

Original Research Article

Clinical outcomes of fractional erbium laser therapy in the treatment of mucosal lichen planus

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ABSTRACT

Introduction: Lichen planus is a chronic inflammatory condition affecting the skin and mucous membranes, with a prevalence of 1% to 2.2% in the general population. This study aims to evaluate the clinical outcomes of fractional erbium laser therapy for mucosal lichen planus, focusing on its efficacy in relieving symptoms and improving quality of life. The aim of the study was to evaluate the clinical effectiveness and safety of fractional erbium laser therapy in treating mucosal lichen planus.

Methods: This prospective observational study took place in the Department of Dermatology at Bangladesh Specialist Hospital, Dhaka, Bangladesh, from March 2021 to February 2023, involving 30 patients with mucosal lichen planus. Participants provided informed consent, and their lesion severity was assessed prior to administering fractional erbium laser therapy. Outcomes were measured and analyzed using SPSS version 22.0.

Result: Participants had a mean age of 58 ± 8.6 years, with 96.67% being female. After fractional erbium laser therapy, 90% achieved complete remission, and 83.33% reported no side effects. Pain scores dropped from 7.0 ± 1.5 to 2.3 ± 1.2 , while lesion size decreased from 3.8 ± 0.8 cm² to 1.0 ± 0.5 cm². Satisfaction was high, with 80% highly satisfied, and follow-up indicated a 66.67% no recurrence rate of lesions.

Conclusion: Fractional erbium laser therapy is an effective and safe treatment for mucosal lichen planus, showing high remission rates, minimal side effects, and patient satisfaction.

Keywords: Fractional erbium laser, Mucosal lichen planus, Clinical outcomes, Oral lichen planus, Laser therapy

INTRODUCTION

Lichen planus is a chronic inflammatory condition affecting the skin and mucous membranes, with an estimated prevalence of 1% to 2.2% in the general population.^{1,2} Mucosal lichen planus (MLP) is particularly notable for its chronicity and the lack of a definitive cure.³ Oral lichen planus (OLP) prevalence has been reported between 0.5% and 2.6%, posing diagnostic and therapeutic challenges for clinicians.⁴ Management often requires a multidisciplinary approach involving dermatologists, dentists, and gynaecologists, focusing primarily on alleviating the patient's pain and discomfort during daily

activities such as eating, drinking, speaking, or sexual intercourse. In the oral mucosa, lichen planus typically appears as white lesions, frequently accompanied by erosions that can significantly affect patients' quality of life.⁵

he goal of healing OLP extends beyond merely reducing symptoms; it also aims to prevent tissue degeneration and potential dysplasia, as untreated lesions may progress to malignancy.⁶ Current treatment options for mucosal lichen planus mainly consist of traditional management strategies, which typically include topical medications, systemic therapy, or surgical intervention; however, each

method comes with its own limitations and drawbacks.⁷ Corticosteroids are the first-line treatment, administered either topically or systemically, but about one-third of patients using topical corticosteroids may develop secondary candidiasis, and there is a risk of tachyphylaxis, which can reduce the drugs' biological effectiveness.⁸⁻¹¹ In light of these challenges, laser therapy has recently emerged as a promising non-invasive treatment option for these lesions, potentially offering fewer side effects compared to conventional therapies.¹²

Various lasers have been employed in managing oral mucosal lesions, including carbon dioxide (CO₂), diode, and neodymium-doped yttrium aluminum garnet (Nd) lasers, each utilizing specific wavelengths for targeted tissue interaction and thermal effects that enhance therapeutic effectiveness.¹³ Recent studies suggest that fractional erbium lasers ablate vertical microscopic columns in the mucosa, promoting neocollagenesis and improving the penetration of topical corticosteroids for mucosal membrane lesions.^{14,15}

Pretreatment with fractional laser resurfacing has also shown potential to increase the bioavailability of photosensitizers, like methyl amino levulinate (MAL), thereby boosting photodynamic therapy (PDT) effectiveness for actinic cheilitis. The Er ablative fractional laser (AFL) is particularly beneficial, offering controlled penetration and minimal thermal damage, commonly used to optimize PDT outcomes.^{16,17} Advances in laser technology have led to both invasive and non-invasive options for tailored dermatological treatments. Ablative lasers target the superficial skin layers to improve texture after re-epithelialization, whereas non-ablative lasers preserve the skin surface, stimulating collagen and elastin production for rejuvenation.¹⁸

Current treatments for mucosal lichen planus often fall short in effectively alleviating symptoms and may lead to significant side effects. This highlights the urgent need for alternative therapies that are both safe and effective. Fractional erbium laser therapy offers a promising, non-invasive option that could enhance treatment outcomes while minimizing adverse effects. Therefore, the purpose of this study is to evaluate the clinical outcomes of fractional erbium laser therapy in treating mucosal lichen planus, aiming to assess its efficacy in symptom relief and improvement in patients' quality of life.

The aim of the study was to evaluate the clinical effectiveness and safety of fractional erbium laser therapy in treating mucosal lichen planus.

METHODS

Study place

This prospective observational study was conducted in the Department of Dermatology at Bangladesh Specialist Hospital, Dhaka, Bangladesh.

Study duration

from March 2021 to February 2023. A total of 30 patients diagnosed with mucosal lichen planus were enrolled in the study.

Inclusion criteria

Adults aged 18 years and older. Patients with a confirmed diagnosis of mucosal lichen planus (histopathologically proven). Individuals who provided written informed consent for participation in the study.

Exclusion criteria

Patients with contraindications to laser therapy. Individuals receiving systemic or topical treatments for lichen planus within the last three months. Pregnant or breastfeeding women. Patients with other significant dermatological conditions. Patients suffering from fungal or bacterial infections of the mucosal membrane.

Written informed consent was obtained from all participants to ensure confidentiality and voluntary participation. Upon enrolment, detailed medical histories were collected through structured interviews, and clinical examinations assessed the severity of lichen planus lesions. Fractional erbium laser therapy was administered with treatment sessions conducted at regular intervals according to the established protocol.

Clinical outcomes were closely monitored, measuring various parameters, including pain scores using a Visual Analog Scale (VAS) and lesion size in square centimeters. Follow-up assessments evaluated treatment efficacy and recurrence of lesions post-therapy.

Statistical analysis

Data were compiled and analyzed using SPSS version 22.0, employing descriptive statistics, including frequencies and percentages, to summarize demographic characteristics, clinical outcomes, and satisfaction levels of participants. The primary outcomes measured included rates of complete and partial remission, incidence of side effects, pain reduction, changes in lesion size, and patient satisfaction levels, with statistical significance defined at a p value of <0.05 .

RESULTS

Table 1 shows the demographic profile of the study participants. The mean age of the participants was 58 ± 8.6 years. Among the 30 participants, 4 (13.33%) were aged 40–49 years, 11 (36.67%) were aged 50–59 years, 12 (40.00%) were aged 60–69 years, and 3 (10.00%) were aged 70–79 years. In terms of gender distribution, 29 (96.67%) participants were female, while 1 (3.33%) was male.

Table 1: Demographic characteristics of the study participants (n=30).

Variable		Frequency (N)	%
Age (in years)	40-49	4	13.33
	50-59	11	36.67
	60-69	12	40.00
	70-79	3	10.00
	Mean±SD	58±8.6	
Gender	Female	29	96.67
	Male	1	3.33

Table 2: Clinical outcomes of fractional erbium laser therapy in the treatment of mucosal lichen planus (n=30).

Clinical outcome	Frequency (N)	%
Complete remission	27	90.00
Partial remission	3	10.00
Total	30	100.00

Table 2 presents the clinical outcomes of 30 patients with mucosal lichen planus treated using fractional erbium laser therapy. Complete remission was observed in 27 patients (90%), while 3 patients (10%) achieved partial remission.

Table 3: Side effects in patients undergoing fractional erbium laser therapy (n=30).

Side effect	Frequency (N)	%
Mild erythema	3	10.00
Transient edema	2	6.67
No side effects	25	83.33

Table 3 shows the side effects observed in the study participants after undergoing fractional erbium laser therapy. Among the 30 participants, mild erythema was reported in 3 individuals (10.00%), while transient edema occurred in 2 participants (6.67%). Importantly, the majority 25 participants (83.33%) experienced no side effects, highlighting the safety profile of the treatment.

Table 4: Comparative analysis of pain and lesion size pre- and post-treatment (n=30).

Metric	Pre-treatment value	Post-treatment value	P value
Pain score (VAS)	7.0±1.5	2.3±1.2	<0.01
Lesion size (cm ²)	3.8±0.8	1.0±0.5	<0.01

Table 4 presents the pre-treatment and post-treatment values for pain score and lesion size among participants undergoing fractional erbium laser therapy for mucosal lichen planus. The mean pain score significantly decreased from 7.0±1.5 to 2.3±1.2 post-treatment ($p<0.01$), and

lesion size reduced from 3.8±0.8 cm² to 1.0±0.5 cm² ($p<0.01$), indicating substantial clinical improvement.

Table 5 presents the satisfaction levels of participants following fractional erbium laser therapy for mucosal lichen planus. Out of the 30 participants, 24 (80.00%) reported being "Highly Satisfied" with the treatment outcome, indicating a strong positive response to the therapy.

Additionally, 4 participants (13.33%) were "Satisfied," while only 2 participants (6.67%) expressed a "Neutral" satisfaction level.

This table shows the follow-up outcomes following fractional erbium laser therapy for the treatment of oral mucosal lesions. Among the 30 patients evaluated, 66.67% (20 patients) experienced no recurrence of lesions after treatment. In contrast, 33.33% (10 patients) required additional treatment sessions due to recurrence.

Table 5: Satisfaction levels among study participants following fractional erbium laser therapy (n=30).

Satisfaction level	Frequency (N)	%
Highly satisfied	24	80.00
Satisfied	4	13.33
Neutral	2	6.67

Table 6: Follow-up outcomes of oral mucosal lesions after treatment (n=30).

Follow-up outcomes	No. of patients	%
No recurrence	20	66.67
Recurrence (treated with additional session)	10	33.33
Total	30	100.0

DISCUSSION

This study evaluates the clinical effectiveness and safety of fractional erbium laser therapy in treating mucosal lichen planus, a chronic inflammatory condition that significantly impacts patients' quality of life. Characterized by persistent lesions in the oral mucosa, mucosal lichen planus can lead to discomfort and potential malignancy risks. The results demonstrate a high rate of complete remission and minimal side effects associated with the therapy, emphasizing its potential as a viable treatment option. The findings also highlight the importance of innovative non-invasive therapies in managing challenging dermatological conditions, suggesting that fractional erbium laser therapy could play a pivotal role in improving patient outcomes and satisfaction in those affected by this condition.

In our study, the demographic profile of the participants indicated a mean age of 58±8.6 years, which aligns with the study by Selim et al, who reported a mean age of

58±9.4 years among their participants.¹⁹ The majority of our participants were aged 60–69 years, with 12 individuals (40.0%) in this age group. Furthermore, the gender distribution revealed that 29 participants (96.67%) were female, closely mirroring the 97% female predominance observed by Selim et al.¹⁹ This similarity underscores the consistent trend of mucosal lichen planus predominantly affecting women across different cohorts. The high percentage of female participants in our study emphasizes the need for targeted therapeutic approaches and ongoing research to optimize clinical outcomes for this demographic in the context of fractional erbium laser therapy.

Clinical outcomes following fractional erbium laser therapy in our study showed a 90% complete remission rate, closely aligning with findings by Nisticò et al, who observed an 89.6% remission rate with similar laser applications.²⁰ The partial remission rate in our cohort was also comparable, supporting the efficacy of erbium laser in achieving significant improvements in lesion appearance. These similar remission rates highlight the consistency of erbium laser outcomes across different patient samples, suggesting the treatment's potential as a reliable approach for managing mucosal lichen planus.

The side effects observed following fractional erbium laser therapy were minimal in our study. Specifically, mild erythema was reported in 3 participants (10.00%), while transient edema occurred in 2 participants (6.67%). Notably, 25 participants (83.33%) experienced no side effects at all. These findings suggest a favorable safety profile for this therapy, comparable to the limited side effects noted by Graber et al, which included prolonged erythema and edema.²¹ The high percentage of participants without side effects underscores the safety and tolerability of this treatment modality, indicating that, with proper patient selection and management, fractional laser therapy can be a reliable option with minimal adverse effects.

Our study demonstrated a significant decrease in pain scores following treatment, with mean VAS scores dropping from 7.0±1.5 pre-treatment to 2.3±1.2 post-treatment. This aligns closely with results from Bhagat et al, who reported a similar reduction in pain scores from 7.5 to 3.2 after laser therapy for oral mucosal lesions.²² Additionally, we observed a notable reduction in lesion size, from 3.8±0.8 cm² to 1.0±0.5 cm², consistent with another study's finding of a 60% reduction in lesion size, further highlighting the efficacy of laser therapy in managing mucosal lesions.²²

Participant satisfaction with fractional erbium laser therapy was high in our study, with 80.00% reporting "Highly Satisfied" outcomes, mirroring the satisfaction rates observed in another study, where 80% of patients also reported high satisfaction.²² This parallel underscore the effectiveness of fractional erbium laser therapy as a treatment option. Furthermore, with only 6.67% of participants indicating a "Neutral" response, these findings

suggest that patient experiences with the therapy are overwhelmingly positive, supporting its role as a viable and well-tolerated treatment option.

Finally, our study found that 66.67% of patients experienced no recurrence of oral mucosal lesions after treatment, while 33.33% required additional sessions for recurrence management. This aligns with findings from Choi et al, who reported a similar recurrence rate, with 70.0% of participants achieving favorable outcomes without further intervention.²³ Their study highlighted that recurrence rates were effectively managed with additional sessions in a smaller subset of patients, reflecting our results where 10 out of 30 patients needed further treatment. These findings highlight the efficacy of laser therapy in managing mucosal lesions and emphasize the importance of follow-up to ensure optimal long-term outcomes.

In conclusion, fractional erbium laser therapy demonstrates significant efficacy and safety in managing mucosal lichen planus, with high remission rates and patient satisfaction. These findings underscore the importance of continued research and clinical application of innovative therapies to enhance treatment outcomes for patients suffering from this challenging condition.

This study had some limitations like the study was conducted in a selected tertiary-level hospital. The sample was not randomly selected. The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

CONCLUSION

Fractional erbium laser therapy demonstrates notable efficacy and safety in treating mucosal lichen planus. The study indicates a high rate of complete remission among participants, coupled with minimal side effects, underscoring the treatment's favorable safety profile. Additionally, the majority of patients expressed satisfaction with their outcomes, and a significant portion experienced no recurrence during follow-up. These findings suggest that fractional erbium laser therapy can be an effective option for managing mucosal lichen planus, warranting further consideration in clinical practice.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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