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Effect of Low-Level Laser Therapy Versus Bioptron on Psoriasis

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Abstract

Purpose: *The current study was carried-out to examine the effectiveness of low-level laser therapy versus bioptron on psoriasis.* ***Subjects and Methods:*** *60 patients of both sexes with psoriasis contributed in this study and they were aged from 30 to 60 years. They were randomized into two groups of the same number (A and B). Group (A) were given low level laser therapy (LLLT) and medical care, while group (B) were given bioptron light therapy (BLT) and the same medical care that received in group (A). The variables included Psoriasis Area Severity Index (PASI) and Dermoscopic finding were measured pre and post intervention program on psoriatic patients in both groups. Both groups were given treatment program 3 sessions a week for 8 weeks.* ***Results:*** *following 8 consecutive weeks, both groups showed statistically significant improvement in all outcome measures, however there was a significant difference between them post treatment, favoring group (A).* ***Conclusion:*** *Low level laser therapy and bioptron were beneficial treatment modalities in psoriatic patients and LLLT may be more effective in treating psoriasis.*

Keywords: *Psoriasis, Low Level Laser Therapy, Bioptron*

1. Introduction

Chronic Psoriasis is an inflammatory skin disease that is immune-mediated and can be inherited through families. One to three % of the population is affected by it, and both sexes are equally at risk. Although a hereditary predisposition for psoriasis exists, it appears that a number of genetic and environmental risk factors collaborate to cause or exacerbate the condition **(1).**

Psoriasis has a major effect on quality of life of those who suffer from it. The social as well as psychological effect is high. Patients with psoriasis may face a number of psychosocial problems, including increased anxiety, depression, as well as worry, despite the fact that the condition is not considered life-threatening **(2).**

Despite there is currently no permanent cure for psoriasis, the condition typically responds well to treatment. The problem has been treated with a wide variety of topical as well as systemic therapies that work by slowing down the turnover rate of epidermal cells (3). To slow the proliferation of skin cells is essential to treatment. Psoriasis has no known cure; however, its symptoms can be treated.

Moisturizing, not smoking, and learning to deal with stress are all lifestyle choices that could be beneficial **(4).**

A laser is a highly concentrated beam of light that is both electromagnetic and monochromatic (5). The medical application of LLLT is widespread. Different pathological disorders, such as those involving the musculoskeletal system, wounds, and pain management, have been treated with LLLT throughout the past few decades **(6).**

Different biological processes, including collagen creation, DNA synthesis, mitochondrial respiration, as well as ATP production, have been revealed to be modulated by LLLT. LLLT has been shown in various trials to improve both recovery and regeneration (7). Several studies have indicated that low-level laser therapy (LLLT) accelerates wound healing by increasing cell proliferation, facilitating angiogenesis, and reducing inflammation **(8).**

Antioxidant levels in the blood have been shown to increase after being exposed to LLLT irradiation. Multiple genes involved in cell migration, proliferation, anti-apoptosis, as well as prosurvival elements sensitive to nuclear factor kappa-light-chain-enhancer of activated B cells were revealed to be increased by LLLT, in addition to the synthesis of growth factors as well as cytokines **(9).**

By generating light that is identical to the portion of the electromagnetic waves generated naturally by the sun but without the dangerous UV radiation, the Bioptron light treatment medical equipment has received patent protection all over the world. In order to activate biological processes, BLT devices generate light with a spectrum that includes both visible light and infrared radiation **(10).**

Various musculoskeletal problems (11) have been suggested for treatment using non-invasive therapeutic options such as Bioptron light therapy, which uses a coherent light source, as well as Polarized Polychromatic Non-Coherent Light therapy. Electromagnetic radiation within the range required for biological function is exposed to the body both locally and systemically **(12).**

It can aid in the healing process of skin and lessen the discomfort caused by a number of skin conditions. Biostimulative effects have been attributed to BLT. When put on the skin, it activates biomolecules as well as intracellular structures that respond to light. This triggers a cascade of cellular events known as secondary reactions, which can affect more than just the treated patch of skin **(13).**

Furthermore, it has been utilized in the accelerating of wound healing, the healing of skin ulcers, and the alleviation of a wide range of musculoskeletal problems. The rapid reduction of high pro-inflammatory cytokine plasma level and the subsequent rise in anti-inflammatory factor level is a key mechanism underlying the anti-inflammatory impact of phototherapy when applied to localized areas of the human body **(14)**.

2. Materials and Methods

Study design

This study was a randomized controlled trial. Informed consent was obtained from all participants. The participating patients received a consent form clarifying the procedures and aim of the study in detail. The investigated researcher conducted a brief interview to screen patients for their demographic information and ensure they met the research criteria.

This study was carried-out between January to July 2023 and approval was done by the Research Ethical Committee (P.T.REC/012/004671), Faculty of physical therapy, Cairo University, Egypt.

Participants

Sixty patients from both genders were involved in the study and were recruited from the out-patient's clinic, Department of Physical Therapy, General Ahmed Oraby Hospital, El-Obour City, Cairo, Egypt. Patients were randomized into two groups of the same number, the number of patients was 30 patients in each group according to G*POWER statistical software (version 3.1.9.2; Franz Faul, Universitat Kiel, Germany), the minimum proper sample size for the current study was determined. Calculations were conducted utilizing α=0.05, β=0.2 and effect size =0.38 and allocation ratio N2/N1 =1.

The inclusion criteria: 1) Their ages ranged between 30 - 60 years, 2) Both genders were participated in the study and 3) All patients suffered from psoriasis. The exclusion criteria: 1) Cancer patients, 2) Photo sensitive skin, 3) Liver diseases and 4) Pregnant or lactating women.

Patients have right withdrawn from the study at any time. After subjects sign consent form, patients were randomized into two groups of the same number; groups (A and B). Group (A) was treated by LLLT and medical care routine whereas group (B) was treated by BLT and the same medical care routine that received in group (A).

Outcome measures

Dermoscopic finding (DF): It is a valid and reliable assessment of the lesion(s) a dermoscopy that was carried out utilizing a handheld device (a HEINE DELTA® 20 Plus dermatoscope; HEINE Optotechnik GmbH & CO.KG Kientalstrasse 7 82211 Herrsching, Germany). This dermoscopy instrument includes a contact plate for polarization, a scale, 10x original magnification, and bright LED lighting. The pictures have been taken with a digital camera (a Sony DSC-W830 with 20.1 megapixels) **(15).**

Evaluation of dermoscopic finding for psoriatic skin by the following steps: the patient sat or lied in the best position so that the affected area could be examined clearly, the doctor connected the dermoscope to the camera, then focus the device to the area until the affected area appear clear then the doctor measures the area with the device **(16).**

Psoriasis Area Severity Index (PASI): The PASI is a validated and accurate instrument utilized in psoriasis clinical trials for assessing and grading psoriatic lesion severity as well as patient reaction to treatment. It provides a score between 0 and 72. Disease is regarded as moderate between the range of 5 and 10 on the PASI, and severe above 10 **(17).**

The PASI measures severity by dividing one's body into 4 parts, the head (10%), the upper limbs (20%), trunk (30%), as well as the lower limbs (40%) in that order.38 The degree of erythema, induration, as well as scaling in each of these regions is evaluated independently on a scale from 0 (none) to 4 (very severe). The severity of psoriasis can be assessed by one of five categories: For this question, "0" means "not involved at all," "1" "1% to 9%," "2" "10% to 29%," "3" "30% to 49%," "4' "50% to 69%," and "6" "90% to 100%." **(17).**

Therapeutic procedures

Low level laser therapy (LLLT) (Astar Polaris 2 Laser Device): Astar Strazacka81, 43-382 Beilsko-Biala, Poland. SN PM2-33/S1/AN (VER 3.0) Power Adjustment (25%-100% Power) Mode of Operation: Continuous, Pulse Rate: 1-5,000 Hertz Mains Supply: 230 V, 50 Hz, 40 Dimensions: 30 x 23 x 11cm Duty Cycle: 25 - 75%, 50 s Pulse Treatment Timer: Max 99 m 59 s **(18).**

Bioptron light therapy (BLT): It is consistent stream of light with a steady intensity and also a wide range of validity and reliability applications, easy to apply, pain-free and limited duration of treatment (also recognized as power density). 100-240 V, 60/60/ Hz, 0.29 – 0.12 A. Type: Medall. Code: 001-2014-34-2010 (Switzerland) **(19).**

Treatment Program

Low level laser therapy (LLLT): It is applied with a wavelength of 830 to 633 nm, density of (830 nm, 60 J/cm^2; 633 nm, 126 J/cm^2) and power of 20 to 30 mW **(20).**

Methods of application: The patient must be free of any dressings or coverings prior to treatment may begin, clean the area that would be wished to treat, the patient was asked to uncover the affected area and clean the area thoroughly, then sit or lied on the most comfortable position so that LLLT was applied perpendicular to the affected area at a distance 10 cm from the affected area, the device was plugged to the source of electricity during the period of application and unplugged after the application, taking in consideration the room temperature (28-34C) **(18).**

Bioptron light therapy (BLT):

The following parameters were used as the following:

1. Wavelength: 480–3400 nm.
2. Grade of polarization >95%, 590–1550 nm.

3. Treatment diameter: 5 cm.
4. Rated power of halogen: 20 W.
5. Power density: 40 mW/cm^2.
6. Light intensity: 10,000 lux.
7. Light energy each minute: 2.4 J/cm^2.
8. timing of every session: 15 min.
9. Light energy each session: 24 J/cm^2. **(19)**

Methods of application: prior to starting treatment, the patient was put in a position that would allow for accurate measurement and maximum comfort (sit or supine position).

a- Device preparation: After plugging the BLT machine into the wall outlet and turning it on, the treatment parameters were adjusted.

b- BLT application: Before each radiation therapy session, the treated area was disinfected with betadine as well as alcohol wipes then disinfected with local antimicrobial wipes to ensure that no surface contamination existed. The device was positioned at a 10 cm operating separation from the skin's surface, perpendicular to the treated area, for optimal penetration. The device was turned on for 15 minutes, and this process was repeated five times **(14)**

Statistical Analysis

The age of the groups was compared using an unpaired t-test. The distribution of sexes among study groups was compared using the Chi-squared test. The median values of the PASI and DF were compared among groups using the Mann-Whitney U test, while among pre- and post-treatment using the Wilcoxon signed ranks test. All statistical tests were conducted with a p-value of less than 0.05 considered significant. The Windows version of IBM's Statistical Package for the Social Sciences (SPSS) version 25 (IBM SPSS, Chicago, IL, USA) was used for all statistical analysis.

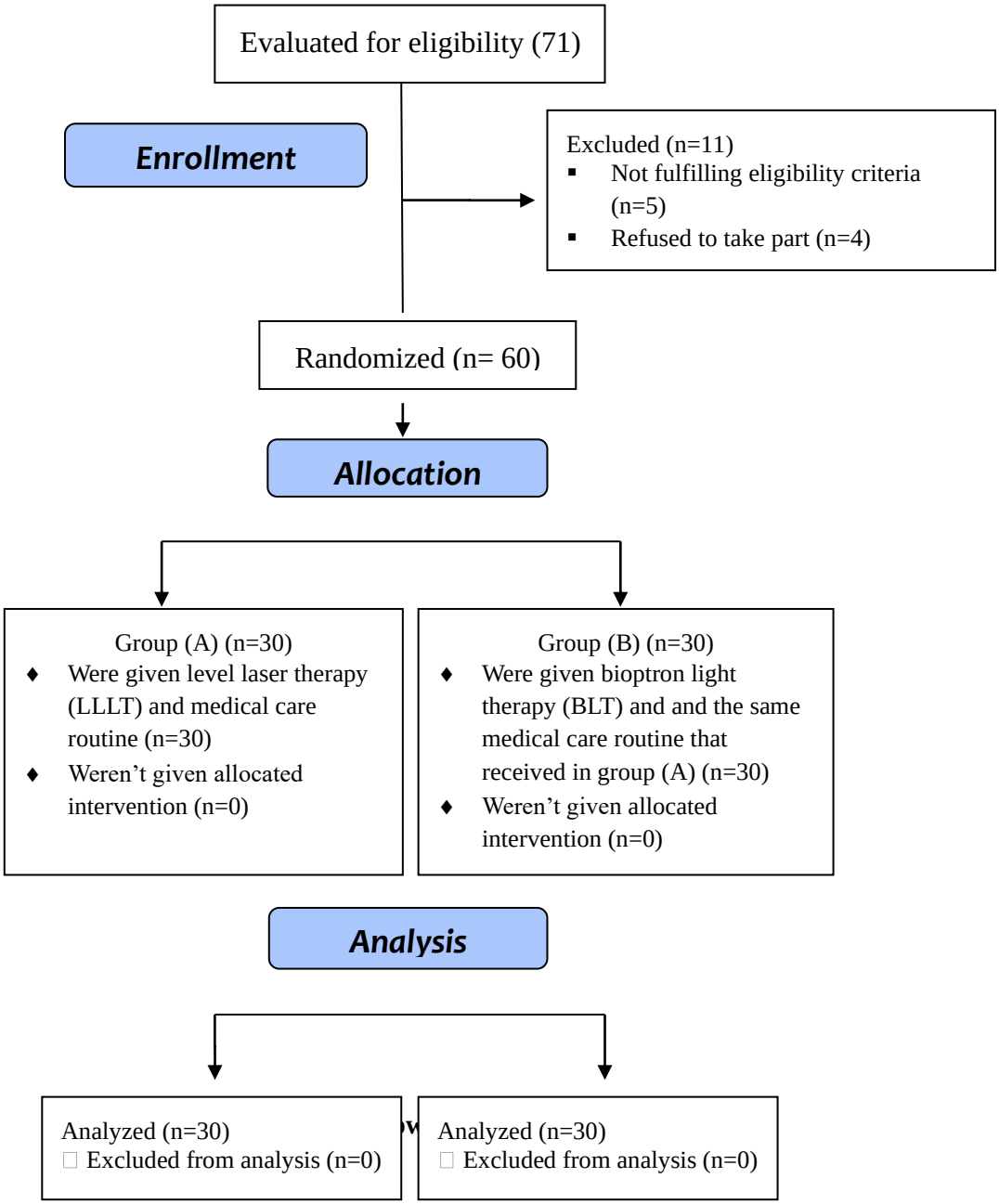

Figure (1): The flow chart of the study.

3. Results and Discussion

Subjects demographic data

Based on the data in table (1), we can see that the mean ± SD age of group (A) was 44.10 8.96 years, with a range from 60 to 30. Ages in group (B) ranged from 30 to 60 years old, with a mean of 43.56 9.72 years. In terms of mean age, there was no statistically significant difference among the groups (p = 0.82).

Table (1): Comparison of age between groups (A and B).

Age (years)	Group (A)	Group (B)
$\bar{x}$ ± SD	44.10 ± 8.96	43.56 ± 9.72
Maximum	60	60
Minimum	30	30
MD	0.54	
t-value	0.22	
p-value	0.82	
Significance	NS	

x̄: Mean	SD: Standard deviation	MD: Mean difference
t value: Unpaired t value	p value: Probability value	NS: Non-significant

Gender distribution

The gender distribution of group (A) showed that there were 20 (67%) females as well as 10 (33%) males whereas in group (B) showed that there were 19 (63%) females as well as 11 (37%) males. There was no significant difference among groups in gender distribution (p = 0.78) (Table 2).

Table (2): The frequency distribution and chi squared test for comparison of sex distribution between groups (A and B).

	Group (A)	Group (B)	χ2	p-value	Sig
Females	20 (67%)	19 (63%)	0.07	0.78	NS
Males	10 (33%)	11 (37%)			

χ2 : Chi squared value	p value: Probability value	NS: Non-significant

Measured variables:

PASI:

Pre-treatment median values of PASI of both groups (A and B):

Group (A) had a pre-treatment PASI median (IQR) of 30 (40-30), while group (B) had a PASI median (IQR) of 35 (50-27.5). Table 3 shows that there was not a statistically significant difference among groups A and B (p = 0.42).

Table (3): Comparison of pre-treatment median values of PASI between groups (A and B).

	PASI	U- value	p-value	Sig
	Median (IQR)			
Group (A)	30 (40-30)	397.5	0.42	NS
Group (B)	35 (50-27.5)			

IQR: Interquartile range	U value: Mann-Whitney test value
p values: Probability values	NS: Non-significant

Pre and post treatment median values of PASI of group (A):

In group (A), the median (IQR) PASI values pre-treatment was 30 (40-30), whereas post treatment, it was 0 (10-0). As observed in Table 4, there was a statistically significant reduction post treatment in comparison with pre-treatment.

Table (4): Comparison between pre and post treatment median values of PASI of group (A).

	Pre-treatment	Post treatment	Z- value	p-value	Sig
	Median (IQR)	Median (IQR)			
PASI	30 (40-30)	0 (10-0)	-4.83	0.001	S

Z- value: Wilcoxon signed ranks test value	p-value: Probability level	S: Significant

Pre and post treatment median values of PASI of group (B):

In group (B), the median (IQR) PASI values pretreatment was 35 (50-27.5), whereas post treatment, it was 10 (20-0). There was a statistically significant reduction post treatment in comparison with pre-treatment (p = 0.001) (Table 5).

Table (5): Comparison between pre and post treatment median values of PASI of group (B):

	Pre-treatment	Post treatment	Z- value	p-value	Sig
	Median (IQR)	Median (IQR)			
PASI	35 (50-27.5)	10 (20-0)	-4.86	0.001	S

Z- value: Wilcoxon signed ranks test value	p-value: Probability level	S: Significant

Post treatment median values of PASI of both groups (A and B):
Post treatment, the median (IQR) PASI value for group (A) was 0 (10-0), while it was 10 (20-0) for group (B). Table 6 shows that there was a statistically significant difference (p = 0.01) among groups A and B.

Table (6): Comparison of post treatment median values of PASI between groups (A and B).

	PASI Median (IQR)	U- value	p-value	Sig
Group (A)	0 (10-0)	300	0.01	S
Group (B)	10 (20-0)			

IQR: Interquartile range **U value: Mann-Whitney test value**
p values: Probability values **NS: Non significant**

2- DF:
Pre-treatment median values of DF of both groups (A and B):
Pretreatment DF values in group (A) were 35 (43-35) and 39.5 (55.5-34) for group (B), respectively. Table 7 shows that there was not a statistically significant difference (p = 0.36) among groups A and B.

Table (7): Comparison of pretreatment median values of DF between groups (A and B).

	DF Median (IQR)	U- value	p-value	Sig
Group (A)	35 (43-35)	389	0.36	NS
Group (B)	39.5 (55.5-34)			

IQR: Interquartile range **U value: Mann-Whitney test value**
p values: Probability values **NS: Non-significant**

Pre and post treatment median values of DF of group (A):
In group (A), the median (IQR) values of DF before treatment were 35 (43-35), while after treatment, it was 0 (12-0). As can be seen in Table 8, there was a statistically significant reduction post treatment in comparison with pre-treatment.

Table (8): Comparison between pre and post treatment median values of DF of group (A):

	Pre-treatment Median (IQR)	Post treatment Median (IQR)	Z- value	p-value	Sig
DF	35 (43-35)	0 (12-0)	-4.80	0.001	S

Z- value: Wilcoxon signed ranks test value **p-value: Probability level** **S: Significant**

Pre and post treatment median values of DF of group (B):
In group (B), the median (IQR) value of DF before treatment was 39.5 (55.5-34), while after treatment, it was 12 (24-0). There was a statistically significant decline after treatment in comparison with pre-treatment (p = 0.001) (Table 9).

Table (9): Comparison between pre and post treatment median values of DF of group (B):

	Pre-treatment Median (IQR)	Post treatment Median (IQR)	Z- value	p-value	Sig
DF	39.5 (55.5-34)	12 (24-0)	-4.78	0.001	S

Z- value: Wilcoxon signed ranks test value **p-value: Probability level** **S: Significant**

Post treatment median values of DF of both groups (A and B):
After treatment, the median (IQR) DF values for group (A) was 0 (12-0), while it was 12 (24-0) for group (B). Table 10 shows that there was a statistically significant difference among groups A and B (p = 0.02).

Table (10): Comparison of post treatment median values of DF between groups (A and B).

	DF Median (IQR)	U- value	p-value	Sig
Group (A)	0 (12-0)	310	0.02	S
Group (B)	12 (24-0)			

IQR: Interquartile range **U value: Mann-Whitney test value**
p values: Probability values **NS: Non-significant**

The current study was conducted to examine the impact of LLLT and bioptron on patients with psoriasis. It was enrolled on sixty patients, they were aged from 30 – 60 years. They were randomized into two groups (A and B) of the same number.

When comparing between the pre-as well as post- treatment results of group (A) showed a significant difference that comes in agreement with **Huang et al., (21)** claims that LLLT can safely improve plaque psoriasis by decreasing keratinocyte proliferative activity, modulating T cell immunological responses, and reducing inflammation. Inflammation, edema, and pain can all be reduced using LLLT. Improved immunity as well as intensive repair are induced without any uncomfortable heat or pain. Psoriasis flares can be reduced and their severity minimized by focusing a mild beam on the affected area, which helps damaged cells regenerate and stabilize inflammation, redness, as well as itching-ups.

Avci et al. (22) revealed that LLLT has positive impacts on wrinkles, acne scars, hypertrophic scars, as well as healing of burns, which provides support to the significant reduction of PSAI in group (A). LLLT can be used to treat and avoid UV damage. By increasing melanocyte growth, LLLT may improve pigmentation in pigmentary conditions like vitiligo, and by inhibiting autoimmune, it can decrease depigmentation. Psoriasis, acne, and other inflammatory skin conditions may also improve.

The significant decrease of DF in group (A) are agreed with **Albon, (20)** who said that LLLT exhibit great potentials for decrease PASI, it has been observed to decrease psoriasis both area and severity and had an effect for the enhancement of the patients' health and it is recommended that program prescriptions need to include laser therapy in optimum proportions.

The post treatment results of our study in group (A) are confirmed with **Chung et al., (23)** who discovered that LLLT can enhance mitochondrial performance in cell redox by enhancing ATP production, reactive oxygen species production, and cellular redox activity. In addition, Huang et al. (21) noted that LLLT's positive effects are dependent on the enzyme cytochrome oxidase's activation of the mitochondrial respiratory chain.

When comparing between the pre and post- treatment findings of study group (B) revealed a significant difference that supported with the study of **Waked and Deghidi, (24)** who found that there was a significant effect of BLT by its reduction effects in PASI & skin thickness after 4 weeks of treatment for experimental (BLT) group more than control group. The percentage of improvement as regard to PASI & skin thickness was 43% & 47% respectively for experimental group while the percentage of improvement for control group as regard to PASI & skin thickness was 9% & 3% respectively.

The significant decrease of PSAI in group (B) was supported by **Zhevago and Samoilova, (25)** who stated that the mechanism explanation of BLT may be increase the anti-inflammatory effect and decrease elevated pro inflammatory cytokine including TNF-α, IFN-γ, and IL-2. By acting in a natural way to promote the body's regeneration ability, it aids the body in releasing its inherent healing

potential by stimulating and modulating reparative, regenerative mechanisms as well as the processes of the individual's defensive-system.

Consistent with the findings of Medrado et al. (26), who suggested that photobiomodulation could clarify the mechanism of BLT, we find a significant reduction in DF in group (B). Greguss (27) built on this concept, explaining that biomodulation involves manipulating a cell's or tissue's typical biochemical reaction to a stimulus while still remaining within the cell's or tissue's functional range. Photobiomodulation, as demonstrated by Lee et al. (28), can control inflammatory reactions and enhance natural healing.

On the other hand, the post treatment results of our study in group (B) are agreed with the study of **Aronis et al., (10)** who suggested that BLT could help treat skin problems including atopic dermatitis by reducing pain and inflammation and accelerating the body's natural healing process in wounds to the skin.

When comparing between the post- treatment results among groups (A and B) showed significant differences favoring group (A) that came in accordance with **Treewittyapoom et al., (29**) who proved that LLLT has been widely used to treat vascular ecstatic disorders and has some efficacy in treating plaque psoriasis, likely due to the disease's demonstrated angiogenesis and increased vascularity.

As regard to side effects, results of study reported no side effects results from application of BLT and this finding is supported by **Durovic et al., (30)** findings as they reported in their study conclusion that polarized light is useful in the treatment of pressure ulcers and there is no description of the potential treatment complications after polarized light therapy.

Limitations

this study has some limitations. The 1st is that the sample size was quite low, which could restrict the study's generalizability. 2nd, evaluations of interventions were conducted after only 4 weeks of treatment. As a result, this study did not find evidence that the benefits of treatment will last long-term.

Strength

One potential strength of the present study is that it uses an objective, valid, as well as trustworthy assessment instrument to try to establish the combined impact of LLLT and bioptron on psoriasis patients, which has not been previously reported.

Weakness:

LLLT and bioptron have been shown to be effective in the treatment of psoriasis, and there has been no study that compares their combined effects.

4. Conclusion

Low level laser therapy was more effective than bioptron in decreasing pain and inflammation in psoriatic patients.

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Disclosure statement

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Conflicts of interest

No conflict of interest has been declared by the authors of this academic work.

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