



# Lichen Planopilaris and Low-Level Light Therapy: Four Case Reports and Review of the Literature About Low-Level Light Therapy and Lichenoid Dermatitis

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## ABSTRACT

Lichen planopilaris (LPP) is a cell-mediated scarring alopecia that causes inflammation of the scalp and the eventual destruction of hair follicles in affected areas. Current literature on treatment of LPP remains limited with no definitive treatment approach being recognized, although a combination of topical/intralesional steroids and orally administered hydroxychloroquine remains the most utilized option. Low-level light therapy (LLLT) is an expanding technology shown to be effective in a variety of dermatologic conditions. We report here four patients with LPP who show a dramatic response to LLLT, including a reduction of

inflammation, disappearance of symptoms, and evident hair regrowth with no side effects. We review the possible role of LLLT in LPP and other lichenoid conditions.

**Keywords:** Alopecia; Cicatricial alopecia; Fibrosing alopecia with a pattern distribution (FAPD); Hair loss; Hair regrowth; Lichenoid dermatosis; Lichen planopilaris (LPP); Lichen planus; Low-level light therapy (LLLT); Scarring alopecia

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## Key Summary Points

Review of the current literature regarding the treatment of lichen planopilaris (LPP) and other lichenoid dermatosis with low-level light therapy (LLLT)

LLLT has been utilized with success in the treatment of LPP and oral lichen planus

Description of four patients with LPP who had evident improvement after LTTT treatment

Moving forward, larger controlled studies are needed to fully elucidate the benefits of LLLT on treatment of LPP

## INTRODUCTION

Lichen planopilaris (LPP) is a rare chronic inflammatory scalp disease and considered a prototype for lymphocytic cicatricial alopecias. The exact pathogenesis of LPP is not fully understood but involves the cell-mediated permanent destruction of follicular stem cells located in the hair bulge, causing a loss of the hair follicle's ability to regenerate [1]. Low-level light therapy (LLLT) is a rapidly expanding technology for treatment of a variety of conditions that require improvement of inflammation and pain to ultimately restore function [2]. LLLT is approved by the US Food and Drug Administration (FDA) for treatment of male and female androgenic alopecia (AGA) and acute or chronic musculoskeletal pain. LLLT has shown some effectiveness in treating other dermatologic conditions including inflammatory acne, skin aging, vitiligo, and hypertrophic scarring [2–5]. With a wide range of benefits, LLLT is theorized to have possible therapeutic uses for patients with LPP. To date, two studies have directly tested LLLT for treatment of scarring alopecia such as LPP [6, 7] and several studies have tested LLLT in oral lichen planus [8–13].

Here we present four cases of LPP including a case of fibrosing alopecia with a pattern distribution (FAPD) who had dramatic improvement in inflammation and hair regrowth with LLLT and review the literature on use of LLLT in LPP and other lichenoid dermatosis.

## CASE SUMMARY

A 60-year-old woman with no significant past medical history or family history, first presented in 2016 with history of hair loss, hair thinning, and scalp pruritus. At that time, she had a scalp biopsy which showed scarring alopecia consistent with LPP and miniaturization. On examination the patient was noted to have scarring patterned alopecia with absence of follicular openings, hair shaft variability, and multiple peripilar casts on trichoscopy. The patient was diagnosed with FAPD and started on clobetasol 0.05% lotion once a day, naltrexone 3 mg daily, and LLLT (272 pulsed laser diode cap with

1360 mW total output) 6 min daily. Follow-up with photography showed significant improvement with evident regrowth of hair after 3 and 6 months.

The other three cases are also women aged from 28 to 65 years old, affected by LPP that remained active despite systemic treatment. All of them complained of itching and presented with peripilar casts and loss of follicular openings on dermoscopy. Duration of LLLT treatment ranged from 6 to 18 months and all patients used the device daily. Treatment duration ranged from 5 to 7 min a day depending on device. All patients had improvement of symptoms and signs of disease on dermoscopy after 3 months. Clinical improvement was also perceived. All of them are still on treatment (Figs. 1, 2).

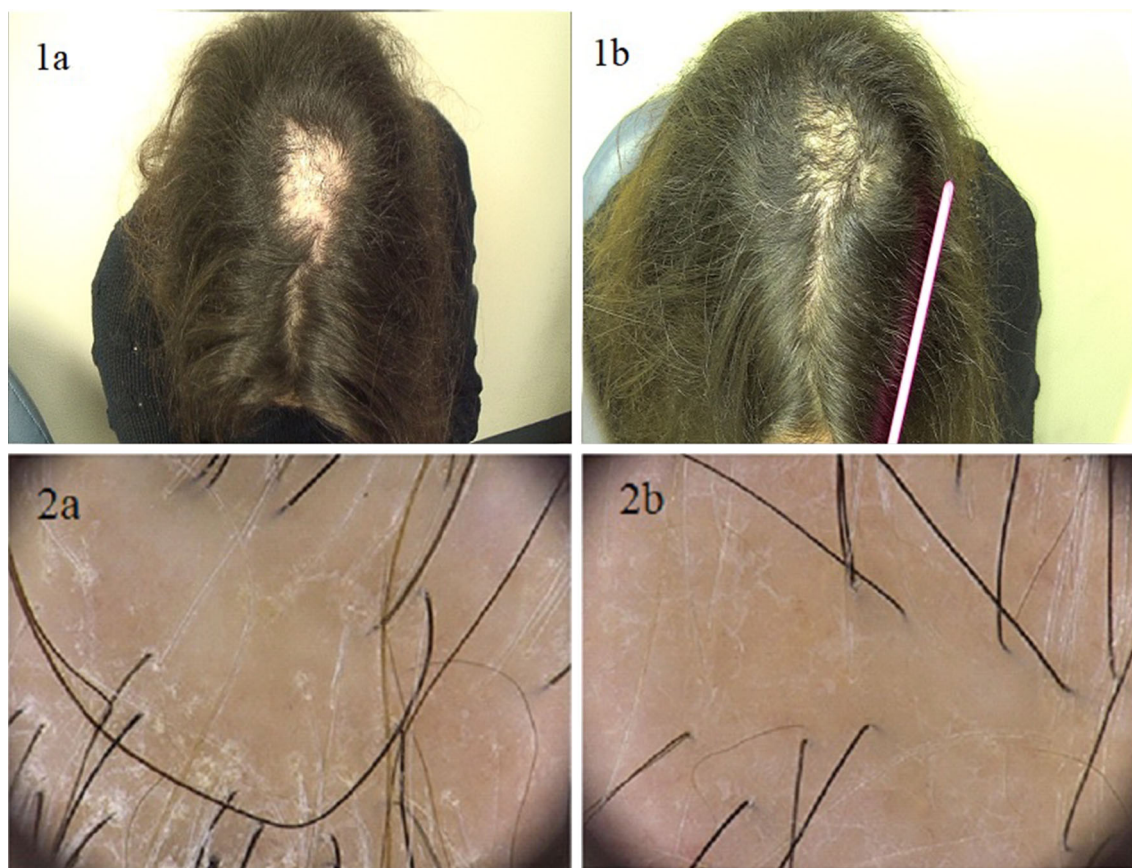
While institutional review board approval was not required for this case series, all patients provided consent for the publication of this report. Additional informed consent was obtained from all patients for whom identifying information is included in this article.

Our four cases are summarized in Table 1.

## DISCUSSION

LPP can present as patchy, marginal, or patterned alopecia in its different variants that include “classical LPP”, frontal fibrosing alopecia (FFA), and FAPD, which is a variety of LPP characterized by the presence of miniaturization. LPP is more common in women than men, with peak onset between 30 and 60 years of age [14]. Initially, patients will commonly experience increased hair shedding, pruritus, tenderness, and burning of the scalp. In active disease, trichoscopy shows peripilar casts often surrounding tufts of hairs. Scalp erythema is also usually present. Hair loss becomes more evident with progression of the disease with the eventual disappearance of follicular openings in affected areas [15, 16]. LPP generally has a slow and insidious course of disease, although less frequently, extensive hair loss can occur within months in a more rapid disease course [14, 17].

Currently, as a result of the infrequency of the disease and limited literature availability, no



**Fig. 1** A 42-year-old patient **1a** before and **1b** after 18 months of treatment with LLLT with evident hair regrowth. Scalp under  $\times 50$  magnification trichoscopy **2a**

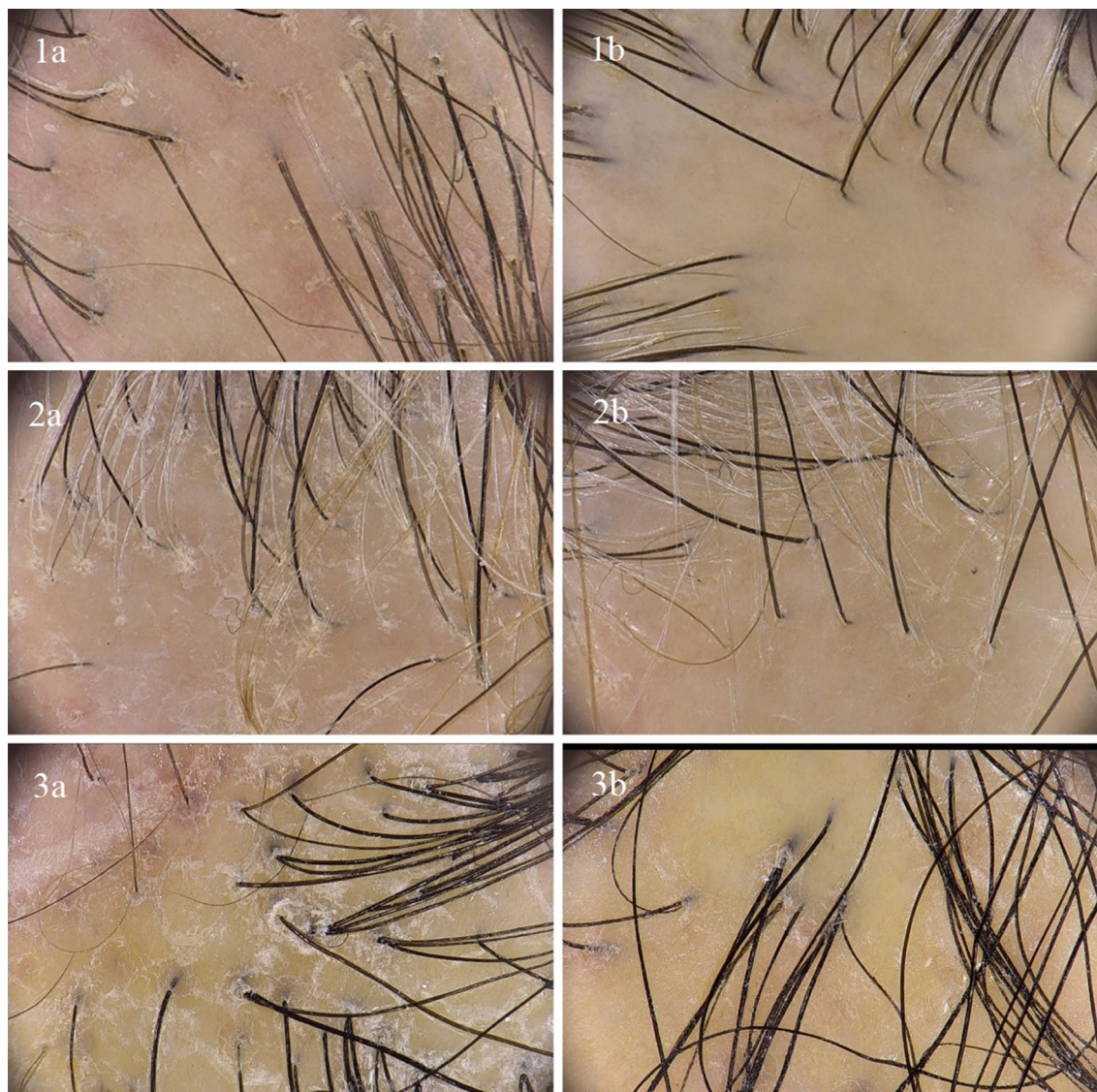
before and **2b** after 4 months of treatment with LLLT, showing reduction of peripilar casts

definitive treatment approach has been recognized. There remains no curative therapy and the main goal of treatment is reducing inflammatory symptoms and slowing the progression of hair loss. Treatment commonly involves the use of high potency topical and/or intralesional corticosteroids and orally administered hydroxychloroquine [18]. Other systemic treatment options include tetracyclines, pioglitazones, cyclosporine, mycophenolate mofetil, methotrexate, or systemic corticosteroids. A systematic review concluded that topical/intralesional steroids or hydroxychloroquine can be seen as first-line agents for treating classic LPP, although this is not based on direct comparisons and the quality of evidence for many therapeutic options is low [19]. In recent years, naltrexone has been shown to have anti-

inflammatory properties with the potential to be used as a treatment modality for autoimmune conditions [20]. A case series of four patients on low dose naltrexone for treatment of LPP is the only study on the subject and has shown therapeutic benefits including a decrease in inflammation and inflammatory symptoms with slowed disease progression [21] (Table 2).

LLLT is a non-invasive therapy that has shown some effectiveness in treating inflammatory skin disorders. A literature review on use of LLLT in lichenoid conditions showed that LLLT is an effective therapy for oral LPP where it can be seen as an alternative to corticosteroids [8–13].

Two studies directly looked at the effectiveness of LLLT for the treatment of scarring alopecia including FFA and LPP with a total of



**Fig. 2** Scalp under  $\times 50$  magnification trichoscopy. A 60-year-old patient **1a** before and **1b** after 6 months of LLLT treatment. A 65-year-old patient **2a** before and **2b**

after 6 months of LLLT treatment. A 28-year-old patient **3a** before and **3b** after 12 months of LLLT treatment

24 subjects. Results showed promising findings including a reduction of symptoms and decreased inflammation [6, 7].

Our experience supports the limited existing literature on the use of LLLT for patients with LPP; in particular, we suggest this treatment in cases of LPP that have incomplete response to topical and systemic therapy with steroids and antimalarials. Our patients had consistent improvement with reduction of inflammation, disappearance of symptoms, and evident hair

regrowth with no side effects. All patients are still on LLLT treatment, and two of them were able to reduce the oral medications without relapses. The downside of this treatment could be the cost of highly sophisticated devices, daily regimen, and the lack of clear treatment protocol and parameters. Moving forward, larger controlled studies should be performed to fully elucidate the benefits of LLLT and to evaluate the best treatment regimen of this technology for patients with LPP.

**Table 1** Case summaries

Age (years)	Sex	Diagnosis	Duration (years)	Concurrent treatment	Follow-up (months)	Outcome	LLLT specifications
60	Female	LPP	3	Clobetasol 0.05% lotion/naltrexone 3 mg/day	6	Reduction of peripilar casts and clinical improvement	105 light-emitting diodes cap 650 nm wavelength 5 mW power per light (Tricoglam™) 5 min/day or 20 min × 2/week
65	Female	LPP	3	Hydroxychloroquine 5 mg/kg/day/clobetasol 0.05% lotion once a day	6	Reduction of peripilar casts and clinical improvement	105 light-emitting diodes cap 650 nm wavelength 5 mW power per light (Tricoglam™) 5 min/day or 20 min × 2/week
42	Female	LPP	6	Hydroxychloroquine 5 mg/kg/day/clobetasol 0.05% lotion once a day/topical 2% minoxidil Hydroxychloroquine reduced to 2.5 mg/kg/day	18	Reduction of peripilar casts and clinical improvement	272 pulsed laser diode cap 650 nm wavelength with 1360 mW (CapillusPro™) 6 min daily
28	Female	LPP	2	Hydroxychloroquine 5 mg/kg/day/clobetasol 0.05% lotion once a day	12	Reduction of peripilar casts and clinical improvement	204 light diodes cap 660 nm wavelength 25.5 mW/cm <sup>2</sup> irradiance (Capellux 19™) 7 min daily

**Table 2** Summary of literature on the use of low-level light therapy for treatment of lichenoid dermatosis

Authors (year)	Disease process	Type of study	Methods	LLLT specifications	Results
Fonda-Pascual et al. [6]	LPP	Prospective study of LLLT for treatment of LPP	8 subjects (5 female, 3 male) received LLLT 15 min daily for 6 months	246 red LED $\lambda = 630$ nm Exposure = 15 min	All patients had reduction of symptoms, erythema, and perifollicular hyperkeratosis. And an increase in terminal hair thickness
Gerkowicz et al. [7]	FFA and LPP	Prospective study of sLED as adjuvant therapy	16 female subjects (8 FFA, 8 LPP) received sLED 1 × a week for 10 weeks	Lamp with 78 pulsed diodes $\lambda = 630 \pm 5$ nm (red light) Power density = 100–120 mW/cm <sup>2</sup> Exposure time = 13 min 47 s	FFA and LPP severity improved. sLEDs can be used as adjuvant therapy in these patients
Dillenburg et al. [8]	Oral LPP	Randomized controlled trial comparing topical clobetasol to LPT	Topical clobetasol 0.05% gel applied 3 × per day for 30 days ( $n = 21$ ) versus LPT 3 × per week for 12 total sessions ( $n = 21$ )	Continuous wave diode laser $\lambda = 660$ nm (red light) Output density = 1000 mW/cm <sup>2</sup>	LPT had higher percentage of complete lesion resolution. 4 and 8 weeks after treatment LPT had no recurrence of lesions, while clobetasol exhibited worsening
Agha-Hosseini et al. [9]	Oral LPP	Randomized clinical trial comparing CO <sub>2</sub> laser therapy to LLLT	CO <sub>2</sub> laser ( $n = 13$ ) versus LLLT for 5 sessions every other day ( $n = 15$ )	Diode laser with two probes 1st probe: $\lambda = 890$ nm (infrared) 2nd probe: wavelength = 633 nm (red)	After 3 months, LLLT had 100% improvement. CO <sub>2</sub> had 85% improvement

**Table 2** continued

Authors (year)	Disease process	Type of study	Methods	LLLT specifications	Results
El Shenawy and Eldin [10]	Oral LPP	Randomized clinical trial comparing LLLT to topical steroids	Topical 0.1% triamcinolone acetonide Orabase ( $n = 12$ ) versus LLLT for 2 sessions twice a week ( $n = 12$ )	Diode laser $\lambda = 970$ nm (infrared) Exposure time = 8 min ( $4 \times 2$ min application)	Both groups showed significant decreases in pain scores. Groups had no difference in pain score during pretreatment or follow-up. Corticosteroids showed lower pain scores during post treatment
Jajarm et al. [11]	Oral LPP	Randomized clinical trial comparing dexamethasone mouthwash to LLLT	LLLT for $2 \times$ a week with a maximum of 10 sessions ( $n = 15$ ) versus dexamethasone mouthwash $4 \times$ a day for 30 days ( $n = 15$ )	Continuous diode laser $\lambda = 630$ nm (red) Exposure time = 2.5 min	LLLT was as effective as dexamethasone mouthwash in reducing appearance of lesion, pain, and lesion severity
Kazancioglu and Erisen [12]	Oral LPP	Randomized clinical trial comparing LLLT to ozone therapy to topical corticosteroid therapy	LLLT $2 \times$ a week for maximum of 10 sessions versus ozone therapy $2 \times$ a week for maximum of 10 sessions versus dexamethasone mouthwash $4 \times$ a day for 1 month	Continuous diode laser $\lambda = 808$ nm Exposure time = 2.5 min	Improvement was seen with LLLT, ozone, and steroids, although ozone and corticosteroids were more effective

**Table 2** continued

Authors (year)	Disease process	Type of study	Methods	LLLT specifications	Results
Othman et al. [13]	Oral LPP	Randomized clinical trial comparing LLLT to topical corticosteroids	LLLT 2× a week for maximum 10 sessions ( $n = 12$ ) versus 0.1% triamcinolone acetonide Orabase for 4 weeks ( $n = 12$ )	Continuous diode laser $\lambda = 970$ nm Exposure time = 8 min in 4 applications	Steroids improved disease variables more so than LLLT. Light therapy can be used as an alternative treatment when steroids are not indicated

*LPP* lichen planopilaris, *LLLT* low-level light therapy, *FFA* frontal fibrosing alopecia, *sLED* superluminescent diodes, *LPT* laser phototherapy,  $\lambda$  wavelength, LED light-emitting diode

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all patients for whom identifying information is included in this article.

**Data Availability.** Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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