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Effect of Low Level Laser Versus Bee Venom Phonophoresis on Shoulder Dysfunction in Postmastectomy Patients

NARDEN M.Z. GERGES, M.Sc.*; HAIDY N. ASHM, PhD .*; MOHAMED GABER IBRAHIM, M.D.** and ROICAIA A. ZAIN EL-ABEDEEN MOHAMED, Ph.D.*

The Department of Physical Therapy for Surgery, Faculty of Physical Therapy, Cairo University and Department of Surgical Oncology, Faculty of Medicine, Alexandria University***

Abstract

Background: Mastectomy, in which breast tissue is surgically removed, can cause physical, mental, and social issues for patients Some of the major side effects included infection, pain, phantom breast disorder, seroma, hemorrhage lymphedema, as well as frozen shoulder.

Aim of Study: The goal of the study is to compare the therapeutic impact between low level laser versus bee venom phonophoresis on shoulder dysfunction in postmastectomy patients.

Patients and Methods: Fifty-two patients took part in this study. They were aged from 30 to 55 years. They were selected from Alexandria Police Hospital and randomized into 2 groups equal in number. Group (A): 26 patients were given 20min low level laser therapy 3 sessions per week as well as selected physiotherapy program according to Canadian Cancer Society Guidelines for 6 weeks. While, Group (B): 26 patients were given 10min bee venom phonophoresis 3 sessions per week as well as selected physiotherapy program according to Canadian Cancer Society Guidelines for 6 weeks.

Results: This study demonstrated that there was a statistically highly significant enhancement in Visual analogue scale and shoulder Range of motion of group (A) when compared with its corresponding value in group (B).

Conclusion: The use of low-level laser therapy was more beneficial than bee venom phonophoresis in improvement shoulder pain as well as ROM in postmastectomy patients

Key Words: Mastectomy — Shoulder dysfunction — Low level laser therapy technique — Bee venom phonophoresis.

Introduction

THE surgical removal of breast tissue, either from one breast or both, is known as a mastectomy. The most common causes for having a mastectomy are treating or preventing breast cancer. Removing already malignant cells from the breast is the most common cause for performing the procedure [1].

Shoulder pain, disability and impaired movements are frequently reported complications in postmastectomy patients. Most patients who have had a mastectomy suffer from frozen shoulder, which causes shoulder pain as well as disabilities **[2].**

Photobiomodulation **(PBM),** also known as Low Level Laser Therapy (LLLT), is a form of light therapy that utilizes very low levels of light to achieve their therapeutic effects. It's not a heat effect, but rather a photochemical one. Photons are taken in by cellular photoreceptors, which then starts off a cascade of metabolic reactions, similar to the process of photosynthesis in plants **[3].**

In patients who have shoulder dysfunction following mastectomy, bee venom phonophoresis improves their pain as well as function while also enhancing their shoulder's abduction as well as flexion ranges of motion. Bee venom phonophoresis is effective because it has anesthetic as well as anti-inflammatory properties. Enzymes, peptides, in addition to low-molecular-weight (non-peptide) chemical molecules make up the majority of BY. BV mostly consists of the peptides melittin, apamin, along with adolapin **[4].**

Patients and Methods

Patients:

Fifty-two patients took part in this study. They were aged from 30 to 55 years. They were selected from Alexandria Police Hospital From January 2023 — April 2023 and randomized into two groups equivalent in number.

Patients who fulfilled the subsequent criteria were included in the study: (1) They were aged from 30 to 55 years. (2) Patients were 3-6 months post mastectomy. (3) All patients had shoulder dysfunc-

Correspondence to: Dr. Narden MZ. Gerges,
E-Mail: dr.nardenmaher@gmail.com

tion with ROM limitation (.20° ROM limitation compared to the sound shoulder). (4) Informed consent was attained from all study participants prior to enrollment.

Patients were excluded from the study if they had one of the subsequentproblems: (1) Allergy to bee venom. (2) Patients with complications (musculoskeletal, neurological, etc.) that exacerbate the pain sensation. (3) Patients with vascular problems except grade 1 lymphedema. (4) Photosensitive patients or who take photosensitizing agents. (5) Patients who had skin diseases. (6) Patients who had previous injury or fracture in shoulder joint.

Design:

In this clinical experiment, patients were randomized into one of two groups using envelope method; both groups had the same number of patients. All aspects of the study were discussed and consent form was obtained. After that, a physiotherapist who was blinded of the study's procedures was instructed to select an envelope. The chosen card determined which group each participant would join. Following the 1st week of the randomization process, treatment initiation dates were established. The physiotherapist conducting the evaluation did not take part in the randomization process as well as was unaware of who received which treatment. They were told to tell the physiotherapist nothing about their treatment plan during the evaluation. Subjects were instructed to report any negative effects they had during the course of treatment.

Evaluation methods:

VAS: Clinically, VAS is a valid as well as reliable assessment tool for measuring pain levels. It has a 100 mm either vertically or horizontally line with the words "no pain" and "worst pain you can imagine" at each end. This is the most common way to measure how much pain an individual was feeling. Patients were then requested to make a mark on that line to indicate how much pain they are feeling [5].

Universal goniometer: The range of motion of the shoulder was measured using a goniometer (flexion-abduction-external rotation). The patient was positioned supine and the thorax was securely fastened to the table throughout measurement to prevent body motion that would tend to compensate for shoulder movement [6].

Treatment:

Fifty-two patients took part in this study. They were aged from 30 to 55 years. They were selected from Alexandria Police Hospital and randomized into two groups equivalent in number. Group (A): 26 patients were given 20min low level laser therapy 3 sessions per week as well as selected physiotherapy program according to Canadian Cancer Society Guidelines for six weeks. While, Group (B): 26 patients were given 10min bee venom phonophoresis 3 sessions per week as well as selected physiotherapy program according to Canadian Cancer Society Guidelines for 6 weeks. Shoulder pain was evaluated by VAS and Shoulder ROM was evaluated by universal goniometer before and after the intervention.

Statistical analysis:

The normality assumption test and homogeneity of variance were performed on the data. Using the Shapiro-Wilk normality test, it was determined that the data was normally distributed ($p>0.05$) following elimination of outliers identified by box and whiskers plots. In addition, Levene's test for examining the homogeneity of variance found no significant difference ($p>0.05$). All of these results permitted parametric and nonparametric analysis. Normal distribution is assumed and parametric analysis is performed.

The statistical analysis was carried out using the SPSS Package programme for Windows, version 25. (SPSS, Inc., Chicago, IL). Quantitative data for age, pain intensity, shoulder flexion, shoulder abduction, and shoulder external rotation variables are reported as mean and standard deviation. To compare between group A and group B for women age variable was used independent t-test. The main variables of interest were compared between groups and time points using multivariate analysis of variance (MANOVA). The first independent variable (inter subject factors) was the experimental group, which had two levels (a 2 x 2 MANOVA design) (group A vs. group B). Two-level measuring periods served as the second independent variable (within-subject factor) (before- and after-treatment). Shoulder flexion, abduction, and external rotation were used to measure the intensity of the pain. When the MANOVA test revealed statistical significance for a given variable (F), the Bonferroni adjustment test was used to conduct paired within and between group analyses of that variable. No statistically insignificant results were found (p.0.05).

Results

In the present study, an overall of 52 women patients who had shoulder dysfunction after receiving mastectomy operation were participated and randomized into 2 groups (26 women/group). The findings of age women patients (Table 1 and Fig. 1) revealed that there was no significant difference ($p>0.05$) among group A and group B in participants women age ($p=0.609$) in the study.

Table (1): Comparison of patient's age between group A & group B.

Items	Groups (Mean ± SD) Group A (n=26)	Group B (n=26)	P- value
Age (years)	45 .50±6.19	44 .54±7 .22	0.609

- Data are reported as mean ± standard deviation and compared by t-independent test. p-value: Probabiity value. NS: Non-significant.

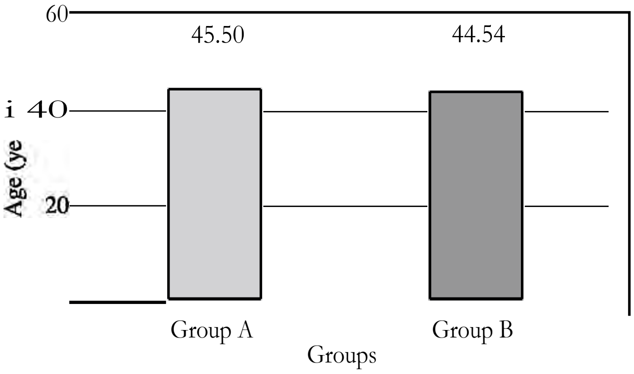

Fig. (1): Mean of participants women age (year) in group A and group B.

Multiple pairwise comparison tests (time effect) for outcome variables (shoulder pain intensity, shoulder flexion, shoulder abduction, as well as shoulder lateral rotation) within every group (Table 2) revealed that there were significantly ($p<0.05$) reduced in shoulder pain intensity (Table 2 and Fig. 2) post treatment compared to pre-treatment within group A ($p=0.0001$) and group B ($p=0.0001$). Time effect had significantly higher shoulder flexion (Table 2 and Fig. 3), shoulder abduction (Table 2 and Fig. 4) and shoulder lateral rotation (Table 2 and Fig. 5) post-treatment than pre-treatment in group A ($p=0.0001$, $p=0.0001$, and $p=0.0001$, respectively) and group B (p43.011, p43.027, and $p=0.015$, respectively). These significant differences in shoulder pain intensity, shoulder flexion, shoulder abduction, as well as shoulder lateral rotation were favoring the group A (LLLT) than the group B (bee venom phonophoresis). Moreover, the women in group A which were given the LLLT program improved higher pain intensity, flexion, abduction and external rotation of shoulder (69.34, 12.59, 21.78, and 30.10%, respectively) than those in group B which treated by the bee venom phonophoresis program (27.51, 5.53, 4.10, and 7.91%, respectively).

Multiple pairwise comparison tests (group effect) for outcome variables (shoulder pain intensity, shoulder flexion, shoulder abduction, in addition to shoulder lateral rotation) among group A and group B (Table 2) revealedthat no significant differences ($p>0.05$) pre-treatment among group A and group B in shoulder pain intensity ($p=0.226$), shoulder flexion ($p=0.765$), shoulder abduction (p43.622), and shoulder lateral rotation (p43.837). However, there were significant differences ($p<0.05$) post treatment among group A and group B in shoulder pain intensity ($p=0.0001$), shoulder flexion (p43.019), shoulder abduction (p43.0001), and shoulder lateral rotation (p43.0001). These significant decrease in shoulder pain intensity (Table 2 and Fig. 2) and increase in shoulder flexion (Table 2 and Fig. 3), shoulder abduction (Table 2 and Fig. 4) and shoulder external rotation (Table 2 and Fig. 5) at post treatment are favorable of the low level laser therapy program (Group A) than bee venom phonophoresis program (Group B).

Table (2): Mixed MANOVA within and between groups comparison for shoulder outcomes variables.

Variables	Items	Groups (Mean ±SD) Group A (n=26)	Group B (n=26)	Change (MD)	*p*-value
Shoulder pain intensity	Before-treatment	835±1.16	7.96±1.15	0.39	0 226
	After-treatment	2.56±0.98	5.77±1.24	3.21	0.0001*
	Change (MD)	5.79	2.19		
	Improvement %	6934%	27.51%		
	p-value	0.0001*	0.0001*		
Shoulder flexion	Before-treatment	104.73±13.92	103.65±14.62	1.08	0.765
	After-treatment	117.92±7.68	109.38±14.20	8.54	0.019*
	Change (MD)	13.19	5.73		
	Improvement %	12.59%	5.53%		
	p-value	0.0001*	0.011*		
Shoulder abduction	Before-treatment	90.55±12.93	88.92±14.12	1.63	0.622
	After-treatment	11027±5.90	92.57±12.79	17.70	0.0001*
	Change (MD)	19.72	3.65		
	Improvement %	21.78%	4.10%		
	p-value	0.0001*	0.027*		
Shoulder external rotation	Before-treatment	63.65±8.07	64.08±8.18	0.43	0.837
	After-treatment	82.81±4.90	69.15±7.97	13.66	0.0001*
	Change (MD)	19.15	5.07		
	Improvement %	30.10%	7.91%		
	p-value	0.0001*	0.015*		

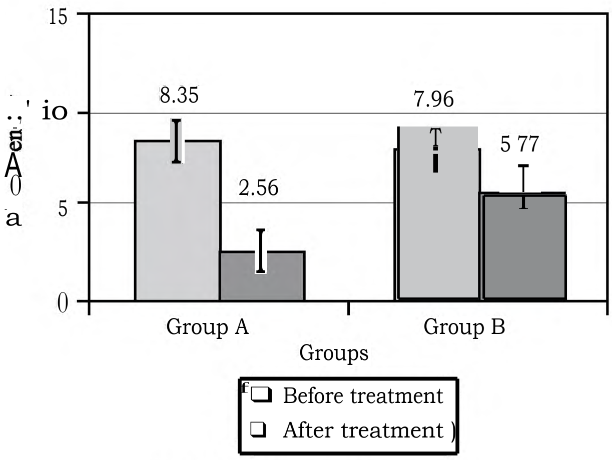

Fig. (2): Shoulder pain intensity.

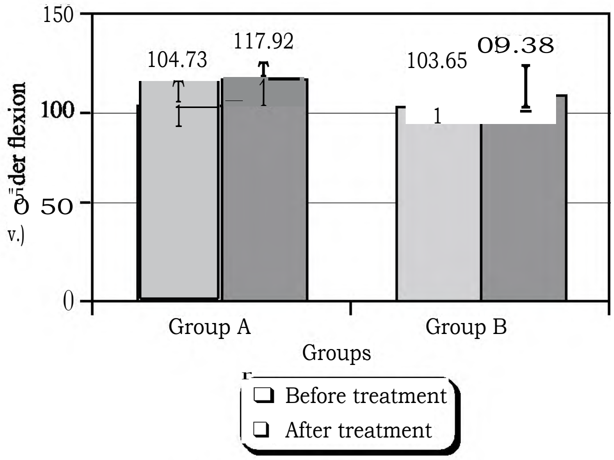

Fig. (3): Shoulder flexion

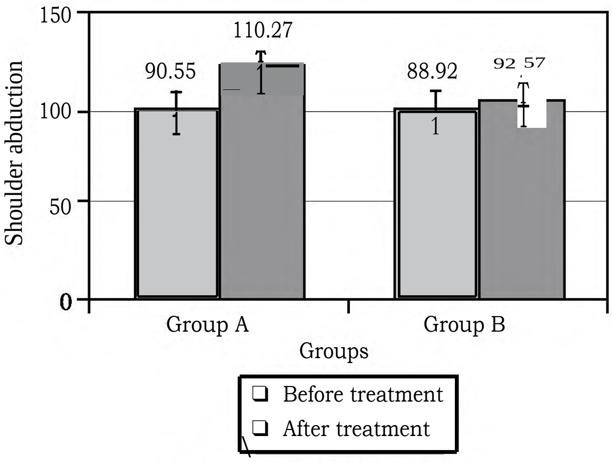

Fig. (4): Shoulder abduction.

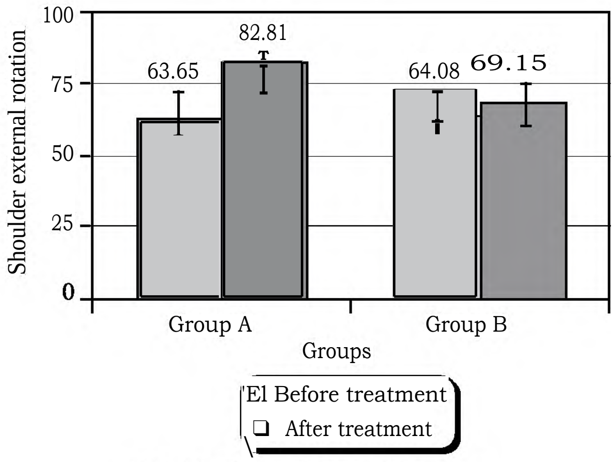

Fig. (5): Shoulder external rotation.

Discussion

This study was carried-out to compare the therapeutic impact between LLLT versus bee venom phonophoresis on shoulder dysfunction in postmastectomy patients.

This study presented that there was a statistically highly significant enhancement in VAS and shoulder **ROM** of group (A) when compared with its corresponding value in group (B), so it can be indicated that LLLT was more effective than bee venom phonophoresis in improvement shoulder pain and **ROM** in postmastectomy patients.

The findings of this study come in accordance with El-Gendy, et al., m who studied the impact of LLLT and manual exercises on shoulder impingement syndrome and they discovered that LLLT has emerged as a popular way to treat musculoskeletal problems in the last few years. The way that LLLT relieves pain is not well understood. Inflammatory pain can be controlled by LLLT by lowering the amounts of biochemical mediators, neutrophil cell invasion, oxidative stress, as well as the edema. These impacts are dose-dependent. Other theories about how LLLT relieves pain are that it changes nerve excitation as well as conductivity in peripheral nerves and triggers the secretion of endogenous endorphins This leads to the conclusion that LLLT directly stimulates cell growth, collagen as well as protein production, tissue repair, wound healing, as well as pain reduction without a thermal reaction [7].

The findings of this study agreed with that of Bahl Giiloglu, **[8]** who compare between LLLT as well as extracorporeal shock wave therapy in patients suffering from subacromial impingement syndrome and showed that LLLT is a noninvasive treatment method for musculoskeletal disorders that has become more common in recent years. LLLT treatment has been shown in different studies to reduce pain and inflammation LLLT wasstated to be efficient in clinical symptoms including pain as well as loss of sensation, and this impact was supposed to be owing to the capability of the LLLT to specifically inhibit painful signals in peripheral nerves, in addition to its capability to make biophysical actions in nerve tissue. Conclusions Both LLLT as well as ESWT were beneficial modalities on shoulder **ROM** evaluations, pain, activity level, sleep, anxiety, and depression as well as quality of life in the short along with medium term in patients having SIS, consistent with previous reports that laser improves local circulation which contributes to the alleviation of symptoms in patients suffering from musculoskeletal problems **[8].**

In contrast, Ordahan et al., **[9]** tested low-level laser therapy to high-intensity laser therapy for the treatment of adhesive capsulitis. Three weeks following treatment, the VAS and SPADI scores improved significantly in both the LLLT and HILT groups; however, the improvement was significantly greater in the HILT group than in the LLLT group. There was no improvement in goniometric scores between the two groups and the baseline. The study indicated that HILT + stretching exercise was more effective than LLLT + stretching exercise for treating shoulder dysfunction patients' functional parameters and discomfort **[9].**

Awotidebe et al. **[10]** investigated the extra benefits of LLLT to exercise in patients with shoulder musculoskeletal diseases. According to the findings of the study, physiotherapists may consider using low-laser treatment as an adjuvant to exercise in the short term to relieve pain in patients with shoulder musculoskeletal diseases. In the near term, however, low-laser therapy combined with exercise is no more beneficial than exercise alone in improving shoulder function and range of motion **[10].**

El-Hefnawy et al. [11], who investigated the impact of bee venom phonophoresis on patients with shoulder impairment following mastectomy, reached the same conclusion, which was supported by the current study's findings. Enzymes, peptides, as well as low-molecular-weight (non-peptide) chemical molecules are the main components of BY. Pain, itching, as well as swelling are all local effects of melittin. However, it's possible that has a systemic anti-inflammatory effect. Bee venom phonophoresis was found to be as efficient as conventional ultrasonic in reducing shoulder dysfunction following mastectomy. It decreases the synthesis of inflammatory cytokines such as interleukin-6 (IL-6), IL-8, tumor necrosis factor (TNF), as well as interferon (IFN) [11].

Therapeutic use of bee venom for the treatment of rheumatoid arthritis was investigated by Ang et al., **[12],** and their findings supported those of the present study. Bee venom as well as melittin have been found to inhibit 113 kinase as well as NFB activities and the production of inflammatory mediated cells, which has implications for their use in the food as well as drug industries. Their anti-arthritic and anti-inflammatory effects can be attributed in part to their ability to inhibit the JNK pathway. Melittin also inhibited the stimulation of transcription factors and the production of antiapoptotic genes, which led to the death of apoptosis-resistant synoviocytes. Additionally, melittin decreased MMP3 production and NF-B activity, both of which contributed to its anti-arthritic effects [12].

In contrast, Jang et al. **[13]** examined the clinical efficacy and unfavourable effects of bee venom therapy. According to a study, bee venom phonophoresis may cause modest and temporary cutaneous reactions such as itching, redness, and edoema. Anaphylaxis and other well-known severe side effects may have gone unnoticed in RCTs with smaller sample sizes. Additionally, weeks or months following the BVA therapy, granulomas or plaques were seen. Therefore, the study came to the conclusion that skin reactions such itching and edoema were the most frequently reported adverse bee venom phonophoresis events **[13].**

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Conflict of interest: Nil.

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تأثير العلاج بالليزر منخفض المستوى في مقابل سم العسل المُدخل عن طريق الموجات فوق الصوتية على الخلل الوظيفى للكتف بعد إستئصال الثدى

أجريت هذه الدراسة للمقارنة بين تأثير الليزر منخفض الشدة مقابل سم العسل المُدخل عن طريق الموجات فوق الصوتية على الخلل الوظيفى للكتف بعد إستئصال الثدى. حيث شارك فى هذه الدراسة ٥٢ سيدة تعانى من خلل وظيفى للكتف بعد إستئصال الثدى، تراوحت أعمارهن من ٣٠ إلى ٥٥ عاما. تم إختيارالمرضى من مستشفى الشرطة بالإسكندرية وتم تقسيمهم عشوائيا إلى مجموعتين متساويتين فى العدد. تلقت المجموعة (أ): ٢٠ دقيقة من العلاج بالليزر منخفض الشدة ٣ مرات فى الأسبوع لمدة ٦ أسابيع بالإضافة إلى برنامج العلاج الطبيعى وفقًا لإرشادات جمعية السرطان الكندية، بينما تلقت المجموعة (ب): ١٠ دقيقة من سم العسل المُدخل عن طريق الموجات فوق الصوتية ٣ مرات فى الأسبوع لمدة ٦ أسابيع بالإضافة إلى برنامج العلاج الطبيعى وفقًا لإرشادات جمعية السرطان الكندية تم تقييم ألم الكتف عن طريق المقياس البصرى التناظرى قبل وبعد العلاج وتقييم المدى الحركى للكتف عن طريق مقياس الزوايا العالمى قبل وبعد العلاج وقد أظهرت النتائج أن هناك تحسن ذو دلالة إحصائية فى المجموعتين فى متوسط قيم الألم، المدى الحركى ولكن فى المجموعة الأولى (أ) أكثر من المجموعة الثانية (ب).

وبعد مناقشة هذه النتائج وتحليلها، تبين أن الليزرمنخفض الشدة له تأثير أفضل وذو دلالة إحصائية عن العسل المُدخل عن طريق الموجات فوق الصوتية على الألم والمدى الحركى للكتف بعد إستئصال الثدى.