Effect of Low-Level Laser on Axillary Web Syndrome Post Mastectomy

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ABSTRACT

Background: Axillary Web Syndrome (AWS) is characterized by axillary pain radiating down the ipsilateral arm, shoulder range-of-motion limitation, and an axillary web of tissue most obvious on physical examination when the patient tries to abduct her arm. The use of laser as a non-surgical medical treatment modality for assisting the normal processes of healing has increased over the last few years. However, the efficacy of laser in reducing pain or promoting tissue repair remains controversial. **Objective:** This study was undertaken to determine the effect of low-level laser therapy on axillary web syndrome post mastectomy. **Patients and Methods:** This study included forty female patients who underwent mastectomy and received their treatment in Tagamoo branch of National Cancer Institute. Their ages ranged 40 to 55 years and body mass index ranged 25 to 30 (kg/m^2). The patients were selected from Medical Oncology Department, National Cancer Institute, between January 2019 to June 2019.

Results: The results of this study revealed that Group A and Group B showed significant improvement in shoulder mobility (Flexion, Abduction and External rotation) and decrease of pain but by comparison between the two groups, group A showed greater improvement than Group B.

Conclusion: It could be concluded that low level laser in addition to traditional therapy and medical therapy can improve shoulder mobility and decrease pain more than using only traditional and medical therapy. The result of this study supported the expectation that Low Level Laser had a position effect on axillary web syndrome.

Keywords: Low Level Laser Therapy, Axillary Web Syndrome, Mastectomy.

INTRODUCTION

The axillary web syndrome (AWS) is characterized by palpable cords in the breast, under arm, medial arm, forearm and is clinically associated with pain and limited shoulder range of motion **(1).** After Sentinel lymph node biopsy, the incidence of axillary web syndrome was reported by 20% of women **(2).**

Low Level Laser Therapy (LLLT) is also known as Low Intensity Light Therapy (LILT), cold laser, phototherapy, light therapy, low-energy laser therapy, photobiomodulation among other terms (Meditech/ BioFlex). Laser is an acronym for "**L**ight **A**mplification by **S**timulated **E**mission of **R**adiation". The radiation referred to is electromagnetic radiation which travels in waves of photons and different types of electromagnetic radiation possess different wavelengths and thus different intensities **(3).** The aim of this study was to determine the effect of low-level laser therapy on axillary web syndrome post mastectomy.

PATIENTS AND METHODS

This randomized controlled study included a total of 40 female patients who underwent mastectomy and received their treatment at the 5th settlement branch of Medical Oncology Department, National Cancer Institute, Cairo. This study was conducted between January 2019 to June 2019.

Patients ages ranged 40 to 55 years with body mass index ranged 25 to 30 (kg/m^2). They were randomly divided into two equal groups: **Group (A):** Composed of 20 patients with breast cancer surgeries had axillary web syndrome and they received low level laser therapy for one month plus Physical Therapy treatment (Active ROM ex, Stretching techniques and Soft tissue mobilization) for 4 weeks (Three sessions/week) , in addition to medical treatment was follow the defined surgery according to the case and it's histopathology together with the guidelines of the National Cancer Institute, and **Group (B):** Composed of 20 patients received Physical Therapy treatment (Active ROM ex, Stretching techniques and Soft tissue mobilization) for 4 weeks (Three sessions/week), assessment was carried out by standardized goniometer and visual analogue scale for both groups.

Low Level Laser Therapy **(LLLT)**: (Multiwave locked system MLS) gallium aluminum arsenide (GaAlAs; 820 and 830 nm). The laser device (Manufactured by ASA Bravoteerza Series) was for providing combined of He-Ne and infrared laser. The device has the following treatment options: Frequency; from 1 to 10.000 Hz, wavelength; up to 905nm, intensity; up to 20 joules, pulse duration; from 50 msec to 200msec.

Procedures of the study:

The passive ROMs (pROMs) and active ROMs (aROMs) for flexion, abduction, and external rotation were measured at a neutral position using a plastic steel goniometer. Each subject was seated on a stool and the ROM in each direction using a goniometer were measured. Shoulder range of motions were measured before and after the study to detect the difference between the two groups after using of low-level laser therapy and Traditional treatment (Active ROM ex, Stretching techniques and Soft tissue mobilization) in patients followed after the defined surgery. The forty

Received:17 /1 /2021
Accepted:14 /3 /2021

female patients with breast cancer surgeries had axillary web syndrome were classified into two groups, the patients of the first group were received low level laser therapy for one month. Plus Traditional treatment (Active ROM ex, Stretching techniques and Soft tissue mobilization) for **4** weeks, in addition to medical treatment (chemotherapy +/- radiotherapy +/- hormonal treatment +/- targeted therapy) and the patients of the second group were received Traditional treatment (Active ROM ex, Stretching techniques and Soft tissue mobilization) only for **4** weeks , in addition to medical treatment (chemotherapy +/- radiotherapy +/- hormonal treatment +/- targeted therapy) followed after the defined surgery according to the case and it's histopathology together with the guidelines of the National Cancer Institute. Before starting the procedure, every step was explained to the patient. Shoulder range of motions were measured before and after each session by using plastic goniometer for both groups. Pain assessment**:** The VAS was explained to the patients and each patient was asked to put mark on one of the scale numbers Distance from the zero point to the donut mark was measured and expressed as pain intensity [(4)].

The test was performed three consecutive times by the author and other therapist and the mean value of three measures was considered as the value of pain intensity the treatment procedure was started at 4-5 weeks post-operative [(5)]. Each patient was placed in a comfortable position. The laser unite was recalibrated before the study to ensure its accuracy and objectivity of its parameters.Low level laser therapy parameters (Wavelength, power, power density, Pulse parameters, Energy density, Total energy and time) were Wave length 760-850 nm [(6)]**.** Treatment times per point are in the range of 30 seconds to 1 minute [(6)]. Dosage of 1.5 J/cm2 [(4)] frequency of 1000Hz and pulse duration of 55 nsec power intensity of 25 mW [(4)]**.**

Time session was 45 minutes (24-25 minutes of low level laser [(4)] and 20 minutes of traditional physical therapy exercises) . Three times per week. The laser treatment probe was held in contact with and at right angles to the skin in every point. Each point had been irradiated for one minute with total duration of 8 minutes. This procedure had been repeated for three consecutive trials in same setting therefore the total duration of treatment was 24 minutes. The applied dose of energy per acupuncture point was 9 points (4.5 J/cm2) Each patient received Low Level Laser Therapy (LLLT) every other day three times per week for four weeks (12 treatment sessions)[(4)]. Manual techniques in form of (Active ROM ex, Stretching techniques and Soft tissue mobilization such as trigger points therapy and myofacial release) were used to reduce pain and to increase shoulder range of motion (ROM) were applied for all patients in both groups.

Ethical considerations:

Prior to the study, the study procedures were explained for all participants. All patients signed a consent form. **The study was approved by Research Ethical Committee, Faculty of Physical Therapy, Cairo University.**

Statistical analysis

Descriptive statistics and unpaired t-test were conducted for comparison of subject characteristics between both groups A & B. Normal distribution of data was checked using the Shapiro-Wilk test for all variables. Levene's test for homogeneity of variances was conducted to test the homogeneity between groups. Unpaired t-test was conducted to compare the mean values of shoulder ROM and VAS between the group A and B. Paired t-test was conducted for comparison between pre and post treatment in each group. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 22 for windows (IBM SPSS, Chicago, IL, USA).

RESULTS

Table (1) shows subject characteristics. Group A: Twenty patients with web syndrome post mastectomy were included in this group. Their mean ± SD age, weight, height, and BMI were 46.35 ± 4.48 years, 74.8 ± 6.09 kg, 162.45 ± 5.64 cm and 28.3 ± 1.32 kg/m² respectively. Group B: Twenty patients with web syndrome post mastectomy were included in this group. Their mean ± SD age, weight, height, and BMI were 47.6 ± 4.87 years, 76.6 ± 6.76 kg, 163.7 ± 4.61 cm and 28.53 ± 1.43 kg/m² respectively. Comparing the general characteristics of the subjects of both groups revealed that there was no significance difference between both groups in the mean age, weight, height and BMI ($p > 0.05$). Table (1) showed the subject characteristics of the group A and B. There was no significant difference between both groups in the mean age, weight, height and BMI ($p > 0.05$).

Table (1): Comparison of subject characteristics between group A and B:

	$\bar{x}$ ± SD		MD	t- value	p-value
	Group A	**Group B**			
Age (years)	46.35 ± 4.48	47.6 ± 4.87	-1.25	-0.84	0.4
Weight (kg)	74.8 ± 6.09	76.6 ± 6.76	-1.8	-0.88	0.38
Height (cm)	162.45 ± 5.64	163.7 ± 4.61	-1.25	-0.76	0.44
BMI (kg/m²)	28.3 ± 1.32	28.53 ± 1.43	-0.23	-0.51	0.61

X, mean; SD, standard deviation; p value, probability value

Effect of treatment on shoulder ROM and VAS:

- Within group comparison:

There was a significant increase in shoulder flexion, abduction and external rotation post treatment compared with that pretreatment in the group A and B ($p < 0.001$). The percent of increase in shoulder flexion, abduction and external rotation in the group A were 60.56, 63.37 and 86.98% respectively, while that in the group B were 28.72, 28.57 and 31.9% for shoulder flexion, abduction and external rotation respectively. Also, both groups showed significant decrease in VAS post treatment compared with that pretreatment ($p < 0.001$). The percent of decrease in VAS in the group A was 84.56% and that in group B was 37.88. (table 2, figure 1-2).

- Between groups comparison:

There was no significant difference in shoulder ROM and VAS between both groups pre-treatment ($p > 0.05$). Comparison between both groups post treatment revealed a significant increase in shoulder flexion, abduction and external rotation of the group A compared with that of the group B ($p < 0.001$). Also, there was a significant decrease in VAS of the group A compared with that of the group B post treatment ($p < 0.001$). (table 2, figure 1-2).

Table (2): Mean shoulder ROM and VAS pre and post treatment of the group A and B:

	Group A	Group B			
	$\bar{x}$ ± SD	$\bar{x}$ ± SD	MD	t- value	p value
Flexion ROM (degrees)					
Pre treatment	98.25 ± 10.16	94 ± 11.42	4.25	1.24	0.22
Post treatment	157.75 ± 12.2	121 ± 10.71	36.75	10.12	0.001*
MD	-59.5	-27			
% of change	60.56%	28.72%			
t- value	-20.2	-14.22			
	p = 0.001*	***p = 0.001****			
Abduction ROM (degrees)					
Pre treatment	101 ± 8.36	98 ± 8.8	3	1.1	0.27
Post treatment	165 ± 6.88	126 ± 9.26	39	15.11	0.001*
MD	-64	-28			
% of change	63.37%	28.57%			
t- value	-27.03	-21.92			
	p = 0.001*	***p = 0.001****			
External rotation ROM (degrees)					
Pre treatment	42.25 ± 6.58	40.75 ± 5.2	1.5	0.8	0.42
Post treatment	79 ± 3.83	53.75 ± 4.83	25.25	18.29	0.001*
MD	-36.75	-13			
% of change	86.98%	31.9%			
t- value	-25.11	-17.08			
	p = 0.001*	***p = 0.001****			
VAS					
Pre treatment	6.8 ± 0.76	6.6 ± 0.94	0.2	0.73	0.46
Post treatment	1.05 ± 0.75	4.1 ± 0.78	-3.05	-12.46	0.001*
MD	5.75	2.5			
% of change	84.56%	37.88%			
t- value	30.22	21.79			
	p = 0.001*	***p = 0.001****			

$\bar{x}$, mean; SD, standard deviation; MD, mean difference; p-value, probability value; *, significant

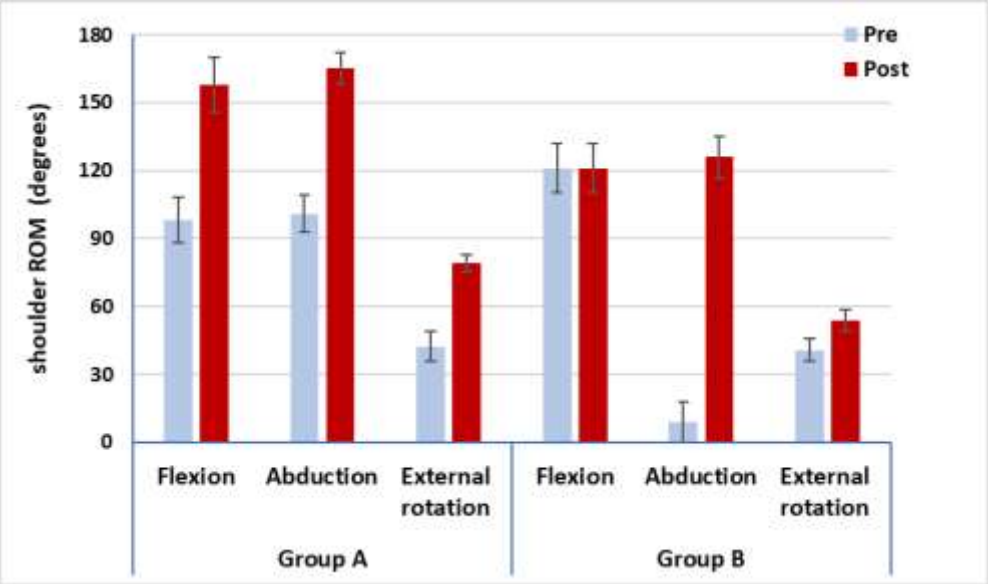

Figure (1): Mean shoulder ROM pre and post treatment of the group A and B.

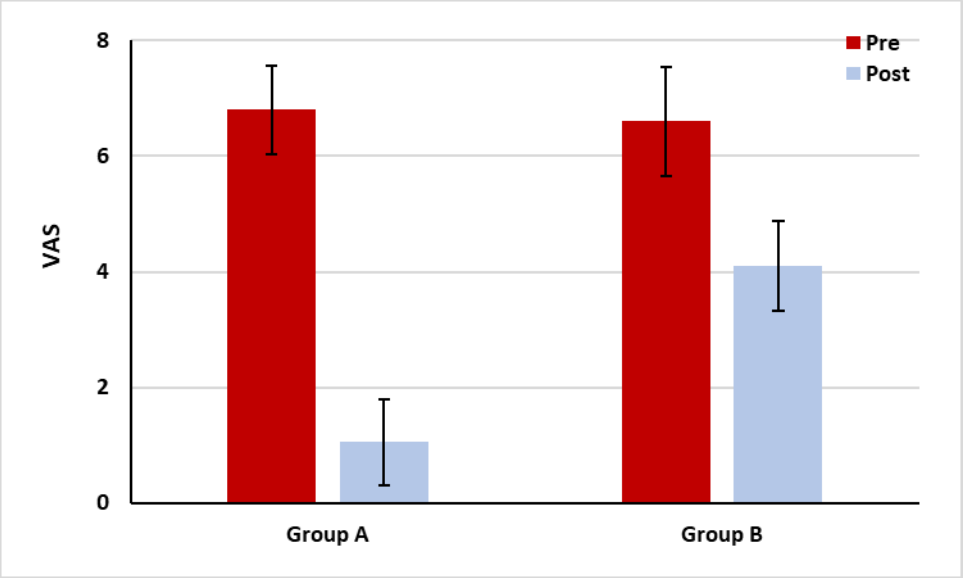

Figure (2): Mean VAS pre and post treatment of the group A and B.

DISCUSSION

The present study was carried out to detect the efficacy of low-level laser therapy on axillary web syndrome post mastectomy. Shoulder range of motion assessment by using goniometer and pain assessment by using visual analogue scale were done for each patient of both groups pre the 1st session (pre-1) and post 12th session (post 1). VAS post treatment of the group A was 1.05 ± 0.75 and that of the group B was 4.1 ± 0.78. The mean difference between both groups was -3.05. There was a significant decrease in the VAS in the group A compared with group B post treatment Flexion ROM post treatment of the group A was 157.75 ± 12.2 degrees and that of the group B was 121 ± 10.71 degrees. The mean difference between both groups was 36.75 degrees.

There was a significant increase in the flexion ROM in the group A compared with group B post treatment. Abduction ROM post treatment of the group A was 165 ± 6.88 degrees and that of the group B was 126 ± 9.26 degrees. The mean difference between both groups was 39 degrees. There was a significant increase in the abduction ROM in the group A compared with group B post treatment. External rotation ROM post treatment of the group A was 79 ± 3.83 degrees and that of the group B was 53.75 ± 4.83 degrees. The mean difference between both groups was 25.25 degrees. There was a significant increase in the external rotation ROM in the group A compared with group B post treatment Data obtained from both groups regarding shoulder range of motion (Flexion,

Abduction and External rotation) and Pain Analogue Scale were statistically analyzed and compared.

The result of the present study revealed that there was a significant increase in shoulder range of motion and improve of pain of both groups at the end of the sessions compared with that at pretreatment (p = 0.0001). But we found that the group in which the patient received low level laser therapy plus Traditional treatment (Active ROM ex, Stretching techniques and Soft tissue mobilization) for 4 weeks, in addition to medical treatment, (group **A**) showed that there was a significant increase and improvement in shoulder range of motion (Flexion , Abduction and External rotation) and pain compared with that of group **B** in which the patient only received Traditional treatment (Active ROM ex, Stretching techniques and Soft tissue mobilization) only for 4 weeks, in addition to medical treatment. **Borhan *et al.*** [4] examined the effect of Laser puncture on postoperative pain and edema after facial cosmetic surgery showed improvement in pain intensity, like the results of our study which showed improvement in the pain intensity according to pain analogue scale by percent 90% of patients.

Bashiri [7] LLLT applied with a sufficient level of intensity causes an inhibition of action potentials where there is an approximately 30% neural blockade within 10 to 20 minutes of application, and which is reversed within about 24 hours. The laser application to a peripheral nerve does have a cascade effect whereby there is suppressed synaptic activity in second order neurons so that cortical areas of the pain matrix would not be activated.

Carrasco *et al.* [8] LLLT can have short-, medium- and long-term effects. Fast acting pain relief occurs within minutes of application, which is a result of a neural blockade of the peripheral and sympathetic nerves and the release of neuromuscular contractions leading to in a reduction of muscle spasms. The long term effects of LLLT occur within a week or two and can last for months and sometimes years as a result of improved tissue healing.

In an agreement with the current study, **Gamal *et al.*** [9] examined the effect of physical therapy modalities (ROM, Soft tissue mobilization, Myofascial release, Trigger points therapy) on axillary web syndrome, the results revealed that there's significant improvement in the values of VAS (Pain analogue scale) between pre and post treatment was 5.3 and the improvement was 76.81% in decreasing the pain, (p = 0.0001)**.**

Also, **Fourie and Robb** [10], who support the effect of myofascial release on decrease pain in case study discussed the physiotherapy management of a patient with AWS, included manual therapy, mostly using soft tissue treatment techniques, combined with education and advice. It was also often reported that a painless audible "popping" sound would be heard during treatment, resulted in an immediate increase in the range of abduction of the arm and relieved the pain and also agree with [11]**.**

Oliveira *et al.* [12] Low-level laser therapy (LLLT) has been shown to modulate the inflammatory process without adverse effects, by reducing pain and swelling and promoting the repair of damaged tissues. Because pain, swelling and muscle spasm are complications found in virtually all patients following surgery, this model has been widely used to evaluate the effects of LLLT on the inflammatory process involving bone and, connective tissue and the muscles.

It would appear from this study that low level laser therapy in addition to traditional therapy and medical therapy had a great effect on shoulder range of motion and pain on group A (Study group) more than group B (Control group) who had only traditional therapy and medical therapy.

So, in the current study the results of shoulder range of motion and pain were improved as low level laser therapy in addition to traditional therapy and medical therapy helped the patients with breast cancer surgeries who had axillary web syndrome to improve pain and upper limb mobility resulting in improve quality of life and self-dependence**.** Also, low level laser therapy helped these patient's upper limb in increasing blood circulation, thus increases oxygen available for tissues and the pain causing factors are diverted [13]**.**

LIMITATIONS

Noncooperation of some patients, small sample size, error in measurements, Psychological state of the patient during the period of treatment. Individual differences in patients and their response to the treatment, possible human errors, Instability of hemodynamic data (Bp, HR and RR) during the session, absence of the patients from the sessions.

CONCLUSION

It could be concluded that applying of the Low-Level Laser in addition to Physical Therapy and medical therapy had a significant effect on patients with axillary web syndrome post mastectomy than using only traditional and medical therapy due to the shoulder range of motion (Flexion, Abduction and External rotation) and pain with LLL and Physical Therapy treatment improved more than only Physical Therapy treatment.

RECOMMENDATIONS

This study was designed to detect the effect of Low-Level Laser Therapy on Axillary Web Syndrome post Mastectomy.

Acknowledgements: The authors express their thankful to all subjects who participated in the study.

Financial support and sponsorship: Nil.

Conflict of interest: None.

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