Efficacy of Two Different Programmes for Pulsed Electromagnetic Field Therapy on Post-Herpetic Neuralgia of the Sciatic Nerve

Zakaria Mowafy Emam Mowafy*, Hamed Abd Allah Hamed ** .Aya Gamal Fawzy El-Sayed *, and Osama Fouad Sayed Ahmed *

* Physical Therapy Department for Surgery, Faculty of Physical Therapy, Cairo University, Egypt.

** Dermatology Department, Faculty of Medicine, Cairo University, Egypt.

ABSTRACT

Purpose: to evaluate and compare the efficacy of two different pulsed electromagnetic field therapy programmes on post-herpetic neuralgia of the sciatic nerve. **Methods:-** Thirty patients who had post-herpetic neuralgia of the sciatic nerve and their ages ranged from 25 to 40 years were divided into two groups. Group (A) composed of 15 patients who received the traditional physical therapy treatment plus the PEMFT programme (1) of strong impulses, stimulating South polarity of the magnetic pulses with frequency fluently changing from 12.5- 50 Hz, with buttons 1,3 and 6 up while buttons 2,4 and 5 down. Group (B) composed of 15 patients who received the traditional physical therapy treatment plus the PEMFT programme (2) of mild impulses, soothing North polarity of the magnetic pulses with frequency of 12.5Hz with buttons 1,2,4 and 5 down while buttons 3 and 6 up, duration of the application was 20 minutes applied day after day 2months. **Results:** Results showed Highly significant decreases of the VAS and the CMI in both groups. Estimation gear instruments: 1-Visual Analog Scale (VAS): beginning treatment (first record), aggravation level was estimated utilizing visual simple scale (VAS), afterward again following two months treatment (as second last record). 2-Estimation Carbamazepin Intake: (CMI): It was used to evaluate improvement in sciatic nerve post-herpetic. **Conclusion:-** Both PEMFT programs had a valuable effects on post- herpetic neuralgia of the sciatic nerve and the mild impulses, soothing North polarity of the magnetic pulses was more beneficial than the strong impulses, stimulating South polarity of the magnetic pulses.

Key words (Strong impulses, stimulating South polarity PEMFT, Mild impulses, soothing North polarity PEMFT, Post-herpetic neuralgia, Sciatica, Visual analogue scale and Carbamazepin Intake).

INTRODUCTION

Post - herpetic neuralgia (Shingles) is the result of a virus (herpes zoster) that attacks one or more dorsal root ganglia and corresponding sensory nerves **Alster TS and Manni CA, (2008).** Diagnosis of post- herpetic neuralgia is initially difficult when skin eruptions (vesicles or blisters) are not yet apparent and the only complaint is pain, so a previous history of chickenpox may aid in the diagnosis. This initial phase commonly lasts for 2 to5 days prior to the appearance of the skin rash **Aokyi FY, Law BJ and Hammond GW, (2009).** Skin rash follows the involved nerve as well as its sensory (dermatomal) area and may last for up to 6 weeks **Chalmers EQ, (2006).** The acute phase is characterized by burning pain that frequently decreases as regeneration of new fibers occurs **Colbert (2008).** The involved area becomes hyperesthetic and non –noxious stimuli can cause a painful response. The severe pain of post –herpetic neuralgia may be triggered by light touch, clothing rubbing against the skin, noise, temperature changes, sweating and emotional upsets **Devor M. (2013).**

Postherpetic neuralgia (PHN) is a neuropathic pain syndrome resulting from a combination of inflammatory and viral damage to primary afferent fibres of sensory nerves and the corresponding levels of the spinal cord, as well as peripheral and central sensitization. **Campbell BJ, Rowbotham M and Davies PS et al.. (2002)**. PHN has been defined as pain persisting in the dermatomes affected by herpes zoster (shingles) after the disappearance of the characteristic rash caused by the infection. Postherpetic neuralgia is debilitating complication of herpes zoster (HZ). The risk of PHN after HZ increases with age. 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 **Deitz LG, Schwardt JK and Chen DL. (2002)**. 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. Allodynia may be remarkable in some cases or absent in others. 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 **Devor M. (2009)**. Pain, unlike most other sensory modalities, has an essential function in survival. 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 **Devor M. (2017)**

Magnetic field is the space permeated by the magnetic lines force surrounding a permanent magnet or coil of wire carrying electric current. A magnetic field always exists when there is an electric current flowing. There are three types of magnetic field; a static magnetic field, a time varying magnetic field, and pulsed magnetic field. The human body is transparent to the magnetic field, so during application, it acts on all molecules, and has a non-selective action.[19]

Since the magnetic field generated can penetrate through high resistance structures as bone, fat, skin, clothes, or even plaster cast, it had been shown that electromagnetic fields provide a practical exogenous method for inducing cell and tissue modifications which can correct selected pathological states **Dworkin RH, Johnson RW and Breuer J et al. (2007).**

Electromagnetic fields are considered as one of the most developing and common used modalities in the field of physical therapy. Physical therapists use almost all types of electromagnetic fields in the management of different cases. Electromagnetic fields are now being used in many diseases such as skin, osseous, ligamental, or nervous reparation, diabetes, as well as myocardial or cerebral ischaemia **Gaston SR. (2006).** The biological effects and interactions of magnetic fields with living organisms are very complicated. It is too early to give the mechanism, a lot of research activities are needed to be carried out to give satisfactory explanations for the phenomena, but the newly findings about the magnetic field effects on the biological and living systems are influences of the magnetic fields on properties of the biological liquid crystals and ionic motion **Hinton PR, (2004).**

Pulsed electromagnetic field therapy (PEMFT) is a physical therapy modality that has been widely used for increasing permeability of the cell membrane and blood circulation, increasing oxygen supply, increasing ATP production, stimulating healing process and epithelialization of the injured tissues, accelerating bone healing, improving fibroblastic as well as osteoblastic activities, plus its anti-inflammatory and analgesic effect **Jerry IJ, Roger GW and Larry CK. (2001).**

Bio magnetism is the relation between magnetism and biology, is usually associated with the effect of an external magnetic field on living organisms or parts of them. The action of a magnetic field causes either intensified growth of living organisms or a slow-down of their activities or even death. Magnetic field changes the properties of circuits, even if there is no current passing through it. This applies to liquid crystalline circuits. Liquid crystals are present in every cell; they change their properties under the effect of the magnetic field. They are compounds whose form neither a liquid nor a crystal but transitional form between liquid and crystals **Kathleen BA, Christopher DI, and John SO. (2001).**

MATERIAL AND METHODS:

SUBJECTS:

They were picked under accompanying standards:

Comprehensive standards:

-The patients' ages went from 25 to 40 years.

-Patients who had post-herpetic sciatic nerve.

-All were cognizant. Selective measures:

They were inspected by dermatologist or potentially nervous system specialist review who prohibited from this study were accompanying:

-Patients who were diabetic or hypertensive.

-Patients those acquainted with PEMFT.

- with discharge, especially stomach related framework drain rectum dying.

- with extreme contagious diseases viral contaminations.

-Patients with dynamic tuberculosis cancers as well as those with peacemakers.

This study was carried out on thirty patients who had post-herpetic neuralgia of the sciatic nerve were participated in the study. They recruited from the dermatology and neurology departments of Cairo University Hospitals. Their ages ranged from 25 to 40 years. They were randomly divided into 2 equal groups in number, 2 study groups (A) and (B). Group A This group included 15 patients who received the traditional physical therapy treatment plus programme (1) of strong impulses, stimulating South polarity of the magnetic pulses with frequency Fluently changing from 12.5-50 Hz, with buttons 1,3 and 6 up while buttons 2,4 and 5 down. Group B: Study group (B): This group included 15 patients who received the traditional physical therapy treatment plus the PEMFT second programe programme (2) of mild impulses, soothing North polarity of the magnetic pulses with frequency of 12.5Hz with buttons 1,2,4 and 5 down while buttons 3 and 6 up.

Instrumentation:

In this study the measuring equipment were, the Visual Analogue Scale (VAS) and Estimation of the Carbamazepin Intake (CMI) Leisner SH, Shahar RS and Levin HK. (2002).

Procedures:

Evaluation:

Measurement procedures:

Methods of evaluation (Measurement of the visual analogue scale (VAS) and estimation of the Carbamazepin Intake (CMI):

1- Visual Analogue Scale (VAS):

The pain level was assessed by visual analogue scale (VAS) before starting treatment (first record) then after 2 months (as second final record). The visual analogue scale (VAS) consisted of a line, usually 10 cm long, whose ends are labeled as the extremes of pain (e.g., no pain to unbearable pain). Patient was asked to place a mark at the point on the line which best represent his or her experience of pain between two "no pain" to "worst pain", then the operator measured the distance from the zero "no pain" in centimeters **Coce FA, Korsic MM and Martinac MA. (2003).**

2-Estimation of the Carbamazepin Intake: (CMI): it was used to evaluate the improvement in the post-herpetic neuralgia of the sciatic nerve. All the aforementioned parameters (VAS and the CMI) were measured 2 times; the baseline record that was taken before starting of the study, the second record was taken after 2 months from the starting of the study **Kathleen BA, Christopher DI, and John SO. (2001).**

- **Treatment procedures:** In this study the treatment protocol was presented under the following: Patients were given information about the measurement and treatment procedures as well as about the PEMFT device before the beginning of the treatment. All patients in the 2 groups (A) and (B) received the same traditional physical therapy in the form of 10 minutes infrared irradiation for the gluteal and hamstring regions, 5 minutes effleurage for the same previous regions and 5 minutes stretching exercises for the hamstring. Also all patients received the same medical care and medications.

Procedures of the PEMFT (JAMAVA apparatus) for the study groups (A)&(B): Active surface of the JAMAVA apparatus: at L5-S1 (errectro-spinae motor point) level paravertebrally for 5 minutes. Then the active surface of the JAMAVA apparatus: on the tender buttock, upper motor point of gluteus maximums for another 5 minutes. **Frederick DT, Nepola JZ and Baker Jl. (2000)**. Then active surface of the JAMAVA apparatus: at the midpoint between ischial tuberosity and greater trochanter at level of buttock and posterior upper thigh for 5 minutes, and finally the active surface of the JAMAVA apparatus: just superior to popliteal crease for another 5 minutes. The active surface of the JAMAVA apparatus was fixed directly over the aforementioned 4 points by adhesive tapes or the therapist hand, also active surface of the JAMAVA apparatus was covered with disposable Cling's film to avoid cross contamination among patients **Prochazka MS. (2002).**

Data analysis:

VAS and CMI, were measured pre-treatment as a first record and after two months intervention as a second final record in both groups. Collected data were fed into computer for the statistical analysis; descriptive statistics as mean, mean differences, standard deviation, minimum and maximum were calculated for each group. The t-test was done to compare means within each group. Alpha point of 0.05 was used as a level of significance.

RESULTS

As shown in table (1) and figure (1), the mean value of the of the VAS in degrees before treatment was (8.942 ± 0.499) in the Strong impulses PEMFT group, while after treatment was (3.400 ± 0.541) degrees. These results revealed a highly significant decrease ($P < 0.0001$). While in the Mild impulses PEMFT group, the mean value of the VAS in degrees before treatment was (8.877 ± 0.418) degrees, while after treatment was (2.700 ± 0.501) degrees. These results revealed also a highly significant decrease in the VAS in degrees ($P <0.0001$).

Table (1): Comparison of the mean values of the of the VAS in degrees before and after treatment in the two groups

	Before		**After**		**Mean difference**	**T-**	**P.value**	**Level of significance**
	Mean	SD	Mean	SD				
Strong impulses PEMFT Group	8.942	0.499	3.400	0.541	5.54200	29.16	0.0001	Highly significant decrease
Mild impulses PEMFT Group	8.877	0.418	2.700	0.501	6.17700	36.67	0.0001	Highly significant decrease

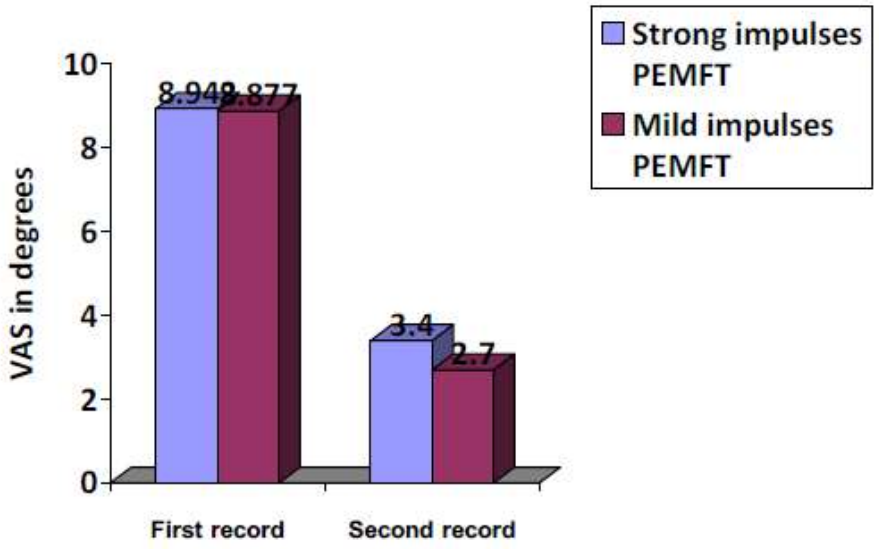

Fig (1): Mean values of the of the VAS in degrees before and after treatment in the two groups.

As shown in table (2) and figure (2), the mean value of the CMI in mg before treatment was (1050.0 ± 155.1) in the strong impulses PEMFT group, while after treatment was (450.0 ± 154.9) mg. These results revealed a highly significant decrease, (P > 0.0001), while in the mild impulses PEMFT group, the mean value of the CMI in mg before treatment was (1040.0 ± 152.2) mg, but after treatment was (400.0 ± 66.1) mg, these results also revealed a highly significant reduction in the CMI in mg (P < 0.0001).Mean difference within the strong impulses PEMFT group was (5.542) while mean difference within the mild impulses PEMFT group was (6.177).

Table (2): Comparison of the mean values of the 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				
Strong impulses PEMFT Group	1050.0	155.1	450.0	154.9	600.000	14.98	0.0001	Highly significant decrease
Mild impulses PEMFT Group	1040.0	152.2	400.0	66.1	640.000	14.94	0.0001	Highly significant decrease

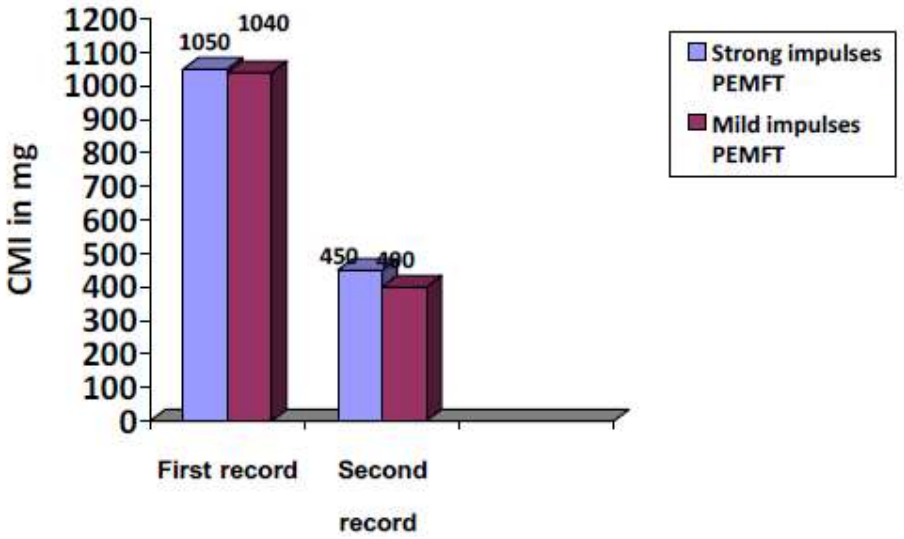

Fig (2): Mean values of the CMI in mg of the 2 records in both groups.

Discussion:

Derry et al., 2014 mentioned that postherpetic 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, while there is no agreed definition of what constitutes PHN, current research tends to define the condition as pain persisting 3 months after zoster rash onset. In addition, some studies require that pain should be 'significant'; for example, scoring >3 on a 0-10 scale, where 0 = no pain and 10 = worst imaginable pain. The majority of patients with PHN describe characteristic patterns of pain, often consisting of at least two of the following: (i) spontaneous, constant, deep burning, throbbing, aching pain; (ii) intermittent sharp, stabbing, shooting, lancinating pain, which may also be spontaneous; and (iii) evoked allodynia that usually lasts well beyond the duration of the stimulus (hyperpathia). Allodynia, which is present in at least 70% of PHN patients, is often described as the most distressing and debilitating component of PHN. Identified risk factors for PHN include advancing age, greater acute pain, severe rash, prodromal pain, ophthalmic location and possibly female sex.

Campbell et al., 2002 revealed that PHN is one of the most painful syndromes seen in a pain practice. Its diagnosis is based mainly on the clinical presentation, course, temporal relationship of pain to acute zoster, and the physical examination. The clinical presentation of PHN is variable, and no two individuals experience identical symptoms. Patients may describe their pain as burning, deeply aching, tearing, electric shock-like, lancinating, itching, and/or stabbing. The pain in PHN can be either spontaneous or stimulus-evoked. Some patients also report abnormal sensations in affected dermatomes, including allodynia and/or hyperpathia. Dysesthesia such as a crawling sensation may also be described. Sensory function may remain intact or may be lost in a dermatomal pattern. Mechanical allodynia to light touch is very common, heat hyperalgesia may be present in some patients, and cold hyperalgesia is rare. Patients may have distinct sensory symptoms and findings, which can coexist in all combinations. Response to therapy also shows significant inhomogeneity. This variability results from damage to a variety of neurological pathways.

Plan review: In this review, were doled out into 2 equivalent gatherings in number, 15 for each gathering: Group

This gathering included 15 who got customary exercise based recuperation treatment in addition to program (1) solid motivations, invigorating South extremity attractive heartbeats with recurrence fluently changing from 12.5-50 Hz, with buttons 1,3 6 up while buttons 2,4 5 down. While Group B: Study bunch (B): This gathering included 15 who got conventional active recuperation treatment in addition to PEMFT second program (2) gentle motivations, calming North extremity attractive heartbeats with recurrence 12.5Hz with buttons 1,2,4 5 down while closes 3 6 up.

Devor, 2017 mentioned that 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. Allodynia may be remarkable in some cases or absent in others. 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. Pain, unlike most other sensory modalities, has an essential function in survival. 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.

Alster and Manni, 2008 revealed that sciatica neuralgia, or Sciatica, is a common medical condition in which there is a disruption in the function of the sciatic nerve, typically due to inflammation or compression of the nerve. The sciatic nerve is a peripheral nerve bundle, which arises from the lower lumbar and sacral nerve roots, and runs through the pelvis, and into the back of the legs. The sciatic nerve is responsible for carrying sensory and motor signals to and from the muscles of the thigh and lower legs.

The findings of the present study showed that there was a highly significant decrease between the means of the second record VAS (2) and the first record VAS (1) ($P < 0.0001$) in both groups.

Findings of the present study showed that there was there was a highly significant decrease between the means of the second record CMI (2) (after two months of the Strong impulses PEMFT application) and the first record CMI (1) (pre- application of the Strong impulses PEMFT) ($P< 0.0001$).

The results of this study indicated that there was a highly significant decrease in CMI between means of the CMI (2) and CMI (1), in the second experimental group (application of the mild impulses PEMFT) (P<0.0001).

The significant differences within the Strong impulses PEMFT group (A) and the Mild impulses PEMFT group (B), which were in the form of a highly significant decreases in the VAS and CMI, were consistent with those observed and recorded by Aaron et al., 2004; Alfano, 2001; Campbell et al., 2002; Chen et al., 2010; Colbert, 2008; Derry et al., 2014; Devor, 2009, 2013&2017; Eccles, 2006; Funk, 2009; Gaston, 2006; Hannemann, 2011; Hazlewood and Markov, 2009; Markov, 2007; and Rosen, 2010.

Results of this study support the expectation that application of both the strong impulses, stimulating South polarity of the magnetic pulses and the mild impulses, soothing North polarity of the magnetic pulses on post-herpetic neuralgia of the sciatic nerve had a valuable effects as manifested by the highly significant decreases in VAS and CMI. Compare the mean differences between two groups reflected more beneficial effects in favor to the mild impulses, soothing North polarity of the magnetic pulses.

Conclusion:

Application of both the strong impulses, stimulating South polarity of the magnetic pulses and the mild impulses, soothing North polarity of the magnetic pulses on post-herpetic neuralgia of the sciatic nerve had a valuable effects as manifested by the highly significant decreases in VAS and CMI. But the mild impulses, soothing North polarity of the magnetic pulses was more beneficial than the strong impulses, stimulating South polarity of the magnetic pulses.

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