International Journal of PharmTech Research
CODEN (USA): IJPRIF, ISSN: 0974-4304, ISSN(Online): 2455-9563
Vol.9, No.10, pp 40-47, 2016

Effect of Polarized Light Therapy on Hair Regrowth in Alopecia

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Abstract : Purpose: to determine the effect of polarized light therapy on hair regrowth in alopecia. **Methods of evaluation:** Measurement of the global photographs via the 7- point assessment scale and hair counting. **Methods:**- Thirty patients (male and female) with ages ranging from 25-40 years suffering from alopecia (alopecia areata and androgenic alopecia).They were selected randomly from Cairo University hospitals, they were randomly divided into 2 equal groups in number, one study group (A) and a control one (B). the control group (B) who not received the polarized light therapy (Bioptron light therapy) or any treatment as minoxidil, finastride or corticosteroids and they were instructed about their nutrition, the study group (A) who received the polarized light therapy (Bioptron light therapy) for 10 minutes every session, application was done 3 times per week for 3 months as a total period of treatment. Measurements were conducted before starting the treatment as a first record and at the end of the third month of treatment as a second (final) record. **Results and conclusion:**-Result showed that the polarized light therapy was effective and fruitful in increasing hair regrowth in alopecia as evidenced by the highly significant increase in the 7- point assessment scale and hair counting. **Conclusion:** - polarized light therapy is beneficial in improving hair regrowth in alopecia.
Key words (polarized light therapy, Alopecia and Hair regrowth).

Introduction

Hair loss (alopecia) affects men and women of all ages and often significantly affects social and psychological well-being . Although alopecia has several causes , a careful history close attention to the appearance of the hair loss, and a few simple studies can quickly narrow the potential diagnoses . Androgenetic alopecia , one of the most common forms of hair loss, usually has a specific pattern of temporal-frontal loss in men and central thinning in women,[1, 2,3.]

Alopecia affects both men and women and may result from a variety of causes. The cosmetic consequences may have a substantial emotional impact on the patient. As might be expected, many patients are not in the least content with their hair loss and seek the advice of a physician in search of a remedy. Depending on the cause and extent of the problem, medical and surgical therapies exist which may offer assistance for the patient experiencing alopecia. These modalities may be used alone or in combination, and the particular regimen must be individualized to meet the particular needs of the patient. The physician is obligated to ensure that the patient has a clear understanding of his/her condition and expectations in order for a realistic and

thoughtful treatment plan to be devised. This presentation will consider the etiology of alopecia and patient selection with an emphasis on the medical and surgical management of the disorder, [4,5, 6,7.]

Associated symptoms are dyspareunia (pain with intercourse), chronic constipation, slow urinary stream, food sensitivities that worsen symptoms**, r**adiating pain in the groin, vagina, rectum, or sacrum. Associated co-morbidities are anxiety, depression, migraine, chronic fatigue syndrome, dysmennorrhea, vulvodynia, fibromyalgia , irritable bowel syndrome (IBS), urethral burning and pelvic floor dysfunction,[8,9,10,11.]

The use of light for therapeutic purposes dates back to the ancient Egyptians, Greeks and Romans. Current research into the physiological benefits of light therapy has developed an area of great interest which is the laser. Most research in the uses of laser was reported by European sources. Only during the past decade have American research workers begun to add the results of their studies. The notion that light, in the visible and near infrared ranges, can produce photo chemical and photo biological changes that ameliorate pain and inflammation as well as promote tissue repair was first observed in the late 1960s. At this time the prevailing notion was that lasers were uniquely photo destructive, promoting attempts to develop powerful lasers that may yield military superiority. Thus, the mood was not right and neither were medical minds ready to accept the idea that a tool that can cut, vaporize, and otherwise destroy tissue could be used for beneficial purposes, [12,13,14.]

Polarized light from low power lasers and non-laser devices has been used as a non-invasive therapy in the treatment of various musculoskeletal disorders, acceleration of wound healing and treatment of skin ulcers, although the polarized light is known to have numerous photo-biostimulatory effects including cell proliferation, enhanced collagen synthesis, changes to the circulatory system and anti-inflammatory actions, the precise mechanism of its action still remains unclear. The available non-laser optical devices are the Bioptron products which emit a wide beam of polarized, non-coherent, polychromatic, low energy light that contain wavelengths from the visible spectrum (480-700nm) and infrared radiation (700-3400nm); this range provides optimal penetration and stimulation of the tissues without the risk of DNA damage, [15,16, 17.]

Bioptron light therapy device emits light that is polarized, polychromatic, non-coherent and of low energy. The light emitted has a wide range of wavelengths (480-3400nm) and differs from laser light, which is mono-chromatic (of narrow wavelength), coherent, polarized and of high or low energy. Possible risk of burns is present with the laser therapy, while not possible with the Bioptron light therapy. User skills are essential in laser therapy, but not essential with the Bioptron light therapy**.** Higher costs are present with the laser therapy, but not with the Bioptron light therapy, in addition, treatment of large area is available with the Bioptron light therapy,[18,19,20,21,22,23.]

Bioptron light therapy system has a low energy density (fluency) of an average of 2.4 J/cm². Bioptron light reaches the area to be treated with a constant, steady intensity; this energy density has biostimulative effects. With Bioptron light therapy, the energy density dosage can be precisely determined. Furthermore, the effect exerted by light is also defined by its power density. As it is measured at the skin's surface, it varies depending both on the intensity of the light's source and its distance from the area to be treated. The specific power density of Bioptron light is approximately 40 mW / cm² at a treatment distance of 10 cm; this is equivalent to an energy density (fluency) of an average of 2.4 J/ cm² per minute. These properties of Bioptron light allow it to penetrate the surface of the skin with minimum heating effect, no damage to skin and no known side-effects,[24, 25,26,27.]

Material and Methods

Subjects:

Thirty patients (male and female) with ages ranging from 25-40 years suffering from alopecia (alopecia areata and androgenic alopecia).They were selected randomly from Cairo University hospitals, they were randomly divided into 2 equal groups in number, one study group (A) and a control one (B). the control group (B) who not received the polarized light therapy (Bioptron light therapy) or any treatment as minoxidil, finastride or corticosteroids and they were instructed about their nutrition, the study group (A) who received the polarized light therapy (Bioptron light therapy) for 10 minutes every session, application was done 3 times per week for 3 months as a total period of treatment. Measurements were conducted before starting the treatment as a first record and at the end of the third month of treatment as a second (final) record, [3,8,10,12,14,16.]

Treatment instrumentation:

The treatment protocol was achieved by using the Bioptron Compact III light therapy system (PAG-860) developed and produced by Bioptron AG, Switzerland. BLT was a single unit emitting a broad range of light wavelengths at constant intensity for safe light therapy with filter diameter approx: 4 cm**,** power supply: 100-230 V ~, 50/ 60 Hz**,** power consumption: 56 VA**,** rated power of halogen: 20 W**,** weight: 0.5 kg**,** ambient temperatures: (A) for operation is + 10 °C to + 40 ºC, Wavelength: 480-3400 nm**,** Degree of polarization: > 95% (590-1550 nm)**,** Specific power density: av. 40 mW/ cm²and light energy per minute: av. 2.4 Joule/ cm², [17,18,19,20,22.]

Procedures

Evaluation:

A- Global photographs via the 7- point assessment scale:

Global photographs for each patient was taken before the polarized light therapy (Bioptron light therapy) application and 3 months after the polarized light therapy (Bioptron light therapy) application. Three expert dermatologists independently evaluated the global photographs for each time point compared with the baseline global photograph. These global photographs were assessed versus the baseline global photographs using the same 7-point scale,[1,3, 8,9,10.]

+3	Greatly decrease
+2	Moderately decrease
+1	Slightly decrease
0	No change
-1	Slightly increase
-2	Moderately increase
-3	greatly increased

B- Hair counting:

Hair count was measured in a 1-inch-diameter determined circular area centered at the leading edge of the area of frontal scalp hair. Hair-count data were obtained from macrophotographs of the area by converting all visible hairs in the macrophotographs to dot maps. The hairs in the dot map were counted using computer-assisted image analysis, which detected only "non-vellus-like/miniaturized" hairs. Thus, hair counts measured only "cosmetically significant" hairs. Hair counts were assessed by the difference between the count at each time point versus the baseline count, and the mean hair count values for each treatment group were determined using Least Squares Means, [6,8,10, 11.]

Treatment:

Patients were treated as outpatients. When the patient attends for treatment, they received full explanation about the purpose of the treatment, the therapeutic and physiological benefits of the polarized light therapy (Bioptron light therapy) device. Before starting the treatment, all the previous measurements of each patient was taken for a comparison. Patients were informed to follow the physical therapist and the dermatologist instructions. Every patient was placed in suitable comfort sitting position. Before beginning of the treatment, the polarized light therapy (Bioptron light therapy) device was checked to be sure that, it is switched off. Application of the polarized light therapy (Bioptron light therapy) on the scalp after cleaning of the scalp with alcohol to remove any oil or cream. After drying hair, turn on polarized light therapy device then direct polarized light therapy device flat on the scalp. Place the polarized light therapy device on a spot and leaving it there for 4 seconds then moving it 1/2 inch to the next spot, move the polarized light therapy device from front to back then from bottom to top. Total time of application was 10 minutes, 3 times per week for 3 months, [16,18,19, 20,21,22.]

Data analysis:

The 7- point assessment scale and hair counting were measured before and after the treatment program and the collected data were fed into computer for the statistical analysis; descriptive statistics as mean, standard deviation, minimum and maximum were calculated for each group. The t-test was done to compare the mean difference of the two groups before and after application and within each group. Alpha point of 0.05 was used as a level of significance, [28].

Results

In the present study, effects of polarized light therapy on hair regrowth in alopecia were investigated. As shown in table (1) and figure (1), the mean values of the global photographs via the 7- point assessment scale measurement (7-PAS) for the frontal scalp hair before treatment was (-2.000 ± 0.541) degrees in the study group, while after treatment was (-0.300 ± 1.020) degrees. These results revealed a highly significant increase in the global photographs via the 7- point assessment scale measurement (7-PAS) for the frontal scalp hair($P<0.0001$). While the mean values of the global photographs via the 7- point assessment scale measurement (7-PAS) for the frontal scalp hairbefore treatment was (-2.055± 0.804) degrees in the control group, while after treatment was (-2.051 ± 0.661) degrees, these results revealed non-significant difference in the global photographs via the 7- point assessment scale measurement (7-PAS) for the frontal scalp hair($P>0.05$).

Table (1): Comparison of the mean values of the global photographs via the 7- point assessment scale measurement (7-PAS) for the frontal scalp hair before and after treatment in the two groups in degrees.

	Before treatment		After treatment		Mean difference	T.value	P.value
	Mean in degrees	± SD	Mean in degrees	± SD			
Study group (True MENS group)	-2.000	0.541	-0.300	1.020	-1.70000	-5.70	0.0001
Control group (False MENS group)	-2.055	0.804	-2.051	0.661	-0.004000	-0.01	0.988

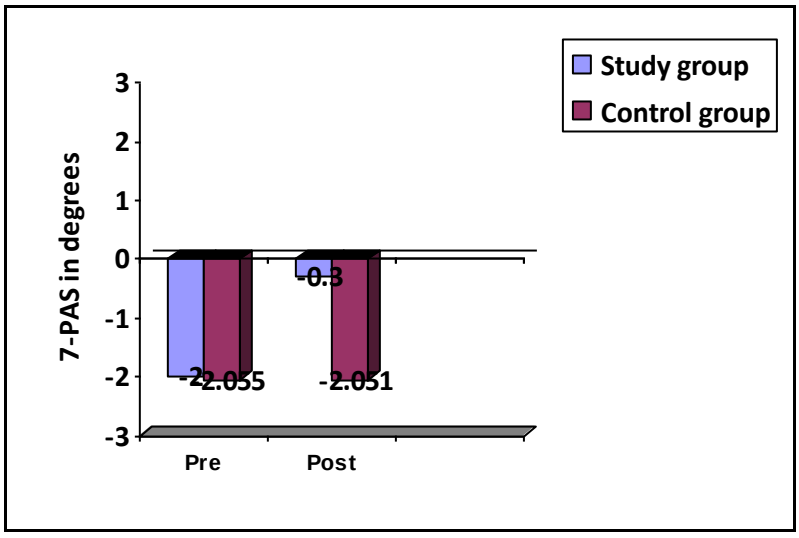

Fig (1): Mean values of the global photographs via the 7- point assessment scale measurement (7-PAS) for the frontal scalp hair before and after treatment in the two groups.

Also as shown in table (2) and figure (2), the mean value of the hair counting measurement (HCM) for the frontal scalp hair before treatment was (226.00 ± 15.09) hairs in the study group, while after treatment was

(297.00 ± 20.11) hairs. These results revealed a highly significant increase in the hair counting measurement (HCM) for the frontal scalp hair(P<0.0001). The mean value of the hair counting measurement (HCM) for the frontal scalp hair before treatment was (228.00 ± 15.25) hairs in the control group, while after treatment was (227.00 ± 15.22) hairs, these results revealed non-significant difference in the hair counting measurement (HCM) for the frontal scalp hair (P > 0.05).

Table (2): Comparison of the mean values of the hair counting measurement (HCM) for the frontal scalp hair in hairs before and after treatment in the two groups.

	Before treatment		After treatment		Mean difference	T.value	P.value
	Mean in mg	± SD	Mean in mg	± SD			
Study group (True MENS group)	226.00	15.09	297.00	20.11	-71.0000	-10.94	0.0001
Control group (False MENS group)	228.00	15.25	227.00	15.22	1.00000	0.18	0.859

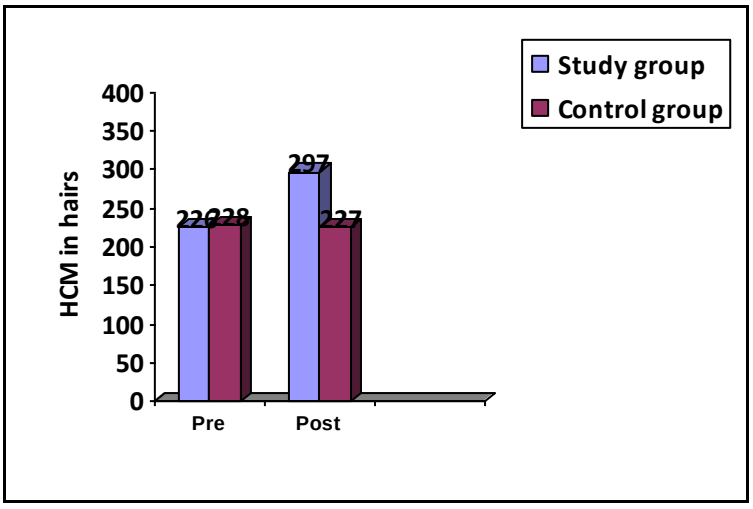

Fig (2): Mean values of the hair counting measurement (HCM) for the frontal scalp hair in hairs before and after treatment in the two groups.

Discussion

Hair has many useful biologic functions, including protection from the elements and dispersion of sweat gland products (e.g., pheromones). It also has psychosocial importance in our society, and patients with hair loss (alopecia) or excessive hair growth often suffer tremendously. Not surprisingly, the demand for drugs that alter hair growth and appearance has led to a multibillion-dollar industry, yet few drugs that are effective for these purposes are available. However, recent progress in our understanding of the biology and pathology of hair follicles should lead to more effective therapies for disorders of hair growth, [2,4,5,7.]

Normal development and cycling of hair follicles depend on the interaction of the follicular epithelium with the adjacent mesenchymal dermal papilla. The dermal papilla induces hair-follicle formation from the overlying epithelium during fetal development, and at the onset of each new follicular cycle in adults the dermal papilla interacts with secondary germ cells in the hair-follicle bulge to regenerate the lower follicle. The bulge consists of a cluster of biochemically distinct cells in the outer-root sheath, which is located near the insertion of the arrector pili muscle. These cells have the characteristic properties of epithelial stem cells: they are the slowest-cycling and longest-lived epithelial cells within the hair follicle, [1, 3, 6,7.]

Alopecia affects both men and women and may result from a variety of causes. The cosmetic consequences may have a substantial emotional impact on the patient. As might be expected, many patients are not in the least content with their hair loss and seek the advice of a physician in search of a remedy. Depending on the cause and extent of the problem, medical and surgical therapies exist which may offer assistance for the patient experiencing alopecia, [8,9,10,11.]

Alopecia is the term used for loss of hair, either diffuse or patchy, due to a structural or functional defect in the follicle or to a change in the hair itself. In the normal situation at least 80 per cent of scalp hairs are in the growing phase (anagen), up to 1 percent in the regressing phase (catogen) and the remainder in the resting phase (telogen), [1,2,3,4, 8.]

Bioptron light therapy is ideally suited as a complementary treatment in rehabilitation. It is often required with standard physiotherapeutic procedures and it can be successfully used as an integral part of complex physiotherapeutic procedures for sports injuries, burns, ankle and knee injuries, shoulder and elbow problems, bruises and stretching of tendons. Musculoskeletal pain can be caused by inflammation, degeneration, or trauma to the skeletal or myofascial tissues. Recent investigation in the field showed that Bioptron light therapy could be used for providing temporary relief of minor chronic and shoulder pain of musculoskeletal origin. The Bioptron light therapy can be used both as a complementary treatment to support conventional medical methods and as a monotherapy for specific indications, [12, 13,14,15.]

Light is a form of energy and has wave-like properties; the difference between the various colors of light is determined by their wavelength. Light has been used as a healing tool since ancient times. Scientists now have a better understanding of which components of natural light are useful in the stimulation of healing. This has led to the development of optical devices to produce various types of medically useful light such as the Bioptron light therapy (BLT) system. BLT devices emit light containing a range of wavelengths that correspond to visible light plus infrared radiation, both of which have been reported to stimulate the biological reactions and importantly no harmful ultraviolet radiation is present in the BLT, [16,17, 18,19,20,21,22].

When the BLT device is held over the skin surface, energy from the emitted light penetrates the underlying tissues. This produces a biological response, called photo-biostimulation, causing various reactions within these tissues that may result in the reduction of pain and promotion of healing. BLT is believed to reduce pain sensation in several ways; improving local blood supply and reducing muscle spasm, reducing the release of chemicals that stimulate pain receptors (called anti-inflammatory effect), inducing the release of the body's natural pain-killing agents (endorphins) and direct action on nerve fibers to prevent transmission of pain impulses to the brain. Therefore, the positioning of the BLT device over the injured area allows light therapy to be applied to reduce pain and discomfort, [23,24,25,26,27.]

Findings of the present study showed non-significant difference in the pre-treatment records of the 7-point assessment scale and hair counting, between the mean values of the study and the control groups. Results of this study revealed a highly significant increase in the mean values of the 7- point assessment scaleand hair countingin the study group after the application of polarized light therapy, also comparing second records of the 7- point assessment scale and hair counting, between the mean values of the study and the control groups showed highly significant increase indicating that polarized light therapy was fruitful and beneficial in increasing hair regrowth in alopecia as evidenced by the highly significant increase in the 7- point assessment scale and hair counting.

Significant differences showed in this study were consistent with those observed and recorded by Zcharia et al., 2005; Heike, 2003; Bolton and Young, 2008; Byrnes et al., 2004; Eichler et al., 2005;Fenyo, 2004; Iordanou et al., 2007; Karu and Kolyakov, 2005; Lubart et al., 2009; Pinheiro et al., 2004 and Yamasaki et al., 2003.

Results of this study supports the expectation that application of polarized light therapy was fruitful and beneficial in increasing hair regrowth in alopecia as evidenced by the highly significant increase in the 7- point assessment scale and hair counting.

Conclusion

Application of polarized light therapy was fruitful and beneficial in increasing hair regrowth in alopecia as evidenced by the highly significant increase in the 7- point assessment scale and hair counting.

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