



Photobiomodulation With a Continuous Wave Red Laser (660 nm) as Monotherapy for Adult Alopecia Areata: A Case Presentation

Luiz Felipe Palma^{1*}, Luana Campos², Cristina Maria Arvate Álvares², Rafael Verardi Serrano¹, Luís Otávio Carvalho de Moraes³

¹Department of Pathology, Federal University of São Paulo. São Paulo, SP, Brazil

²Graduate Program in Implantology, University of Santo Amaro, School of Dentistry, São Paulo, SP, Brazil

³Department of Morphology and Genetics, Federal University of São Paulo, São Paulo, SP, Brazil

*Correspondence to

Luiz Felipe Palma,
Email: luizfelipep@hotmail.com

Received: February 4, 2023

Accepted: June 7, 2023

Published online July 15, 2023



Abstract

Introduction: Alopecia areata (AA) is an autoimmune, inflammatory, non-scarring hair loss in which T-cells target hair follicles. Given that the available therapeutic options generally do not induce and sustain remission of AA effectively and many adverse effects may occur, monochromatic light sources have been recently gaining attention from clinicians. Therefore, the present paper aimed to report the first case in which photobiomodulation therapy (PBMT) with a continuous wave red laser (660 nm) was used as monotherapy for AA.

Case Presentation: An isolated round area of complete hair loss was subjected to daily PBMT sessions, resulting in significant regrowth (hair of normal coloration and thickness) within 7 days. On the 21st day, the patient's aesthetic concern was completely resolved.

Conclusion: PBMT with a continuous wave red laser seems to be a promising therapeutic option for the treatment of AA; however, additional studies are necessary to obtain more robust evidence.

Keywords: Low-level laser; Alopecia areata; Hair.

Introduction

Alopecia areata (AA) is an autoimmune, inflammatory, non-scarring hair loss¹ in which T-cells target hair follicles.² Typical clinical manifestations include single or multiple well-delimited patches with partial or total hair loss. The course of AA is unpredictable and uncertain and there is currently no known cure.³

Corticosteroids are the conventional mainstay of treatment for AA² but several other pharmacological agents may also be employed.⁴ As the therapeutic options often fail to effectively induce and maintain remission of AA,⁵ and they may also be associated with adverse effects, there has been a growing interest in the use of monochromatic light sources as an alternative approach.⁶

Photobiomodulation therapy (PBMT), a non-invasive, safe, and low-cost treatment, is widely applied in Medical and Dental practices to mitigate pain, stimulate wound healing, and control inflammation.^{7,8} Very recently, its beneficial effects in modulating immunologic processes have also been suggested,⁹ providing new insights into many dermatologic conditions and diseases.

In light of these facts, the current paper aims to report the first case in which PBMT utilizing a continuous wave red laser was employed as monotherapy for AA.

Case Presentation

A 31-year-old Caucasian woman was referred to a health center with a complaint of abrupt hair loss. According to her, a burning sensation in the affected area had arisen some days earlier and then hair loss had occurred suddenly during a single night.

On physical examination, an isolated round area of complete hair loss (7.5 × 3.5 cm) was observed on the right parietal and temporal regions (Figure 1A). Trichoscopy further revealed the presence of yellow and black dots, as well as tapered, broken, and vellus hairs. Considering the clinical features and the patient's medical history, the diagnosis of AA was established.

Treatment with topical application of minoxidil and clobetasol was proposed; however, the patient declined it due to concerns about the impact on the aesthetic appearance of her long hair. Thus, daily PBMT sessions with a continuous wave InGaAlP diode laser (in contact mode) were suggested applying the following parameters: 660 nm, 10 J/cm², 40 mW, 0.4 J, and 10 seconds by irradiation point, totaling 12 points (scattered throughout the affected area) and 4.8 J (Table 1). The patient provided informed consent before the clinical procedures.

Significant hair regrowth (normal coloration and

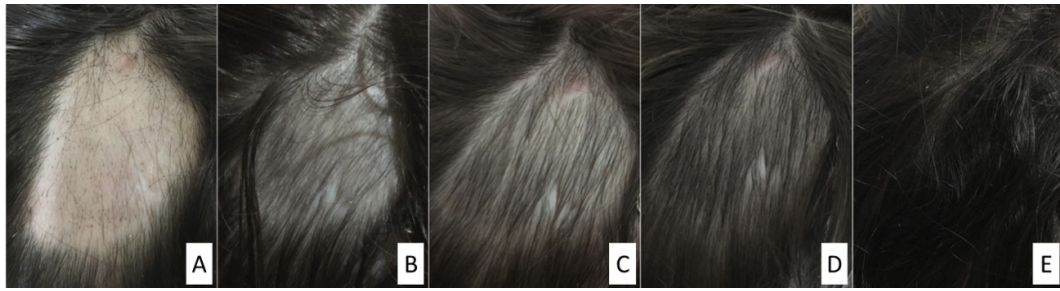


Figure 1. The Clinical Progression of an Area Affected by Alopecia Areata and Treated With Photobiomodulation Therapy. (A) Initial presentation: a 7.5 cm × 3.5 cm area exhibiting complete hair loss. (B) 7 days: rapid hair regrowth observed throughout the affected area. (C) 14 days: progressive improvement in hair regrowth. (D) 21 days: final clinical outcome, with complete hair regrowth. (E) 4-month follow-up period: no relapses observed during the period

Table 1. Device Information and Irradiation/Treatment Parameters

Features	Information
Manufacturer	MMOptics® Ltda
Model Identifier	Twin Flex III Evolution
Number of Emitters	One emitter
Emitter Type	InGaAlP
Type of laser	Diode
Operation mode	Continuous
Center wavelength	660 nm
Exposure duration	10 s
Delivery system	Optical fiber
Energy density	10 J/cm ²
Energy per point	0.4 J
Number of points irradiated	12 points
Total radiant energy	4.8 J
Peak radiant power	40 mW
Average radiant power	40 mW
Focus spot area	0.04 cm ²
Beam spot size at target	0.04 cm ²
Irradiance at target	1 W/cm ²
Application technique	Skin contact
Number and frequency of treatment sessions	21 days, daily sessions
Beam divergence	No

thickness) was noticeable within 7 days (Figure 1B), with further progressive improvement over time (Figure 1C). On the 21st day (Figure 1D), given the patient's high level of satisfaction with the treatment outcomes and the absence of any remaining aesthetic concerns, PBMT sessions were discontinued. No relapses were observed following the cessation of PBMT, considering a 4-month follow-up period (Figure 1E).

Discussion

Although many patients with mild presentations of AA may not require therapeutic interventions, some authors believe that cosmetic hair regrowth cannot be expected within 3 months.¹⁰ In more severe cases, however, AA generally takes a year or more to resolve but it may also

become chronic and resistant to treatments for long periods.⁴

In the present study, on the other hand, we reported a case in which PBMT was highly effective in the management of AA within a short period (21 days), resulting in the resolution of the patient's aesthetic complaint.

Within the field of dermatology, lasers have long been recognized as an important therapeutic option for addressing aesthetic-related conditions and diseases but only recently substantial efforts have been made to elucidate their anti-inflammatory effects and potential clinical applications – particularly for immune-mediated diseases.⁹ The underlying mechanisms of PBMT in the context of AA, however, are still not fully understood.¹¹ As it is an autoimmune disease and results in a pro-inflammatory environment for the hair follicle, PBMT appears to be advantageous due to its notable anti-inflammatory effects.^{1,5} Some authors also propose that PBMT would have a role in the autoimmune response but there is a limited understanding of this matter.¹²

Although a study investigated the use of a pulsed infrared laser for the treatment of AA,¹¹ no other one has employed a continuous wave red laser for this purpose. Indeed, most studies have used 308-nm excimer laser/light devices but their costs are considered a barrier to patient access.⁶ The decision to select a red continuous wave laser device in the present study was primarily driven by considerations of cost-effectiveness and practicality.⁸ Another significant factor behind the device selection was the absence of studies to evaluate comparatively the clinical effects of near-infra-red and red wavelengths, as well as continuous and pulsed sources, in hair regrowth resulting from any condition or disease.¹

While the findings of the current report are promising, it is important to note that the study design itself (i.e., case report) is ranked low in the hierarchy of evidence-based medicine.¹³ Moreover, further investigation is necessary to determine the best laser protocol for AA and to enhance the understanding of the precise photonic mechanisms involved in this condition.

Conclusion

PBMT with a continuous wave red laser seems to be a

promising therapeutic option for the treatment of AA; however, additional studies are necessary to obtain more robust evidence.

Authors' Contribution

Conceptualization: Luiz Felipe Palma, Luana Campos, Cristina Maria Arvate Álvares, Rafael Verardi Serrano, Luís Otávio Carvalho de Moraes.

Data curation: Luiz Felipe Palma.

Formal analysis: Luiz Felipe Palma.

Investigation: Luiz Felipe Palma, Luana Campos, Cristina Maria Arvate Álvares, Rafael Verardi Serrano, Luís Otávio Carvalho de Moraes.

Methodology: Luiz Felipe Palma, Luana Campos.

Project administration: Luís Otávio Carvalho de Moraes.

Supervision: Luís Otávio Carvalho de Moraes.

Writing—original draft: Luiz Felipe Palma, Luana Campos, Cristina Maria Arvate Álvares, Rafael Verardi Serrano, Luís Otávio Carvalho de Moraes.

Writing—review & editing: Luiz Felipe Palma, Luana Campos, Cristina Maria Arvate Álvares, Rafael Verardi Serrano, Luís Otávio Carvalho de Moraes.

Competing Interests

No potential conflict of interest was reported by the authors.

Disclaimer

The findings and conclusions of this case report are the responsibility of the authors.

Ethical Approval

Informed consent was obtained from the he patient for publication of this report.

Funding

None.

References

1. Avci P, Gupta GK, Clark J, Wikonkal N, Hamblin MR. Low-level laser (light) therapy (LLLT) for treatment of hair loss. *Lasers Surg Med*. 2014;46(2):144-51. doi: [10.1002/lsm.22170](https://doi.org/10.1002/lsm.22170).
2. Lee JH, Eun SH, Kim SH, Ju HJ, Kim GM, Bae JM. Excimer laser/light treatment of alopecia areata: a systematic review and meta-analyses. *Photodermatol Photoimmunol Photomed*. 2020;36(6):460-9. doi: [10.1111/phpp.12596](https://doi.org/10.1111/phpp.12596).
3. Gómez-Quispe H, Muñoz Moreno-Arrones O, Hermosa-Gelbard Á, Vañó-Galván S, Saceda-Corralo D. Trichoscopy in alopecia areata. *Actas Dermosifiliogr*. 2023;114(1):25-32. doi: [10.1016/j.ad.2022.08.018](https://doi.org/10.1016/j.ad.2022.08.018).
4. Fiedler VC, Alaiti S. Treatment of alopecia areata. *Dermatol Clin*. 1996;14(4):733-7. doi: [10.1016/s0733-8635\(05\)70399-5](https://doi.org/10.1016/s0733-8635(05)70399-5).
5. Hamblin MR. Photobiomodulation for the management of alopecia: mechanisms of action, patient selection and perspectives. *Clin Cosmet Investig Dermatol*. 2019;12:669-78. doi: [10.2147/ccid.s184979](https://doi.org/10.2147/ccid.s184979).
6. Darwin E, Arora H, Hirt PA, Wikramanayake TC, Jimenez JJ. A review of monochromatic light devices for the treatment of alopecia areata. *Lasers Med Sci*. 2018;33(2):435-44. doi: [10.1007/s10103-017-2412-6](https://doi.org/10.1007/s10103-017-2412-6).
7. Louzeiro GC, Cherubini K, de Figueiredo MAZ, Salum FG. Effect of photobiomodulation on salivary flow and composition, xerostomia and quality of life of patients during head and neck radiotherapy in short term follow-up: a randomized controlled clinical trial. *J Photochem Photobiol B*. 2020;209:111933. doi: [10.1016/j.jphotobiol.2020.111933](https://doi.org/10.1016/j.jphotobiol.2020.111933).
8. Berlingieri G, Alvares CMA, Serrano RV, Palma LF, Campos L. Phototherapies for COVID-19-associated opportunistic oral infections. *Photodiagnosis Photodyn Ther*. 2022;37:102678. doi: [10.1016/j.pdpdt.2021.102678](https://doi.org/10.1016/j.pdpdt.2021.102678).
9. Wickenheisser VA, Zywt EM, Rabjohns EM, Lee HH, Lawrence DS, Tarrant TK. Laser light therapy in inflammatory, musculoskeletal, and autoimmune disease. *Curr Allergy Asthma Rep*. 2019;19(8):37. doi: [10.1007/s11882-019-0869-z](https://doi.org/10.1007/s11882-019-0869-z).
10. Messenger AG, McKillop J, Farrant P, McDonagh AJ, Sladden M. British Association of Dermatologists' guidelines for the management of alopecia areata 2012. *Br J Dermatol*. 2012;166(5):916-26. doi: [10.1111/j.1365-2133.2012.10955.x](https://doi.org/10.1111/j.1365-2133.2012.10955.x).
11. Waiz M, Saleh AZ, Hayani R, Jubory SO. Use of the pulsed infrared diode laser (904 nm) in the treatment of alopecia areata. *J Cosmet Laser Ther*. 2006;8(1):27-30. doi: [10.1080/14764170600607368](https://doi.org/10.1080/14764170600607368).
12. Ablon G. Combination 830-nm and 633-nm light-emitting diode phototherapy shows promise in the treatment of recalcitrant psoriasis: preliminary findings. *Photomed Laser Surg*. 2010;28(1):141-6. doi: [10.1089/pho.2009.2484](https://doi.org/10.1089/pho.2009.2484).
13. Albrecht J, Werth VP, Bigby M. The role of case reports in evidence-based practice, with suggestions for improving their reporting. *J Am Acad Dermatol*. 2009;60(3):412-8. doi: [10.1016/j.jaad.2008.10.023](https://doi.org/10.1016/j.jaad.2008.10.023).