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Low-Level Laser Versus Pneumatic Compression Pump on Lymphedema Post Mastectomy

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ABSTRACT

Purpose: This study was designed to provide a guideline about the difference between these two methods on the reduction of limb size (circumference) in Post-mastectomy lymphedema and to assist in planning an ideal treatment regimen for reducing limb volume in lymphedema. Subjects: This study was carried out on 30 patients (females) with post-mastectomy lymphedema their ages ranged from 40-55years, they were free from any other diseases that might affect or influence the results and they were selected from National Cancer Institute, Cairo University and randomly distributed into two equal groups. *Methods:* Patients assigned randomly into two groups (A and B) equal in number: Group (A): This group included 15 patients who received 2 hours of compression therapy in addition to their physical therapy program (active range of motion and elevation), hygiene and skin care for four weeks. Group (B): This group included 15 patients who received 20 minutes of laser therapy in addition to their physical therapy program (active range of motion and elevation), hygiene and skin care for four weeks. *Evaluation:* evaluations of both groups (A and B) were done before starting the treatment and at the end of the study by tape measure. *Results:* The results of this study showed that there was a statistically significant decrease in ΔC after 4 weeks of treatment application in both groups but there was no significant difference in ΔC after 4 weeks of application of compression therapy in the group (A) when compared with laser therapy in the group (B). *Conclusion:* pneumatic compression and Low-Level Laser are effective in reduction of limb size in Postmastectomy lymphedema.

Keywords: Mastectomy, Lymphedema, Low-level laser, Pneumatic compression pump.

Introduction

A mastectomy is the removal of all of the tissue from one or both breasts. Mastectomies are primarily performed to remove or prevent breast cancer. The operation is most often carried out to remove existing cancerous cells within the breast and thereby reduce the potential for breast cancer to spread (Newman, 2017).

Breast cancer-related lymphedema is the most common chronic impairment following breast cancer surgery. Lymphedema is a chronic disease where lymph accumulation in the limbs was mostly due to obstruction of the proximal lymphatic system due to lymph node dissection for cancer treatment. It is a debilitating disease which can lead to swollen, heavy, painful, and infection-prone limbs. (Yang *et al.,* 2018).

In a recent systematic review about commonly recommended therapies, it was suggested that treatments that are predominantly administered by health professionals, such as complex physical therapy, manual lymphatic drainage, laser therapy and pneumatic pump therapy, generally yielded the larger volume reductions. (Moseley *et al.,* 2007).

Pneumatic compression therapy allows translocation of retained fluid from the interstitial into the lymphatic lumen by producing a pressure gradient (Tiwari *et al.,* 2003)

Low-level laser therapy presumably increases lymph flow, reduces the amount of excess tissue protein and fluid, and improves the limb performance (Kozanoglu *et al.,* 2009).

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Subject and Methods:

This study was started from February 2018 to September 2018 at National Cancer Institutein Cairo, Egypt.

Subjects:

This study was carried out on 30 patients (females) with post-mastectomy lymphedema their ages ranged from 40-55 years, they were free from any other diseases that might affect or influence the results and they were selected from National efficient cognition and education enough to understand the requirements of the study.

Exclusive criteria:

All Patients with Current metastases, venous thrombosis and Photosensitivity were excluded from this study.

Equipment:

The study equipment was divided into two different categories, measuring and therapeutic equipment.
- Measuring Equipment: Tape measurement. Both limbs measured for comparison of circumferences at similar anatomic locations to compare differences in girth. Periodically, total limb circumference calculated for comparison over time. (Megens *et al.,* 2001).
- Treatment Equipment: Pneumatic compression device with pressure 60 mmHg and Low- Level Laser with 1.5 J/cm2**.**

The procedure of application:

The subjects will be informed about the nature of the study; each subject signed a consent form before participating in the study. Treatment time of the present study was given in the period of 4weeks.
-Group A: This group included 15 patients who received 2 hours of compression therapy in addition-to their physical therapy program (active range of motion and elevation), hygiene and skin care for four weeks.
-Group B**:** This group included 15 patients who received 20 minutes of laser therapy in addition to their physical therapy program (active range of motion and elevation), hygiene and skin care for four weeks**.**

Ethical consideration:

Confidentiality was assured by signing the consent form and respect to all patients was ascertained through explaining the objectives of the study and its benefits. The study was approved by the Ethical Committee of the faculty of Physical Therapy, Cairo University.

Results:

Comparing the general characteristics of the subjects of both groups revealed that there was no significant difference between both groups in the mean age ($p > 0.05$). As shown in the table. (1).

The mean value of ΔC before treatment application (pre-treatment) of pneumatic compression pump was 23.1 ± 7.45 cm, while the mean value of ΔC after 4 weeks of treatment application (post-treatment) was 15.86 ± 6.04 cm,

As reflected from table (2), there was a statistically significant decrease in ΔC after 4 weeks of treatment application (post-treatment) of group A ($p < 0.001$), when compared with the corresponding mean value before treatment application (pre-treatment) and the percentage of

improvement of ΔC was 31.34% after 4 weeks of treatment application (post-treatment) of group A when compared with before treatment (pre-treatment).

Table 1: Comparison of patient demographic data (age) in both groups of the study (A and B groups):

Item	Age (years)	
	Group A	Group B
$\bar{x}$	48.26	48.13
±SD	4.38	3.73
MD	0.13	
T- value	0.09	
p-value	0.92	
Level of significance	NS	

$\overline{X}$: Mean SD: Standard Deviation MD: Mean difference

p value: Probability value NS: Non significant

Table 2: Comparison between pre-treatment and post-treatment mean values of ΔC of the compression therapy and physical therapy program group (group A):

Item	ΔC (cm)	
	Pre-treatment	Post-treatment
$\bar{x}$	23.1	15.86
±SD	7.45	6.04
MD	7.24	
% of improvement	31.34	
T- value	4.39	
p-value	0.001	
Level of significance	Highly significant	

$\overline{X}$: Mean SD: Standard Deviation MD: Mean difference

p-value: Probability value

The mean value of ΔC before treatment application (pre-treatment) of Low Level- Laser was 21.26 ± 8.31 cm, while the mean value of ΔC after 4 weeks of treatment application (post-treatment) was 13.03 ± 3.67 cm.

As reflected from table (3), there was a statistically significant decrease in ΔC after 4 weeks of treatment application (post-treatment) of group B ($p < 0.002$), when compared with the corresponding mean value before treatment application (pre-treatment) and the percentage of improvement of ΔC was 38.71% after 4 weeks of treatment application (post-treatment) of group B when compared with before treatment (pre-treatment).

Table 3: Comparison between pre-treatment and post-treatment mean values of ΔC of the laser therapy and physical therapy program group (group B):

Item	ΔC (cm)	
	Pre-treatment	Post-treatment
$\bar{x}$	21.26	13.03
±SD	8.31	3.67
MD	8.23	
Percentage of improvement	38.71	
T- value	3.85	
p-value	0.002	
Level of significance	Highly significant	

$\overline{X}$: Mean SD: Standard Deviation MD: Mean difference

p-value: Probability value

Table (4) shows that there was non significant difference between both groups (A and B) in mean values of ΔC pre-treatment ($p > 0.05$).

It is clear from table (4) that there was non significant difference in ΔC after 4 weeks of application of compression therapy and physical therapy program in the group A when compared with laser therapy and physical therapy program in the group B ($p > 0.05$).

Table 4: Comparison of pre and post treatment mean values of ΔC between both groups (A and B):

Item	Pre- treatment		Post-treatment	
	Group A	Group B	Group A	Group B
$\bar{x}$	23.1	21.26	15.86	13.03
±SD	7.45	8.31	6.04	3.67
MD	1.84		2.83	
T-value	0.63		1.55	
p- value	0.53		0.13	
Level of significance	NS		NS	

$\overline{X}$: Mean SD: Standard Deviation MD: Mean difference

p-value: Probability value

Discussion

The present study was designed to compare the effect of low-level laser and pneumatic compression pump on the reduction of limb size (circumference) in Postmastectomy lymphedema using the tape measure as a method of evaluation was measured at different times:

- Pre Treatment application (before treatment).
- Post Treatment application (after 4 weeks of treatment).

Pneumatic compression and Low-level laser (LLLT) can be used in the treatment of Postmastectomy lymphedema. Several types of research and studies have reported significant effects of pneumatic compression and Low-level laser (LLLT) on reducing limb circumference in patients with Postmastectomy lymphedema.

Therapeutic results of the significant outcomes of Pneumatic compression are summarized as follow:

Pneumatic compression therapy allows translocation of retained fluid from the interstitial into the lymphatic lumen by producing a pressure gradient.

Pneumatic compression produced unidirectional flow without backflow.

Pneumatic compression acts as a "muscle pump" which facilitates the flow of lymph in lymphedema. During compression, the lymph vessels collapse and their content is shifted toward proximal parts of the extremity while the release of compression during a decompression interval allows refilling of lymph vessels with lymph.

Pneumatic compression is also a safe and effective intervention for many suffering from chronic lymphedema.

Therapeutic results of the significant outcomes of the low-level laser are summarized as follow:

Low-level laser therapy increases lymph flow, reduces the amount of excess tissue protein and fluid, and improves the limb performance.

The low-level laser has anti-inflammatory and anti-edematous actions by reducing prostaglandin synthesis.

Low-level laser therapy aids in resorption of both microscopic and gross oedema fluid.

Low-level laser increase lymph vessel diameter, contractility, lymphatic regeneration, and stimulates phagocytic activity of neutrophils and Monocytes.

LLLT encourages lymphangiogenesis.

LLLT stimulates fibroblasts, macrophages, and lymphocytes under physiologic stress or in pathologic conditions.

Low- level laser reduces inflammation, promote lymph vessel regeneration, improve lymphatic motility, and prevent tissue fibrosis.

LLLT to the axillary region can assist in resolving Postmastectomy lymphedema by reducing fibrosis caused by breast cancer–related intervention, stimulating the generation of surviving lymphatic drainage pathways and activating the localized immune response.

Positive clinical efficiency of pneumatic compression and Low-Level Laser:

This concept was supported by some previous studies and past literature that conducted by following authors Uzkeser *et al.* (2015), Kozanoglu *et al.* (2009), Lau *et al.* (2009).

Uzkeser *et al.* (2015) conducted a study to evaluate the effect of manual lymphatic drainage and intermittent pneumatic compression pump on extremity circumference and volume of lymphedema. They statistically showed a significant decrease after treatment as compared with before treatment in both groups, but there were no significant differences in extremity circumference and volume between the two groups that corresponded with the results of this study.

Kozanoglu *et al.* (2009) compared 12 low-level laser therapy (LLLT) sessions to 20 sessions of intermittent pneumatic compression (IC). Statistically, significant improvement was noted in limb circumference differences compared to baseline in both groups immediately after treatment ($p<0.001$), at 3 months ($p<0.001$), and at 6 months(IC group $p<0.01$; LLLT group $p<0.05$). Only the LLLT group maintained significant improvement at 12-month follow- up ($p<0.01$). The improvement was greater in the LLLT group compared to the IC group at 12-month follow-up ($p=0.02$).

Lau *et al.* (2009) investigated the effect of LLLT compared to a waitlist control group.In the laser group (n=11), there was a 16 % average reduction in arm volume immediately after treatment (84.2±8.5 %, $p<0.0001$) and 28 % average reduction at 4 weeks post-treatment (71.9±6.3 %, $p<0.0001$). In the control group, there was an average 6 % increase in arm volume by 4 weeks post-treatment (106.0±4.3 %, $p<0.0001$). The authors suggest that12 sessions of LLLT at the axillary region for about 20 min are effective in reducing the volume of the affected arm and tissue hardness. LLLT may be useful in conjunction with other therapies to accelerate the benefits of treatment.

Conclusion:

From the previous results and discussions, it could be concluded that both pneumatic compression and Low-Level Laser are effective in reduction limb circumference in a patient with Postmastectomy lymphedema.

References

Kozanoglu, E and S. Basaran, 2009. Efficacy of pneumatic compression and low-level laser therapy in the treatment of postmastectomy lymphedema: A randomized controlled trial. Clin Rehabil; 23:117.

Lau, R.W. and G.L.Cheing, 2009. Managing postmastectomy lymphedema with low-level laser therapy. Photomed Laser Surg., 27(5):763–769.

Megens, A.M., S.R. Harris, C. Kim-Sing and D.C. McKenzie, 2001. Measurement of upper extremity volume in women after axillary dissection for breast cancer. Arch Phys Med Rehabil; 82:1639-44.

Moseley, A.L., C.J. Carati and N.B. Piller, 2007. A systematic review of common conservative therapies for arm lymphoedema secondary to breast cancer treatment. Ann Oncol; 18: 639–46.

Newman, T., 2017. What is a mastectomy?" *Medical News Today*. Medi Lexicon, Intl., 23 May. Web. 2 Jan. 2018.

Tiwari, A., K.S. Cheng, M. Button, F. Myint and G. Hamilton, 2003. Differential diagnosis, and current treatment of lower limb lymphedema. The investigation, and current treatment of lower limb lymphedema. Arch Surg; 138: 152–61.

Uzkeser, H., S. Karatay, B. Erdemci, M. Koc and K. Senel, 2015: Efficacy of manual lymphatic drainage and intermittent pneumatic compression pump use in the treatment of lymphedema after mastectomy: a randomized controlled trial. Breast Cancer; 22(3): 300-7.

Yang, J.C, S.C. Wu, M.H. Chiang, W.C. Lin and C.H. Hsieh, 2018. Intraoperative identification and definition of “functional” lymphatic collecting vessels for super microsurgicallymphatic-venous anastomosis in treating lymphedema patients. J Surg Oncol. ; 1–7.