POLARIZED LIGHT THERAPY VERSUS PULSED ELECTROMAGNETIC FIELD THERAPY IN THE TREATMENT OF POST-HERPETIC NEURALGIA OF THE SCIATIC NERVE

Zakaria Mowafy Emam Mowafy[1], Hamed Abd Allah Hamed[2], Marwa Mahdy Abd El-Hameed[3], Maher Khalil Ibrahim Botros[4]

ArticleHistory:Received:12.02.2022 **Revised:**29.03.2023 **Accepted:**15.04.2023

Abstract

Purpose: to trace the effectiveness of both pulsed electromagnetic field therapy (PEMFT) and polarized light therapy (BLT) in the treatment of sciatic nerve post-herpetic neuralgia.
Methods of evaluation: The evaluation is done via the estimation of the consumption of carbamazepine (CMI) and the measurement of the serum cortisol level (SCL).
Methods: Participants in the current academic work were 40 cases with post-herpetic neuralgia of the sciatic nerve (30 men and 10 women), ranging in age from 25 to 40. They were randomly sub-categorized into two study domains; 2 equal groups (A) and (B). Twenty cases from Group (A) underwent BLT in addition to conventional physical therapy. Twenty cases from Group (B) got PEMFT in addition to standard physical therapy care. For a total treatment length of three months, BLT and PEMFT were adopted successfully. Each session lasted 30 minutes and was performed unilaterally over the afflicted side along the sciatic nerve pathway from up to down, while the case is having the prone position. In groups (A) and (B), the BLT and JAMAVA apparatuses, respectively, were administered paravertebrally at the l5-S1 (erector-spinae motor point) level for ten minutes. The painful buttock and upper motor point of the gluteus maximus were then treated with the BLT and JAMAVA apparatus for an additional 10 minutes. Then, for 5 minutes, BLT and JAMAVA devices were applied at the junction of the greater trochanter and ischial tuberosity at the level of the buttock and posterior upper thigh. Finally, they were administered for a further five minutes right above the popliteal crease. **Results & conclusion:** By the end of the treatment protocol, SCL and CMI markedly decreased in groups (A) and (B). With a substantial reduction in SCL and CMI, both BLT and PEMFT were crucial in treating post-herpetic neuralgia of the sciatic nerve. Nevertheless, in comparison to Bioptron light therapy, pulsed electromagnetic field therapy (PEMFT) proved more advantageous (BLT).

Keywords: Polarized light therapy, Pulsed electromagnetic field therapy, post-herpetic neuralgia of the sciatic nerve, Serum cortisol level, and estimation of the carbamazepine intake.

1. Professor of Physical Therapy, Departmentfor Surgery, Faculty of Physical Therapy, CairoUniversity, Egypt.
2. Professor of Dermatology, Faculty of Medicine, Cairo University, Egypt.
3. Lecturer of Physical Therapy Department for Surgery, Faculty of Physical Therapy, Cairo University, Egypt.
4. Ph.D. Candidate, Physical Therapy Department for Surgery, Faculty of Physical Therapy, Cairo University, Egypt.

Corresponding author: Maher Khalil Ibrahim Botros **Email:** Mah_1988@hotmail.com
DOI: 10.31838/ecb/2023.12.4.085

INTRODUCTION:

A virus (herpes zoster) that targets one or more dorsal root ganglia and associated sensory neurons causes postherpetic neuralgia (Shingles). The trigeminal, intercostal, and major extremities peripheral nerves are typically affected by postherpetic neuralgia. A prior history of chickenpox may help with the diagnosis of post-herpetic neuralgia because it might be challenging to make the diagnosis when skin eruptions (vesicles or blisters) are not yet visible and the only complaint is pain. Prior to the development of the skin rash, this first phase typically lasts 2 to 5 days. Skin rash can last up to 6 weeks and follows the affected nerve and its sensory (dermatomal) area.

Burning agony that frequently subsides as new fibers are regenerated characterizes the acute phase. After the initial phase, there may be months or even years' worth of spontaneously occurring searing, stabbing, and shooting pain episodes. A painful reaction may be triggered by non-noxious stimuli in the affected area, which becomes hyper-esthetic. Light touch, clothing rubbing against the skin, noise, temperature changes, sweating, and emotional upheavals can all cause post-herpetic neuralgia's acute pain [6,7,10,12,14].

The slow regeneration of the faster-conducting, big -A- fibers, the summation process, and the delayed conduction velocity may all be responsible for the frequent delay of a few seconds in the onset of pain following non-noxious stimuli. The majority of the endogenous opiate system, negative feedback loop, locus coeruleus-norepinephrine-neurohormonal system, and diffuse noxious inhibitory controls were involved in the process of modulating pain, and the serum beta-endorphin level would be the criterion for the stress of pain and the relief of pain. Inflammatory and viral injury to the primary afferent fibers of sensory nerves, the corresponding levels of the spinal cord, as well as peripheral and central nerves, results in postherpetic neuralgia (PHN), a neuropathic pain syndrome.

PHN is described as pain that continues in the herpes zoster (shingles)-affected dermatomes after the rash associated with the infection has subsided. Herpes zoster (HZ) is a painful condition that can lead to postherpetic neuralgia. Age raises the risk of PHN following HZ. In a major population-based study, the prevalence of PHN—defined as at least 90 days of documented pain—rose from 5% in people under the age of 60 to 10% in people between the ages of 60 and 69, and to 20% in people 80 years and older[10,12,14,21,27,28].

The skin surface of the affected part always exhibits hyposensitivity, such as hypoesthesia or anesthesia, along with single or combined complaints of burning pain, aching pain, shooting pain, lancinating pain, night pain, etc. This is how PHN pain is distinguished from other types of pain. Allodynia may be noticeable or nonexistent depending on the situation. The body responds to pain as a warning sign of potential tissue damage. Pain, according to Sherrington, is a psychological component of a protective reaction that serves to cause the injured tissue to retreat from potentially harmful stimuli. Contrary to most other sensory modalities, pain plays a crucial role in survival.

Intense heat, mechanical, or chemical stimuli activate nociceptive primary afferents, which then provide the experience of pain. These nociceptor sites are tiny, unattached nerve terminals found throughout the body's various tissues. Pain's exact nature as a distinct entity is yet unknown. It has been determined biologically which specific fiber types transmit pain, and there is proof that these painful sensations are transmitted along particular tracts in the spinal cord. However, there is no assurance that cutting off these fibers will totally eradicate or modify the perception of pain, as has been observed in cases of cancer pain, phantom pain, and causalgia [14,21,27,28].

Numerous musculoskeletal diseases, wound healing speedup, and skin ulcer treatment have all benefited from the use of polarized light from low-power lasers and non-laser devices. The specific mechanism of polarized light's impact is yet unknown, despite the fact that it is known to have many photo-bio stimulatory effects, such as cell proliferation, increased collagen synthesis, alterations to the circulatory system, and anti-inflammatory effects. The Bioptron products are the only non-laser optical devices currently on the market. They emit a broad beam of polarized, non-coherent, polychromatic, low-energy light with wavelengths from the visible spectrum (480–700 nm) and infrared radiation (700–3400 nm); this range offers the best tissue penetration and stimulation without the risk of DNA damage[1, 2,3,4,9,13].

The Bioptron light treatment (BLT) device produces low-energy, polarized, polychromatic, and non-coherent light. Unlike laser light, which is monochromatic (of short wavelength), coherent, polarized, and of high or low energy, the light released has a wide range of wavelengths (480-3400nm). Burns is a potential concern with laser therapy but not with Bioptron light therapy. User skills are not required for laser therapy, in contrast to Bioptron light therapy. Compared to laser therapy, Bioptron light therapy is less expensive and can cure a wider range of conditions [13, 20, 22, 23, 25, 26].

The light that the Bioptron light therapy device emits is polarized, polychromic, incoherent, and low energy. Polarized light oscillates on parallel planes. The multi-layer mirror system, or Brewster mirror, is particularly effective in achieving linear polarization through reflection and may achieve a polarization degree of 95%. The wavelength range of the Bioptron light therapy device extends from 480 nanometers to 3400 nanometers; this spectrum includes visible light and some infrared radiation. (The electromagnetic spectrum of Bioptron light does not contain ultraviolet radiation). The light waves of Bioptron are not synced, making it incoherent or "out-of-phase" light[11,22,23,25,26].

In the discipline of physical therapy, electromagnetic fields are one of the most advanced and often employed modalities. Nearly all kinds of electromagnetic fields are used by physical therapists in the treatment of various

conditions. Many disorders, including diabetes, myocardial or cerebral ischemia, skin, osseous, ligamental, or neurological reparation, are now treated with electromagnetic fields. Magnetic fields have complex biological impacts and interactions with living things. It is too soon to offer a mechanism; more research must be done to provide adequate explanations for the phenomenon. However, recent research on the impact of magnetic fields on biological and living systems has revealed that these fields have an impact on the characteristics of biological liquid crystals and ionic motion.

Physical therapy called pulsed electromagnetic field therapy (PEMFT) has been widely used to increase cellular permeability, blood flow, oxygen delivery, ATP production, the rate of bone healing, fibroblastic and osteoblastic activity, as well as its anti-inflammatory and analgesic effects[5, 8,15,16,17,19,24,29].

MATERIAL AND METHODS:

Subjects:

Forty individuals with post-herpetic sciatic nerve neuralgia participated in this investigation, which was conducted on them. They hired from the Cairo University Hospital's dermatology and neurology departments. They were between the ages of 25 and 40. Two equal groups were created by randomly dividing them into two study groups (A) and (B). Twenty patients from each of the two equal groups were divided up into the study's subjects. **Group:(A):** Twenty individuals in this group also got conventional physical therapy in addition to BLT.**Group B:** Twenty patients who received both the PEMFT and conventional physical therapy were a part of this group. Both before the therapy began as a first record and after the treatment was complete as a second (final) record, measurements were taken.

Instrumentation:

The measurement tools used in this study were the estimation of carbamazepine intake and the blood cortisol level, while the pulsed electromagnetic field treatment unit and Bioptron Compact III polarized light therapy system wasadopted as the therapeutic tools: (JAMAVA® S Magneto Therapy Device [4,5,9,15,20,29].

Procedures:

Evaluation:

Measurement procedures:

A- Serum Cortisol Level:

Prior to beginning treatment (first record), and then three months later, the pain level was evaluated by serum cortisol level using an ALinity instrument for serum blood analysis. (Asthe second final record). All. The scheduling of a cortisol test is crucial because cortisol levels fluctuate throughout the day during a blood test. Subsequently,morning 610 is the greatest option[14,21].

B- Estimation of the Carbamazepine Intake: (CMI): It was adopted to assess how well the sciatic nerve's post-herpetic neuralgia had improved. The baseline record was taken prior to the study's start, and the second record was taken three months after the study's start. All the aforementioned parameters (SCL and CMI) were assessed twice[7,10,14,21,28].

1- Treatment procedures:

The same typical physical treatment, consisting of 10 minutes of infrared radiation for the gluteal and hamstring regions, 5 minutes of effleurage for the same regions, and 5 minutes of hamstring stretching exercises, was given to all cases in the two study domains: Group (A) and Group (B). The same medical treatment and drugs were given to each case.

A- Procedures of the BLT for the study groups (A):

Therapy guidelines offered in this study:

- Before initiating the therapy, cases should receive all the needed information on the measurement and treatment processes as well as the BLT equipment.
- Cases would be asked to follow directions. For each case, the measurement techniques that were described in the measurement section were adopted successfully.
- All cases should receive a written consent before initiating the treatment protocol.
- Devices should be checked to make sure they are turned off before the therapy starts.
- The case should lie in a prone position that is adequate and comfortable.
- One medical filter is used throughout each session for ten minutes. yellow filter for two (10 minutes) and 3 red filters for 10 minutes.

Setting up a BLT device entails turning on the on/off switch and plugging the BLT unit into the primary power source. After that, establish the BLT therapy settings. The application entails holding the BLT at a right angle (90°) perpendicular to the treated area's surface, aiming the laser beam at the area to be treated, and maintaining a 10 cm distance between the BLT and the treated area's surface. Switch off the devices when the therapy is over, and then check the treated area. After the acute stage, BLT was applied once daily and three times weekly for a total of three months.Each session lasted 30 minutes and was done unilaterally across the affected side along the sciatic nerve pathway from

up to downside with the patient prone as follows:10 minutes at the paravertebral l5-S1 (erector-spinae motor point) level, 10 minutes on the gluteus Maximus upper motor point, 5 minutes on the painful buttock, and then another 5 minutes directly above the popliteal crease [1,3,4,9,13,20.]

B- Procedures of the PEMFT (JAMAVA apparatus) for the study groups (B):

JAMAVA apparatus active surface: paravertebrally at l5-S1 (erector-spinal motor point) level for 5 minutes. The JAMAVA device's active surface was then applied for an additional 5 minutes to the gluteus Maximus upper motor point and the sore buttock. The JAMAVA device's active surface should then be positioned for five minutes at the level of the buttock and posterior upper thigh, halfway between the ischial tuberosity and greater trochanter. The JAMAVA device's active surface is located right above the popliteal crease for a further five minutes. The therapist's hand or adhesive tapes would be used to fix the active surface of the JAMAVA apparatus directly over the aforementioned 4 spots. In order to prevent cross-contamination, the active surface of the JAMAVA apparatus would also be covered with disposable Cling's film to avoid cross-contamination among cases. The second PEMFT program for research group (B) two contained the following features: With buttons 1, 2, 3, and 4 down and buttons 5 and 6 up, the JAMAVA device's fourth program, which is the least powerful program, emits calming North polarity magnetic pulses at a frequency of 1.6 Hz [8,17,19,24,29].

Data analysis:

Before initiating the therapy as a first record and three months later as a second final record, serum cortisol levels and an estimation of carbamazepine intake were measured in both study domains. For statistical analysis, the data were entered into a computer, and descriptive statistics, such as mean, standard deviation, minimum, and maximum, were generated for each study domain. The t-test was successfully adopted to examine the mean differences between the two groups before and after application, as well as within each study domain. The alpha point was set at 0.05, and the significance levelwas[18,30].

Results:

According to **Table (1)** and **Figure (1)**, the mean SCL in g/dl in the BLT group was 36.200 ±0.330 before treatment and (25.300 ±0.313) g/dl after treatment. These findings demonstrated a marked reduction in the SCL (P< 0.0001). The mean SCL value in the PEMFT group was (36.205± 0.514) g/dl before treatment and (25.100± 0.310) g/dl after treatment. These findings likewise showed a noticeable decline in the SCL (P< 0.0001).

Table (1): Comparison of the mean values of the serum cortisol level (SCL) in µg / dl before and after treatment in the two groups

	Before treatment		After treatment		Mean difference	T-value	P-value	Level of significance
	Mean	SD	Mean	SD				
BLT Group	36.200	0.330	25.300	0.313	10.9000	107.18	0.0001	Highly significant increase
PEMFT Group	36.205	0.515	25.100	0.310	11.1050	82.62	0.0001	Highly significant increase

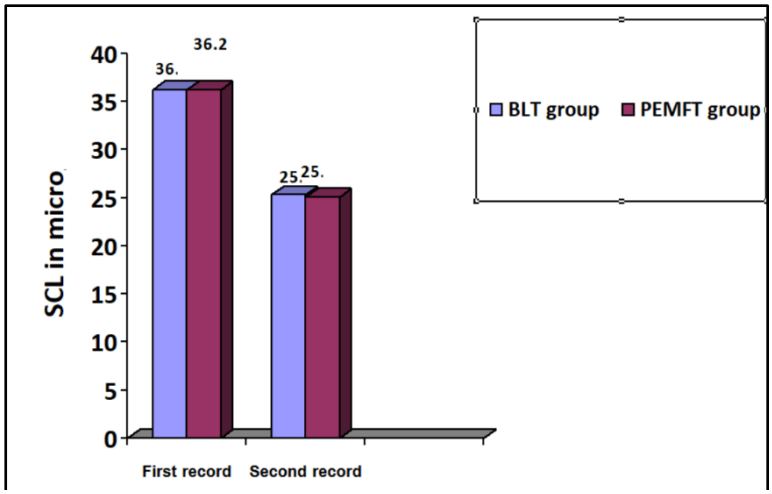

Fig (1): Mean values of theserum cortisol level (SCL) µg / dl before and after treatment in both groups.

As indicated in **Table (2)** and **Figure (2),** the mean Carbamazepine Intake (CMI) in mg for the BLT group was (570.0 ±80.1) mg before treatment and (190.0 ±66.1) mg after treatment. While the mean value of the Carbamazepine Intake (CMI) in mg for the PEMFT group was (560.0 ±88.2) mg before treatment, these results portrayed a notable decrease, (P > 0.0001), while the CMI was (130.0 ±50.2) mg after treatment, these results reflected a marked decrease in the Carbamazepine Intake (CMI) in mg (P< 0.0001).

Table (2): Comparison of the mean values of the Carbamazepine Intake (CMI) in mg before and after treatment in the two groups

	Before treatment		After treatment		Mean difference	T-value	P-value	Level of significance
	Mean	SD	Mean	SD				
BLT Group	570.0	80.1	190.0	66.1	380.000	16.36	0.0001	Highly significant decrease
PEMFT Group	560.0	88.2	130.0	50.2	430.000	18.95	0.0001	Highly significant decrease

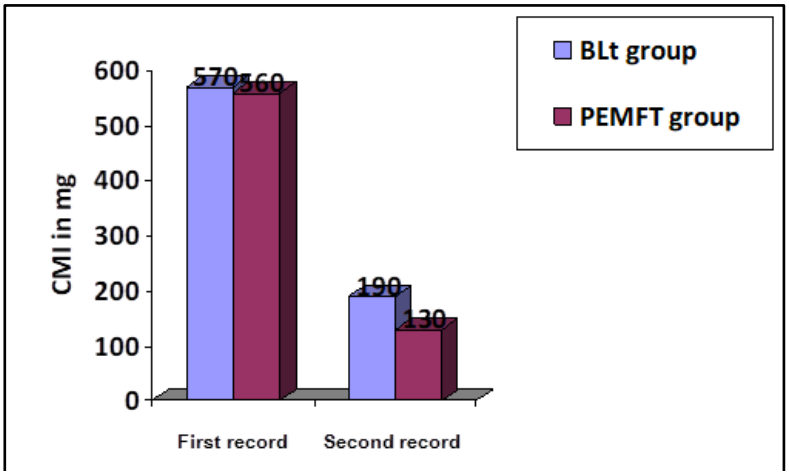

Fig (2): Mean values of theCarbamazepine Intake (CMI) in mg of the 2 records in both groups.

DISCUSSION:

A comparison of the therapeutic benefits of polarized light therapy (BLT) and pulsed

electromagnetic field therapy (PEMFT) for sciatic post-herpetic neuralgia was the goal of the current investigation. Thirty men and ten women with post-herpetic neuralgia of the sciatic nerve took part in the study. Its recruitment sources were the dermatology and neurology departments of Cairo University Hospitals. They ranged in age from 25 to 40. They were divided into two experimental groups (A and B) at random, resulting in the formation of two equal groups. Measurement of the serum cortisol level (SCL) and calculation of the carbamazepine intake (CMI) were the variables examined in the current investigation. The baseline record was obtained prior to the study's start, and the second record was taken three months after the study's start for each patient in both groups of the study **(Drolet et al., 2010).** All the aforementioned parameters (SCL and CMI) were assessed twice.

The aspects of this chapter could be summarized as follows:

Post-herpetic neuralgia (Shingles) is a condition brought on by the herpes zoster virus, which affects one or more dorsal root ganglia and the sensory neurons that surround them. Peripheral nerves in the trigeminal, intercostal, and main extremities are typically impacted in post-herpetic neuralgia. It may be more straightforward to diagnose post-herpetic neuralgia if the patient has previously had chickenpox. This is because the condition can be difficult to identify when the only symptom is pain and no visible skin eruptions (vesicles or blisters) have developed.

This initial stage normally lasts 2 to 5 days before the skin rash appears. A skin rash that follows the damaged nerve and its sensory (dermatomal) area can last up to 6 weeks. The acute phase is characterized by burning anguish that frequently passes when new fibers are formed. After the acute stage, it's possible for stabbing, shooting, and burning pains to arise on their own and linger for months or years.

The affected region develops hyperesthesia. Even benign stimuli have the power to cause unpleasant reactions. Painful post-herpetic neuralgia can be brought on by a mild touch, clothing rubbing against the skin, noise, temperature changes, perspiration, and emotional upheavals **(Gale and Davies, 2002).** Explaining how pulsed electromagnetic fields (PEMF), a subgroup of electromagnetic fields, exhibit frequencies from 6 Hz to 500 Hz, at the low end of the electromagnetic spectrum. The rate of change of PEMF waveforms is another feature. If the biological effect is reliant on the size of the induced current, waveforms with high rates of change e.g., Tesla/second are able to produce substantial biological currents in tissues, allowing them to have bigger biological effects than waveforms with lower rates of change **(Auer, 2004).**

Polarized light from low-power lasers and non-laser devices has helped treat a number of musculoskeletal disorders, wounds more quickly, and skin ulcers. It is known that polarized light has a number of photo-bio stimulatory effects, such as cell proliferation, increased collagen synthesis, changes to the circulatory system, and anti-inflammatory effects, even though the precise mechanism underlying its action is yet unknown. The non-laser optical devices that are currently on the market are produced by Bioptron, and they emit a broad beam of polarized, non-coherent, polychromatic, low-energy light with wavelengths from the visible spectrum (480–700 nm) and infrared radiation (700–3400 nm); this range provides the best tissue penetration and stimulation without the risk of DNA damage **(Begic et al., 2010).**

The objective of this academic work is to trace the claim that BLT markedly improved SCL and CMI in individuals with post-herpetic neuralgia of the sciatic nerve. Patients with sciatic nerve post-herpetic neuralgia benefited significantly after PEMFT in terms of SCL and CMI. Age and sex are just two of the variables in this study. All patients in the two groups were matched in terms of the location of the treated area, the length of the condition, psychic stress, past experiences, family history, and any other characteristics that may have an impact on the healing process.

According to **Bademolu G et al. (2020),** the effect of PEMF was insignificant in the second, fourth, and sixth weeks. Furthermore, in the first and second weeks, the SNI+PMF group's SSI values were considerably greater than those of the SNI group ($p < 0.05$). These findings suggest that while PEMF may be helpful in the short term of recovery, it is ineffective for lengthy periods of application time.

M. Güven et al., 2005 revealed that when the results of the crush and crush + PEMF groups were examined, it was discovered that the PEMF effect was not substantial. According to the scientists, PEMF had no effect on rat sciatic nerve regeneration. The findings of these tests suggest that low-frequency pulsed electromagnetic fields do not affect fast axonal transport rates in operated (crush) or unoperated sciatic nerves, according to **Sisken BF et al. (2005).**

Long-term PEMF use causes delayed histological peripheral nerve regeneration and elevated oxidative stress, but no loss of function recovery, according to **Baptista AF et al.** According to **Shiryan, G.T. et al. (2022),** the results of this study did not demonstrate that linear polarized light therapy was more effective than sham light therapy for enhancing lumbar range of motion

(ROM). This might be explained by the fact that the dose given wasn't sufficient to increase lumbar flexibility. Although lumbar flexion rose by 0.57 cm with a medium effect size (0.7), it is important to note that this improvement did not reach a significant level.

According to **Lin YP et al. (2020),** the usage of light-therapy devices by medical professionals has lately been more popular due to the cheaper costs associated with treating large surfaces as opposed to those treated utilizing laser-based light-therapy equipment. Theoretically, light therapy ought to be a successful LBP treatment. The effectiveness of light treatment in LBP has not yet been determined because there is insufficient evidence to support it. In this prospective, double-blind, randomized, placebo-controlled study, the short-term impact of Light therapy utilizing a light-therapy-based device on LBP was gauged successfully.

Studies examining the impact of Bioptron light treatment on individuals with back pain brought on by sciatica and post-herpetic neuralgia are rare. Generally speaking, different investigations have produced diverse conclusions about polarized light therapy's efficacy. Effectiveness of polarized light therapy and pulsed electromagnetic field therapy as major factors in improving quality of life and reducing the rate of deterioration of health status in instances of psoriasis:

These differences decrease in the SCL and CMI between the second study group (PEMFT group) and the first study group (BLT group), and they were similar to those seen and recorded by **Aaron et al. (2004), Ahmed et al. (2015), Ballyzek et al. (2005), Barker (2007), Begic et al. (2010), Botti (2008), Carpenter and Ayrapntyan (2003), Christopher (2008), David et al.**

The level of serum beta-endorphin would determine the stress of pain and the release of pain.

A combination of viral and inflammatory damage to the primary afferent fibers of sensory neurons results in postherpetic neuralgia (PHN), a neuropathic pain disease with equivalent levels in the spinal cord. Additionally, it causes both cerebral and peripheral sensitization. PHN is characterized as pain that lingers in the herpes zoster (shingles)-affected dermatomes after the rash caused by the infection has subsided. Herpes zoster's incapacitating postherpetic neuralgia is one of these consequences (HZ). Age raises the possibility of PHN following HZ. 5% of those under the age of 18 now have PHN, which is defined as at least 90 days of recorded discomfort.

According to **Dworkin et al. (2008) and Sampathkumar et al. (2009),** prodromal discomfort, characteristic rash, and abnormal distribution are typically used to make a clinical diagnosis of herpes zoster. A collection of vesicles, particularly if they are seen close to the mouth or genitalia, may, however, suggest alternative possibilities. Herpes simplex virus, impetigo, candidiasis, contact dermatitis, insect bites, autoimmune blistering illness, dermatitis herpetiformis, and medication eruptions are among the differential diagnoses for HZ. While viral DNA detection by polymerase chain reaction, when available, is the most useful test because it is sensitive and specific and results can be obtained in a matter of hours, viral DNA detection by shell vial viral culture still serves as the gold standard test against which other diagnostic tests are compared.

According to **Johnson et al. (2008),** pain that lasts for a significant amount of time after the shingles rash has healed is the primary symptom of postherpetic neuralgia. The characteristics of PHN pain might range in intensity from mild to terrible, be continuous or intermittent, or be brought on by insignificant stimuli. Patients express pain in reaction to non-noxious stimuli including wind, clothing pressure, or bed sheets pressing against them. The discomfort experienced by individuals with zoster or PHN, which can last anywhere from a few minutes to continue throughout the day, is described as severe or painful by about half of them. The pain is persistent, unrelieved, and upsetting, and is described as searing and lancinating.

It can interfere with sleep, emotions, job, and everyday activities, lowering quality of life and increasing the risk of depression and social disengagement. Although studies have indicated chronic neural loss and scarring in nerves injured by herpes zoster injury, the pain is generally accepted to be caused by continuous C-fiber nociceptor activity in the nerve cells. However, how the resulting inflammation contributes to pain has not been proven or demonstrated. PHN frequently causes chest or forehead pain.

According to **Davies and Galer (2004),** one theory for the treatment of neuralgia is that acupuncture along the dermatome path promotes blood flow into the muscle tissue, causing the muscle to relax and loosen its hold on the nerve ends. An alternative approach is local nerve modulation. After nerve damage, nerve cells that stimulate nociception and repress nociception become more sensitive to both benign and harmful stimuli. The allodynia and hyperalgesia of neuropathic pain states are probably caused by this sensitization. Acupuncture may help to modulate nociceptor function by causing diffuse noxious sensations.

Begic et al. (2010) claim that polarized light produced by low-power lasers and non-laser devices has been utilized as a non-invasive therapy to treat a number of musculoskeletal issues, hasten the healing of wounds, and has been proven effective in treating skin ulcers. Despite the fact that polarized light is known to have various

photobiostimulatory effects, such as cell proliferation, enhanced collagen synthesis, changes to the circulatory system, and anti-inflammatory effects, the precise mechanism of its activity is still unknown. The available non-laser optical devices are made by Bioptron and emit a wide range of infrared (700-3400 nm) and visible (480-700 nm) frequencies of non-cognizant, polychromatic, low-energy light. The best tissue stimulation and access are provided by this range, and DNA damage is not likely to occur.

According to **Durovi et al. (2008),** the Bioptron light treatment (BLT) device delivers polarized, polychromatic, incoherent, and low-intensity light. In contrast to laser light, which is monochromatic (of limited wavelength), coherent, polarized, and of high or low energy, the light released has a wide range of wavelengths (480-3400nm). Burn danger is a possibility with laser therapy but is not a possibility with Bioptron light therapy. In contrast to Bioptron light therapy, user skills are not necessary for laser therapy. In contrast to Bioptron light therapy, laser therapy has higher expenses. Large-area treatments are also possible using Bioptron light therapy.

According to **Michos et al.,(2016)** the Bioptron light treatment device is said to emit polarized, polychromatic, incoherent, and low-energy. light. Mesmerized light shifts (wavers) on equal planes. Direct polarisation via reflection (the multi-facet reflect framework, Brewster reflect) can produce a polarization level of 95%. The apparent light spectrum and some infrared radiations fall within the Bioptron light treatment framework's frequency range of 480 nm to 3400 nm (bright radiation is absent from the Bioptron light's electromagnetic spectrum). Ultimately, bioptron's light waves are not synchronized; they are disorganized or "out of the stage ".

According to **Rifai (2010),** the Bioptron light therapy system has a low energy density (fluency), averaging 2.4 J/cm^2 on average. A consistent, stable intensity of Bioptron light is applied to the area to be treated; this energy density has stimulating effects. The energy density dosage for Bioptron light therapy may be precisely calculated. Additionally, the power density of light affects the effect it has. At the skin's surface, where it is measured at a treatment distance of 10 cm, Bioptron light has a specific power density of around 40 mW/cm^2, which is similar to an energy density (fluency) of about 2.4 J/cm^2 per minute. Due to these characteristics, Bioptron light may penetrate the skin's surface with little warmth and no skin damage.

According to **Deitz et al.'s** research from 2002, neuropathic pain (NP) from peripheral neuropathy (PN) is caused by ectopic firing of unmyelinated C-fibers with sodium and calcium channel buildup. It was suggested that concentrating pulsed electromagnetic fields (PEMF) energy into the sole of one foot could potentially relieve neuropathic pain because ELF quasi-rectangular currents produced by PEMF can safely depolarize, repolarize, and hyperpolarize neurons.

Vincenzi et al. (2013) claim that during nine consecutive one-hour sessions (excluding weekends), the noninvasive pulsed signal treatment delivers a unidirectional quasi-rectangular waveform with a strength of around 20 Gauss and frequency of about 30 Hz into the soles of the feet. Each case's foot with the most symptoms was treated. For nine days, all 24 feet received therapy. 15 of 24 patients (or 62%) had appointments for follow-up care. However, from baseline to the completion of therapy, mean pain scores dropped by 21% (P = 0.19), compared to 49% from baseline to the end of follow-up. Self-reported PGIC rose by 67% (n = 10) and remained at 33% (n = 5) in both cases. There was a 19% reduction in pain levels from the start to the end of the study, according to an intent-to-treat analysis of all 24 feet.

In 2009, Pulsed Signal Therapy, a subset of pulsed electromagnetic field therapy, has been made available for therapeutic use and research for more than ten years. On the other hand, research into how electrical stimulation affects bone first appeared in the early 1960s. Pulsed electromagnetic field stimulation of non-union became a widely used technique as a result of that research, and it is now used in several clinics all over the world. **Robert et al.'s** book The Body Electric (1985) provides an excellent summary of the history of early research on pulsed electromagnetic fields. Numerous references to the physiological studies that support bone electrical stimulation are included in this book. The electrical stimulation method was changed to an electromagnetic one by a pioneer named Andrew Bassett.

Pulsed electromagnetic fields have been employed as therapeutic agents for the past 40 years, according to **Hannemann et al. (2014).** This is because there is strong evidence that electric currents can speed up bone growth. In particular, electromagnetic-field stimulation gained acceptance as a treatment after it was discovered that exerting physical stress on bones encouraged the production of tiny electric currents linked to bone growth. For cartilage, a similar mechanism has been reported, whereby electrical stimulation of chondrocytes stimulated the synthesis of proteoglycans, the main building block of the cartilage matrix.

According to **Auer (2004),** pulsed electromagnetic fields (PEMF), a subgroup of electromagnetic fields, exhibit frequencies in the low end of the

electromagnetic spectrum, ranging from 6 Hz to 500 Hz. Another characteristic is the PEMF waveforms' rate of change. If the amount of the created current determines the biological effect, waveforms with high rates of change (such as Tesla/second) can create substantial biological currents in tissues, enabling them to have greater biological effects than waveforms with low rates of change.

In a study by **Hayleman in 2006**, it was found that endothelial cells responded to PEMF by speeding up angiogenesis, producing more collagen and glycosaminoglycans, and growing more quickly overall. There are a number of hypotheses as to how magnets are believed to be healing. According to one idea, magnets interact with or stimulate the body's systems and improve blood and lymphatic circulation, which lowers inflammation and lessens pain. Other possibilities include the magnetic field interfering with pain perception, magnets stimulating the body's natural painkiller endorphin production, or magnets stimulating the same acupuncture trigger points.

According to **Carpenter and Ayrapntyan (2003),** the issue of pain management is a crucial socioeconomic and health issue. People of all ages, genders, and cultural backgrounds experience pain in its acute, recurring, and chronic manifestations, which has an annual financial cost of between $10,000 and $15,000 in North America. Estimates of the cost of pain do not include the roughly 30,000 people who pass away annually in North America as a result of stomach lesions brought on by nonsteroidal anti-inflammatory drugs. 17% of persons over the age of 15 experience chronic pain, which interferes with their regular daily activities. Studies show that at least one in four people in North America experience pain on a daily basis. The medical system is heavily dependent on this enormous group of people who are in pain. In an effort to avoid medication dependence, invasive procedures, and/or negative effects, many doctors are now recommending non-drug therapy to patients with chronic pain. This therapy is frequently referred to as "Complementary and Alternative Medicine".

The means of the first record CMI (1) (before the BLT application) and the second record CMI (2) (three months after the BLT application) saw an extremely marked drop, per the study's findings (P 0.0001) .The initial record of CMI had a mean value of 560.0 82.1 mg, a maximum value of 600.0, a minimum value of 400.0, and a range value of 200.0 mg before the application of BLT. The standard error was 18.4, the variance was 6736.8, and the coefficient of variation was 14.66 mg .The median value of the second record of CMI after three months of BLT treatment was 200.0 mg, with a maximum value of 300.0, the lowest value of 100.0, and the range value of 200.0 mg. After three months of receiving BLT therapy, the mean value of the second record of CMI was 195.0 + 68.6 mg. The standard error was 15.3, the variance coefficient was 25.20 mg, and the variance was 4710.5.

The outcomes of this academic work showed a statistically crystal-clear decline in the means of the first record CMI (1) (before PEMFT application) and the second record CMI (2) (after three months of PEMFT treatment) (P 0.0001). The initial record of the CMI had a mean value of 550.0± 88.9 mg, a maximum value of 600.0, a minimum value of 400.0, and a range value of 200.0 mg. The variance was 7894.7, the standard error was 19.9, and the variance coefficient was 16.15 mg. On a different level, the second record of CMI after three months of the PEMFT application had a mean value of 150.0 + 51.3 mg, maximum value of 200.0, minimum value of 100.0, and range value of 100.0. The variance was 2631.6, the standard error was 11.5 and the variance coefficient was 34.20 mg.

There were no statistically marked disparity in the first pretreatment records of the CMI between the first study domain (MENS group) and the second study domain (PEMFT group) when the means of the first pretreatment records of the CMI in the two domains were compared (P > 0.05). However, when the averages of the second records of the CMI were compared between the two domains, only the difference between the second domain (PEMFT group) and the first one (MENS group) was found to be statistically noticeable (P <0.05).

Scientific justification for why pulsed electromagnetic field therapy (PEMF) reduces pain and inflammation in individuals with sciatica postherpetic neuralgia more effectively than polarized light therapy in terms of functional capacity and health status, can be summarized as follows:

PEMF and BLT were designed for:

-Decrease pain and level of inflammation through:

1- Decreases the amount of (CMI) as a drug.

2-decreases Serum cortisol level in the blood (referee to decrease the level of pain).

According to the current study, it can be said that the use of both Bioptron light therapy (BLT) and pulsed electromagnetic field therapy (PEMFT) had beneficial effects in the treatment of post-herpetic neuralgia of the sciatic nerve based on the previous discussion and some literature and studies. As seen by the significantly reduced levels of SCL and CMI, the study's findings support the hypothesis that both Bioptron light therapy (BLT) and pulsed electromagnetic field therapy (PEMFT) were successful in treating post-herpetic neuralgia of the sciatic nerve. However, compared to Bioptron light

therapy (BLT), pulsed electromagnetic field therapy (PEMFT) was more advantageous.

CONCLUSION:

When it comes to adopting a treatment protocol for post-herpetic neuralgia of the sciatic nerve, the adoption of both Bioptron light therapy (BLT) and pulsed electromagnetic field therapy (PEMFT) was beneficial. As seen by the significantly reduced levels of SCL and CMI, the study's findings support the hypothesis that both Bioptron light therapy (BLT) and pulsed electromagnetic field therapy (PEMFT) were successful in treating post-herpetic neuralgia of the sciatic nerve. However, compared to Bioptron light therapy (BLT), pulsed electromagnetic field therapy (PEMFT) was more advantageous.

REFERENCES:

1- Ahmed MM, Maha AH, Hisham GM, and Zakaria Mowafy et al., (2015): Efficacy of Polarized Light in the Treatment of Pressure Ulcers. JMSCR 3(5): 5800- 5809. 21.

2- Ballyzek MA, Vesovic VB, and Johnston AA et al., (2005): Efficacy of polarized, polychromatic, non-coherent light in the treatment of chronic musculoskeletal neck and shoulder pain. St Petersburg Hospital, Russian Academy of Sciences, St Petersburg, Russia.

3- Begic R, Jasmina V,and Sanja et al., (2010): Application of Bioptron Light Therapy in Dermatology and Wound Healing. The European Dermatology 5: 57-60.

4- Bolton PA, Young SH, and Dyson MA et al., (2008): Macrophage responsiveness to laser therapy: a dose-response study. Laser Therapy.2:101–106.

5- Botti SI, (2008): "Pulsed magnetic fields improve osteoblast activity during the repair of an experimental osseous defect" Jorthop Res 11 (5): 664-670.

6- Cao S, Zhang D and Yuan J et al., (2020): Inflammatory cytokine expression in the skin of patients with postherpetic neuralgia. J Int Med Res; 48:300060520929582.

7- Charman SP, (2010):" Pain from herpes zoster and postherpetic neuralgia" AJN; 11(3): pp: 44-52.

8- Christopher SW, (2008): "Assessment of health effects from exposure to power time-frequency electric and magnetic fields". United States of America.PP:9-10.

9- Depuydt KA Monstrey SA and Hoeksema HG et al., (2009): The use of polarized light in the treatment of burn wounds. Abstract presented at the 10th Annual EURAPS Meeting, Madrid, Spain.

10- Drolet M, Brisson M and Schmader K et al., (2010): Predictors of postherpetic neuralgia among patients with herpes zoster: a prospective study. J Pain 2010; 11:1211.

11- Durović A, Marić D, and Brdareski Z et al., (2008): The effects of polarized light therapy in pressure ulcer healing. Vojnosanit Pregl 65(12): 906-912.

12- Dworkin RH, Gnann JW JR, Oaklander AL, et al., (2008): Diagnosis and assessment of pain associated with herpes zoster and postherpetic neuralgia. J Pain; 9: S37.

13- Eiffel SA, (2008): "Clinical observation on the wound healing properties of polarized light". Br. J. Surg.; 75: 679-681.

14- Forbes HJ, Bhaskaran K and Thomas SL et al., (2016): Quantification of risk factors for postherpetic neuralgia in herpes zoster patients: A cohort study. Neurology; 87:94.

15- Goodman UY, (2009): "Electromagnetic field may act directly on DNA" J Cell Biochem. Dec 1; 75(3): 369-74.

16- Hannemann PF, Mommers EH, and Schots JP et al., (2014): The effects of low-intensity pulsed ultrasound and pulsed electromagnetic fields bone growth stimulation in acute fractures: a systematic review and meta-analysis of randomized controlled trials.AU;134(8):1093.

17- Hazelwood GG, (2007): "Response of Pain to static magnetic fields in post–polio patients: a double-blind pilot study". Archives of physical medicine Rehabilitation, 78 (11):1200-1203.

18- Hinton PR, (2004): "Statistics Explained"2nd Ed. Rutledge Taylor &Francis Group London Pp149-155.

19- Huston AS, (2009): "Efficacy of a static magnetic field device against knee pain associated with inflammatory arthritis". J ClinRheumatol, 5:302-304.

20- Iordanou PA, Bellou PP and Ktenas EA et al., (2007): Effect of polarized light in the healing process of pressure ulcers. Int J Nurs Pract; 8; 1, 49-55.

21- Johnson RW, Wasner GP and Baron RJ, (2008): "Herpes zoster and postherpetic neuralgia: optimizing management in the elderly patient" J Drugs Aging; 25(12): pp: 991-1006.

22- Kubasova TA, FenyoMH, andHorvath MK et al., (2008): Effect of visible light on some cellular and immune parameters. Immunology and Cell Biology; 73: 239-244.

23- Kubasova TA, Fenyo MH, and Gazso LK et al., (2006): Investigations on the biological effect of polarized light. Photochemistry and Photobiology; 48:505-509.

24- Larsen DD, (2005): "A preliminary study to evaluate the effect of pulsed electromagnetic

field treatment on lower extremity per ulcer skin microcirculation of diabetic patients". Wounds. 7 (3); 90-93.

25- Medenica LA and Lens MA, (2004): The use of polarized polychromatic non-coherent light alone as AMMAR, TAREK A.: "Monochromatic Infrared Photo Energy in Diabetic Peripheral Neuropathy". ISRN Rehabilitation, 1-8, 2012. 2-

26- Michos XD, **Ioannis NH and Talias et al., (2016)**: Tendinopathy: The Role Polarized Polychromatic Non-Coherent Light Commonly called Bioptron Light. Journal of Prevention & Infection Control 2 (11).

27- Miyazaki TF, Tanabe YE and Iseki MA, (2005):" Treatment and recent topics of postherpetic neuralgia" JMAJ; 48(10): pp: 505-510.

28- Oxman MN, Levin MJ and Johnson GR et al., (2005): A vaccine to prevent herpes zoster and postherpetic neuralgia in older adults. N Engl J Med; 352:2271.

29- Parker TA, (2009): "Biomagnetics in the treatment of human pain". Future. Environ Med; 8: 34-30.

30- Pipkin FB, (1984): "Medical statistics made easy". Edinburgh. London. Melbourne and New York.