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Effect of Low Level Laser on sciatic pain

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Abstract: Investigate the effect of low level laser therapy pain in female patients suffering from chronic low back pain with sciatica. 60 female patients with low back pain divided into two equal groups,their age ranges between 30- 45 years. The study group: received LLLT and exercise program. The control group: received placebo LLLT and the same exercise program. The received of laser in the form of low level laser 910nm with energy 8J\cm2 and power density 140mw\cm2 for 15 sessions (3 times per week), from L4-L5 to S2-S3 in lumbo sacral region as well as the gluteal fascia, posterior sacroiliac ligaments, hamstrings and gastro-soleus muscles of which pain points were palpated from the low back to the foot .Laser will be applied 90sec. for each point the session totally will be 20min.Exercise program was performed 3 days per week, for 5 weeks. Data obtained from both groups regarding pressure pain threshold (PPT), and Modified Oswestry Disability Questionnaire (MODQ) revealed a significant difference in pressure pain threshold (PPT) between both groups. There was a significant increase in PPT of study group at post I, post II and post III compared with control group at all measurements and there was a significant decrease in MODQ of study group at post I, post II and post III compared with control group. Low level laser therapy decrease chronic low back pain and improve functional activity quality of life.
Keywords: Back pain, Laser, Algometer, Sciatica.

Introduction

LBP is a common disorder. It affects a large number of people with highly economic and social costs causing considerable musculoskeletal pain. Mostly of the symptoms resolved within 1–3 months and continuous symptoms more than 3 months become chronic pain[1]

Sciatic pain starting from the lower back and radiating down to the posterior or lateral aspect of thigh[2]. Symptoms include pain more in the lower limb than in the back; (e.g., pain, numbness, cold sensation; and pain that is increase with the Valsalva maneuver (e.g., coughing, sneezing, straining) [3].

Low level laser therapy (LLLT) has been used to relieve pain caused by musculoskeletal disorders. Though reduction of inflammatory markers (prostaglandin E_2, interleukin 1ß, tumor necrosis factor,a) increase the speed of recovery from conduction block or inhibit Aδ- and C-fiber transmission [4]increasing blood flow, vascular permeability, and cell metabolism [5]decreased pain and increased mobility in osteoarthritis of. Zygapophyseal joints by[6].

Low level laser therapy Inhibit the neuromuscular junction effects on myofascial pain and trigger points decreases tenderness in trigger points within 15 min of application[7,8].It has the similar effect of celecoxib ,meloxicam**,** diclofenac, and dexamethasone [9,10,11,4,12,13]**.**

Low level laser therapy with wavelength rang from (800 to 900 nm) has higher effect and power to (l00 mw) allow deeper tissue penetration [14].

Lumbar stabilization is reducing back injury due to repetitive motions or sudden movements by improving muscle strength, endurance and flexibility [15].

Material and Method

Subjects:60 female patients with sciatic back pain, divided to two equal groups, study and control groups. In the study group age, weight, height, and BMI ranges were 38.4 ± 3.28 years, 75.26 ± 4.85 kg, 162.73 ± 4.15 cm, and 28.4 ± 1.12 kg/m² respectively. In the control group age, weight, height, and BMI ranges were 37.73 ± 3.89 years, 77 ± 4.11 kg, 164 ± 5.79 cm, and 28.64 ± 1.17 kg/m² respectively. The study group: received LLLT and exercise program and The control group: received placebo LLLT and the same exercise program low level laser 910nm with energy 8J\cm2 and power density 140mw\cm2 for 15 sessions (3 times per week), from L4-L5 to S2-S3 in lumbo sacral region as well as the gluteal fascia, posterior sacroiliac ligaments, hamstrings and gastro-soleus muscles of which pain points were palpated from the low back to the foot .Laser will be applied 90sec. for each point. The session totally will be 20min.Exercise program was performed 3 days per week, for 5 weeks

Evaluation:

1. Analogue algometer (The Baseline ® Hydraulic Push-Pull Dynamometer) was used to evaluate pressure pain threshold (PPT)
2. Assessment of quality of life by questionnaire before and after treatment using Modified Oswestry Disability Questionnaire (MODQ).

Treatment Procedure:

1-Low level laser therapy (LLLT):Gallium arsenide (Ga As) (Model: LUMIX 2 HFPL Fisioline, Italy), With 910 nm was used for 20 min for 15 session paravertebral and on the trigger points from L4-L5 to S2-S3 in lumbo sacral regionas well as the gluteal fascia, posterior sacroiliac ligaments, hamstrings and gastro-soleus muscles of which pain points were palpated from the low back to the foot Laser will be applied 90sec. for each point the session totally will be 20min

2-Exercise program: Each exercise session lasted within 60 minutes and was performed 3 days per week, for 5 weeks. The physical therapist gave detailed verbal explanation and visual instructions. The final static position was held for 10 seconds, and each exercise was performed for 10 repetitions. There was a pause of 3 seconds between repetitions and a 60-second rest between each exercise. Exercise intensity (holding time and number of repetitions) was increased gradually, based on the tolerance of each patient.

Results

Data obtained from both groups regarding pressure pain threshold (PPT), and Modified Oswestry Disability Questionnaire (MODQ) pretreatment, at the end of 2nd week (post I), at the end of 5th week of treatment (Post II), and at one month after treatment as follow up (Post III) were statistically analyzed and compared.

Pretreatment mean values of PPT of both groups (study and control):

The mean ± SD PPT pretreatment of study group was 7.76 ± 1.97 kg/m² and that of control group was 7.8 ± 2.53 kg/m². The mean difference between both groups was -0.04 kg/m². There was no significant difference in the mean values of PPT between group A and B pretreatment (p = 0.94). (Table 1 & figure 1).

Table 1: T test for comparison between pretreatment mean values of PPT of study and control groups:

	PPT (kg/m²)	MD	t- value	p-value	Sig
	$\overline{X}$ ±SD				
Study group	7.76 ± 1.97	-0.04	-0.06	0.94	**NS**
Control group	7.8 ± 2.53				

$\overline{X}$ **: Mean** **MD : Mean difference** **p value : Probability value**

SD : Standard deviation **t value : Unpaired t value** **NS : Non significant**

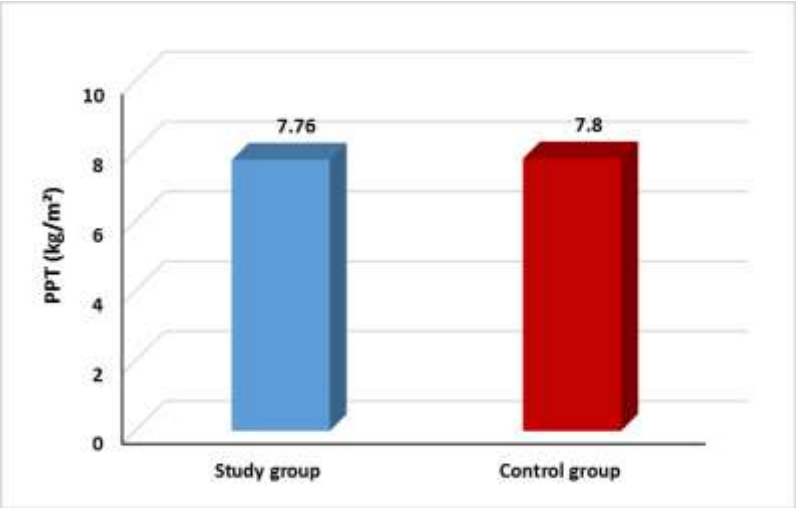

Fig.1: Pretreatment mean values of PPT of study and control groups.

Pretreatment mean values of MODQ of both groups (study and control):

The mean ± SD MODQ pretreatment of study group was 32 ± 2.91 and that of control group was 32.46 ± 1.87. The mean difference between both groups was -0.46. There was no significant difference in the mean values of MODQ between group A and B pretreatment (p = 0.46). (Table 2 & figure 2).

Table 2:T test for comparison between pretreatment mean values of MODQ of study and control groups:

	MODQ	MD	t- value	p-value	Sig
	$\overline{X}$ ±SD				
Study group	32 ± 2.91	-0.46	-0.73	0.46	**NS**
Control group	32.46 ± 1.87				

$\overline{X}$ **: Mean** **MD : Mean difference** **p value : Probability value**

SD : Standard deviation **t value : Unpaired t value** **NS : Non significant**

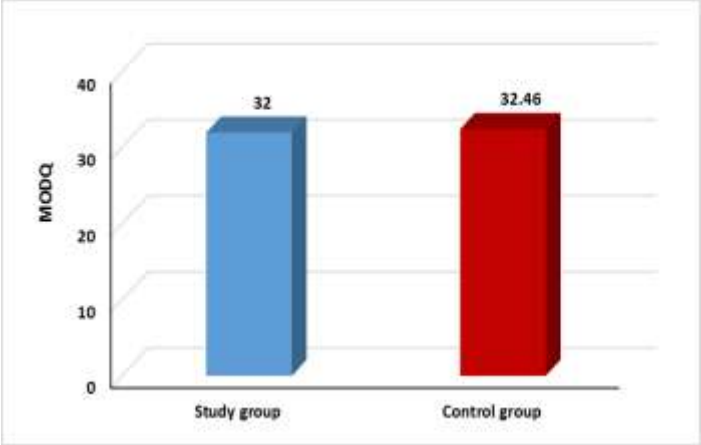

Fig. 2: Pretreatment mean values of MODQ of study and control groups.

Post treatment mean values of PPT of both groups (study and control):

The mean ± SD PPT of study group at post I was 12.56 ± 4.89 kg/m²and that of control group was 10.13 ± 3.09 kg/m². The mean difference between both groups was 3.43 kg/m². There was a significant increase in PPT of study group at post I compared with control group (p = 0.002). (Table 3& figure 3).

The mean ± SD PPT of study group at post II was 20.06 ± 4.77 kg/m²and that of control group were14.7 ± 2.65 kg/m². The mean difference between both groups was 5.36 kg/m². There was a significant increase in PPT of study group at post II compared with control group (p = 0.0001). (Table 3& figure 3).

The mean ± SD PPT of study group at post III was 19.8 ± 4.51kg/m²and that of control group were12.9 ± 3.89 kg/m². The mean difference between both groups was 6.9 kg/m². There was a significant increase in PPT of study group at post III compared with control group (p = 0.0001). (Table 3& figure 3).

Table 3: T test for comparison between post treatments mean values of PPT of study and control groups:

	PPT (kg/m²)		**MD**	**t- value**	**p-value**	**Sig**
	$\overline{X}$ **±SD**					
	Study group	**Control group**				
Post I	13.56 ± 4.89	10.13 ± 3.09	3.43	3.24	0.002	**S**
	20.06 ± 4.77	14.7 ± 2.65	5.36	5.38	0.0001	**S**
Post II	19.8 ± 4.51	12.9 ± 3.89	6.9	6.33	0.0001	**S**

$\overline{X}$	**: Mean**	**MD**	**: Mean difference**	**p value**	**: Probability value**
SD	**: Standard deviation**	**t value**	**: Unpaired t value**	**S**	**: Significant**

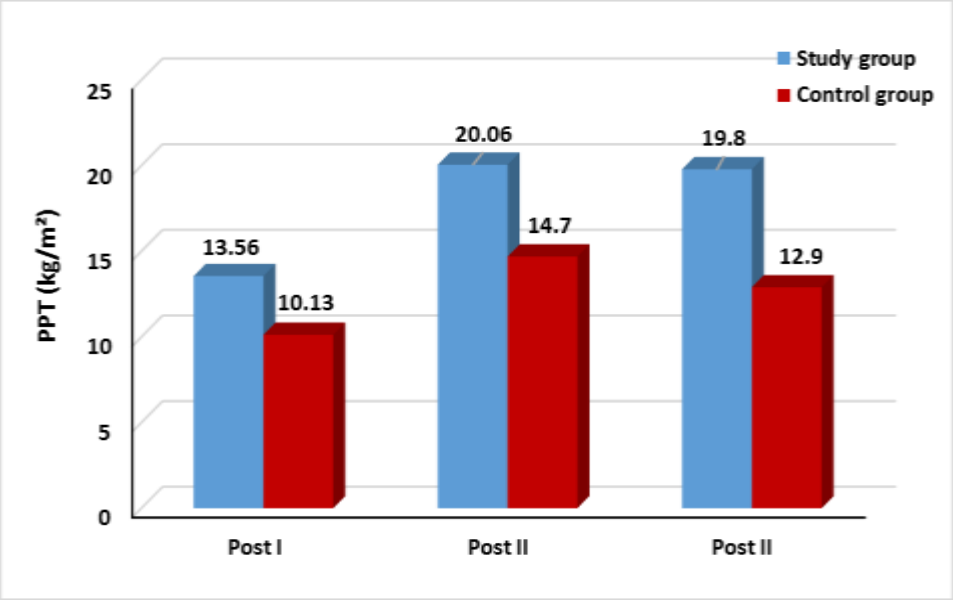

Fig. 3: Mean PPT of study and control groups at post I, post II, and post III

Post treatment mean values of MODQ of both groups (study and control):

The mean ± SD MODQ of study group at post I was 24.26. ± 3.23 and that of control group was 26.1± 3.07. The mean difference between both groups was -1.84. There was a significant decrease in MODQ of study group at post I compared with control group (p = 0.02). (Table 4& figure 4).

The mean ± SD MODQ of study group at post II was 12.2 ± 2.05 and that of control group was 20.36 ± 2.97. The mean difference between both groups was -8.16. There was a significant decrease in MODQ of study group at post II compared with control group (p = 0.0001). (Table 4& figure 4).

The mean ± SD MODQ of study group at post III was 11.76 ± 1.81 and that of control group was 16 ± 2.75. The mean difference between both groups was -4.24. There was a significant decrease in MODQ of study group at post III compared with control group (p = 0.0001). (Table 4& figure 4).

Table 4: T test for comparison between post treatments mean values of MODQ of study and control groups:

	MODQ		MD	t- value	p-value	Sig
	$\overline{X}$ ±SD					
	Study group	Control group				
Post I	24.26 ± 3.23	26.1 ± 3.07	-1.84	-2.24	0.02	**S**
Post II	12.2 ± 2.05	20.36 ± 2.97	-8.16	-12.36	0.0001	**S**
Post II	11.76 ± 1.81	16 ± 2.75	-4.24	-7.03	0.0001	**S**

$\overline{X}$: Mean **MD : Mean difference** **p value : Probability value**

SD : Standard deviation **t value : Unpaired t value** **S : Significant**

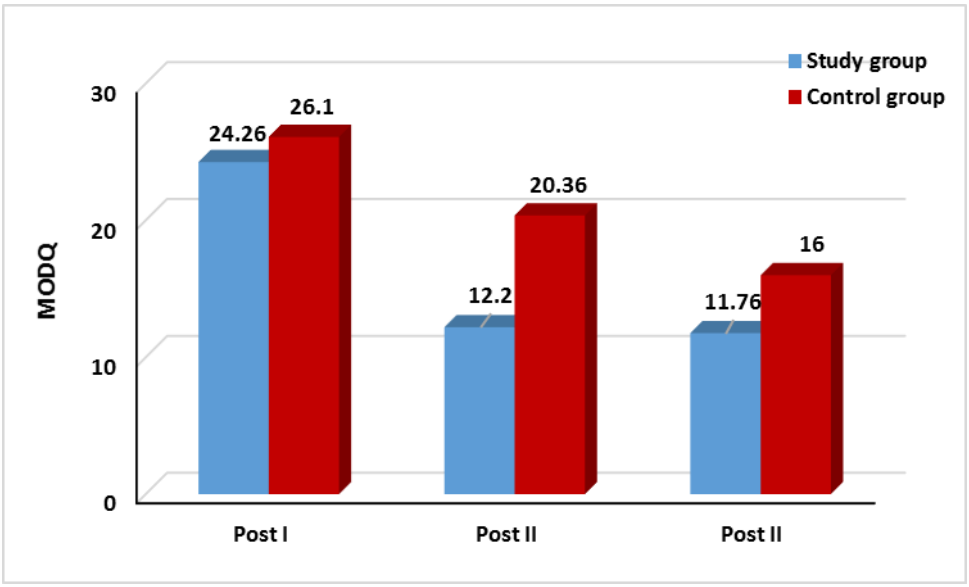

Fig.4: Mean MODQ of study and control groups at post I, post II, and post III.

Discussion

The purpose of this study was to investigate the effect of low level laser therapy on pain in female patients suffering from chronic sciatic low back pain.

Low back pain is a common disorder. It is one of the most common reasons medical cares. It affects a large number of populations during their lifetime causing musculoskeletal pain[1].

Selection of low power laser parameters is very important because it has great effect on results of the treatment as wave length increases more laser penetration occurs. It was found that laser having 830 nm, 904 nm, and 1060 nm are recommended for low back pain patients and 632nm is used for healing and nerve stimulation[16,17,18,19].

The results of this study showed that LLLT combined with exercise program more effective in reducing pain and improve function activity than exercise alone. This may be attributed to the effects of LLLT. Low level laser therapy is believed to increase neurotransmitter production, local blood circulation, production of anti-inflammatory cytokines, oxygen consumption and adenosine triphosphate (ATP) production at the cellular level.It also increases urinary elimination of 5-hydroxyindoleacetic acid, which is a product of serotonin metabolism, adenosine triphosphate production and endorphin release. LLLT is also used as painkiller, itis non-toxic and non-invasive very safe and its capability to penetrate the tissues makes it a stimulant, for cell growth and tissue repair [20,21].

Data were obtained from both groups regarding pressure pain threshold (PPT), and Modified Oswestry Disability Questionnaire (MODQ) pretreatment, at the end of 2nd week (**post I**), at the end of 5th week of treatment (**Post II**), and at one month after treatment as follow up (**Post III).**

In post I, post II, and post III revealed a significant difference in pressure pain threshold (PPT) between both groups. There was a significant increase in PPT of study group at post I, post II and post III compared with control group at all measurements.

In comparing between the measurements of groups, there was a significant decrease in MODQ of study group at post I, post II and post III compared with control group.

From these results, we stated that low level laser therapy combined with exercise program. More effective in reducing pain and improving function activity than exercise alone.

The results of this study come in agreement with Vallone Francesco et al., [22] ;Djavid et al., [23]; Ru-Lan Hsieh and Wen-Chung Lee [24];Gigo- Benato et al.,[25]; Alayat M.S.M et al., [20]; MorshediHadi et al., [26];Basford et al., [16];Kwon et al., [28];. Ana Laura Martins de Andrade a et al.,[29];Alghadir et al., [30]; Malliaropoulos N. et al.,[31];Konstantinovic et al.,[32]; Roberta T Chow et al., [33]; Kelly Jo Lumpkin, [34].

Fulop et al., [35]reported that the recommended LLLT wavelengths are 780–860 nm and 904 nm depending upon the condition being treated.

Ay S et al., [36];Klein and Eek [37]; Gur et al., [38]and Yousefi-Nooraie et al., [39]didn't support the result with current study Various factors play an important role on the effectiveness of LLLT such as laser wavelength, dosage, intensity, energy density, and frequency. The longer a person has experienced LBP, the less likely the person will respond to varied treatments. Therefore, duration of LBP may affect the patient's ability to sense a reduction of pain

Our findings are subjected to several limitations: numbers of participants are small only 30 patients on each group. Study was applied only on female so we should apply further study on both male and female. Repetition of exercise was not under supervision.

Conclusion:

Based on our finding it can be concluded that LLLT may decrease LBP and improve function activity of daily living and suitable to be described to a patient suffering from chronic sciatic back pain.

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