

The Effect of One Session Low Level Laser Therapy of Extracted Follicular Units on the Outcome of Hair Transplantation



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Abstract

Introduction: Photobiostimulation with low level laser (LLL) has been used in medicine for a long time and its effects have been shown in many diseases. Some studies have evaluated the effect of LLL on androgenic alopecia. One of the most important limitations of the use of LLL in the treatment of alopecia is the requirement for multiple sessions, which is hardly accepted by patients. This study was conducted to evaluate the effect of the irradiation of extracted follicular hair units by LLL on the outcome of hair transplantation.

Methods: We enrolled 10 patients with androgenic alopecia and after screening tests for infections and other diseases, we extracted hair follicular units. The hair units were divided in two groups. One group was irradiated by LLL 20 minutes before transplantation (660 nm, 80 Hz, 100 mW) and the other one was used as control. The containing plates were labeled as A and B and sent to the operation room. The surgeon was unaware of the therapy assigned to the plates and transplanted them randomly on the right or left side of the head. One hundred follicular units on each sides of the scalp were transplanted symmetrically. The follicles on both sides were evaluated at 3 and 6 months of transplantation for hair growth rate by another physician, blinded to the treatment assigned to each side.

Results: Ten patient with androgenic alopecia and mean (SD) age of 31.5 (6.6) years (range 25-45 years) completed the study. All patients had 100% hair growth at 3 and 6 months follow-up except one who had hair growth of 20% at three months of transplantation, which changed to 100% at sixth months. There was no significant difference between the groups regarding hair growth ($P > 0.8$).

Conclusion: One session of LLL irradiation has no significant effect on the outcome of transplanted hair follicles. Studies with larger sample size are needed to draw a definite conclusion.

Keywords: Laser Therapy, Low Level; Hair Follicle; Transplantation



Introduction

Androgenic alopecia is the most common form of hair loss that affects about 50% of the population over 50 years of age. It develops secondary to the imbalance in androgenic hormones and can severely affect the quality of life. Clinically, the characteristics of androgenic alopecia are decreased terminal hair of the frontal and vertex areas and their conversion to vellus hair with a length of less than 1 cm, and increase in telogen hair.¹ Surgical techniques and hair transplantation are common treatment modalities for androgenic alopecia.

The effects of low level laser (LLL) and lights on different diseases and pathologic processes such as wound healing, alleviating inflammation, edema, and pain, and decreasing tissue damage have been known for more than 40 years.²⁻⁵

The effect of LLL is related to biostimulation or photostimulation that affects cell differentiation and transformation which influences energy production by mitochondria and accelerates different processes such as healing and collagen synthesis.⁴ Moreover, LLL can increase the synthesis of cytokines and growth factors, and the induction of angiogenesis. Based on the available literature, LLL stimulates cell proliferation. Although the mechanism of cell proliferation is still unknown, it seems that changes in the intracellular oxidation-reduction status and activation of cellular alkalization result in stimulation of nucleic acid synthesis.^{6,7} Furthermore, ionic changes in the cell membrane result in the transportation of some ions into and out of the cells, especially transportation of calcium into the cells, which can increase cell proliferation. Some studies have evaluated the effect of LLL in the treat-

ment of androgenic alopecia. Previous studies have used LLL as a hood or comb to increase the number of hair follicles.^{5,8} One of the most important limitations of the use of LLL in the treatment of alopecia is its requirement for multiple sessions in a definite period of time, which is hardly accepted by patients.

To our knowledge, no previous study had examined pre-transplantation LLL irradiation of the hair follicles on the outcome of transplantation. This study was conducted to evaluate the effect of LLL irradiation on hair follicular units before hair transplantation on the outcome of transplantation.

Methods

Setting

This randomized controlled double-blinded clinical trial was conducted in the Dermatology and Hair Transplantation Clinic of Tehran University of Medical Sciences, Tehran, Iran, during 2014. The study conformed to ethical codes stated in Helsinki declaration and the Ethic Committee on Research of our university approved the protocol of the study.

Patients

Patients with confirmed diagnosis of androgenic alopecia were included. To be eligible patients should had no disease causing androgenic pattern hair loss, ie, endocrine diseases, other hair or skin diseases or infections that might affect hair growth, or other systemic or psychological conditions that might affect the patient's collaboration during the study. The study protocol and its possible benefits were explained to the patients and a written informed consent was obtained from them. Then the patients underwent routine laboratory tests before hair transplantation.

Interventions

After photography and estimation of the required follicles according to the severity of the androgenic alopecia, the follicles were prepared from the skin of the posterior scalp, abscised by surgical blade (about 1 cm² of the posterior scalp is required for 100 follicles). Then the follicles were cut into follicular units and collected in 0.9%

saline-containing plates. Equal number of follicles (100 follicles) was placed in two separate plates. A laser technician, irradiated one of the plates (intervention group) (Figure 1) with low level diode laser device (Azor-2k, AZOR Medical Equipment, Moscow, Russia) for 20 minutes with the following settings: wavelength of 660 nm; frequency of 80 Hz; and energy of 100 mW.

The anterior scalp was divided into two equal parts according to the sagittal plane, ie, left and right. Using random sequence table, we assigned the irradiated follicles for transplantation on one side and non-irradiated to the other side of each patient. The plates were labeled as A and B, which was only known by the laser technician, the dermatologic surgeon was blinded to the state of follicles irradiation.

Outcome Measure

The follicles on both sides were evaluated at 3 and 6 months of transplantation for hair growth rate by another physician, blinded to the assigned treatment.

Statistical Analysis

The collected data were recorded and analyzed with SPSS 13.0 (SPSS Inc., Chicago, Illinois, United States). Wilcoxon signed-rank test was used to compare the results between the two groups. $P < 0.05$ were considered statistically significant.



Figure 1. Low Level Laser Irradiation of Hair Follicles Obtained From Scalp Before Transplantation.

Table 1. The Information of the Patients and the Results of Evaluation at Months Three and Six of Transplantation

Case No.	Age, y	Response to Transplantation, %			
		Irradiated Hair Follicle Unites		Control Units	
		Month 3	Month 6	Month 3	Month 6
1	31	100	100	100	100
2	25	100	100	100	100
3	32	100	100	100	100
4	30	100	100	20	100
5	38	100	100	100	100
6	25	100	100	100	100
7	29	100	100	100	100
8	32	100	100	100	100
9	45	100	100	100	100
10	28	100	100	100	100

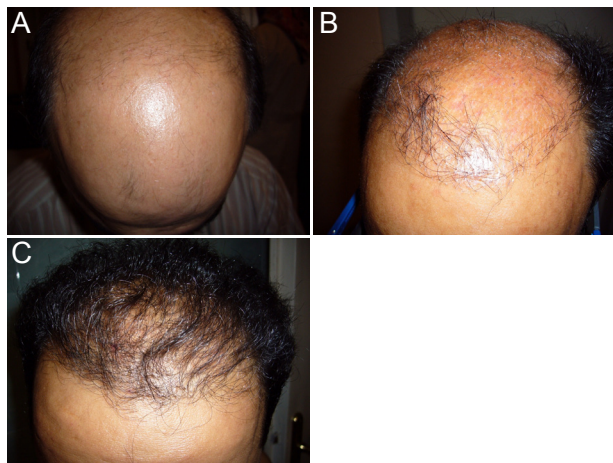


Figure 2. (A) Patient No. 4 Before Hair Transplantation; (B) Patient No. 4, Three Months After Transplantation (the right site is the laser treated site); (C) Photography of the Scalp of Patient No. 4, Six Months After Transplantation (the right site is the laser treated site).

Results

Ten eligible male patients with a mean (SD) age of 31.5 (6.06) years (range, 25-45 years) were enrolled and received hair follicle transplantation. Table 1 presents the patients' information and the results obtained. In only one patient (Case No. 4) the hair follicles did not achieve the desirable results after three months (Figures 2A and 2B) while in others 100% of follicles had favorable growth. After 6 months, all patients had 100% response to transplantation (Figure 2C). There was not a significant difference between the two groups regarding the percentage of response to treatment at 3 and 6 months of transplantation.

Discussion and Conclusion

According to our results, there was no significant difference between irradiated follicles and controls in the outcome of transplantation, which excludes the effect of pre-transplantation irradiation of hair follicular units on the outcome of transplantation.

LLL therapy is a novel treatment modality for hair loss although scientific evidence for its benefits is sparse. For the first time in 1967, Mester et al evaluated whether LLL could cause cancer in mice. For this purpose, the mice were exposed to laser radiation after their back hair was shaved. Although they found no evidence of cancer, they observed an increase in hair growth rate in the laser group.^{9,10} Although we could not find a study that had irradiated hair follicular units before hair transplantation, there are reports on effects of LLL on hair growth in humans. Avram and Rogers recruited seven patients with hair loss and treated them with LLL for 3 weeks, weekly 20 minutes irradiation. At 3 and 6 months after treatment, respectively in five and two patients, the results indicated decrease in villus hairs and increase in hair diameter; however, the effects were not statistically significant.¹¹ Laser Comb devices have been used to treat androgenic alopecia. In a controlled study on 110 patients with androgenic alopecia, those treated with LLL comb device

had significantly higher hair density after 26 weeks in comparison to those who had used sham device.⁵

There are also reports of paradoxical hair growth following laser hair removal. This phenomenon has been reported with diode and alexandrite lasers as well as intense pulsed light laser.¹²⁻¹⁴ The exact mechanism of effect of laser on hair growth is not yet understood. Activation of telogen hair and homogeneous hair growth effect are among suggested hypotheses. Some studies have found that LLL increases ATP production in the mitochondria as studies have shown that LLL therapy can increase the activity of the complexes 2 and 4 of the mitochondria.^{6,7}

Although different LLL devices for the treatment of hair loss have been manufactured, limited studies have assessed their effectiveness.¹⁵

In our study, the lack of laser therapy effect might be attributed to some reasons. The duration of radiation was short while the effect of LLL on hair growth in androgenic alopecia is observed after multiple sessions during several months. Another limitation of this study was its small sample size.

Finally, although LLL has confirmed photobiostimulation effects, their use to achieve desirable clinical results requires further cellular-molecular studies and developing guideline for proper use when there are certain indications. However, the role of LLL as an adjunct therapy is increasing in many diseases.

In conclusion, one session of LLL therapy of hair follicular units before transplantation made no significant difference between treated and untreated follicles. Yet, we do not know how long and how frequent the treatment sessions must be held to achieve favorable results. Further studies with larger sample size and more and longer irradiation sessions with microscopic examination of the treated follicles are needed to determine the effect of pre-transplantation LLL therapy on hair growth and also evaluation of the effect of LLLT after hair transplantation for final outcomes.

Conflict of Interest

The author has no conflict of interest to declare.

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