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Effect of LowLevel Laser Therapy on Pain and Functional activity in Patient with Chronic Compression of the Dorsal Root Ganglion: A randomized control trial

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Abstract--*Damage to or irritation of the Dorsal Root Ganglion can lead to intractable symptoms of neuropathic pain that do not respond to typical treatments. This can lead to additional complications in the form of impairment in functioning for the individual .this study was the first study which used the non invasive technique modalities, it was designed and conducted in kasr el ini hospital Cairo university from may 2017 to may 2019, to evaluate and compare between the effect of (LLLT), (TENS) and (US) therapy related to pain relief, range of motion and restoring functional activity for the patients with chronic compression of dorsal root ganglion in retrospective comparative study. a total number of 40 patients suffer from pain related to chronic compression of dorsal root ganglion in the lumbar region for more 3 months, their ages ranged from(40-65) years, They were randomly assigned in forth equal groups with (10) patients in each group. All were received therapeutic exercises for one month three times per week day after other day (12 sessions) in addition to The first group were received (TENS) frequencies from (10- 20 HZ) according the individual sensation for each patient not more to avoid motor contraction. The second group was received LLLT (GaAs) 808 nm 15 joules .The third group was received LLLT (diode) 632 nm 15 joules. The fourth group was received (US) .The pain severity was assessed by visual analog scale ,range of motions for surrounded joints was evaluated by universal goniometry and improvement in motion and activity daily life was evaluated by patient-specific function scale (PSFS): Fl, F2, and F3. Patient's improvement was followed-up during 1-3 months. The data showed that there was significance difference for Comparison pre and post treatment for each function in each group Pre and post treatment for flexion range, extension range ,leg raising ,standing side bending ,walking ,upstairs: at (P value significant if < 0.05), the study shows significance results for all groups with different modalities at the p value 0.0001. For VAS assessment in the all groups show there was significance difference in pain intensity but there was significance difference in between groups. In comparison between the four modalities of treatment (TENS-LASER1-LASER2-US) results showed that the tens therapy was the best modalities of treatment followed by the laser1 (gallium 808) followed by the laser 2 (diode laser632) followed by the ultrasound modalities. Some cases needed more 12 sittings to achieve full recovery and some cases complained from recurrence of pain after 3 months whose needs*

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for follow up and application more sittings. This results indicate that the non invasive modalities of treatment were used improved the complains from dorsal root ganglion compression.

***Key words**--Dorsal root ganglion compression; Laser; tens; ultrasound..*

I. INTRODUCTION

Lower back pain with sciatica is a common symptom associated with many diseases of the lumbosacral spine, such as herniated intervertebral disc and degenerative disc diseases, can result in functional disability. One of the major causes of this symptom is a narrowing of the intervertebral foramen accompanied by compression of the dorsal root ganglion (DRG) **(Rydevik et al,. 1989**). The DRG is unique in that it has bi-directional afferent branches that extend both to the periphery and into the spinal cord. The DRG is vulnerable to a variety of injuries, including direct compression and traction **(Gilchrist et al,. 2002).**

The basic peripheral nervous system components consist of a cell body located in either the anterior horn (motor) or the dorsal root ganglia (sensory) of the spinal cord and a long extension (axon) covered in a chain-like series of cells known as Schwann cells; these produce myelinated nerve fibers**.(Abram et al ,.2006).**

Dorsal Root Ganglion is a bundle of nerve cell bodies (i.e., a ganglion) located within the posterior region of various vertebrae along the spinal column and is adjacent to the dorsal nerve root. The primary function of DRG is to transmit information regarding sensory function. As such, DRG carries sensory neural signals from the peripheral nervous system to the central nervous system, which includes the spinal cord and brain. **(Abram et al ,.2006**)

One of the major causes of pain in degenerative lumbar spinal disease is mechanical compression of the DRG, which can lead to molecular-based irritation involving the localized release of inflammatory cytokines **(Schaeffer et al,. 2010**). Two of the primary cytokines responsible for the hyperalgesia observed in lumbar spinal diseases are tumor necrosis factor alpha (TNF-α) and interleukin-1 beta (IL-1β) **(De Souza et al,. 2012**). It has been demonstrated that herniated disc tissues release IL-1β, which affects the somatosensory neural response at the dorsal root level **(Ozaktay et al,. 2002**). Previous studies have also shown that TNF-α in the nucleus pulposus plays an important role in radicular pain and that sensory neurons display increased sensitivity to TNF-α in a rat CCD model (**Yamashita et al,. 2008), (Liu et al,. 2002**).

Localized treatment of mechanically compressed DRG – for example, using corticosteroids, lidocaine or a TNF-α antagonist – has been shown to reduce mechanical allodynia and thermal hyperalgesia and attenuate pain-related behaviors **(Zhang et al,. 2000**)–(**Watanabe et al,. 2011].** However, localized spinal injections are considered an invasive procedure.

Damage to or irritation of the DRG can lead to intractable symptoms of neuropathic pain that do not respond to typical treatments. This can lead to additional complications in the form of impairment of functioning for the patient. In these cases, more interventional approaches may be warranted, such as spinal cord stimulation or dorsal root ganglion stimulation. (**Sapunar et al,. 2012**).

DRG stimulation has received approval from the FDA as an effective treatment for some types of chronic pain conditions, including complex regional pain syndrome. (**Schu et al,. 2015**).

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By applying stimulation to the specific region of the DRG that is responsible for the pain, the result is much more effective pain relief, with less stimulation of the neural network in general. Thus, individuals are able to successfully feel relief from their debilitating symptoms of chronic pain, with less impact on surrounding areas (**Schu et al,. 2015).**

Passive modalities such as heat, cold, laser (LLLT), transcutaneous electrical nerve stimulation (TENS), and ultrasound may provide transient analgesia and increased soft tissue flexibility in LSS patients **(Doyle At et al,. 2016) .**

The treatment aims, is to relief pain, maintains ranges of motion, prevents contractures, preserve functions, increases muscle strength, controls symptoms, prevents disease progression, minimizes disability and improve quality of life

Therefore, the objective of the current study is to investigate the non invasive modalities and compare between the effect of (LLLT), (TENS) and (US) therapy related to pain relief, range of motion and restoring functional activity for the patients with chronic compression of dorsal root ganglion **as** alternative methods of treatment for the traditional invasive methods.

II. MATERIAL AND METHODS

A total number of 40 patients suffer from pain related to chronic compression of dorsal root ganglion in the lumbar region for more 3 months, their ages ranged from(40-65) years, They were randomly assigned in forth equal groups with (10) patients in each group. Each group were received therapeutic **exercise as a form of** gentle strengthening exercises for stomach, back, and legs (**Mosby'2009).**,. Stretching exercises **as a form of exercise restore range of** motion imparted to a part by voluntary contraction and relaxation of its controlling muscles-(Hayden et al,.2005).

In addition to therapeutic exercises **The first group** were received (TENS) frequencies from (10- 20 HZ) according the individual sensation for each patient not more to avoid motor contraction, for one month three times per week day after other day (12 sessions) **.**

The second group were received LLLT (GaAs) 808 nm 15 joules for one month three times per week day after other day (12 sessions**). The third group** were received LLLT (diode) 632 nm 15 joules for one month 3 times per week day after other day (12 sessions**) The fourth group** were received (US) by using on un-modulated continuous wave US beam, with intensities limited to 0.5-2.5 W/cm2. For one month three times per week day after other day (12 sessions).

Treatment procedure: Patients would voluntary give their informed consent after the procedure would be fully explained. Questions in regard to their past medical history, their ability to follow up the sittings regularly and avoiding any performance that alter the results of the study would be asked. The tests to be obtained would be explained to the patients in detail.

The instrumentations would be used:

--The light source induces LLL irradiation was a **Ga-Al-As laser** with a wavelength of **808±5 nm** and a **power of ≦300 mW** (TRANSVERSE IND. CO., LTD., Taipei, Taiwan).

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--The other light source induce LLL irradiation was **diode laser** with a wavelength of **632±5** nm (TRANSVERSE IND. CO., LTD., Taipei, Taiwan).The device has the following treatment option: frequency from(1to 10.000) HZ, wavelength (630~980) nm, intensity up to 20 joules, and pulse duration from (50--200 m/sec). The device was adjusted to produce intensity of 9 joules. Safety glasses, was used for both researcher and patients to protect their eyes from laser radiation.

-- (TENS) device. Model: BM-1004 α-wave Healthtronic.china.
-- (US) device. Model (**CSL-1**), Power (**90VA**) and Operative frequency (**800KHZ →1 MHR±5%**) (XIANGSHUI China-Fada Medical Apparatus Factory).

After 12 sittings (1 month) the assessment procedure was by using the following:

Universal goniometry; an instrument used to measure angles, particularly range-of-motion for joints.(**Farlex, 2012**)in this study, the hip joint flexion and extension ranges, the spine bending anterior, posterior and side bending will measured by using universal goniometry

Visual Analogue Scale (VAS):

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 (**Gould et al,. 2001**).it would be used to measure the intensity of pain, pre and post treatment .It is a vertical or horizontal 10 cm line, graduated by different levels of pain, starting from (o)(no pain) to (10) (worst pain) . Each patient, was asked to mark, and score on the line at the point, that representing his or her intensity of pain, before starting the first session, and after the end of the treatment**.**

Function: by patient-specific function scale (PSFS): Fl, F2, and F3:

The Patient-Specific Functional Scale (PSFS) is a self-reported, patient-specific measure, designed to assess functional change, primarily in patients presenting with musculoskeletal disorders. The scale was developed by Stratford and colleagues as a self-report measure of function that could be used in patients with varying levels of independence. Their original description states, "Patients are asked to identify up to five important activities they are unable to perform or are having difficulty with as a result of the problem (Stratford PW **(1995**) it is used pre and post treatment**.**

Statistical Analysis: Results was expressed as mean ± stander deviation (SD), Comparison between the mean values of results, by using paired student test, Statistical computer program; it was used for data analysis, level of significance at P value 0.05

III. RESULTS

Analysis of the **results with paired Samples Statistics show**:

In comparison of flexion (pre-post) the result showed that:

In the Tens group: the mean flex pre and post treatment was (1.43→122.71) showing significance differences at p value=0.0001***, in Laser1 group the mean flex pre and post treatment was (.00→106.11) showing significance differences at p value=0.0001, In Laser2 group the mean flex pre and post treatment was

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(.00→87.86) showing significance differences at p value=0.0001and In Ultrasound group the mean flex pre and post treatment was (..00→79.90) showing significance differences at p value=0.0001.(table 1)

Table 1 show comparison of flexion (pre-post) results

Mean			Std. Deviation	Std. Error Mean	P Value
TENS	flexion pre	1.43	2.344	.626	0.0001
	flexion Post	122.71	18.189	4.861	
Laser1	Laser 1 flexion pre	.00	.000	.000	0.0001
	flexion Post	106.11	13.411	4.470	
Laser2	flexion pre	.00	.000	.000	0.0001
	flexion Post	87.86	8.092	3.058	
Ultrasound	flexion pre	.00	.000	.000	0.0001
	flexion Post	79.90	8.825	2.791	

In comparison of Extension (pre-post) the result showed that:

In the Tens group the mean Ext pre and post treatment was (2.14→38. 393) showing significance differences at p value=0.0001, In Laser1 group the mean Ext pre and post treatment was (00→33.89) showing significance differences at p value=0.0001, In Laser2 group the mean Ext pre and post treatment was (..00→31.00) showing significance differences at p value=0.0001,and In Ultrasound group the mean Ext pre and post treatment was (00→29.70) showing significance differences at p value=0.0001(table 2).

Table 2 show comparison of Extension (pre-post) results

Mean	Std. Deviation	Std. Error Mean	P Value	
Tens extension pre	2.14	2.568	.686	0.0001
extension Post	38. 393	2.129	.569	
Laser1 extension pre	.00	.000	.000	0.0001
extension Post	33.89	6.009	2.003	
Laser2 extension pre	.00	.000	.000	0.0001
extension Post	31.00	5.657	2.138	
Ultrasoundextension pre	.00	.000	.000	0.0001
extension Post	29.70	4.832	1.528	

In comparison of leg raising (pre-post) the result showed that:

In the Tens group the mean leg raising pre and post treatment was (.00→41.43) showing significance differences at p value=0.0001, In Laser1 group the mean leg raising pre and post treatment was (.00→34.11) showing significance differences at p value=0.0001, In Laser2 group the mean leg raising pre and post treatment

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was (..00→30.71) showing significance differences at p value=0.0001, and In Ultrasound group the mean leg raising pre treatment was (.00→31.50) showing significance differences at p value=0.0001.(table 3).

Table 3 Show comparison of leg raising (pre-post) results

Mean	Std. Deviation	Std. Error Mean	P Value	
Tens leg raising pre	.00	.000	.000	0.0001
leg raising Post	41.43	3.056	.817	
Laser1 leg raising pre	.00	.000	.000	0.0001
leg raising Post	34.11	8.115	2.705	
Laser2 leg raising pre	.00	.000	.000	0.0001
leg raising Post	30.71	3.147	1.190	
Ultrasound leg raising pre	.00	.000	.000	0.0001
leg raising Post	31.50	4.577	1.447	

In comparison of standing (pre-post) the result showed that:

In the Tens group the mean standing pre and post treatment was (.43→8.50) showing significance differences at p value=0.0001, In Laser1 group the mean standing pre and post treatment was (..44→7.22) showing significance differences at p value=0.0001, In Laser2 group the mean standing pre and post treatment was (.00→5.86) showing significance differences at p value=0.0001, and In Ultrasound group the mean standing pre and post treatment was (.40→7.50) showing significance differences at p value=0.0001.(table 4).

Table 4 Show comparison of standing (pre-post) results

Mean		Std. Deviation	Std. Error Mean	P Value
Tens standing pre	.43	.514	.137	0.0001
standing Post	8.50	1.225	.327	
Laser1 standing pre	.44	.527	.176	0.0001
standing Post	7.22	1.563	.521	
Laser2 standing pre	.00	.000	.000	0.0001
standing Post	5.86	1.574	.595	
US standing pre	.40	.516	.163	0.0001
standing Post	7.50	1.509	.477	

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In comparison of bending **(pre-post) the result showed that:**

In the Tens group the mean bending pre and post treatment was (.36→7.64) showing significance differences at p value=0.0001, In Laser1 group the mean bending pre and post treatment was (.33→7.00) showing significance differences at p value=0.0001, In Laser2 group the mean bending pre and post treatment was (.33→5.14) showing significance differences at p value=0.0001,and In Ultrasound group the mean bending pre and post treatment was (.20→7.80) showing significance differences at p value=0.0001.(table 5).

Table 5 Show comparison of bending (pre-post) results

	Mean	Std. Deviation	Std. Error Mean	P Value
Tens bending pre	.36	.497	.133	0.0001
bending Post	7.64	1.781	.476	
Laser1 bending pre	.33	.707	.236	0.0001
bending Post	7.00	2.828	.943	
Laser2 bending pre	.00	.000	.000	0.0001
bending Post	5.14	1.952	.738	
Us bending pre	.20	.632	.200	0.0001
bending Post	7.80	1.619	.512	

In comparison of walking (pre-post) the result showed that:

In the Tens group the mean walking pre and post treatment was (.07→8.86) showing significance differences at p value=0.0001, In Laser1 group the mean walking pre and post treatment was (.11→7.78) showing significance differences at p value=0.0001, In Laser2 group the mean walking pre and post treatment was (.14→6.86) showing significance differences at p value=0.0001, and In Ultrasound group the mean walking pre treatment was (.10→8.60) showing significance differences at p value=0.0001.(table 6).

Table 6 Show comparison of walking (pre-post) results

	Mean	Std. Deviation	Std. Error Mean	P Value
Tens walking pre	.07	.267	.071	0.0001
walking Post	8.86	1.406	.376	
Laser1 walking pre	.11	.333	.111	0.0001
walking Post	7.78	1.856	.619	
Laser2 walking pre	.14	.378	.143	0.0001
walking Post	6.86	.900	.340	
Us walking pre	.10	.316	.100	0.0001
walking Post	8.60	1.578	.499	

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In comparison of upstairs (pre-post) the result showed that:

In the Tens group the mean upstairs pre and post treatment was (.50→7.57 showing significance differences at p value=0.0001, In Laser1 group the mean upstairs pre and post treatment was (.11→6.78) showing significance differences at p value=0.0001, In Laser2 group the mean upstairs pre and post treatment was (.00→5.29) showing significance differences at p value=0.0001, and In Ultrasound group the mean upstairs pre treatment was (.30→8.20) showing significance differences at p value=0.0001.(table 7).

Table 7 Show comparison of upstairs (pre-post) results

Mean		Std. Deviation	Std. Error Mean	P Value
Terns upstairs pre	.50	.650	.174	0.0001
upstairs Post	7.57	1.222	.327	
Laser1 upstairs pre	.11	.333	.111	0.0001
upstairs Post	6.78	1.856	.619	
Laser2 upstairs pre	.00	.000	.000	0.0001
upstairs Post	5.29	.951	.360	
Us upstairs pre	.30	.483	.153	0.0001
upstairs Post	8.20	1.135	.359	

ANOVA; test was done to compare between all study groups at post treatment.(table 8).

Table 8 show comparison effect after treatment modalities

Comparison the effect of after treatment modalities on the studied parameters										
		flexion post	**extension post**	**leg raising post**	**ESR POS**	**CRP POS**	**upstairs post**	**standing post**	**bending post**	**walking post**
TENS	Mean	122.71	38.93	41.43	27.14	3.000	7.57	8.50	7.64	8.86
	SD	18.189	2.129	3.056	5.216	.5189	1.222	1.225	1.781	1.406
Laser1	Mean	106.11	33.89	34.11	32.78	3.500	6.78	7.22	7.00	7.78
	SD	13.411	6.009	8.115	4.410	.5000	1.856	1.563	2.828	1.856
Laser2	Mean	87.86	31.00	30.71	32.86	3.857	5.29	5.86	5.14	6.86
	SD	8.092	5.657	3.147	6.362	.4756	.951	1.574	1.952	.900
Ultra sound	Mean	79.90	29.70	31.50	40.50	3.900	8.20	7.50	7.80	8.60
	SD	8.825	4.832	4.577	3.689	.6146	1.135	1.509	1.619	1.578
P Value		0.0001	0.0001	0.0001	0.001	0.001	0.001	0.004	0.051	0.033

VAS assessment for all groups:

For VAS assessment in the group tens show that there was significance (10→1.79). ,laser 1 results show that there was significance (10.00→3.56), the group laser 2 results show that there was significance (10.00→4.00) and the group ultrasound results show that there was significance (10.00→4.70).

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Evaluation of VAS scores using repeated measure ANOVA showed TENS as the most significant effect over the other treatment modalities as p = 0.001. See the below figure; it shows next effects following TENS were laser1, laser2 and finally ultrasound respectively.(table 9.fig 1).

Table 9 GLM (Repeated measure ANOVA) (VAS).

Descriptive Statistics													
Type		**V 1**	**V 2**	**V 3**	**V 4**	**V 5**	**V 6**	**V 7**	**V 8**	**V 9**	**V 10**	**V 11**	**V 12**
TENS	Mean	10	8.71	8.14	6.86	6.21	5.36	4.93	4.43	3.86	3.50	3.07	1.79
	SD	.000	.469	1.167	1.292	1.477	1.393	1.269	1.342	1.231	1.345	1.072	.893
Laser 1	Mean	10.00	9.22	8.89	8.44	7.78	7.22	6.78	6.11	5.56	4.78	4.33	3.56
	SD	.000	.667	1.167	1.014	1.202	1.563	1.394	1.537	1.590	1.563	1.414	1.424
Laser 2	Mean	10.00	9.14	9.14	8.71	8.14	7.71	7.57	6.86	6.14	5.71	4.86	4.00
	SD	.000	.378	.378	.756	.900	.756	.787	.900	1.069	.951	.690	.816
Ultra sound	Mean	10.00	9.10	9.10	8.50	8.00	7.50	7.20	6.70	6.50	6.10	5.60	4.70
	SD	.000	.568	.568	.850	.667	.707	.789	.949	.707	.876	.843	.675
Total	Mean	10.00	9.00	8.73	7.95	7.35	6.73	6.38	5.80	5.30	4.83	4.30	3.30
	SD	.000	.555	1.012	1.300	1.406	1.552	1.547	1.588	1.604	1.615	1.436	1.522

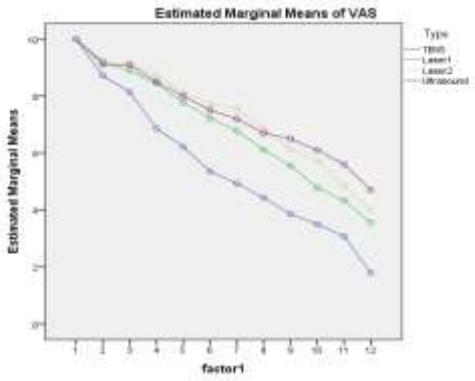

Fig 1 estimated marginal means of VAS.

IV. DISCUSSION

The Aim of this study was to compare between the effect of LLLT, TENS and US therapy related to pain relief, Regaining normal range of motion and restoring functional activity for the patients suffering from CCD as A non invasive modality of therapy.

All the previous studies performed to control pain related to CCD was using the Surgical procedure by implanting an electrode into the nerve root ganglion; and activating the electrode to stimulate the nerve root ganglion which has several risks and disadvantage. (**Schu et al., 2015).**

Passive modalities such as heat, cold, laser, transcutaneous electrical nerve stimulation and ultrasound may provide transient analgesia and increased soft tissue flexibility in LSS patient (Doyle AT et al,. 2016).

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The present study was the first one which avoids the invasive technique for treating the severe pain raised from chronic compression of dorsal root ganglion by using non invasive modalities such as physiotherapy modalities, which applied directly on skin above the root ganglion without any surgical interference or risk.

The application of electrical current through electrodes placed on the skin for pain control. It can be applied with varying frequencies, from low (< 10 Hz) to high (> 50 Hz). Intensity may also be varied from sensory to motor intensities. Sensory intensity is when the patient feels a strong but comfortable sensation without motor contraction. High intensity usually involves a motor contraction but is not painful. (Sluka, **1999)**.

In the present study non invasive Tens technique was used, frequencies from (10- 20 HZ) according the individual sensation for each patient not more to avoid motor contraction .The results showed that there was a statistical significance difference, between pre-treatment and post-treatment, related for improvement in pain intensity, range of motion, and activity daily life, in the group that treated by TENS therapy for one month three time per week. At p value=0.0001. Some of the cases improved complained from pain recurrence after two months no more than 10 percent who needs more sittings afterwards.

Most modern diode lasers use preprogrammed treatment settings that help ensure that adequate numbers of joules of light energy will be irradiated into the patient's tissues. Tasaki found that pain relief was obtained in patients using a GaAlAs laser in the 30 to 80 mW output range.28 Reductions in the size of lumbar disc herniation have been demonstrated by (**Gruzska, Tatsuhide, and others, Abe T,..1989**)

In recent study, to determine the efficacy of laser irradiation compared to lidocaine injection for the dorsal root ganglion of the second lumbar spinal nerve in chronic axial low back pain, Laser irradiation caused an immediate decrease in low back pain post-procedure similar to pain reduction caused by lidocaine injection for chronic back pain. **(Wiley, Lasers Surg, 2016)**.

in The present study non invasive technique was used for the two types of laser, **Ga-Al-As laser** to induce super pulsed infrared laser irradiation with a wavelength of **808±5 nm** and a **power of ≦50 mW** 15 joules/cm2 for one month three times per week day after other day (12 sessions), and **diode laser** to induce super pulsed laser irradiation with a wavelength of **632±5** nm and a **power of ≦50 mW**, 15 joules/cm2 for one month three times per week day after other day (12 sessions). Both are used separately on two groups complained from chronic pain related to chronic compression of root ganglion.

Study show that There was a statistical significance difference, between pre-treatment and post-treatment, related for improvement in pain intensity, range of motion, and activity daily life, in the second group that treated by LLLT (GaAs) 808 nm Laser Therapy. At p value=0.0001.and that There was a statistical significance difference, between pre-treatment and post-treatment, related for improvement in pain intensity, range of motion, and activity daily life, in the third group that treated by LLLT therapy (diode) 632 nm. At p value=0.0001.

In the most present studies, the ultrasound energy from the best methods available to treating a patient with ganglion pain by delivering it epidurally. The ultrasound energy may have a frequency in the range of 20 KHz-2 MHz. which may be delivered from at least one ultrasonic transducer implanted within the patient **(Boston,2013).**

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In one method, the frequency of the ultrasound energy is relatively low (in the range of 20 KHz-100 KHz), thereby heating the DRG. In another method, the frequency of the ultrasound energy is relatively high (greater than 1 MHz), thereby increasing blood flow to the DRG.. **(Boston, 2013).**

Another optional method further comprises delivering ultrasound energy to a central neural axon and/or peripheral neural axon extending from the DRG, thereby modulating the central neural axon and/or peripheral neural axon to treat the pain **(Boston Scientific Neuromodulation Corporation, 2013).**

As the US beam penetrates further into the tissues, a greater proportion of the energy will have been absorbed and therefore there is less energy available to achieve therapeutic effects. As it is difficult, if not impossible to know the thickness of each of these layers in an individual patient, average half value depths are employed for each frequency (1 MHz 4.0 cm3 MHz 2.0 cm), therefore the best recommended frequency for more penetration up to 1 MHZ. (**Leung et al., 2004**).

In The present study non invasive technique was used where US applied in contact on skin directly apove DRG affected,the frequency was used 1 MHZ with intensities ranges to 0.5-2.5 W/cm2 continous mood for treatment of DRG pain and muscle complication for one month three times per week day after other day (12 sessions).the results showed that There was a statistical significance difference, between pre-treatment and post-treatment, related for improvement in pain intensity, range of motion, and activity daily life At p value=0.0001.

In comparison between the four modalities of treatment (TENS-LASER1-LASER2-US) results showed that the tens therapy was the best modalities of treatment followed by the laser1 (gallium 808) followed by the laser 2 (diod laser632) followed by the ultrasound modalities. Some cases needed more 12 sittings to achieve full recovery and some cases complained from recurrence of pain after 3 months whose needs for follow up and application more sittings.

Many of studies assert on the importance of therapeutic exercises when accompanied with therapeutic modalities where it enhance the reliving effect on pain and speed restoring activity daily life, Peripheral stimulation with surface electrodes (TENS) seems to be more effective when associated to exercises. (Bilgili A,et al,. 2016) .

In the present study the use of therapeutic exercises is accompanied with every modalities of treatment which maximize the effect of treatment related to relieving pain and improving the quality of muscles and joints which enable the patient to archive good quality of life.

The results of the present study show good improvement for all function in the four groups treated by the four modalities of therapy but there was important remark that the improvement of the most function were in female than males , it may be due to flexibility of muscles and joints in females more than in males. ***(Rochelle Coleen Tan Dy, 2018*)**

V. CONCLUSION

In general, this study was considered as a guideline for non invasive technique about the effect of transcutanous electrical nerve stimulation (TENS) in proper comparison with laser (gallium arsenide 808 and diode laser 632) and ultrasound in rehabilitation of patients with chronic compression of dorsal root ganglion and joint disability. The results showed that there was a statistical significance difference, between pre-treatment and

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post-treatment, related for improvement in pain intensity, range of motion, and activity daily life, in the all groups. The results showed too that there was a statistical significance difference, between some modalities of treatment over some another where the tense and the laser 808 was the best results over the diode 632 and ultrasound. The results showed too that the therapeutic exercises followed the treatment modalities in sitting have great importance to achieve best results.

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