

Report

## The comparison of two different physiotherapy methods in treatment of lymphedema after breast surgery

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**Key words:** complex decongestive physiotherapy, lymphedema

### Summary

**Background.** The aim of this study was to compare two different physiotherapy methods in the treatment of lymphedema after breast surgery.

**Methods.** This study was performed on 53 patients who had developed unilateral lymphedema after the breast cancer treatment. Twenty-seven patients served as the experimental group and were treated with complex decongestive physiotherapy (CDP) applications including lymph drainage, multi layer compression bandage, elevation, remedial exercises and skin care. Twenty-six patients in the control group were treated with standard physiotherapy (SP) applications including bandage, elevation, head–neck and shoulder exercises and skin care. Both groups were recommended a home program consisting of compression bandage exercises, skin care and walking. Patients were taken to a therapy program once a day; 3 days a week for 4 weeks. The range of motion, circumferential measurement, and volumetric measurement were assessed before and after treatment.

**Results.** The overall improving in the CDP group was shown to be greater than the SP group but when the evaluation results of both groups were compared before and after treatment, a significant statistical difference in edema according to circumferential and volumetric measurements results was found in favor of the CDP group ( $p < 0.05$ ).

**Conclusion.** In the patients with upper extremity lymphedema, the shoulder mobility can be increased and edema can be decreased by the use of complex physiotherapy programs.

### Introduction

One out of every eight women in the United States will develop breast cancer in her lifetime [1,2]. One of the complications of breast cancer treatment is lymphedema of the upper extremity. Lymphedema is defined as a swelling of the arm caused by insufficient lymph drainage [3,4]. There are two kinds of lymphedema, primary and secondary. Primary lymphedema is typically seen in young females. It is characterized by diffuse swelling of the lower extremities. Primary lymphedema results from defects in the lymphatic system and is often recognized at birth. Secondary or acquired lymphedema can be associated with cancer, infection, inflammation, radiation, surgery or trauma. Secondary lymphedema is much more common than the primary form [5–8]. Edema of the arm after axillary lymph node dissection is probably the most common cause of lymphedema. Lymphedema may result in cosmetic deformity, loss of functional ability, physical discomfort, recurrent episodes of erysipelas and psychological distress [9–11]. The incidence of lymphedema after treatment for breast

cancer ranges between 6 and 50%, depending on the extent of axillary surgery and use of the radiotherapy [12–14].

People with lymphedema can be treated with medications or surgery but so far these treatments have been largely unsuccessful. Complex decongestive therapy (CDP) can be effective in reducing lymphedema. CDP is a combination of intensive treatment using compression by bandage, manual lymphatic drainage (MLD), exercises enhancing the lymphatic flow and the skin care. This is usually followed by daily use of compression garments, exercises and skin care [5,15,16].

### Patient and methods

This study was performed on 53 patients who had developed unilateral lymphedema after the breast cancer treatment. These patients were treated in School of Physical Therapy between June 2002 and May 2003. Required explanations were made to our patients and those included gave informed consent. This study was

performed with the approval of the local ethics committee and informed assigned was obtained from each patient.

The criteria for entry in the study were:

- Having mild–moderate degreed lymphedema (A difference in circumference of up to 2 cm indicated mild lymphedema; a difference of 2–5 cm shows moderate lymphedema)
- Lymphedema with a duration of at least 1 year
- Having a 2–5 cm difference between the circumference of the both armPatients were ruled ineligible for the study, according to the following exclusion criteria:
- Obvious ongoing psychiatric illness
- Severe pain in axillar region
- Severe cardiac disease
- Uncontrolled hypertension (>160/95 blood pressure)
- Malignity

### Assessments

At the time of enrolment, a complete history was obtained from each woman on the type and side of the operation; the number of excised axillary lymph nodes; the number of tumor and positive lymph nodes; the used radiotherapy technique; adjuvant systemic treatment; the duration of lymphedema; previous episodes of infections.

### Circumference measurement

The edema of the arm was assessed by circumference measurements. A standard one inch, retractable, fiber-glass tape measure was used to perform circumference measurement. The measurement was made from 10, 15, 20 cm above and below the olecranon process, at wrist and at metacarpophalangeal joints [17,18]. The physiotherapist measured each subject's arm twice. The same procedure was repeated in the other arm. All measurements were recorded in centimeters.

### Volumetric measurement

The volume of the arm was measured with water displacement. The arm was put into a water-filled cylinder and overflowing water was measured. Both arms were measured and the difference between the overflowing water of both arms was calculated. A correction between the affected and non-affected upper extremity was made the volume was calculated in percent, thus:

$OA_{\text{post-treatment}}$  is the volume of the arm on the affected side after treatment,  $NA_{\text{post-treatment}}$  is the volume of the arm on the non-affected side after treatment,  $OA_{\text{pre-treatment}}$  is the volume of the arm on the affected side before treatment and  $NA_{\text{pre-treatment}}$  is the volume of the arm on the non-affected side before treatment [17,18].

### Shoulder mobility

The range of motion of the shoulder joint was quantities with the standard techniques of goniometry. Shoulder function was measured as the active mobility with extension–flexion, abduction–adduction, and external rotation [18].

### Study design

Patients were randomly divided into two groups using cards in unmarked envelopes, to receive either Complex Decongestive Physiotherapy (CDP) or standard physiotherapy (SP). Patients were blind to the intervention.

Twenty-seven patients served as the experimental group and were treated with CDP applications including manual lymph drainage, compression bandage, remedial exercises and skin care. Twenty-six patients in the control group were treated with SP applications including bandage, elevation, head–neck and shoulder exercises. Both groups were recommended a home program consisting of compression bandage, exercises, skin care, and self-massage and walking. Patients were taken to therapy program once a day, 3 days a week for 4 weeks. Assessments including objective measurements were performed before treatment and end of fourth week (after treatment).

Manual lymphatic drainage was performed, using a modification of the method described by Földi and StröBenneother [19]. Massage strokes were applied to the side of the edematous limb, starting at the base of the neck for arm lymphedema and then progressed to the affected limb. Massage was always directed proximally from the upper arm to axilla and then from the hand to the elbow. Finally the whole limb was massaged from the distal to the proximal extremity. Patients were also shown how to massage themselves each evening.

Exercises were used to improve the mobility of joints of the edematous extremities and the function of the muscular pump. Respiratory exercises were also encouraged [18]. Multiple layer compression bandages was applied with the goal of having the most compression at the most distal points and gradually decreasing

$$\frac{(OA_{\text{post-treatment}} - NA_{\text{post-treatment}}) - (OA_{\text{pre-treatment}} - NA_{\text{pre-treatment}})}{OA_{\text{post-treatment}}} \times 100$$

compression as you move proximally. This facilitates lymphatic drainage up toward the heart.

### Statistical analysis

Data were analyzed in the SPSS 11.0 program. Differences between the groups were analyzed using the Wilcoxon Rank Sum test. Mann Whitney *U* test for dependent samples was used to determine the differences in the before and after measurements.  $p < 0.05$  was considered statistically significant[20].

### Results

Demographic data on both groups are presented in Table 1. Initially we had taken 56 patients but 1 in the experimental group withdrew from the study because of breast cancer recurrence; 2 in the control group withdrew from the study because of infection in their arms. This allowed data to be obtained only on 53 patients. The mean age of the all patients was 58 years (range 31–76). Twenty-seven were selected at random to experimental (CDP) and 26 were selected at random to control (SP) groups. The characteristics of the patients in the two groups were similar. All of the patients had developed lymphedema after the first year from surgery. The average duration of lymphedema at the time of treatment was 3 year in patients with post-surgical lymphedema. Thirty-two of the patients had moderate (60.4%), 21 had a mild (39.6%)

lymphedema. Nine of all patients (16.9%) had a history of soft-tissue infection (cellulites). Forty-four patients had no infection. Of all the patients, 24.5% of patients undergone lumpectomy, 64.2% modified radical mastectomy (MRM) and 11.3% radical mastectomy (RM). Radiotherapy and hormonal therapy had been given to 13.2% of patients, radiotherapy and chemotherapy to 37.7% of patients and radiotherapy, chemotherapy and hormonal therapy to 49.1% of patients. All patients had undergone axillary dissection with a range of 2–35 nodes removed (mean = 24.2).

### Edema of arm

When we classified edema as mild and moderate according to circumference and volumetric measurements, classification of patients was similar in the both measurements. Twenty-one of all patients (39.6%) had mild, 32 (60.4%) had moderate lymphedema. The mean percentage reduction in edema was 55.7% in CDP group and 36% in SP group. All patients demonstrated sustained improvement in both groups. But, the reduction in edema was found to be better in the CDP group than SP group ( $p < 0.05$ ), (Table 2).

### Shoulder mobility

Range of motion before and after treatment in both groups is presented in Table 3. When all patients' range

Table 1. Characteristics of the patients

	CDP <i>n</i> = 27		SP <i>n</i> = 26	
	Mild <i>n</i> = 2	Moderate <i>n</i> = 5	Mild <i>n</i> = 9	Moderate <i>n</i> = 17
Age (years)				
Mean ± SD	53.1 ± 3.05	61.3 ± 7.2	54.7 ± 12.1	63.6 ± 0.7
Range	31–67	38–76	35–62	V
Weight (kg)				
Mean ± SD	66.3 ± 9.8	73.9 ± 13.2	64.7 ± 11.4	71.5 ± 6.8
BMI (kg/m <sup>2</sup> )				
Mean ± SD	25.5 ± 1.6	27.2 ± 9.6	24.7 ± 5.5	26.9 ± 7.3
Type of operation (%)				
Radical mastectomy	8.3	13.3	–	17.6
Modified radical mastectomy	75	60	66.8	50.1
Lumpectomy	16.7	26.7	33.2	23.3
Duration of lymphedema (year) Mean ± SD	1.8 ± 3.4	3.3 ± 11.2	2.2 ± 0.1	4.2 ± 7.7
Lymph nodes removed (number) Mean ± SD	4.7 ± 9.5	16.8 ± 5.6	5.2 ± 13.3	19.5 ± 3.1
Effected arm (%)				
Dominant	58.3	60	55.6	58.8
Non-dominant	41.7	40	44.4	41.2
Treatments (%)				
ET + CT + RT	58.3	53.3	44.4	47.1
ET + RT	16.7	6.7	22.3	11.7
CT + RT	25	40	33.3	41.2
History of recurrent cellulites (%)	8.3	20	–	29.4

ET = Endocrine therapy, RT = Radiotherapy, CT = Chemotherapy.

Table 2. The comparison of the affected arm edema before and after the treatment

Edema effected arm	Before treatment		After treatment		<i>p</i>
	Mild Mean ± SD	Moderate Mean ± SD	Mild Mean ± SD	Moderate Mean ± SD	
Circumferential measurement (cm)					
Olecronon	27.5 ± 10.2	30.5 ± 6.4	25.5 ± 12.7	27.3 ± 10.5	0.00
10 cm↑	30.2 ± 9.6	33.1 ± 3.7	26.8 ± 10.4	31.5 ± 8.2	0.00
15 cm↑	33.4 ± 5.5	37.8 ± 1.1	30.5 ± 8.8	34.9 ± 6.6	0.00
20 cm↑	34.5 ± 2.8	39.3 ± 0.7	32.5 ± 3.5	36.5 ± 4.3	0.00
10 cm↓	25.5 ± 1.7	28.5 ± 13.3	23.1 ± 2.9	26.1 ± 12.3	0.00
15 cm↓	23.9 ± 0.3	26.5 ± 2.8	20.6 ± 0.7	24.2 ± 3.1	0.00
20 cm↓	21.3 ± 9.4	24.4 ± 6.5	18.5 ± 9.1	21.7 ± 4.7	0.00
Wrist	15.8 ± 11.2	18.6 ± 7.1	14.3 ± 11.3	15.8 ± 8.4	0.00
MCP	17.2 ± 4.5	19.7 ± 3.9	15.6 ± 6.3	17.2 ± 3.2	0.00
Volumetric measurement (mlt)	370.35 ± 127.4	600.23 ± 189.8	266.15 ± 98.6	299.13 ± 112.7	0.00

MCP: Metacarpophalengial, statistically significant  $p < 0.05$ .

Table 3. The comparison of the range of motion of the shoulder between the groups

Range of motion (°)	Before treatment Mean ± SD	After treatment	<i>p</i>
CDP			
Flexion	162.3 ± 9.9	170.9 ± 11.4	0.00
Abduction	163.6 ± 13.05	178.2 ± 8.1	0.00
External rotation	82.7 ± 12.3	85.1 ± 5.9	0.00
SP			
Flexion	167.3 ± 13.6	171.05 ± 6.6	0.00
Abduction	167.2 ± 3.8	178.6 ± 7.12	0.00
External rotation	84.6 ± 8.1	85.7 ± 6.5	0.00

Statistically significant  $p < 0.05$ .

of motion before treatment was assessed in both groups, we determined that only 45.2% of patients had limitation of range of motion. Reduction in shoulder mobility was 48.1% in CDP group and 42.3% in SP group before treatment. Shoulder flexion, abduction movements in both groups were increased after treatment ( $p < 0.05$ ). Increasing in shoulder external rotation after treatment was minor in both groups. Therefore, significant difference was not found in shoulder external rotation in both groups ( $p > 0.05$ ). When shoulder mobility was compared in the CDP and SP group, there was no significant difference between groups.

## Discussion

Many researchers used circumferential measurements and volumetric measurements with the purpose of evaluating the edema and they regarded volume measurement by water displacement as a gold standard for estimating the volume of an irregular shape [17]. In our study we also used both of these measurements for determining the edema of arms.

Multiple ways of describing the presence and severity of lymphedema in tissues have been published in the literature. Pezner et al. [21] described arm edema as mild, moderate or severe depending on the difference between arm circumference at various points from the elbow when the affected arm is compared with the unaffected arm. Stillwell [22] has criteria with a range from insignificant to severe based on the percentage difference in the size of the normal arm when compared with the affected arm. A volume estimate can be calculated by reducing the measuring intervals to 4 cm, as described by Kurz (Kuhnke's disk model) [23]. In our study, when we classified edema as mild and moderate according to circumference and volumetric measurements, classification of patients was similar in the both measurements. Therefore, one of these methods can use to assess the patients having lymphedema.

Lymphedema can be a serious and disabling complication of breast cancer treatment [24,25]. There is no cure for this condition, and the aim of the treatment is to reduce the swelling, increase joint mobility and to decrease discomfort. Management with CDP is currently a popular and widespread treatment approach, and was recently recommended by a workgroup of the American Cancer Society Lymphedema Workshop [26]. CDP is a combined method of treatment, and the relative efficacy of each of the components of this comprehensive treatment program had not previously been investigated in randomized studies [3,7,25].

Our study showed that both groups obtained a significant reduction in limb volume, a decrease in discomfort and an increased joint mobility during treatment. But the reduction in the edema of the CDP group was found to be better in comparison with that of the SP group.

Andersen et al. [3] found that the mean reduction in absolute lymphedema in the whole treatment group was 43% after 1 month. This is in accordance with the absolute lymphedema reduction of 47% found in a Swedish study by Brorsan and Suensson [27]. In our

present study the mean reduction in lymphedema in CDP group was 55% after treatment. The patients in the Swedish study had a much larger and more severe lymphedema [27]. The mean volume of edema at baseline was 1680 ml and the mean duration of lymphedema was 7.2 years compared with a mean volume of 350 ml and a mean duration of 1.2 years in Andersen et al. [3]. In our study we found that the mean volume was 580 ml and a mean duration was 3.4 years.

Casley-Smith in 1996 discussed their observations in 628 swollen limbs and also showed good results [28]. Ko et al. [29] reported that lymphedema reduction averaged 59.1% after upper – extremity CPD. Wozniewski et al. [30] showed that the average decrease in lymphedema was 43% in patients with minimal edema, 33% in those with moderate edema and 19% in women with severe edema. In our study we found that the average decrease in lymphedema was 72% in patients with minimal edema and 49% in these with moderate edema.

According to many researchers, CDP is a highly effective treatment for both primary and secondary lymphedema [31,32]. This study showed that CDP can effectively promote limb volume reductions in patients with upper lymphedema when combined with self-care. CDP may result in a long-term control of lymphedema. Effective reduction of lymphedema promotes the maintenance of limb function and may reduce the incidence of recurrent infection. The long-term follow up were not stated in this study, but these patients are still following. We aimed to report the short-term effects of CDP in upper extremity lymphedema. The long-term follow up results will be reported in our further study (3rd month, 6th month, 12th month and 24th month).

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