

Clinical Efficacy of Phototherapy on Pruritus with Dermatopathic Patients

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ABSTRACT

Background: A frequent skin condition associated with diabetes called diabetic dermopathy may also be associated with neuropathy. The neurological and dermatologic systems are often linked in the pathophysiology of diabetic itch.

Objective: This research evaluated the efficacy of low-level laser therapy (LLLT) and polarized light therapy (PLT) in treating diabetes patients' pruritus and dermopathy.

Subjects and Methods: This study included forty patients. They were split randomly into two groups with an equal number of people; Group (A): Received low level laser therapy along with medical care (Using antibiotic creams for all patients) for eight weeks; three sessions per week. While, Group (B): Received polarized light along with medical care (Using antibiotic creams for all patients) for eight weeks; three sessions per week. Before and following the treatment, pruritus was measured.

Results: This study found no significant differences of low level laser therapy and polarized light therapy in their favourable effects on diabetic dermopathy and itching ($p > 0.05$).

Conclusion: Both low-level laser therapy and polarised light therapy are secure approaches that effectively treat pruritus and dermopathy.

Keywords: Low level laser, Polarized light, Pruritus, Dermopathy, Diabetes.

INTRODUCTION

Diabetes is one of the most prevalent and quickly spreading diseases in the world. It is an endocrine system condition characterised by unusually high blood glucose levels. Absolute or relative insulin shortage can result in hyperglycemia that may be due to cellular dysfunction, insulin resistance, or both. It is not a single disease, but rather a spectrum of conditions that are collectively identified by a single diagnostic criterion^[1-3]. Alterations in the microcirculation and changes in protein glycosylation brought on by persistent hyperglycemia are what lead to lesions that are more visible in the kidneys, retina, nerves, and skin. The signs of these abnormalities include diabetic dermopathy (the most prevalent skin disorder that affects people with diabetes mellitus), renal failure, retinopathy, peripheral, and autonomic neuropathy^[4]. Diabetic dermopathy (DD) is characterised by small, brownish skin lesions that are confined and usually affect the lower extremities. Also known as pigmented pretibial patches or shin spots, this condition affects more males and persons over 50^[5].

Although it was also proposed that dermopathy lesions may be caused by subcutaneous nerve degeneration, the relationship between DD and microvascular consequences of diabetes is the most plausible theory^[1].

Itching (unpleasant sensation that leads to intensive scratching) commonly noted in diabetic patients. Even though the pathogenesis of diabetic itching is not entirely known, skin dryness and diabetic polyneuropathy are the two main elements linked to this symptom^[6]. Low intensity light treatment called photobiomodulation (PBM) has a photochemical

impact. As photons are absorbed by cellular photoreceptors, the light induces metabolic changes within the cells^[7].

Low-level laser therapy (LLLT) is a type of phototherapy or photobiomodulation that uses photons to enhance biological processes like ATP synthesis, blood flow increase, pain and inflammation reduction, and the stimulation of the regeneration of various tissues and neurons^[8].

A relatively recent therapeutic method called polarized phototherapy has beneficial biological effects for enhancing the functions of cell membranes and speeding up ATP synthesis. In addition, it lessens inflammation, improves microcirculation, tissue oxygenation, fibroblast proliferation, collagen formation, and speeds up epithelialization^[9].

The study's objective is to evaluate the impact of low level laser and polarised light on pruritus in diabetic individuals with dermopathy.

SUBJECTS AND METHODS

Subjects: Forty patients from both genders who were suffering from dermopathy and itching due to diabetes participated in this study. They were selected from Cairo University Hospitals, Cairo, Egypt. The study was conducted from March 2022 to October 2022.

They were assigned randomly into two groups (A) and (B) equal in number. Group (A) received LLLT (He-Ne), and medical care (Using antibiotic creams for all patients) 3 sessions/week for 8 weeks. While, Group (B) received polarized light, and medical care (Using antibiotic creams for all patients) 3 sessions/week for 8 weeks.

The following were the inclusion requirements: Age ranged from 50 to 65 years, all patients had

diabetes, both sexes were represented, pigmented patches on shins, chronic itching in lower legs, and all participants gave their informed consent before being involved in the study.

The following were the exclusion requirements: Patients with diabetic foot wound, tumor, photosensitivities, and infections.

Materials:

Assessment tool:

5-D itching scale to assess pruritus.

- An evaluation was done both before and after the 8-week course of therapy.
- Every patient received an explanation of the scale.
- Each point on the scale's five criteria received the appropriate mark.
- These parameters include duration, degree, direction, disability and distribution of itching.
- The first three questions (duration, degree, and direction) are single-item domains, and the scores range from 1 (indicating minimal engagement according to the question) to 5 (indicating maximal involvement). Disability is a multi-item area that encompasses how scratching affects everyday activities including sleep, leisure and socialising, housekeeping and errands, and job and school. The highest score among the four subdomains that have been reviewed is used to determine the score for the disability domain. The distribution of itching across 16 body areas during the last two weeks is evaluated in the fifth item (Distribution). Five score bins are created based on the quantity of damaged components. The total of 0–2 is regarded as the score of bin 1, whereas the sums of 3–5, 6–10, 11–13, and 14–16 result in scores of 2, 3, and 5, respectively. The 5-D scale ranges from 5 (no itching) to 25 (the worst itching) [10].

Treatment devices:

- He–Ne laser.
- Bioptron Pro1 device (Switzerland).

Procedures

Group (A): Low Level Laser Therapy Group:

- Before to receiving LLLT treatment, the patient was put in a comfortable position, the affected region was cleansed with saline, and the limb was properly positioned.
- Throughout the session, the patient and the therapist both wore safety goggles to shield their eyes from the laser light.
- The injured lower leg was treated with the scanner laser, which was administered perpendicular to it and 30 cm distant.
- The 632 nm wavelength, 25 Hz frequency, and 2.5 J/cm² energy density of the scanning He-Ne laser were employed.
- Application frequency: three sessions per week for eight weeks [11].

Group (B): Polarized Light Therapy Group:

- The patient was seated in a comfortable position with the limb properly in place. The affected regions were cleansed with saline before to exposure to polarised light.
- The light was directed at right angle (90°) perpendicularly to the treated area with distance of 10 cm from the surface of the lower leg.
- The energy density of 40 mW cm, and power of 2.4 joule/cm² per min; were the parameters of polarized light.
- Filters used: 1) Fluorene filter. 2) Yellow filter for nerve regeneration.
- Frequency of application: 3 sessions per-week for 8 weeks [12].

Ethical approval:

The study was approved by the Ethics Board of Cairo University and an informed written consent was taken from each participant in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical Analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 25 for Windows (IBM SPSS, Chicago, IL, USA). An unpaired t-test was applied to compare age, duration of diabetes, and the results between the 2 groups. Pre- and post-treatment data were compared in each group using a paired t-test. The significance level for all statistical tests was set at p ≤ 0.05.

RESULTS

The subject characteristics for groups A and B were displayed in table 1. Age and diabetes duration did not significantly differ across groups.

Table (1): Comparison of subject characteristics between group A and B

	Group A (N=20)	Group B (N=20)	P-value
	Mean ± SD	Mean ± SD	
Age (years)	55.9 ± 4.55	55.7 ± 4.49	0.89
Duration of diabetes (years)	16 ± 7.86	17.1 ± 7.24	0.64

SD: standard deviation

Effect of treatment of pruritus:

Within group comparison:

In groups A and B, there was a substantial reduction in pruritis after therapy compared to before. In group A, the pruritis scale changed by 14.88% whereas it changed by 18.4% in group B (Table 2).

Between groups comparison:

No significant change in the pruritis scale was seen between the groups before and after treatment (Table 2).

Table (2): Mean pruritis scale pre and post treatment of group A and B

	Group A	Group B	MD	t- value	p value
	Mean ± SD	Mean ± SD			
Pruritis scale					
Pre treatment	8.4 ± 3.37	8.15 ± 3.24	0.25	0.23	0.81
Post treatment	7.15 ± 2.49	6.65 ± 1.84	0.5	0.72	0.47
MD	1.25	1.5			
% of change	14.88	18.4			
t- value	3.68	3.81			
	p = 0.002	p = 0.001			

SD: standard deviation; MD: mean difference.

DISCUSSION

This study was done to investigate the effect of low level laser versus polarized light on healing of pruritus (The probable cause of diabetic dermopathy), and dermopathy. Forty patients with dermopathy complaining of pruritus participated in this study. They were divided into 2 even groups, 20 patients for each one. Group A received LLLT and antibiotic creams, while group B received polarized light and antibiotic creams.

According to the study's findings, group A and B experienced significantly less pruritus after therapy compared to before treatment (p <0.05). There was no discernible difference in post-treatment pruritus between the two groups when compared (p = 0.81).

The results of this study agreed with **Hazari et al.** [13] who used LLLT on dermatopathic patient and found that there was a markedly improvement in cutaneous manifestation as well as in neuropathy.

According to **Andrade et al.** [14], low-level laser therapy can stimulate significant physiological effects in skin wounds, including the anti-inflammatory resolution, neoangiogenesis, epithelial and fibroblast proliferation, collagen synthesis and deposition, revascularization, and wound contraction and that was obvious in my study.

The findings of this study were consistent with those of **Emam et al.** [15], who came to the conclusion that LLLT can be used to treat pruritus and relieve itching pain. This was supported by the extremely significant reduction in itching VAS and 5-D Pruritus Scale.

According to **Monstrey et al.** [16], who assessed the impact of polarised light on the healing of standardised wounds, the findings demonstrated that polarised light sped up epithelialization and enhanced the quality of early growth of scar tissue during the healing of these standardized wounds. So as, the study

demonstrated a highly significant improvement in patches.

The findings of this study were in agreement with those of **Elgohary et al.** [17], who investigated the effectiveness of polarised light in the conservative treatment of chronic hand eczema. His research demonstrated that polarised light has an effective anti-inflammatory effect, reduces high levels of pro-inflammatory cytokines, by promoting the body's regenerative capacity and so helps the body in developing its own healing skills, accelerates and changes tissue repair and regeneration processes, and activates human defence systems.

The findings of this investigation supported those of **Leguina-Ruzzi et al.** [18], who assessed the efficiency of polarized light therapy in a patient with non-atopic dermatitis (NAD). Results showed that light treatment effectively decreased pruritus and skin dryness without any negative side effects or pain.

According to **On-Ong-Arj et al.** [19], yellow laser stimulation may improve spinal cord recovery via an increase in brain-derived neurotrophic factor (BDNF) and a reduction in the spinal cord lesion's levels of oxidative stress, apoptosis, and inflammation. The improvement of pruritus in this study may be attributable to the onset of nerve regeneration. This may have happened as a result of yellow light.

CONCLUSION

Low level laser therapy and polarized light therapy had a positive effect on dermopathy and pruritus in diabetic patients with no significant difference between both therapies. Both therapies are safe, non-invasive, easy applicable modalities with significant biological effects on different tissues.

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Competing interests: Nil.

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