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Visual Analogue and Neuropathic Pain Scales Response to Low Level Laser in Cases of Postherpetic Neuralgia of the Sciatic Nerve

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Abstract: Postherpetic neuralgia is one of the most painful syndromes seen in a pain practice. It affects multiple aspects of the patient life. This study has been conducted to evaluate the efficacy of the low level laser in treatment of post herpetic neuralgia of the sciatic nerve. A sample of forty patients with post herpetic neuralgia of the sciatic nerve with no other systemic or metabolic disorders were randomly divided into two groups. Group (A) received low level laser while Group (B) (Control group) received the placebo laser, along the sciatic nerve course, duration of treatment was 20 minutes once per week for three months. The clinical findings of the patients were analyzed before and after the treatment via the Visual Analogue Scale (VAS) and the Neuropathic Pain Scale (NPS).The results indicated that all forty patients completed the study. There were no adverse effects observed. The Visual Analog Scale (VAS) score difference before and after the treatment was statistically significant ($p = 0.0001$). Also statistical difference was found before and after the treatment in the Neuropathic Pain Scale ($p = 0.0001$). In relation to the VAS and NPS scores, the study revealed that the results obtained in the study group were superior to that of control group.So, it can be conclude that the low level laser may be considered as an effective treatment modality in the treatment of Post herpetic neuralgia of the sciatic nerve.
Key Words: Laser, Post herpetic neuralgia, Visual analogue scale, Neuropathic pain scale.

Introduction

Post herpetic neuralgia (PHN) is a neuropathic pain syndrome resulting from a combination of inflammatory and viral damage to primary afferent fibers of sensory nerves and the corresponding levels of the spinal cord, as well as peripheral and central sensitization, [(1), (2),(3)].

Post herpetic neuralgia is debilitating complication of herpes zoster (HZ)[(4)]. The risk of PHN after HZ increases with age [(5)]. In a large population- based study, the rate of PHN (defined as at least 90 days of documented pain)increased from 5% in those younger than 60 years to 10% in those aged 60-69 years and to 20% in those aged 80 years or older,[(6)].

The pain of PHN is characterized by the fact that the skin surface of the affected part always presents hyposensitivity such as hyposthesia or anesthesia including pain sensation, accompanied by single or combined

complaints of burning pain, aching pain, shooting pain, lancinating pain, tight pain, etc[7, 8]. Allodynia may be remarkable in some cases or absent in others,[9].

By definition chronic pain implies a long standing condition present for months, years or even decades[9]. Patients will usually have tried a wide variety of different therapies and have consulted a number of medical specialists. Eventually intractable pain that is unremitting and unrelieved will produce some degree of emotional overlay and a varying disturbance of affect. These subjective changes usually results in patients adopting a negative attitude to their pain which even serve to make treatment more difficult,[10, 11].

Laser is an acronym for Light Amplification by Stimulated Emission of radiation; it is a form of phototherapy which involves the application of monochromatic light over biological tissue to elicit a biomodulative effect within that tissue [12]. It is a generic term that defines the therapeutic application of a relatively low output (<500mw) laser and monochromatic super luminous diodes for the treatment of disease and injury at dosage usually <35J/cm2, generally considered to be low that to affect any detectable heating of the irradiated tissue[13].

The salutary effect of laser therapy in medical practice connects with the improvement of microcirculation and the activation of cell proliferation [14,15].The concepts of free radical mechanism of low level laser irradiation (LLLI) stimulating action to the endogenous porphyrins, which are chromophores of LLLI in the red spectral range and known as photo sensitizers, localized in blood cells membrane and absorb photons of the LLLI.[16,17] This process is the basis for initiation of photosensitized free radical reaction including lipid peroxidation of blood leukocyte membranes with subsequent formation of lipid hydroperoxides.[12] Peroxidative modification of membrane lipids increases cell membrane ionic permeability for calcium ions, [18,19,13].

Laser irradiation in LLLT inhibited both the asynchronous firing that was induced by turpentine and increased part of the slow components of the action potentials[20]. The laser irradiation thus selectively inhibited the signals of the nociceptors to the peripheral nerves[21]. In addition, LLLT is recognized as activating the dorsal horn gate control theory, thereby selectively blocking or attenuating impulses along the incoming C and A ä pain transmission fibers[22]. The therapeutic implication of LLLT for PHN in acute phase was performed for peripheral neuritis due to viral infection as an anti inflammatory agent and in chronic phase for improvement of afferent pathway blockade and chronic pain attenuation[23, 24].

Materials and Methods

Subjects:

Forty volunteer patients with post herpetic neuralgia of the sciatic nerve with no other systemic or metabolic disorders and their ages were ranged from 45 to 65 years, were randomly divided into two groups. Group (A) received low level laser while Group (B) (Control group) received the placebo laser, along the sciatic nerve course, duration of treatment was 20 minutes once per week for three months.

Evaluation Procedures:

1- Visual analog scale (VAS): Figure(1) A Visual Analogue Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured. For example, the amount of pain that a patient feels ranges across a continuum from none to an extreme amount of pain. Operationally a VAS is usually a horizontal line, 10 cm in length, anchored by word descriptors at each end. The patient marks on the line the point that they feel represents their perception of their current state. The VAS score was determined by measuring in centimeters from the left hand end of the line to the point that the patient marks.[25]

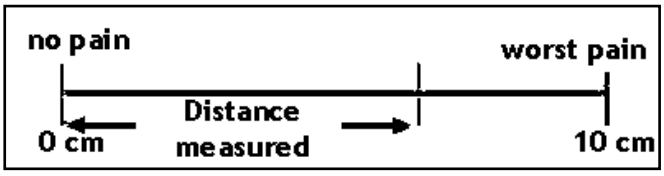
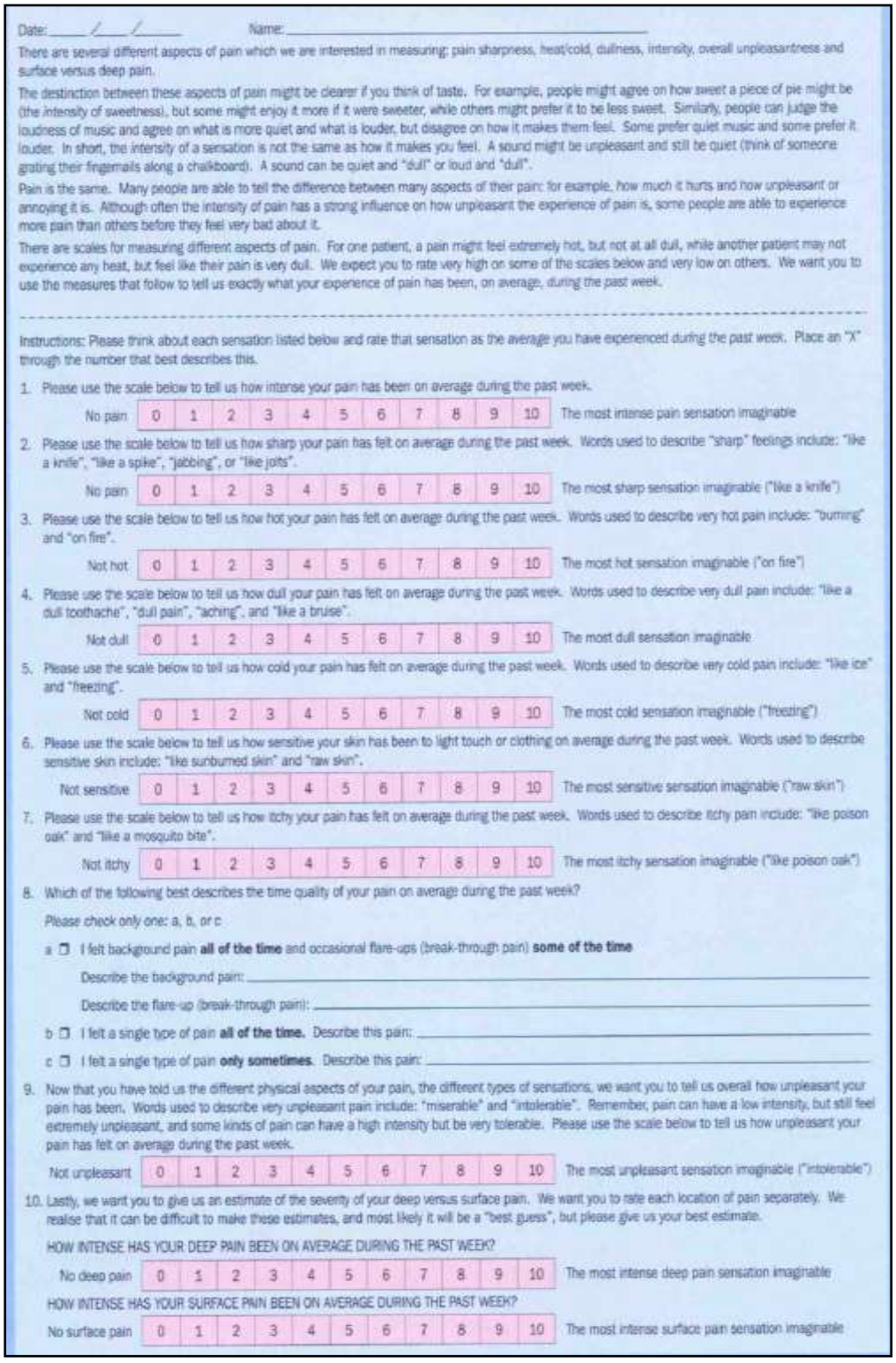


Figure (1): Visual Analogue Scale

2- Neuropathic pain scale (NPS): Figure (2) The neuropathic pain scale has eight descriptive qualities of neuropathic pain, which the patient scores from 0 – 10 using a numerical rating scale. It also includes a measure for how unpleasant or intolerable the pain is and whether it is surface or deep pain. It is sensitive to the effects of treating and managing of neuropathic pain. The 10 NPS items are able to distinguish patients from different diagnostic groups, and show different levels of response to pain treatment, supporting the potential of the NPS items to detect treatment effects not detected by pain intensity ratings alone. All patients were instructed to circle a number from 0 to 10 on each line of the 10 items of the NPS and eventually the total score was summated to be statistically treated.



Date: ____ /____ /_____ Name: _____

There are several different aspects of pain which we are interested in measuring: pain sharpness, heat/cold, dullness, intensity, overall unpleasantness and surface versus deep pain.

The destinction between these aspects of pain might be clearer if you think of taste. For example, people might agree on how sweet a piece of pie might be (the intensity of sweetness), but some might enjoy it more if it were sweeter, while others might prefer it to be less sweet. Similarly, people can judge the loudness of music and agree on what is more quiet and what is louder, but disagree on how it makes them feel. Some prefer quiet music and some prefer it louder. In short, the intensity of a sensation is not the same as how it makes you feel. A sound might be unpleasant and still be quiet (think of someone grating their fingernails along a chalkboard). A sound can be quiet and "dull" or loud and "dull".

Pain is the same. Many people are able to tell the difference between many aspects of their pain: for example, how much it hurts and how unpleasant or annoying it is. Although often the intensity of pain has a strong influence on how unpleasant the experience of pain is, some people are able to experience more pain than others before they feel very bad about it.

There are scales for measuring different aspects of pain. For one patient, a pain might feel extremely hot, but not at all dull, while another patient may not experience any heat, but feel like their pain is very dull. We expect you to rate very high on some of the scales below and very low on others. We want you to use the measures that follow to tell us exactly what your experience of pain has been, on average, during the past week.

Instructions: Please think about each sensation listed below and rate that sensation as the average you have experienced during the past week. Place an "X" through the number that best describes this.

1. Please use the scale below to tell us how intense your pain has been on average during the past week.

No pain	0	1	2	3	4	5	6	7	8	9	10	The most intense pain sensation imaginable

2. Please use the scale below to tell us how sharp your pain has felt on average during the past week. Words used to describe "sharp" feelings include: "like a knife", "like a spike", "jabbing", or "like jolts".

No pain	0	1	2	3	4	5	6	7	8	9	10	The most sharp sensation imaginable ("like a knife")

3. Please use the scale below to tell us how hot your pain has felt on average during the past week. Words used to describe very hot pain include: "burning" and "on fire".

Not hot	0	1	2	3	4	5	6	7	8	9	10	The most hot sensation imaginable ("on fire")

4. Please use the scale below to tell us how dull your pain has felt on average during the past week. Words used to describe very dull pain include: "like a dull toothache", "dull pain", "aching", and "like a bruise".

Not dull	0	1	2	3	4	5	6	7	8	9	10	The most dull sensation imaginable

5. Please use the scale below to tell us how cold your pain has felt on average during the past week. Words used to describe very cold pain include: "like ice" and "freezing".

Not cold	0	1	2	3	4	5	6	7	8	9	10	The most cold sensation imaginable ("freezing")

6. Please use the scale below to tell us how sensitive your skin has been to light touch or clothing on average during the past week. Words used to describe sensitive skin include: "like sunburned skin" and "raw skin".

Not sensitive	0	1	2	3	4	5	6	7	8	9	10	The most sensitive sensation imaginable ("raw skin")

7. Please use the scale below to tell us how itchy your pain has felt on average during the past week. Words used to describe itchy pain include: "like poison oak" and "like a mosquito bite".

Not itchy	0	1	2	3	4	5	6	7	8	9	10	The most itchy sensation imaginable ("like poison oak")

8. Which of the following best describes the time quality of your pain on average during the past week?

Please check only one: a, b, or c

a ☐ I felt background pain **all of the time** and occasional flare-ups (break-through pain) **some of the time**

Describe the background pain: _____

Describe the flare-up (break-through pain): _____

b ☐ I felt a single type of pain **all of the time.** Describe this pain: _____

c ☐ I felt a single type of pain **only sometimes.** Describe this pain: _____

9. Now that you have told us the different physical aspects of your pain, the different types of sensations, we want you to tell us overall how unpleasant your pain has been. Words used to describe very unpleasant pain include: "miserable" and "intolerable". Remember, pain can have a low intensity, but still feel extremely unpleasant, and some kinds of pain can have a high intensity but be very tolerable. Please use the scale below to tell us how unpleasant your pain has felt on average during the past week.

Not unpleasant	0	1	2	3	4	5	6	7	8	9	10	The most unpleasant sensation imaginable ("intolerable")

10. Lastly, we want you to give us an estimate of the severity of your deep versus surface pain. We want you to rate each location of pain separately. We realise that it can be difficult to make these estimates, and most likely it will be a "best guess", but please give us your best estimate.

HOW INTENSE HAS YOUR DEEP PAIN BEEN ON AVERAGE DURING THE PAST WEEK?

No deep pain	0	1	2	3	4	5	6	7	8	9	10	The most intense deep pain sensation imaginable

HOW INTENSE HAS YOUR SURFACE PAIN BEEN ON AVERAGE DURING THE PAST WEEK?

No surface pain	0	1	2	3	4	5	6	7	8	9	10	The most intense surface pain sensation imaginable

Figure (2): Neuropathic Pain Scale

Treatment Procedures

A GaAlAs laser is used in this study with 830nm wavelength. The laser application was conducted in a linear pathway, unilaterally over the affected side from up to down side in a contact mode with the patient prone as follow: **First point of application:**wasat l5-S1 (errectro-spinae motor point) level paravertebrally. **Second point of application**: was on the tender buttock, upper motor point of gluteus maximus. **Third point of application**: was at the midpoint between ischial tuberosity and greater trochanter at level of buttock and posterior upper thigh. **Fourth point of application**: was done just superior to popliteal crease. LLLT was performed once per week for 3 months, 5 min for each site of application with the treatment session total time was 20 min. The patient was placed into a comfortable supported prone position that allows the vision of the treated area. Both the therapist and patient wear protective eye glasses during the treatment and the patient was asked not to look to laser rays.

Data analysis:

Visual analogue scale (VAS) and neuropathic pain scale (NPS) were measured pre-treatment as a first record and after 3 months as a second final record in both groups. 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, [26].

Results

As shown in table (1) and figure (3), the mean value of the VAS before treatment was (9.000 ± 0.858) degrees in the study group, while after treatment was (2.650 ± 0.587) degrees. These results revealed a highly significant reduction in VAS ($P < 0.0001$).While in the control group, the mean value of the VAS before treatment was (9.050 ± 0.394) degrees, while after treatment was (8.950 ± 0.224) degrees. These results revealed non-significant difference in the VAS ($P > 0.05$).

Table (1): Comparison of the mean values of visual analogue scale (VAS) measurement in degrees before and after treatment in both groups

	Before treatment		After treatment		Mean difference	T-value	P-value	Level of significance
	Mean	±SD	Mean	±SD				
Study group	9.000	0.858	2.650	0.587	-6.35000	-38.11	0.0001	Highly Significant decrease
Control group	9.050	0.394	8.950	0.224	-0.10000	-1.45	0.163	Non-significant difference

SD: Standard deviation, MD: Mean difference, p value: Probability

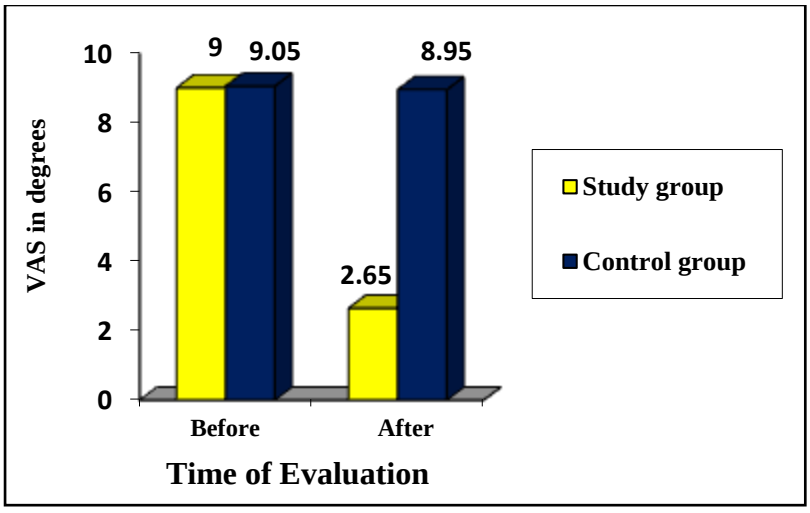


Figure (3): Mean values of the VAS before and after treatment in both groups.

Table (2): Comparison of the mean values of NPS before and after treatment in both groups

	Before treatment		After treatment		Mean difference	T-value	P-value	Level of significance
	Mean	±SD	Mean	±SD				
Study Group	72.500	8.660	25.000	4.867	-47.5000	-32.24	0.0001	Highly Significant decrease
Control Group	72.250	5.495	72.000	6.366	-0.250000	-0.27	0.789	Non-significant Difference

SD: Standard deviation, MD: Mean difference, p value: Probability

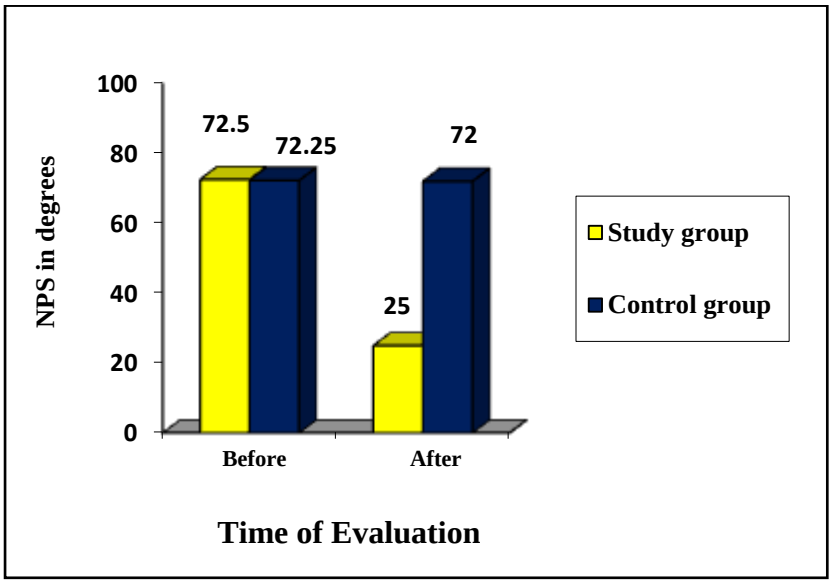


Figure (4): Mean values of the NPS before and after treatment in both groups.

Also, as shown in table (2) and figure (4), the mean value of the neuropathic pain scale (NPS) in degrees before treatment was (72.500 ± 8.660) degrees in the study group, while after treatment was (25.000 ± 4.867) degrees. These results revealed a highly significant reduction in NPS ($P < 0.0001$), while in the control group, the mean value of the NPS before treatment was (72.250 ± 5.495) degrees, while after treatment was (72.000 ±6.366) degrees, these results revealed non-significant difference in the NPS ($P > 0.05$).

Discussion

Pain is a warning signal that helps to protect the body from tissue damage. Sherrington defined pain as a psychological adjunct to a protective reflex, the purpose of which is to cause the affected tissue to be withdrawn from the potentially noxious stimuli [(1)]. Pain, unlike most other sensory modalities, has an essential function in survival [(2)]. The sensation of pain originates from the activation of nociceptive primary afferents by intense thermal, mechanical, or chemical stimuli. These nociceptor sites are small, free nerve endings in the numerous tissues of the body [(3)].

Neuropathic pain, likely due to neuronal damage and inflammation resulting from the multiplication and spread of the reactivated VZV, is a major manifestation of HZ, especially in older persons, the dermatomal HZ rash is frequently preceded by neuropathic pain; neuropathic pain usually accompanies the rash; and neuropathic pain and discomfort (e.g., allodynia and severe pruritus) may persist or develop after the dermatomal rash has healed a debilitating complication of HZ known as "post herpetic neuralgia" (PHN) [(7), (8)].

Since 1980, LLLT have been applied for PHN. Although many of the direct effects of low level Laser irradiation at a cellular and local level have been elucidated by leading photo biologists, the systemic effect of

LLLT and its physiological pathways remain unclear.LLLT is effective for PHN in the acute and chronic phase and the results demonstrate a significant reduction in PHN pain intensity and other complaints therefore LLLT will appear to be a valuable method for treating PHN [(29)].

The findings of the present study showed non-significant differences in the pre-treatment records of the VAS between the mean values of the study and the control groups. As well as in the pre –treatment records of the NPS, between the mean values of both groups.

Results of the study group revealed a highly significant decrease in the mean values of VAS and NPS, after application of the Ga-Al-As Laser, when compared against the pre-application results.

Also results of the study group revealed a highly significant decrease in the mean values of VAS and NPS, after application of the Ga-Al-As Laser, when compared with the control group results after application of the placebo laser.

In one study a group of 20 patients were allocated randomly into two groups; study group and placebo group, the study was double blinded, by the end of the trail all patient showed a reduction in pain severity between 40-95% and a reduction in pain distribution between 49-84%.the mean difference between the two groups were highly significant [(30)].

In another study the overall effective response was a 71% with a significant reduction of symptoms using a GaAlAs diode which delivers a continuous wave of 830 nm and an overall power output of 60 mW [(31)].

In another study a 123 patient showed an overall total improvement of 60.16% and it was concluded that LLLT was effective for PHN for the acute and chronic phase, but LLLT was particularly effective for the acute onset patient whose onset before treatment was 6 months or less [(29)].

Results of this study support the expectation that application of the Ga-Al-As Laser had valuable effects in improving post herpetic neuralgia of the sciatic nerve as evidenced by the highly significant decreases in the visual analogue scale (VAS) and the neuropathic pain scale (NPS).

Conclusion

Post herpetic neuralgia (PHN) is a chronic pain syndrome that disproportionately affects the elderly; its incidence is anticipated to increase as the population ages. PHN presents as pain (continuous burning or intense paroxysmal), most often with tactile allodynia, which may be severe and disabling, resulting in poor quality of life and depression [(27)].LLLT is noninvasive, painless and safe method of treatment and should be recommended as an early intervention for pain therapy of PHN [(28)]. In this study the Ga-Al-As Laser proved to be effective in improving post herpetic neuralgia of the sciatic nerve as evidenced by the highly significant decreases in the visual analogue scale (VAS) and the neuropathic pain scale (NPS).

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