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Comparative evaluation of low-level laser therapy with and without topical corticosteroid in symptomatic oral lichen planus: A clinical trial

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Abstract:

Oral lichen planus (OLP) is a chronic inflammatory mucosal disease in which treatment primarily aims to reduce pain and improve healing. Therefore, it is of interest to evaluate and compare the efficacy of low-level laser therapy (LLLT) alone with combination therapy using topical triamcinolone acetonide and LLLT in 22 patients with bilateral symptomatic OLP of the buccal mucosa. Clinical outcomes were assessed using visual analogue scale (VAS), symptom score and sign score over four weeks. Combination therapy showed greater improvement in pain and symptom scores, whereas no statistically significant difference was observed in sign scores between the two treatment modalities. Thus, data shows that combining topical corticosteroids with LLLT provides superior symptomatic relief while maintaining comparable clinical healing to LLLT alone.

Keywords: Oral lichen planus (OLP), low-level laser therapy (LLLT), corticosteroid**Background:**

Oral lichen planus (OLP) is a chronic mucocutaneous disease and first described by Wilson in 1869 [1]. It follows a chronic course characterized by periods of exacerbation and remission [2]. Andreassen divided oral lesions of OLP into six types according to their clinical appearance as; reticular, papular, plaque, atrophic, ulcerative and bullous [3]. Oral lichenoid reactions may result from systemic drug exposure or local allergic contact hypersensitivity [4]. Topical corticosteroids are the most commonly employed and useful agent for the treatment of OLP [5]. Over the past decade, there has been a significant increase in research on the clinical applications of lasers in dentistry [6]. In the 1960s, Miaman introduced laser in dentistry [7]. Recently, low-level laser therapy has shown promising results in the management of oral soft tissue lesions because of its analgesic, anti-inflammatory and biostimulatory effects [8]. Recent randomized trials and evidence syntheses continue to support photobiomodulation as an effective alternative or adjunct to topical corticosteroids for symptomatic OLP. Therefore, it is of interest to evaluate and compare the efficacy of low-level laser therapy alone with combination therapy comprising topical corticosteroid and low-level laser therapy in the treatment of symptomatic oral lichen planus patients.

Materials and Methods:**Study design:**

This split-mouth clinical study was conducted in the Department of Oral Medicine and Radiology, SMBT Dental College and Hospital, Sangamner. Twenty-two patients with bilateral symptomatic oral lichen planus of the buccal mucosa were enrolled after institutional ethical approval (SMBT/DC/879/2019, dated 09/10/2019) and written informed consent.

Inclusion criteria:

Eligible participants had symptomatic oral lichen planus involving both buccal mucosae, had received no prior treatment for the current lesions and were not taking drugs known to cause lichenoid reactions.

Exclusion criteria:

Patients were excluded for lesions involving the gingiva, tongue or labial mucosa; suspected drug- or restoration-related lichenoid lesions; pregnancy or lactation; relevant deleterious habits or systemic disease; or any contraindication to topical corticosteroid therapy.

Sample size estimation:

The final sample comprised 22 patients with bilateral symptomatic oral lichen planus, with each participant contributing one lesion to each treatment condition. Sample size was estimated using the standard formula for comparing two proportions, in which $Z\alpha$ and $Z\beta$ represent the selected significance level and study power and P1 and P2 represent the expected response proportions.

Methods:**Group 1 (LLLT alone):**

- [1] The right buccal lesion received low-level laser therapy using a 940-nm Biolase InGaAsP diode laser.
- [2] Standard laser-safety precautions were followed, including wavelength-appropriate protective eyewear for the patient, operator and assistant.
- [3] The diode laser was set at 0.8-0.9 W in non-contact defocused mode for 4-5 minutes per session and applied twice weekly for 4 weeks.

Group 2 (LLLT + topical corticosteroid):

- [1] The left buccal lesion received the same low-level laser therapy protocol together with topical corticosteroid therapy.

- [2] Low-level laser therapy was delivered using the same wavelength, power, mode, duration and visit schedule as Group 1.
- [3] Patients additionally applied 0.1% triamcinolone acetonide ointment topically after meals four times daily for 4 weeks.

Method of measurement:

Symptoms were scored from 0 to 100 using the Tel-Aviv-San Francisco criteria (**Table 1**) [9]. Clinical signs were scored from 0 to 5 using the Thongprasom *et al.* criteria (**Table 2**) [9].

Table 1: Symptom score based on the Tel-Aviv-San Francisco scale

Stage	Symptom Score
100	Asymptomatic
75	Low level of symptoms, does not interfere with usual daily activity
50	Symptoms interfere with regular daily activity
25	Sore and painful; greatly interferes with regular daily activity
0	Impossible to live with the severe symptoms

Table 2: Sign score based on the Thongprasom scale

Stage	Sign Score
Score 0	No lesion, normal mucosa
Score 1	Mild white striae, no erythematous area
Score 2	White striae with atrophic area < than 1 cm ²
Score 3	White striae with atrophic area ≥ 1 cm ²
Score 4	White striae with erosive area < than 1 cm ²
Score 5	White striae with erosive area ≥ 1 cm ²

Statistical analysis:

Data were analyzed using SPSS version 21 for Windows. Normality was assessed with the Shapiro-Wilk test. The unpaired t-test was used to compare mean VAS, symptom and

sign scores between the two lesion groups and $p < 0.05$ was considered statistically significant.

Results:

In the present study the mean age of study population was 47.59 years with age range of 19 years to 80 years. The study population included 22 patients; out of them 10 patients were male while 12 patients were female. Evaluation of symptom score using Standard criteria by Tel-Aviv San Francisco [9]. In the present study, Group 2 showed better overall change in the mean value of symptom score that is 35.22 as compared to Group 1 was 28.4. Thus, at the follow up there was no statistically significant difference between the Group 1 and Group 2 in the present study. ($p = 0.07$, $t = -1.862$) (**Table 3**) (**Figure 1**). Evaluation of sign score using Standard criteria by Thongprasom *et al.* [9]. In the present study, there was no statistically significant difference in overall change of sign score between the two groups based on unpaired t-test. ($p = 0.154$, $t = -1.452$) Although the overall change in sign score was 1.22 in Group 1 and 1.45 in Group 2, they were not statistically significant (**Table 4**) (**Figure 2**). Evaluation of post treatment complications Side effects reported in the Group 1 were insignificant and only one patient had moderate pain and functional disturbances immediately after laser application by the end of 1st week. In Group 2, two patients developed mild to moderate burning sensation, erythema and functional disturbances. In the present study, difference in post treatment complications between Group 1 and Group 2 was not found to be statistically significant, but it was clinically significant (**Table 5**) (**Figure 3**).

Table 3: Intergroup comparison of symptom score between Group 1 (LLLT) and Group 2 (Topical Corticosteroid + LLLT) at different study time intervals respectively

SymptomScore	Group 1 (LLLT) Mean (SD)	Group 2 (Topical Corticosteroid + LLLT) Mean (SD)	Unpaired t test	P value, Significance
1 st week	39.77 (12.58)	39.77 (12.58)	$t = 0.00$	$p = 1.000$
2 nd week	44.31 (17.13)	53.4 (15.99)	$t = -1.819$	$p = 0.046^*$
3 rd week	55.68 (18.79)	67.04 (11.91)	$t = -2.395$	$p = 0.021^*$
4 th week	68.18 (11.39)	75.0 (15.43)	$t = -1.667$	$p = 0.103$
Overall Change	28.4 (8.78)	35.22 (14.75)	$t = -1.862$	$p = 0.07$

$p > 0.05$ – no statistically significant difference * $p < 0.05$ – significant

Table 4: Intergroup comparison of sign score between Group 1 (LLLT) and Group 2 (Topical Corticosteroid + LLLT) at different study time intervals respectively

Sign Score	Group 1 (LLLT) Mean (SD)	Group 2 (Topical Corticosteroid + LLLT) Mean (SD)	Unpaired t test	p value, Significance
1 st week	2.86 (1.03)	2.81 (1.09)	$t = 0.141$	$p = 0.888$
2 nd week	2.59 (0.95)	2.18 (0.85)	$t = 1.495$	$p = 0.142$
3 rd week	2.09 (0.92)	1.77 (0.81)	$t = 1.215$	$p = 0.231$
4 th week	1.63 (0.72)	1.4 (0.59)	$t = 1.139$	$p = 0.261$
Overall Change	1.22 (0.42)	1.45 (0.59)	$t = -1.452$	$p = 0.154$

$p > 0.05$ – no statistically significant difference * $p < 0.05$ – significant

Table 5: Intergroup comparison of post treatment complications between Group 1 (LLLT) and Group 2 (Topical Corticosteroid + LLLT) at different study time intervals respectively

Follow up interval	Post Treatment Complications			
	Group 1 (LLLT)	Group 2 (Topical Corticosteroid + LLLT)	Chi square test	p value (intergroup)
1 st week	1/22 (4.5%)	0 (0%)	Chi = 0.632	$p = 0.826$
2 nd week	0 (0%)	0 (0%)	Chi = 0.00	$p = 1.000$
3 rd week	0 (0%)	1/22 (4.5%)	Chi = 0.632	$p = 0.826$
4 th week	0 (0%)	1/22 (4.5%)	Chi = 0.632	$p = 0.826$

$p > 0.05$ – no statistically significant difference

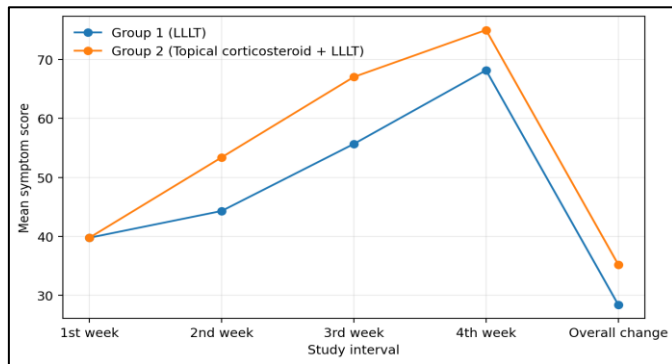


Figure 1: Intergroup comparison of symptom score between Group 1 (LLLT) and Group 2 (Topical Corticosteroid + LLLT) at different study time intervals respectively

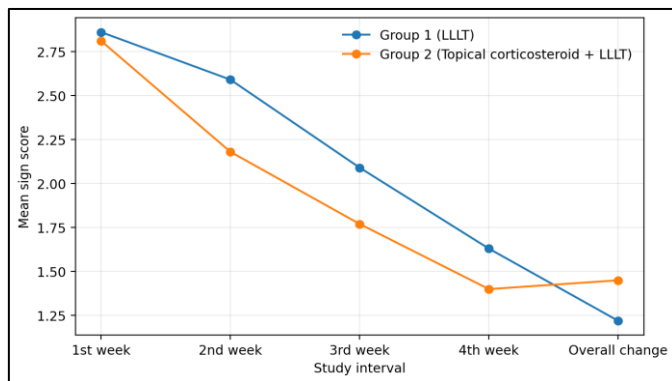


Figure 2: Intergroup comparison of sign score between Group 1 (LLLT) and Group 2 (Topical Corticosteroid + LLLT) at different study time intervals respectively

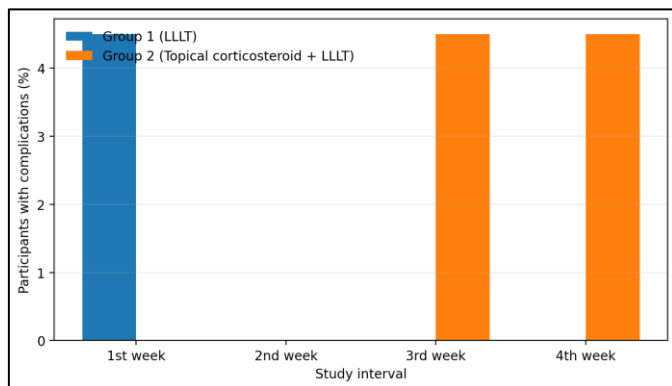


Figure 3: Intergroup comparison of post treatment complications between Group 1 (LLLT) and Group 2 (Topical Corticosteroid + LLLT) at different study time intervals respectively

Discussion:

Oral lichen planus (OLP) is a chronic inflammatory mucosal disease characterized by means of relapses and remissions [8]. It is a T-cell-mediated autoimmune disease in which the cytotoxic CD8+T cells cause apoptosis of the basal cells of the oral epithelium. In assessment, the atrophic and erosive forms of OLP shows erythematous, ulcerative areas which lead to

symptoms ranging from a burning sensation to intense pain [10]. Triamcinolone acetonide 0.1% was a relatively safe drug to be used without systemic absorption in the standard dose regimen for oral lichen planus reported by Ramadas *et al.* [11]. Soliman *et al.* reported beneficial, non-invasive photobiomodulation outcomes with diode laser therapy [12]. In the present study, a 940-nm diode laser was used at 0.8-0.9 W in non-contact defocused mode for 4-5 minutes per session, consistent with the analgesic, anti-inflammatory and biostimulatory rationale for low-level laser therapy [13]. The application was done 2 times a week for a maximum of 5-6 sessions. Jain *et al.* [14] supported the view that the effect of LLLT adds up with the therapeutic effects of topical steroids resulting in a far better clinical outcome. The mean age of the patients with oral lichen planus in the present study was 47.59 years. A female predominance was seen in the study population. These findings were consistent with the studies given by Cafaro *et al.* [15], Kia *et al.* [16] and Bakhtiari *et al.* [17]. OLP affects women more than men at a ratio of approximately 1.4:1 reported by Sugerman *et al.* [18]. In the present study, Group 2 showed better overall change in the mean value of VAS Score and symptom score. Statistically significant symptom improvement was achieved after treatment by the end of second and third week. At the follow up there was no statistically significant difference between the Group 1 and Group 2 in the present study. The results were consistent with studies reported by Jajarm *et al.* [19]. In the present study, the overall change in sign score was 1.22 in Group 1 and 1.45 in Group 2. The results in present study were in agreement with Jajarm *et al.* [19] and Panchal *et al.* [8]. Triamcinolone acetonide was significantly effective in the management of signs and patients showed improvement after 4 weeks reported by Thongprasom *et al.* [9] and Kia *et al.* [16]. Side effects reported in the Group 1 were insignificant and only one patient had moderate pain and functional disturbances immediately after laser irradiation by the end of 1st week. Similar results were reported by Soliman *et al.* [12] and Jajaram *et al.* [19]. Out of 22 patients, two patients in Group 2 developed mild to moderate burning sensation, erythema and functional disturbances; one in 3rd and another in 4th week of follow up. Vincent *et al.* reported that, 39% of patients treated with 0.1-0.2% Triamcinolone acetonide for symptomatic oral lichen planus subsequently developed candidiasis [20]. More recent evidence reports meaningful pain and lesion improvement with photobiomodulation, while topical corticosteroids remain effective comparators; combination regimens may provide additional symptomatic benefit in selected patients [8, 12 and 21-24].

Conclusion:

Both treatments improved symptomatic oral lichen planus, but adding topical triamcinolone acetonide to LLLT produced greater symptomatic improvement over four weeks. The combination may be a useful short-term option when pain control is a priority, although larger paired trials with longer follow-up are needed to confirm durability and safety.

Future aspects:

This preliminary study supports further evaluation of diode-laser-based therapy for buccal oral lichen planus. Larger studies with longer follow-up are needed to confirm treatment durability, recurrence patterns and adverse effects.

Clinical significance of the study:

Low-level laser therapy provides photobiomodulatory, anti-inflammatory and analgesic effects without intentional thermal tissue injury. Combining LLLT with topical corticosteroid therapy may improve short-term symptom control in selected patients with symptomatic oral lichen planus.

Limitations of the study:

Pain measurement is subjective and may vary between participants. The small sample and short follow-up limit assessment of recurrence and uncommon adverse effects; topical corticosteroids may predispose to candidiasis, while transient discomfort can occur after laser application.

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