Original Article

EFFICACY OF LOW LEVEL LASER THERAPY IN THE TREATMENT OF ALOPECIA AREATA

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ABSTRACT

Background: Alopecia areata is a chronic inflammatory disease which affects the hair follicles and sometimes the nails.

Purpose: The purpose of this study was to evaluate the efficacy of low level laser therapy in the treatment of alopecia areata of the scalp.

Method: Twenty three patients (14 male and 9 female) had 2 or more patches of the scalp, one patch was left for comparison as a control patches. The age ranged from 22 to 39 years with 30 ± 6.09 years mean. The study patches received12 sessions of low level laser therapy for 2 minutes/cm² of the affected patch with the dose of 1.5 J/cm². Each subject received 3 sessions per week for one month. Hair count, the hairs number within the one square centimeter space and Visual analog scale of hair loss were assessed pre-treatment, post-treatment and follow-up time (2 months).

Results: showed significant improvement in the two outcomes of study patches ($p < 0.05$) with non-significant improvement of control patches ($p > 0.05$).

Conclusion: Using low level laser therapy was effective in the treatment of alopecia areata of the scalp.

KEYWORDS: Low Level Laser Therapy, Alopecia Areata.

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INTRODUCTION

Alopecia areata (AA) is a common disease of non-scarring alopecia including the scalp and/or body, characterized by hair loss without any clinical inflammatory signs. It is one of the most common form of hair loss seen by dermatologists and accounts for 25% of all the alopecia cases.[1] Both males and females are equally affected and it can occur at any age, the highest prevalence age was between 30-59 years. [2]

The etiology of AA is attributed to an autoimmune process, which may be modified by genetic factors and aggravated by emotional stress. Many studies have reported an abnormal cell-mediated immune reaction in AA. There is an increased suppressor T-cell function in patients experiencing hair regrowth. [3]

Alopecia areata usually presents as patches of hair loss on the scalp but any hair-bearing skin can be affected. The involved skin may be slightly reddened but otherwise appears normal. Short broken hairs (exclamation mark hairs) are frequently seen around the edges of expanding patches of alopecia areata. The nails are affected in about 10% of patients referred for specialist advice.[4] It may present as single or multiple patches. Small distinct patches may merge and form larger patches. Scalp is the most common site (90%). Alopecia areata can be classified

depending on extent and pattern of hair loss.[5] Alopecic patches or plaques of varying size and number on the scalp (whether as a single patch or multiple ones) is the most common, other clinical presentations such as alopecia totalis (hair loss from the entire scalp), alopecia universalis (loss of body hair as well), ophiasic AA (pattern of hair loss affecting the frontoparietal, temporal, and occipital regions), sisaipho AA (hair loss affecting the entire scalp except the peripheral ring), reticular AA (numerous patches of hair loss on the scalp with areas of hair remaining in between), alopecia diffusa (acute and generalized hair loss, which may be hard to diagnose).[6]

The diagnosis of AA may include: fungal culture, skin biopsy, serology for lupus erythematosus, and serology for syphilis. The high frequency of autoimmune disease in patients with alopecia areata is probably insufficient to justify routine screening.[4]

There are two principal treatment options: the use of an immunosuppressive regimen (preferable for patients with acute and rapidly progressing alopecia areata) or an immune-deviation strategy that manipulates the intracutaneous inflammatory milieu (favored for patients with the chronic, relapsing form).[7] Potent topical glucocorticoids are also widely used, especially in children and in adults with less than 50% loss of scalp hair. High-potency topical glucocorticoids with occlusive dressings are most effective and lead to improvement in more than 25% of involved patients; however, glucocorticoid-induced folliculitis is a common adverse effect. [8]

Low-level laser therapy (LLLT) has been studied and used for the treatment of a variety of clinical indications including pain management, wound healing, and recently to enhance hair regrowth. Each of these applications is based on the principles of photobiomodulation which have demonstrated biological effects in living organisms.[9] LLLT has been used to treat patches of AA with variable success rates[10], most studies agree that LLLT is safe for the treatment of hair loss, but more studies are needed to confirm its therapeutic effects. [11]

The present study is designed to find the efficacy of low level laser therapy (LLLT) in the treatment of alopecia areata (AA) of the scalp.

MATERIALS AND METHODS

Sample of this self-study clinical research was based on 22-39 year's male and female subjects (14 male and 9 female) had 2 or more alopecia areata of the scalp (2-4 affected area). This study was performed over the period from May to September 2013 at the physiotherapy department of New Kasr El-Aini Teaching Hospital, Cairo University, Egypt.

Subjects were met the following inclusive criteria, which are years between 20 and 40 years old and clinically diagnosed as alopecia areata (AA) which was manifested as the hair loss in well-circumscribed patches of normal-appearing skin, most commonly on the scalp (2 or more patches of the scalp). Exclusion criteria consisted of any patient suffering from AA in eye brow, beard, and moustache, patients who had used topical, intralesional, or systemic therapies for AA, had no visual evidence of new hair growth within the last 6 months or who had hair disorders other than AA or systemic diseases that might affect the results, patients with history hair loss less than 6 months. In addition, patients were not permitted to enter the study if they were pregnant or lactating; had a history of uncontrolled bacterial, viral, fungal, atypical mycobacterial, or opportunistic infection (eg, systemic fungal infections or parasites); had significant pulmonary or cardiovascular disease, a history of active tuberculosis (TB) or currently undergoing treatment for TB, liver disease or abnormal hepatic function. Patient with history of LLLT in their previous treatment and inability to comply with treatment requirements were also excluded.

The dependant and outcome variable were hair count and visual analogue scale (VAS) of hair loss (0 representing no hair loss and 100 indicating total hair loss). The independent variable was low level laser therapy (LLLT) on the scalp.

Procedure

The subjects were assessed and informed consent with ethical approval was taken.

Patients had multiple patches; one patch was left for comparison as control patches. Outcomes measures were performed pre-treatment, post-

treatment (one month) and follow-up time (2 months after last session). Baseline demographic variables include age, gender and number of patches carried out. Two criteria were used to evaluate the outcome of the study. First, hair count, the hairs number within the one square centimeter space (marked with a medical tattoo using green ink using aseptic technique) were pulled and counted using a surgical skin hook and a lens with five times magnification (hair counts were carried out two times to confirm the accuracy of the data). [12] Second, Visual analog scale (VAS) of hair loss. A VAS is quantifiable and easy for the patient to understand and use. In the present study using a 100 mm VAS, with 0 representing no hair loss and 100 indicating total hair loss. Negative values indicate hair loss and positive values indicate hair regrowth compared to baseline.[13]

This study included 52 resistant patches (patches had not responded to different modalities of treatment) from 23 patients suffering from AA in the scalp. All patients had multiple patches (2-4 patches), one patch was left for comparison as a control patches (23 patches). Twenty nine patches of AA of the scalp as a study areas were subjected to be treated by LLLT application, [14] (ENDOLASER 422 – Enraf-Norius®, Netherland), subjects were comfort-ably seated in an adjustable chair with back support and feet on the floor and wore protective goggles (Endolaser 422-Extra quality) to protect their eyes from the hazards of laser therapy. The areas of skin to be treated of the scalp were cleaned with soap and water. The procedure consisted of 12 sessions of LLLT for 2 minutes/cm² of the affected patch with the dose of 1.5 J/cm². Each subject received 3 sessions per week (day after day) for one month. The total time of session was changed from one subject to another according to the size of each patch. The laser used to treat the patches was a low-level invisible pulsed infrared diode laser (905 nm) wavelength and (5000 Hz) frequency with a peak power of 100 W. The treatment technique was carried out by multiple application of the LLLT in a series of circles in close contact with each other toward the center until the total area of the patch was treated. The laser probe is 100 mW, pulsed laser diode (LP 100) with peak power of 100 W. The probe was in contact with the skin of the treated area. Subjects were advised not to use any other treatment modality during laser therapy, and 2 months after the last session (follow-up time). All Subjects were assessed every session for any adverse effects such as itching, erythema and scaling.

Data analysis

All statistics were calculated by using the statistical package of social sciences (SPSS) version 16. Descriptive statistics (mean and standard deviation) were computed for all data. A repeated measure ANOVA with a Green-Geisser correction was applied within the group for hair count and VAS of hair loss. Post hoc tests using the Bonferroni correction was applied within group for hair count and VAS to determine the significance difference between repeated measures. Unpaired t- test was applied for hair count and VAS of hair loss between study and control patches.

RESULTS AND TABLES

The mean age of the subjects was 30 ± 6.09 years. The mean of number of patches of the subjects was 2.26 ± 0.54.

The mean changes in hair count of study patches and control patches are summarized in table 1. There was a statistically significant difference between time points (F= 128.05, P<0.004) in study patches. Post hoc tests using the Bonferroni correction revealed that a high improvement in hair count from pre-treatment, post-treatment, and follow-up time (18.79±8.84, 37.93±16.48, 41.48±17.3, respectively) where P<0.001 existed between three time points. The mean changes of hair count in control patches weren't statistically significant difference between time points (F= 0.468, P>0.004). Comparison revealed that there were no significant differences in mean changes for hair count pre-treatment between study patches and control patches (P>0.05) on the other hand, there were a significant differences in mean changes post-treatment and follow-up time between study patches and control patches (P<0.05).

The mean changes in VAS of hair loss of study patches and control patches are summarized in Table 2. There was a statistically significant

difference between time points (F= 148.69, P<0.004) in study patches. Post hoc tests using the Bonferroni correction revealed that a high reduction in VAS of hair loss in target patches when comparing pre-treatment and post-treatment (87.79±7.64, 40.94±26.92, respectively) where P < 0.005. There was a significant reduction in VAS of hair loss when comparing pre-treatment and follow-up time (87.79±7.64, 26.1±31.33, respectively) where P < 0.003. Also, between post-treatment and follow-up time there was also a significant difference revealed reduction in VAS of hair loss (40.94±26.92, 26.1±31.33, respectively) where P <0.003. The mean changes in VAS of hair loss of control patches weren't statistically significant difference between time points (F= 1.167, P>0.004). Comparison revealed that there were no significant differences in mean changes for VAS of hair loss pre-treatment between study patches and control patches(P>0.05) on the other hand, there were a significant differences in mean changes post-treatment and follow-up time between study patches and control patches (P<0.05).

Table 1: Hair count pre-treatment, post-treatment and follow-up time between study and control patches.

Time of evaluation	Study patches	Control patches	
	Mean ± SD	Mean ± SD	P- value
Pre-treatment	18.79 ± 8.84	19.08 ± 7.62	0.871
Post-treatment	37.93 ± 16.48	19.39 ± 8.03	0.001
Follow-up	41.48 ± 17.3	19.69 ± 9.01	0.001
P- value	0.001	0.051	

Table 2: VAS of hair loss pre-treatment, post-treatment and follow-up time between study and control patches.

Time of evaluation	Study patches	Control patches	
	Mean ± SD	Mean ± SD	P- value
Pre-treatment	87.79 ± 7.64	89.78 ± 7.14	0.761
Post-treatment	40.94 ± 26.92	88.82 ± 8.07	0.001
Follow-up	26.1 ± 31.33	88.52 ± 9.75	0.001
P- value	0.001	0.303	

Fig.1 demonstrates the mean values difference of hair count pre-treatment, post-treatment and follow-up time between study and control patches and Fig. 2 demonstrates the mean values difference of VAS of hair loss pre-treatment, post-treatment and follow-up time between study and control patches.

Fig.1: Hair count pre-treatment, post-treatment and follow-up time between study and control patches.

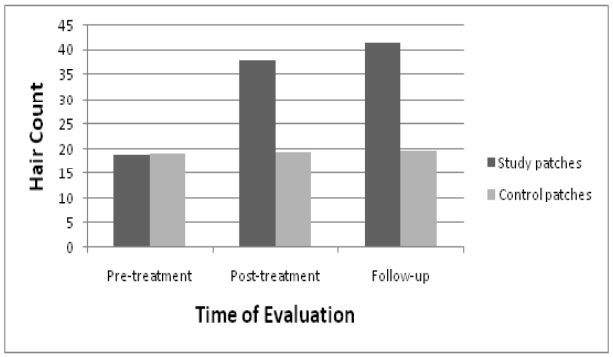
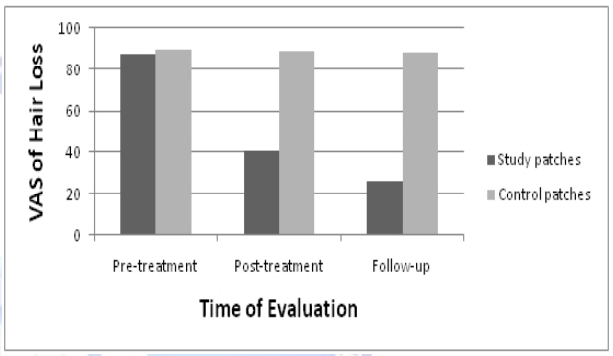


Fig.2: VAS of hair loss pre-treatment, post-treatment and follow-up time between study and control patches.



DISCUSSION

This study was carried out to examine the efficacy of low level laser therapy (LLLT) in the treatment of alopecia areata (AA) of the scalp. Loss of hair from the head and body is known as alopecia, sometimes resulting in baldness. When hair loss occurs in only one section, it is known as alopecia areata. This is the most common form of the disease and is associated with a sudden loss of hair, causing patches to appear on either the scalp or other bodily areas such as eyebrow, beard and moustache.[15]

Hair count is an appropriate and objective tool in the evaluation of hair growth. In study by Satino and Markou, hair count approach was used for evaluation of hair growth after LLLT using a Hair-Max LaserComb. Number of hair was estimated within one cm² using a surgical skin hook and lens with 5 times magnification.[12] VAS is the simplest method of subjective evaluation of alopecia. There are two different methods to use VAS in alopecia. First method in the trial of subcutaneous efalizumab is not effective in treatment of alopecia areata by Price et al who applied a 100 mm VAS, with 0 representing no hair loss and 100 indicating total hair loss.[13] The second method in study of oral

finasteride improved the quality of life of androgenetic alopecia patients by Yamazaki et al who applied VAS by patients to rate their level of satisfaction with the condition of their hair on a scale 0% (totally dissatisfied) to 100% (totally satisfied).[16] In the present study the first methods was applied by patients to determine their improvement in hair growth.

The application of LLLT is a well known tool in physical therapy and other fields as its biological effects are widely reported, including anti-inflammation, pain reduction, wound healing, anti-edema, antibiosis, immunity and local blood circulation improvement.[17] The theory of LLLT at wavelengths in the red range affects the functioning of the stem cells that cause hair growth. LLLT activates cytochrome c oxidase and enhances mitochondrial electron transport [18], which leads to an increase in ATP (adenosine triphosphatase) and subsequent reversal of hair follicles from the dormant telogen stage of growth, to the active growth or anagen stage.[19,20]

There were many previous studies using a variety of light sources, wavelengths, and treatment parameters for the treatment of AA with LLLT. In study by Gundogan et al reported that 2 cases of AA showing homogenous and thick regrowth of hair after 11–12 treatment sessions with the 308 xenon chloride excimer laser and explained this as a result of the immunosuppressive action of the excimer laser which may induce T-cell apoptosis.[21] Yamazaki et al used linear polarized infrared irradiation in treatment of AA, a study was conducted with 15 patients (6 men, 9 women) using Super LizerTM, a medical instrument emitting polarized pulsed linear light with a high output (1.8W) of infrared radiation (600–1,600nm) , they concluded that LLLT accelerates the process of hair regrowth in AA patients.[22] Waiz et al used pulsed infrared diode laser (904 nm) in the treatment of alopecia areata, which gives high local energy with less heat. That means LLLT can give sufficient energy and during a pulse does not raise the temperature because heat dissipates between the pulses so there is no heat build-up but it can influence the molecules which play an important role in treatment of AA.[14]

In the present study patients received low-level invisible pulsed infrared diode laser (905 nm) wavelength and (5000 Hz) frequency with a peak power of 100 W, was used to treat AA of the scalp. The data analysis revealed that study patches (n=29) which received LLLT showed highly significant improvement in hair count, VAS of hair loss pre-treatment ,post-treatment, and follow-up time. On the other hand the data analysis of the control patches (n=23) which left without treatment for comparison showed non-significant improvement in the same two parameters. Moreover the analysis revealed that LLLT elicited a high improvement in hair count and highly reducing in VAS of hair loss in follow-up time (after 2 months), therefore, LLLT had a long lasting effect on hair growth.

In this study, wavelength of laser used was (905nm) which was of prime importance for producing an effect on a specific molecule. Researchers suggested that even though they did not know the actual effect of LLLT in increasing hair follicles and tensile strength, it was agreed that one or more factors among improved micro-vascular circulation, reduced inflammation and increased cell energy in the form of ATP worked together.[23] The patients of the present study reported that laser was an effective therapy without any side effects and the hair remained to grow after completion of treatment which gave a long lasting effect of LLLT in hair regrowth. The control patches which left for comparison were applied to LLLT as in study patches after the end of the study to get the benefit from the procedure.

AA of the scalp is a common disease of hair follicle that leads to a potentially revisable type of hair loss. In the present study, more than one method of evaluation was used to confirm findings definite efficacy of LLLT in treatment of AA and regrowth of hair. Left control patches without treatment for comparison was non-significant improvement, but use of LLLT in study patches gave a significant improvement with long lasting effect.

CONCLUSION

The present study shows the efficacy of low level laser therapy in treatment of alopecia areata of the scalp. There were greater improvement in hair count and reducing visual analogue scale of hair loss in study patches underwent LLLT compared to control patches.

List of abbreviations :

AA	Alopecia areata
ANOVA	Analysis of Variance
ATP	Adenosine triphosphatase
Hz	Hertz
J/cm²	Joule per square centimeter
LLLT	Low-level laser therapy
LP	pulsed laser diode
mW	milliWatt
n	Number
nm	Nanometer
P-value	Probability
SD	Standard Deviation
SPSS	Statistical Package of Social Sciences
TB	Tuberculosis
T-cells	Transmission cells
VAS	Visual Analogue Scale
W	Watt

Conflicts of interest: None

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