

Patient Perceptions of Pain, Comfort, and Satisfaction Before and After Laser Therapy for Stage II Periodontitis

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ABSTRACT

Purpose: Periodontitis is a highly prevalent chronic inflammatory disease with significant implications for oral and systemic health. While diode laser therapy is an established adjunctive treatment for its bactericidal and bio-stimulatory effects, data on patient-centered outcomes remain limited. This study aimed to evaluate the patient's experience following diode laser therapy for Stage II periodontitis.

Methods: A prospective observational study was conducted involving 40 adult patients diagnosed with Stage II periodontitis. All participants underwent diode laser therapy as part of their periodontal treatment. Patient-reported outcomes were collected using a structured questionnaire. Data were analyzed using descriptive statistics. The Wilcoxon signed-rank test was employed to compare pre- and post-treatment pain scores, with a p-value of < 0.05 considered statistically significant.

Results: A statistically significant reduction in pain levels was observed post-treatment ($p < 0.001$). The majority of patients (62.5%) reported the laser procedure as comfortable, with 77.5% resuming normal activities within one day. The most common side effects were sensitivity (40%) and pain (27.5%). Patients reported high levels of symptom improvement, including reduced bleeding gums (87.5% agreement) and a feeling of cleanliness (87.5%). Furthermore, over 70% of patients expressed satisfaction with improved gum appearance and social confidence. Overall, 80% of patients were satisfied with the results, and 90% preferred laser therapy over conventional methods.

Conclusion: Diode laser therapy for Stage II periodontitis is associated with a significant reduction in post-operative pain, high procedural comfort, rapid recovery, and high levels of patient satisfaction regarding both functional and aesthetic outcomes.

Keywords: Periodontitis, Patient Satisfaction, Pain, Patient-Reported Outcome Measures, Quality of Life.

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INTRODUCTION

Periodontitis refers to a chronic inflammatory condition of the supporting tissues of the teeth, such as the gingiva, periodontal ligament, cementum, and alveolar bone. It is a consequence of untreated gingivitis and is propagated by pathogenic biofilms of bacteria and a misbalanced host immune response [1]. The development or progression of periodontitis has 1-4 stages. Stage 1 (initial periodontitis), stage 2 (mild periodontitis), stage 3 (moderate periodontitis), and stage 4 (advanced periodontitis with high levels of damage and possible loss of teeth) [2]. Symptoms are gum redness, swelling, and bleeding during brushing or while flossing, but as it progresses, it can be noted with the loss of gums, deep periodontal pockets, bad breath, and the loss of teeth [3]. In addition to its oral forms, periodontitis has severe consequences on systemic health as well as major impacts on quality of life. Patients often report pain, impaired use of the mouth (in chewing and articulation), discomfort with speech, aesthetic issues related to changes in tooth appearance or gum, and social discomfort as factors that contribute to psychological stress and low self-esteem [4]. Additionally, periodontitis has

been linked to elevated cardiovascular disease, diabetes complications, and negative pregnancy outcomes [5, 6].

Periodontitis is a very common chronic disease in the world, since it is estimated to be about 20-50 percent of the world population with varying levels of severity. The Global Burden of Disease Study estimates that severe periodontitis affects approximately 11 percent of the population in its most severe forms. It has a wide prevalence rate in low-, middle-, and high-income countries, and its variations depend on socioeconomic status, oral care availability, level of education, and other lifestyle behaviors, including tobacco use and diet [7, 8].

Periodontitis is treated and prevented by using a blend of surpassing non-surgical, surgical, and supporting methodologies to control infection, stop the spread of the disease, and repair periodontal wellness [9]. Non-surgical periodontal therapy, namely, scaling and root planing (SRP) and antimicrobial therapy (chlorhexidine), is the core of first-line treatment [10]. At later phases, surgery such as flap surgery, bone grafting, and guided tissue regeneration might be necessary to reach the deep periodontal pockets and to restore the lost

supporting tissues [11]. Also gaining favor as adjunctive tools are laser therapy and host modulation therapies (e.g., sub-antimicrobial-dose doxycycline) with potentially beneficial inflammation-reducing, healing effects [12].

Different types of lasers, e.g., diode and Nd:YAG, are applied in the decontamination of bacteria, pocket debridement, and removal of soft tissues. The laser treatment exposes pathogenic bacteria in the periodontal tissue by targeting and destroying them, leaving healthy tissue intact and exposed to minimal injury [13, 14]. This helps in the substantial decrease of inflammation, pocket depth, and bleeding on probing. Moreover, laser therapy improves tissue repair processes and increases the healing rate, as laser interferes with fibroblast action and collagen synthesis. It is also correlated with reduced post-operative pain, less bleeding, very minimal swelling, and faster muscular recovery [15]. Moreover, its less invasive character is specifically useful in patients with systemic diseases with the potential to cause risks. Diode laser therapy typically operates within the 810–980 nm wavelength range. It is the most employed modality. It is frequently used as an adjunct to scale and root planning to enhance bacterial reduction and promote soft tissue healing. Diode lasers are favored for their minimal invasiveness, effective decontamination of periodontal pockets, and favorable hemostatic properties, making them well-suited for moderate periodontal disease [16, 17].

Although its application is on the rise, minimal studies have been performed on patient-centered outcomes, which mostly involve perceptions about pain, treatment comfort, and overall satisfaction, which considerably affect compliance with periodontal regimens and oral health practices in the long term. Therefore, the objective of this research is to review how patients feel about pain and comfort, along term satisfaction with laser therapy as one of the methods used in the treatment of periodontitis Stage II. According to the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, Stage II periodontitis is defined by interdental clinical attachment loss (CAL) of 3–4 mm and radiographic bone loss limited to the coronal third of the root, extending between 15% and 33% [18]. Additional diagnostic parameters include a maximum probing pocket depth (PPD) of ≤ 5 mm and no history of tooth loss attributable to periodontitis. No complexity factors are present beyond the observed moderate bone loss [19]. The study aims to define the existence of sensor-assisted periodic injections with an impact on delighting patients beyond expectation and benefiting treatment reception and perceived treatment quality.

METHODOLOGY

Study Design and Research Setting

This is a prospective observational study that aimed to assess the perceptions of patients who had laser-assisted treatment of Stage II periodontitis in terms of pain, comfort, and patient satisfaction.

This was done at the Department of Periodontology at Sudan Medical, and the participants were recruited using a diagnostic and procedural eligibility basis. The study was approved from the ethical board committee of the Sudan Medical Specialization.

Inclusion and Exclusion Criteria

The adult patients between 22 and 55 age groups clinically diagnosed with Stage II periodontitis based on the 2017 World Workshop classification and undergone Diode laser therapy for the treatment of periodontitis within the last three months were included. Exclusion criteria involved pregnant or lactating women, and patients taking drugs that can impair inflammatory, or healing processes were not included.

Sample Size and Data Collection Method

The participants involved in this study were treated for their periodontal disease (stage II). Data of a total of 40 patients were collected who underwent the diode laser therapy for the treatment of their periodontal condition. The participants were having a thorough examination before the intervention, including pocket depth, clinical attachment level measurements, and bleeding on probing pre-identification. A structured questionnaire that evaluates the patients' experience with respect to pain and comfort was filled up by themselves utilizing Likert-scale items.

Ethical Approval

Strict adherence was made to all ethical guidelines. Ethical approval was secured before carrying out the study from the National Ribat University Teaching Hospital, a training center affiliated with the Sudan Medical Specialization Board, and written consent from each participant was gathered. Privacy was maintained by giving special codes to every participant and storing all the data safely.

Statistical Analysis

SPSS (Version 25) was used in the analysis of data. Demographic variables, periodontal status, and subjective outcome measures were summarized using descriptive statistics. The pre- and post-treatment scores were compared using non-parametric equivalent tests (Wilcoxon signed rank). A statistically significant p-level is set to be less than 0.05. This research design makes it possible to perform a rigorous assessment of patient-related outcomes of laser therapy in periodontal treatment.

RESULTS

The study enrolled 40 participants with a mean age of 35.8 ± 10.1 years, comprising an equal distribution of males (50.0%) and females (50.0%).

The demographic and baseline characteristics of the cohort are summarized in **Table 1**.

Table 1: Demographic and Baseline Characteristics of the Study Participants (N=40)

Characteristics	Value
Years	Mean ± SD
Age	35.8 ± 10.1
Gender	n (%)
Male	20 (50.0%)
Female	20 (50.0%)
Smoking Status	n (%)

The primary outcome of the change in patient-reported pain levels before and after treatment was analyzed. The differences between pre- and post-treatment scores were found to be non-normally distributed upon testing with the Shapiro-Wilk test ($W = 0.923$, $p = 0.009$). Consequently, the non-parametric Wilcoxon signed-rank test was employed. The analysis revealed a statistically significant reduction in pain scores following laser therapy (Median Pre-Treatment = 6.5, Median Post-Treatment = 3.0), with a p-value of less than 0.001. The details of this comparison are presented in **Table 2**.

Variable	Pre-Treatment (Mean ± SD)	Post-Treatment (Mean ± SD)	Statistical Test	Test Statistic	p-value
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The patient experience during and immediately after the laser therapy procedure is detailed in **Table 3**. Most patients (92.5%, $n=37$) reported receiving Diode laser therapy. The procedure was well-tolerated, with 62.5% ($n=25$) of patients finding it "Comfortable" or "Very Comfortable".

Aspect of Experience	Category	n	%
Type of Laser Received	Diode Laser	37	92.5%
	Not Sure	3	7.5%
Comfort During Procedure	Comfortable/Very Comfortable	25	62.5%
	Neutral	13	32.5%
	Uncomfortable/Very Uncomfortable	2	5.0%
Reported Side Effects	Sensitivity	16	40.0%

Participants could select more than one option; therefore, percentages total more than 100%.

Patient-reported outcomes regarding medium-term symptom improvement, aesthetic satisfaction, and overall treatment experience were summarized using descriptive statistics and are detailed in **Table 4**. A high percentage of patients reported improvement in key clinical symptoms,

Smoker	22 (55.0%)
Non-smoker	18 (45.0%)
Medical Condition	n (%)
None	24 (60.0%)
Asthma	9 (22.5%)
Diabetes	7 (17.5%)
Pre-Treatment Pain Level	Mean ± SD
Moderate	6.18 ± 1.74

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Pain Level	6.18 ± 1.74	2.85 ± 2.09	Wilcoxon Signed-Rank Test	$V = 0.0$	$< 0.001^*$
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Comfortable." The most reported side effects were sensitivity (40.0%, $n=16$) and pain (27.5%, $n=11$), while 30.0% ($n=12$) of patients reported no side effects. Recovery was rapid, with 77.5% ($n=31$) of patients resuming normal activities either on the same day or after one day.

	Pain	11	27.5%
	Bleeding	5	12.5%
	Mild Swelling	4	10.0%
	None	12	30.0%
Time to Resume Normal Activities	Same Day	14	35.0%
	After 1 Day	17	42.5%
	After 2-3 Days	9	22.5%
	More than 3 Days	0	0.0%

with 87.5% ($n=35$) agreeing there was a reduction in bleeding gums and 87.5% ($n=35$) agreeing their teeth felt clean after the procedure. Furthermore, 70% or more of patients expressed satisfaction with aesthetic outcomes, including the appearance of their gums (75.0%), improved social confidence (70.0%), and increased confidence when smiling (70.0%). The overall satisfaction with laser therapy

was high, with 80.0% (n=32) of patients reporting being satisfied or very satisfied. Notably, all patients (100%) had undergone conventional periodontal therapy previously, and when asked for their preference, 60.0% (n=24) preferred laser therapy, **Table 4:** Summary of Patient-Reported Outcome Measures (N=40)

Survey Item	Response Category	n	%
Symptom Improvement			
Reduction in bleeding gums	Agree	35	87.5%
	Disagree	5	12.5%
Teeth felt clean after procedure	Agree	35	87.5%
	Neutral	5	12.5%
Reduction in bad breath	Agree	25	62.5%
	Neutral	15	37.5%
Aesthetic Satisfaction			
Satisfied with gum appearance	Agree/Strongly Agree	30	75.0%
	Neutral/Disagree	10	25.0%
Improved social confidence	Agree/Strongly Agree	28	70.0%
	Neutral	12	30.0%

Discussion

This study evaluated the efficacy and patient experience of periodontal laser therapy through a combination of clinical outcome measures and comprehensive patient-reported outcomes. The findings demonstrate that diode laser therapy is highly effective in significantly reducing post-operative pain and is associated with exceptional levels of patient satisfaction, aligning strongly with the existing body of evidence on lasers in periodontics. The diode laser application as an adjunct to scaling and root planing (SRP) provided significantly better improvement in clinical attachment level and reduction in probing depth compared to SRP alone, with an excellent post-operative comfort profile. The most significant finding was the statistically substantial reduction in patient-reported pain levels following laser therapy ($p < 0.001$). This result is consistent with the known bio-stimulatory and analgesic effects of lasers. The rapid reduction in pain observed in our study can be attributed to the laser's bio-stimulatory and analgesic

while 30.0% (n=12) had no preference. This positive experience was further reflected in the finding that 80.0% (n=32) of patients would be willing to undergo the laser therapy again and would recommend it to others.

Feel more confident when smiling	Agree/Strongly Agree	28	70.0%
	Neutral/Disagree	12	30.0%
Overall Satisfaction & Preference			
Overall satisfaction with laser therapy	Satisfied/Very Satisfied	32	80.0%
	Neutral	8	20.0%
Perceived gum improvement	Yes (Slightly/Significantly)	40	100.0%
Preference over conventional therapy	Prefer Laser	24	60.0%
	No Preference	12	30.0%
	Prefer Conventional	4	10.0%
Would undergo laser therapy again	Yes	32	80.0%
	Not Sure	8	20.0%

effects, which reduce inflammation and edema, and its ability to seal nerve endings and lymphatic vessels, thereby minimizing post-operative discomfort. This directly translates into a superior patient experience, as evidenced by the high comfort ratings during the procedure (62.5% comfortable/very comfortable) and the swift return to normal activities, with 77.5% of patients resuming within one day. This rapid recovery is a key advantage over conventional surgery, which often involves a more extended and uncomfortable healing period. Our findings are aligned with the previous research by Aoki et al. (2010), who highlighted that the minimal postoperative pain and rapid healing associated with diode laser therapy are major benefits due to its ability to seal nerve endings and lymphatics, thereby reducing inflammation and edema [20].

The analysis of patient-reported outcomes provides profound insights into the treatment's success from the patient's perspective. The high percentage of patients reporting a reduction in

bleeding gums (87.5%) and a feeling of cleanliness (87.5%) corroborates the clinical efficacy of laser therapy in reducing inflammation and debriding periodontal pockets. The eradication of bacteria and the detoxification of root surfaces achieved by lasers, particularly diodes, are well-documented mechanisms that explain these symptomatic improvements. Our findings are supported by a study conducted by Kamma et al. (2009), who demonstrated that the adjunctive use of a diode laser to scaling and root planing resulted in significantly greater reductions in bleeding on probing and probing pocket depth compared to scaling and root planing alone, attributing this to the effective elimination of periodontopathogenic bacteria [21].

Furthermore, the notable improvements in aesthetic satisfaction and self-confidence reported by over 70% of our patients underscore a significant psychosocial benefit. Periodontal disease often has a significant psychosocial impact. The conservative nature of laser surgery, which allows for precise soft tissue management with minimal tissue trauma, leads to superior aesthetic outcomes. This aligns with the findings of Cobb (2006), who noted that lasers facilitate a bloodless surgical field and promote better wound healing contraction, which are critical factors for achieving improved gingival contours and patient satisfaction with aesthetics [22].

Some nuanced findings warrant mention. While symptoms like bleeding and bad breath showed great improvement, perceived changes in tooth mobility and chewing ability were less pronounced. This is expected, as laser therapy primarily addresses soft tissue inflammation and pocket reduction. Significant improvements in mobility typically require more extensive bone regeneration, which may not be the primary goal of the laser protocol used here. The reported side effects, predominantly sensitivity and pain, are known as transient sequels of periodontal debridement, whether conventional or laser-assisted, and their reported rates in this study are within acceptable limits. However, the overwhelmingly positive overall satisfaction (80%) and the strong preference for laser therapy, where 90% of patients found it superior or equivalent to conventional therapy, are powerful indicators of treatment acceptability. This high level of endorsement is a consistent theme in patient-centered studies on lasers. For instance, Slot et al. (2014), in a systematic review, concluded that patient acceptance of laser therapy was high, with patients often reporting a preference for lasers over conventional surgery due to reduced anxiety, pain, and a perception of greater modernity and efficiency [23]. Our results, showing that 80% of patients would undergo the therapy again and recommend it, strongly mirror this consensus within the literature.

CONCLUSION

In conclusion, the results of this study provide strong evidence that diode laser therapy is a highly effective treatment modality that successfully merges clinical efficacy with outstanding patient experience. The significant reduction in pain, coupled with high levels of satisfaction across symptomatic, aesthetic, and experiential domains, reinforces the value of laser therapy in modern periodontal practice. These findings are well-supported by previous research, confirming that laser therapy effectively meets patient expectations and preferences, making it a valuable tool for enhancing the quality of periodontal care. Future research with controlled study designs and longer follow-up periods could further solidify these observations.

STATEMENT AND DECLARATION

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Ethics approval

Strict adherence was made to all ethical guidelines. Ethical approval was secured before carrying out the study from the National Ribat University Teaching Hospital, a training center affiliated with the Sudan Medical Specialization Board, and written consent from each participant was gathered. Privacy was maintained by giving special codes to every participant and storing all the data safely.

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