (2014)[19]	RCT	1.Parallel-arm study 2.Non-surgical Periodontal therapy
Aena PJ, Parul A, Siddharth P, Pravesh G, Vikas D, Vandita A. (2015)[4]	RCT	1. No post-operative follow-up at 3 months
Sanz-Moliner JD, Nart J, Cohen RE, Ciancio SG. (2013)[20]	RCT	1.PPD, CAL/RAL are not assessed
Gokhale SR, Padhye AM, Byakod G, Jain SA, Padbidri V, Shivaswamy S. (2012)[21]	RCT	1. No post-operative follow-up at 6 months

Study Characteristics: Table 2: Table Of Included Studies

AUTHORS And YEAR	SAMPLE SIZE	COMPARISON AND INTERVENTION	OUTCOMES CONSIDERED FOR SYSTEMATIC REVIEW	MEASUREMENT OF PARAMETERS	FOLLOW-UP
Kolamala N, Nagarakanti S, Chava VK. (2022)[1]	15 patients, 30 sites	Control sites – Conventional OFD alone Test sites – Laser-assisted OFD (LA-OFD)(DL)	1.PPD 2.CAL/RAL	UNC-15 +Occlusal acryl ic stent - to stand ardize the measurements of clinical parameters	Baseline and 3, 6 months after surgery.
Doğan ŞB, Akça G. (2022)[22]	18 patients	Control sites - Modified Widman Flap and application of sham DL Test sites - Modified Widman Flap (MWF) and by applying active DL to the inside of the MWF.	1.PPD 2.CAL	UNC-15 +Occlusal acry lic stent - to stan dardize the measurements of clinical parameters	Baseline and 3, 6 months after surgery.
Rathod Swati et al. (2019)[25]	20 patients	Control sites – OFD Test sites –OFD + DL application	1.PPD 2.CAL	UNC-15 +Occlusal acryli c stent - to stand ardize the measurements of clinical parameters	Baseline and 3, 6 months after surgery.
Dr Nada Musharraf Ali1.(2019)[10]	16 patients	Control sites – OFD Test sites – OFD + DL application	1.PPD 2.CAL	UNC-15 +Occlusal acryli c stent - to stand ardize the measurements of clinical parameters	Baseline and 3, 6 months after surgery.
Jonnalagadda BD,Gottumukkala SNVS, Dwarakanath CD,Koneru S. (2018)[26]	23 patients	Control sites - CAPF: Conventional access periodontal flap LAPF - Laser assisted periodontal flap(DL)	1.PPD 2.RAL	UNC-15	Baseline and 3, 6 months after surgery.
Lobo TM, Pol DG.(2015)[2]	30 patients	Control sites – MWF technique Test sites – MWF + DL	1.PPD 2.CAL	UNC-15 +Occlusal acryli c stent - to stand ardize the measurements of clinical parameters	Baseline and 3, 6 months after surgery.

Risk Of Bias In Studies:

Figure-2 Overall Risk Of Bias Of Included Studies

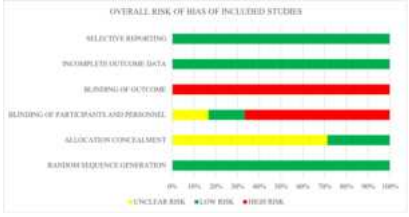


Figure-3 Risk Of Bias Of Individual Studies

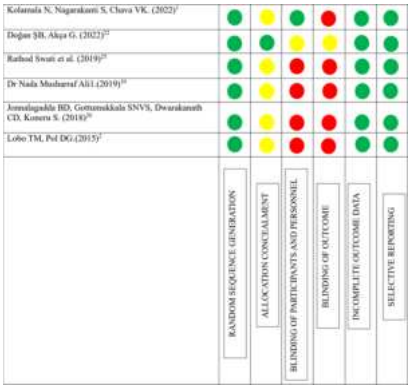


Table-3 Results Of Cal/ral

AUTHORS		Mean CAL/RAL		p-value
		CONTROL SITES	TEST SITES	
Kolamala N, Nagarakanti S, Chava VK. (2022)[1]	Baseline	9.26	9.53	0.413
	3 months	7.46	7.20	0.334
	6 months	0.83	0.83	0.001
Doğan ŞB, Akça G. (2022)[22]	Baseline	6.5 (5.00–7.30)	6.60 (5.11–7.04)	> 0.05
	3 months	2.57 (1.88–3.98)	2.68 (1.95–3.78)	
	6 months	2.54 (2.00–4.01)	2.71 (1.88–3.78)	
Rathod Swati et al. (2019)[25]	Baseline – 3 months	2.15 + 0.745	2.05 + 0.605	0.644
	3 months – 6 months	3.65 + 1.04	3.70 + 2.827	0.617
Dr Nada Musharraf Ali1.(2019)[10]	Baseline	6.2500 ± 1.00	5.8750 ± 0.95	0.968
	3 months	3.5000 ± 0.63	3.0000 ± 0.63	0.126
	6 months	3.3125 ± 0.62	2.7500 ± 0.47	0.014
Jonnalagadda BD, Gottumukkala SNVS, Dwarakanath CD, Koneru S. (2018)[26]	Baseline	9.23±1.31	9.08±1.43	0.6785
	3 months	7.45±0.71	7.69±1.11	0.5977
	6 months	7.24±0.64	7.24±1.20	0.9699

Lobo TM, Pol DG.(2015)[2]	Baseline	6.64±0.84	6.83±1.09	0.001
	3 months	4.87±0.63	5.23±0.79	
	6 months	4.75±0.47	5.18±0.78	

Table-4 Results Of Ppd

AUTHORS		Mean PPD		p-value
		CONTROL SITES	TEST SITES	
Kolamala N, Nagarakanti S, Chava VK. (2022)[1]	Baseline	7.00	7.40	0.271
	3 months	5.20	5.06	0.670
	6 months	5.20	4.40	0.005
Doğan ŞB, Akça G.(2022)[22]	Baseline	6.17 (4.92–7.02)	5.95 (4.95–7.04)	> 0.05
	3 months	3.72 (2.66–4.72)	3.69 (2.54–4.98)	
	6 months	3.85 (2.07–5.19)	3.79 (2.32–4.98)	
Rathod Swati et al.(2019)[25]	Baseline – 3 months	2.80 + 0.696	2.80 + 0.616	1.000
	3 months – 6 months	4.3 + 0.979	4.2 + 0.768	0.7210
Dr Nada Musharraf Ali1.(2019)[10]	Baseline	5.8125 ± 0.75	5.8750 ± 0.95	1.000
	3 months	3.1875 ± 0.54	3.0000 ± 0.63	0.382
	6 months	3.1875 ± 0.54	2.7500 ± 0.57	0.037
Jonnalagadda BD, Gottumukkala SNVS, Dwarakanath CD, Koneru S. (2018)[26]	Baseline	4.48±0.81	4.43±1.03	0.6647
	3 months	2.04±0.48	2.36±1.63	0.7063
	6 months	1.81±0.31	1.84±0.43	0.8802
Lobo TM, Pol DG.(2015)[2]	Baseline	6.08±0.91	6.02±0.81	0.001
	3 months	2.81±0.59	2.53±0.53	
	6 months	2.56±0.49	2.35±0.50	

RESULTS OF SYNTHESES:

Kolamala et al., 2022 [1] conducted a monocentric, triple-blind, split-mouth randomized clinical trial to evaluate the effect of DL as an adjunct to OFD in treatment of periodontitis in which control sites were treated with conventional OFD alone whereas test sites were treated with Laser-assisted OFD (LA-OFD). Clinical outcomes of sites showed a significant reduction in values of PPD and gain in RAL at 3 months and 6 months compared to baseline, and also significance was observed from 3 months to 6 months.

Doğan et al., 2022 [22] conducted randomized control split-mouth study to evaluate the post-operative discomfort and tissue response following the surgical periodontally treated sites. The control sites were treated with modified widman flap(MWF) by applying sham DL and the test sites were treated with MWF by applying active DL (810 nm –5; Picasso-AMD) to the inside of the MWF. No significant difference in reduction of PPD and CAL gain between control and test sites was observed at any time points post-operatively at 6 weeks, 3 months, and 6 months.

Rathod et al., 2019 [25] conducted a split mouth study in subjects diagnosed with chronic periodontitis. Control sites in this study were treated with OFD and the contralateral quadrant i.e. the test sites were treated with OFD and DL. The PPD in both the groups from baseline to 6 months was statistically significant. Control sites showed marginally greater reduction, this was not significant. The results showed statistically significant gain in RAL as compared to baseline in both sites. However, the difference in RAL in the two groups at the end of 6 months was statistically insignificant.

Dr Nada Musharraf Ali1 (2019)[10] conducted a double blinded, randomized, comparative, split-mouth clinical trial to evaluate the effect of 810nm DL in OFD as compared to conventional mechanical debridement in patients on Low dose aspirin. The control sites received Modified Widman Flap(MWF) surgery using conventional methods, whereas test sites received MWF surgery using 810nm DL as an adjunct. Clinical parameters considered for this review from this study are : PPD, RAL assessed at baseline, 3 months, and 6 months after surgery. There was a greater reduction in PPD (statistically significant at 3, 6 months) and greater gain in CAL(statistically significant) in the test sites when compared to the control sites.

Jonnalagadda et al., 2018 [26] conducted a split-mouth, randomized single-blinded clinical trial to compare postoperative healing and the clinical parameters of DL-assisted access flap surgery with access flap surgery alone. Clinical parameters considered for this review from this study are : PPD, RAL assessed at baseline, 3 months, and 6 months after surgery. In both the test and the control sites, conventional access flap surgery was performed. In the test sites, in addition, the inner surface of the flap was lased using semiconductor DL. Both groups showed a reduction in PPD and gain in RAL at 3 and 6 months, which were not statistically significant.

Lobo et al., 2015 [2] conducted a split-mouth study to evaluate the adjunctive benefit of a DL to conventional mechanical debridement in the surgical treatment of chronic periodontitis. The MWF technique was used in both control and test sites. In the test sites, a 940 nm DL unit was used as an adjunct. Both the sites showed a reduction in PPD and gain in CAL at 3 and 6 months, which were statistically significant. Risk of bias is overall low with regard to random sequence generation in all studies. Allocation concealment is unclear in all studies. Low risk of bias with regards to blinding of participants is assessed with four [1,10,22,26] out of six included studies, unclear with one study [25] and high with one study [2]. Risk of bias is low with regard to blinding of outcome in three studies [1,22,10] and high in three studies [2,25,26]. Risk of bias is overall low in all studies with respect to incomplete outcome data and selective reporting.

Heterogeneity in studies were due to different settings in each study with respect to power settings and wavelength of DL used. Also, time of exposure of soft tissue to laser differed in all studies.

DISCUSSION

Periodontal therapy is directed at disease prevention, slowing or arresting disease progression, regeneration of lost periodontal tissues, and maintaining the achieved therapeutic objectives. Longitudinal clinical trials of various conventional treatment techniques such as MWF and full-thickness flap procedure with or without osseous recontouring have shown to be effective in treating moderate-to-advanced periodontitis. Thus, flap surgery in deeper pockets results in greater pocket reduction and attachment gain.

In recent years, the use of laser therapy has been investigated as an alternative or adjunctive tool to conventional, mechanical procedures commonly employed in the treatment of periodontal and peri-implant diseases. Mechanical instrumentation of root surface for the reduction of bacteria and removal of soft- and hard-tissue deposits results in partial removal of pocket epithelium, which remains as the gold standard and healing by formation of a long junctional epithelium.

Lasers used in this regard have shown to retard epithelial downgrowth and help in formation of new connective tissue attachment. A significant reduction of periodontopathogenic bacteria has been demonstrated, regardless of laser wavelength.[27]

De-epithelialization with the laser retards epithelial downgrowth following periodontal surgery for up to 14 days longer than conventional flap techniques. This delay in epithelialization is due to laser-induced thermal necrosis of the wound margin and formation of a firm eschar that impedes epithelialization.[28] Whereas, it was found that a delay in onset of epithelial migration, not a decreased rate of migration, was responsible for the delayed epithelialization. It was speculated that the reduced inflammatory response retards the stimulus for epithelial migration by sealing the small vasculature and lymphatics and not allowing release of chemical mediators.[29]

Every laser has a different property and different tissue interactions, which depend upon the wavelength, power, waveform, tissue optical properties and tissue thermal properties. DL is an excellent soft tissue laser and is available in smaller cost-effective units. The radiation of DL shows greater absorption and less penetration than does Nd:YAG laser, especially in blood-rich tissue. Therefore, collateral damage with DL is less than with Nd:YAG or CO_2 laser.[30] The wavelength of DL is absorbed by the hemoglobin, which leads to tissue coagulation and

formation of charred layer. DL leads to thermocoagulation of the blood vessels, which is responsible for its hemostatic effect.[30]. The laser mode of antisepsis has several potential advantages over traditional biochemical antibiotics. A therapeutic dose can be delivered to a greater depth locally and leaves no residual concentration.[31] Laser radiation affects equally extracellular and intracellular pigmented pathogens and can access other privileged sites such as calculus and dentinal tubules. Laser antisepsis has no known systemic side effects, resistances, or negative interactions with other modes of therapy.[31] Laser energy also has the potential to breach the protective mechanisms of biofilms.[32]

The present systematic review analysed the outcomes of DL as an adjunct to OFD comparing the outcomes with OFD in patients with chronic periodontitis as there is limited research to conclusively evaluate the effectiveness of DL as an adjunct to OFD.

In all the included studies, the outcomes were assessed using custom made occlusal acrylic stents with grooves to standardize the UNC 15 probe angulation and position to determine PPD and CAL.

This systematic review indicated that DL didn't have an additive benefit on clinical paramaters of chronic periodontitis that were assessed i.e; PPD, CAL. Three (1,10,2)out of six included studies concluded that DL significantly led to reduction in PPD or gain in CAL when DL was used as adjunct to OFD. Whereas, other three (22,25,26) out of six included studies concluded that DL did not significantly lead to reduction in PPD or gain in CAL when DL was used as adjunct to OFD.

Gokhale et al[21] evaluated the efficacy of DL as an adjunct to mechanical debridement in periodontal flap surgery, on the basis of clinical parameters (plaque and gingival index, PPD and RAL) and microbiological analysis (subgingival plaque samples) of test and control groups. Results showed difference between the clinical parameters in the test and control groups did not reach a statistical significance. However, there was a statistically significant reduction in colony forming units (CFU) of obligate anaerobes in the test group as compared with the control group. The bactericidal effect of the DL was clearly evident by greater reduction of CFU of obligate anaerobes in the test group than in the control group.

Roy S et al [13] aimed to determine the efficacy of 940 nm DL exposure in combination with conventional periodontal flap surgery for the treatment of chronic periodontitis to evaluate postoperative discomfort and clinical parameters (visual analog scale (VAS) score ,gingival inflammation ,PPD, CAL, and sulcus bleeding index (SBI)) and concluded that DL as an adjunct to the surgical procedure can demonstrate appreciable benefits by increasing the CAL and minimizing the postoperative pain and the probing pocket, but such additional effects were not observed with gingival inflammation.

DL has proved to improve the gingival index, decrease probing pocket depth, bleeding on probing, bacterial content of periodontal pockets and improve the overall health of the periodontium. The keyword in the American Academy of Periodontology report is alternative, and the laser is used as an adjunct to standard treatments rather than as a replacement for standard treatments.[33]

Limitations:

1. The DL was used in different settings in each study with respect to power settings and wavelength. Also, time of exposure of soft tissue to laser differed in all studies.
2. Most of the studies did not blind the operator or outcome accessor, leading to potential performance and reporting biases.

Implications of the results for practice:

DL can be used as an adjunct to standard treatment of chronic periodontitis rather than as a replacement for standard treatment.

Policy:

This policy brief is based on the highlights of the studies considered in this systematic review which concludes that DL as an adjunct to OFD does not have additional benefits in the treatment of chronic periodontitis as compared to conventional surgical periodontal treatment(OFD).

Future research:

There remains a future scope for more randomized controlled studies to be conducted in multi-centers with a larger sample size and standardization of laser power settings for specific periodontal diseases which may lead to correctly assess the role of DL in the treatment of periodontitis.

CONCLUSION

Within the scope of the present systematic review, the use of DL as an adjunct to OFD did not significantly enhance the treatment outcome on the whole. Thus, the high investment cost for the laser equipment has to be weighed along with the proven clinical benefits.

Other Information

Registration And Protocol:

This systematic review was registered under the number CRD42023421858 in the PROSPERO database, created by the University of York, responsible for the registration and dissemination of systematic reviews and carried out according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.

Support:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing Interests:

The authors declare no conflict of interest.

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