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Research Article

Efficacy of Structured Grip Strengthening Exercise Program to Improve Activity Limitations in Patients with Breast Cancer-Related Lymphedema

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Abstract

Background: Breast cancer is one of the most common cancers found in India. Breast cancer-related lymphedema is a complication found in women who undergo mastectomy and radiation. It causes upper limb disability leading to reduced hand function and grip strength. There is limited research for finding out the efficacy of exercises to improve hand functions and strength. Therefore, this study aims to find out the effect of grip strengthening exercises in women with breast cancer-related lymphedema with reduced hand grip strength.

Method: The study was conducted on 30 women with lymphedema having reduced hand grip strength. The nature and purpose of the study were explained and a consent form was filled out by the participants. The participants were assessed and then they were given simple exercises to perform for 4 weeks. After the 4 weeks, the participants were reassessed and statistical analysis was done to find out the results.

Results: There was a significant increase in hand grip strength of the affected arm as compared to the hand grip strength assessed before the treatment. The study also shows that activities of daily living were performed with more ease after the treatment.

Conclusion: According to the results, hand functions and strength improves with exercise. Thus, reduced hand grip strength in women with lymphedema can be improved by including grip strengthening exercises. It can also be used with other therapeutic interventions for better treatment outcomes.

Keywords: Breast cancer; Breast cancer-related lymphedema; Mastectomy; Hand grip strength

1. Introduction

Cancer is an uncontrolled growth of cells that tend to proliferate and, in some cases, metastasize [1-5]. When the cancer cells grow in distant or nearby tissues the cancer is known as malignant whereas when the cancerous cells do not spread it is known as benign [6].

Breast cancer is the most common form of cancer worldwide and the second leading cause of mortality in women [1]. Breast cancer-related upper limb lymphedema is common in patients who undergo mastectomy. Lymphedema is a clinical condition in which the accumulation of excessive protein-rich fluid leads to chronic swelling in the arm, hand, trunk, or breast [2].

The major signs and symptoms of lymphedema are 1. Increased limb girth, 2. Reduced ROM of affected joints, 3. Stiffness of joints involved, 4. Sensory changes in hand, 5. reduced use of affected extremity for functional tasks [3]. Additionally, chemotherapy results in muscle wasting and reduced muscle strength due to disruption in muscle metabolism (e.g., cytokine dysregulation, ADP dysregulation) [4].

Staging of lymphedema

- Stage 0 (also called subclinical or latent): there are no visible changes to the arm, hand, or upper body, but there may be mild tingling, unusual tiredness, or slight heaviness in the arm, hand, or trunk.
- Stage 1 (mild): the arm, hand, trunk, breast, or other areas may appear mildly swollen as protein-rich fluid starts to accumulate. Pitting is present. Early-stage lymphedema is reversible with treatment.
- Stage 2 (moderate): the affected arm is even more swollen. Non-pitting edema is present. The underlying tissue gets thickened, and stage 2 lymphedema can be managed with treatment but the tissue damage cannot be reversed.
- Stage 3 (severe): this is the advanced stage. The affected limb becomes very large, skin appears leathery or wrinkled.

Etiology

Breast cancer treated with radical mastectomy includes removal of axillary lymph nodes. As the lymph nodes are removed the lymph is not properly drained. This eventually leads to swelling in the affected arm.

The cancerous cells encircling the lymphatic vessels may block the circulation and removal of lymph as a result lymphatic fluid will not be drained properly. This may lead to swelling in the affected arm.

Patients undergo radation treatment, the radiations result in scarring and inflammation of lymph nodes exposed to radiation, this results in incomplete drainage of lymph and swelling of affected arm.

Complications

Lymphedema can lead to skin infections, sepsis, the lymph can leak through skin, the skin may also get thickened.

Grip strengthening

Grip strength is the force applied by hand to pull on an object or to hold an object for a long time.

Power grip is commonly used as an index to assess impairment and treatment outcomes of hand. The fingers assume a position of sustained flexion and the thumb is adducted to clamp the object.

When these muscles are strong, they are much more prepared to handle daily forces and carry out functional activities efficiently.

Normally there is a 10% difference in grip strength between dominant and non-dominant hands.

Grip strength values measured on a sphygmomanometer-

200mmHg or greater is considered as strong grip strength.

100-200mmHg is considered as average grip strength.

100mmHg or less is considered as weak grip strength.

Previous studies that evaluated handgrip strength in women with BCRL showed that there is a significant reduction in handgrip strength in women with BCRL as compared to age-matched women without BCRL [7].

There is limited research to determine the effectiveness of grip strengthening after surgery and radiotherapy treatment in women with breast cancer. Therefore, the purpose of this study is 1. Assess hand grip strength of women with BCRL, 2. Design a home exercise protocol for improving hand grip strength, 3. Implementing the home exercise program in subjects, 4. Evaluating the results after completing the home exercise program.

2. Methodology

Based upon the inclusion and exclusion criteria, a total of 30 participants were selected. The participants were informed about the purpose and nature of the study and consent was signed.

The participants included women with breast cancer-related lymphedema aged between 30-80 years. The duration of lymphedema should be more than 3 months. The participants were assessed for hand grip strength by a sphygmomanometer and were given a DASH questionnaire which assessed activity limitations. DASH questionnaire had 30 questions related to activities of daily living and a score of 5 for each question.

The participants were then given hand grip strengthening exercises as a home protocol regime for 4 weeks. After 4 weeks the participants were reassessed for hand grip strength and activity limitations through a DASH questionnaire.

The pre-intervention and post-intervention data were compared by statistical analysis and the result was interpreted.

2.1 Data collection tools

A consent form was signed by the participants before filling the data collection sheet with all the details explained in Marathi. The respondents were informed about the aim of the study as well as the fact that participation in the survey is voluntary. Data collection sheets were distributed to the participants. The hand grip was assessed by a sphygmomanometer.

3. Results

Outcome measure	P-value
Hand grip strength	<0.0001
DASH score	<0.0001

Table 1: P values of outcome measures used.

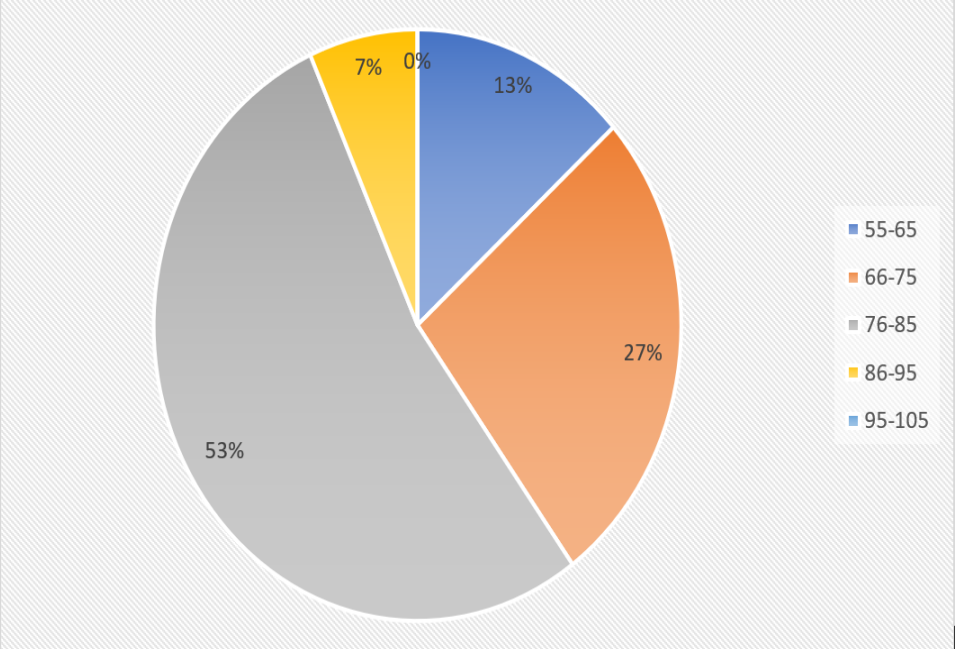

Figure 1: Hand grip strength pre intervention**.** The study showed that pre intervention hand grip was 76-85 mmHg in 53% of patient followed by 66-75mmhg in 27% , 55-65mmhg in 13%, 86-95mmhg in 7%.

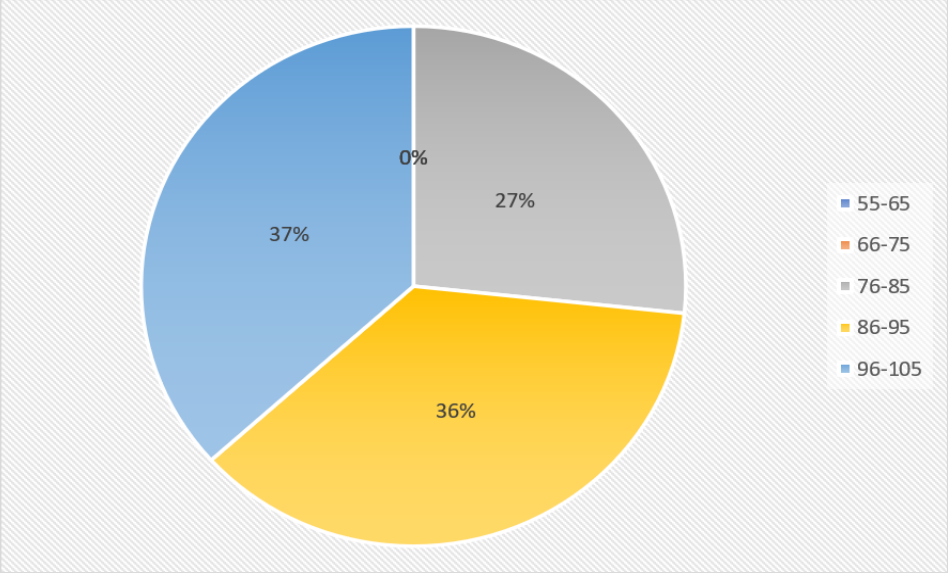

Figure 2: Hand grip strength post interventions. The study showed that post intervention hand grip strength was 96-105mmhg in 37% of patients, followed by 86-95mmhg in 36% , 76-85mmhg in 27% of patients.

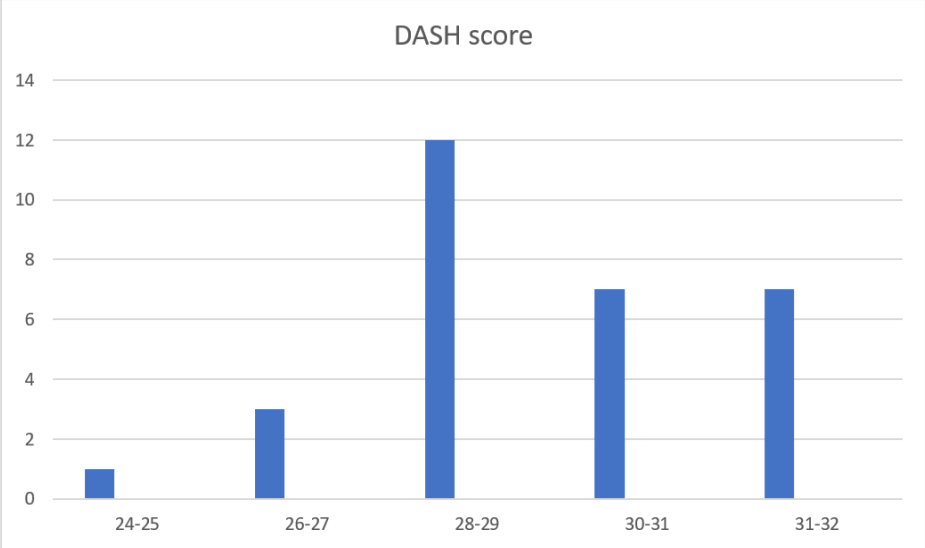

Figure 3: DASH score Pre intervention.

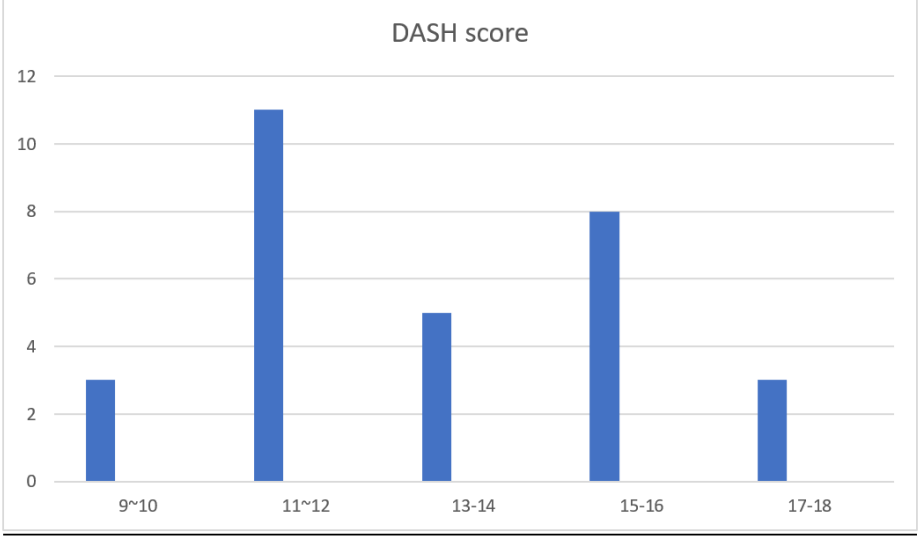

Figure 4: DASH score Post intervention.

4. Discussion

Upper extremity dysfunctions after breast cancer surgery cause difficulties in the daily activities of patients and negatively affects their quality of life [8]. Lymphedema results in decreased shoulder range of motion, pain, and muscle weakness, it also results in chronic upper extremity morbidity due to its poor prognosis [9].

The prevalence of reduced hand grip strength of the affected hand was investigated in several studies. However, it is important to consider the inherent difference between dominant and non-dominant extremities when assessing hand grip strength which is about 10%.

The previous study evaluated the relationship of hand grip strength with upper extremity functionality, daily living activities, and physical activity level in female patients who were operated on for breast cancer and developed secondary lymphedema. The study concluded that there was a reduction in hand grip strength of the

affected side which negatively affects activities of daily living and upper extremity function [8].

This study included 30 patients having reduced hand grip strength secondary to breast cancer-related lymphedema. The patients were given physiotherapy treatment to improve their hand grip strength which included simple exercises like towel curls, ball squeezing, towel squeezing, rubber band exercises, etc. The patients required 4 weeks of treatment for regaining the strength in the affected hand [10-12]. To compare the results, pre-intervention and post-intervention assessments were taken. Hand grip strength was measured by using a sphygmomanometer, activity limitations were assessed by the Disability of arm, shoulder, and hand questionnaire.

In this study, we found that the hand grip strength is reduced in the affected extremity. As a result, the extremity is not used for the majority of functional activities. Pain, swelling, and stiffness of the extremity make the extremity less functionally active. As a result of this, the muscles of the hand lose their strength to carry out daily activities.

In this study, the subjects in the age group of 35-45 years recovered fast as compared to an elderly population. This seems to be because the healing process in the younger population is higher than in the elderly.

Patients benefit from hand grip strengthening exercises given along with conventional physiotherapy treatment. The overall activity limitations according to the Disability of arm, shoulder hand questionnaire improved after the treatment. Thus, grip strength should be assessed and grip strengthening protocol should be included along with other physiotherapeutic approaches while treating a patient post-mastectomy [13].

Some limitations must be taken into consideration while interpreting the results of the study. One of the limitations was that the hand grip was not assessed before the surgery. Therefore, it was difficult to compare the post-physiotherapy treatment results, as a baseline was not established [14,15]. If a pre-lymphedema assessment would have been taken, the results after physiotherapy treatment would have been able to compare in a better way. Another limitation was the present study was conducted at a single institution; therefore, the generalization of the result may be limited. Another limitation of the study was the limited sample size [16].

5. Conclusion

The study concluded that hand grip strength can be significantly improved by giving simple exercise protocol to patients with reduced handgrip strength post-mastectomy [17-20]. Thus, grip strength should be assessed and grip strengthening exercises should be included along with other physiotherapeutic approaches while treating patients with breast cancer-related lymphedema. It helps in regaining muscle strength and thus improves activity limitations in these patients.

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