RESEARCH ARTICLE

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Effectiveness of Scapular Strengthening Exercises on Shoulder Dysfunction for Pain and Functional Disability after Modified Radical Mastectomy: A Controlled Clinical Trial

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Abstract

Background: Breast cancer is the most prevalent from of cancer among women worldwide and leading cause of death. Breast cancer can be treated surgically, systemically (with hormonal therapy, chemotherapy) or with radiotherapy. Through the years, breast cancers management evolved towards conservation surgery. A surgical remove of partial or complete breast tissue, surrounding tissues, and nearby lymph nodes is called mastectomy. In Modified Radical Mastectomy, there is removal of entire breast tissue and lymph nodes. Treatment of modified radical mastectomy may lead to side effects such as shoulder pain, restricted shoulder mobility and anatomical and biomechanical changes of the shoulder, and also reduce functional disability. **Method:** Eighty six participants were included in this study. Two groups, each of 43 were made, Group A (control group) was given conventional exercises and Group B (study group) was given scapular strengthening exercises with conventional exercises. Outcome measures - Shoulder Pain And Functional Disability, Shoulder range of motion were assessed both pre and post-test. **Result:** Group B had lower pain intensity (77.116 ± 5.798vs 82.837 ± 3.860) and functional disability (70.326 ± 5.281 vs 77.791± 5.102) and higher shoulder flexion (167.98 ± 8.230 vs 107.05 ±8.018), abduction (156.91 ± 8.230 vs 107.63 ±8.230) and external rotation (62.372 ± 7.007 vs 41.907 ±6.771) range of motion than Group A. **Conclusion:** The current study concluded that, scapular strengthening exercises along with conventional treatment proved beneficial and effective rather than only conventional treatment on shoulder dysfunction for pain and functional disability after modified radical mastectomy.

Keywords: Modified radical mastectomy- women- scapular strengthening- Physiotherapy

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Introduction

Cancer is the term used for disease in which abnormal cells divide without control and are able to include other tissues (Sariego, 2010). Breast cancer is one of the most common malignancy occurs in women (Rangwala and Badakere, 2004). Breast cancer is also principal cause of death among female globally (DeSantis et al., 2014). It can be life-threatening disease for women worldwide (Hervy, 2005). Breast cancer is the primary cause of death in women at the age over 45 years of age (Pisani et al., 1999). Treatment options in the case of breast cancer include surgical treatment, systemic treatment (hormonal therapy and chemotherapy), and radiotherapy (Del et al., 2008).

A surgical remove of partial or complete breast tissue, surrounding tissues, and nearby lymph nodes is called mastectomy (Brunicardi, 2010). In Modified Radical Mastectomy, there is removal of entire breast tissue and lymph nodes (DeVita et al., 2008). Breast cancer is one of the most common condition leading to long term disability and impairments (Johansen et al., 2014). Treatment of breast cancer may lead to side effects such as shoulder pain, restricted shoulder range of motion and anatomical and biomechanical changes of the shoulder (Shamley et al., 2014). Pain is more likely when breast cancer surgery includes the removal of lymph nodes in underarm area (Cherny and Truong, 2014). Post-operative pain control remains a major problem for patients undergoing breast cancer surgery (Apfelbaum et al., 2003). The causes of shoulder pain related to breast cancer are thought to include muscle tightness, neurogenic pain due to lymph node removal and restricted range of motion (Stubblefield and Custodio, 2006). Functional disability is also common in breast cancer women (Canam, 1999). Functional disability is a complex multi-dimensional assessment of the physical, psychological and social well-being of individual. The physical dimensions include ability to work and physical functioning, the psychological dimensions include coping ability, self-acceptance, perceived health status and adjustment to illness (Akin

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et al., 2008).

Limitations in motion, pain and tightness of tissues around the shoulder, including the skin, muscles and tendons, caused by restricted movement are major dysfunctions that can lead to difficulties in the activities of daily living (Yang and Lin, 2006). Considering the kinematics of shoulder movement, shoulder tightness after modified radical mastectomy affects glenohumeral translation and scapulohumeral rhythm, followed by changes in scapular motion (Lin et al., 2006). In particular, shortened pectoralis major and minor covering the anterior part of the shoulder and chest can impose restrictions in shoulder range of motion (Rundquist, 2007). Flexion, abduction and external rotation range of motion are affected after the breast cancer surgery (Borstad and Ludewig, 2005). The loss of a breast produces soft tissues asymmetry and mass distribution through the chest wall, affecting upper- limb movements and resulting in shoulder discomforts (Naqvi, 2021). The shoulder is a very mobile joint that relies heavily on mid-range stability on muscle control, therefore, evaluation of such control and treatment at its improvement should from an integral part of management of all shoulder disorders (Magarey and Jones, 2003). The scapula has a major and pivotal role in normal shoulder function, its position and motion provide the parameters to allow normal physiology and biomechanics of the shoulder to occur (Kibler, 1998). The glenohumeral joint motion and the scapular motion on the thorax is important for the upper limb to move properly and painlessly (Neto et al., 2018). Function of the upper limb requires adequate mobility of the shoulder, including the scapula and an efficient neuromuscular coordination (Michener et al., 2003).

Physiotherapy in the postoperative period of modified radical mastectomy allow significant improvement in shoulder pain, functional disability and improve shoulder flexion, abduction, and external rotation (McNeely et al., 2010). Scapular strengthening exercises, also known as scapular stabilization exercise, are exercise that aim to enhance shoulder kinematics by stabilizing the scapula through restoring its position, orientation, motor control of the muscles and movement pattern (Ravichandran et al., 2020) . Based on evidences, shoulder pain and functional disability are the common problem associated with modified radical mastectomy and it disrupts patient's activity of daily living (Kwan et al., 2022).

Thus, this study was designed to evaluate the impact of scapular strengthening exercise protocol in improving shoulder pain and functional disability after modified radical mastectomy. These exercises emphasize scapular motion along with glenohumeral joint motion, which may reduce tightness in the shoulder which reduces pain and also reduces disabilities and also increase range of motion in breast cancer after radical modified mastectomy.

Materials and Methods

After approval from institutional protocol and ethical committee, this comparative study was performed in a breast cancer survivor of Krishna Vishwavidyapeeth.The study's major goal was to determine the effectiveness of scapular strengthening exercises for pain and functional disability after modified radical mastectomy.

Participants

Eighty-six breast cancer survivors after modified radical mastectomy were selected for this study. According to Inclusion criteria, unilateral breast cancer followed by chemotherapy and radiotherapy, modified radical mastectomy surgery, upper limb dysfunctions were taken. Patients with recurrent breast cancer, history of previous breast cancer were excluded.

These subjects were then selected and were divided into two equal groups using sequences of random numbers. Both group A (Control group) and group B (Study group) had 43 individuals each. The intervention program should performed exercises 3 times per week for 4 months. Each session lasted for 45 to 50 minutes.

Procedure

All patients were approached and explained about the details related to the study and informed as well as verbal consent was taken from them. Pre – test assessment was taken by using SPADI (Shoulder Pain And Disability Index) to determine shoulder pain and functional disability and pre- test assessment was taken by Goniometer to determine shoulder flexion, abduction and external rotation range of motion. Group A were given conventional exercises and Group B were given scapular strengthening exercises along with conventional exercises. The subjects were instructed on how to perform the exercises correctly. These both groups performed the exercises three times per week for 45 to 50 minutes for 8 weeks under the supervision of the experienced person. Post- test assessment was taken by using SPADI (Shoulder Pain And Functional Disability Index) and Goniometer. The interpretation of the study was done on the basis of comparing pre- test and post- pest values of both the group by using Instat software.

Outcome Measures-
SPADI

The subject was explained about Shoulder Pain And Disability Index (SPADI). It is a self- administered questionnaire that was found to be both sensitive and reliable. It contains thirteen items, which assess two domains (pain and disability). The subject circled the best number that reflected their pain on a scale from 0 to 10, which has five items subscale to measure pain. The subject circled the best number that reflected their disability on a scale from 0 to 10, which has 8 items subscale to evaluate disability.

Range of motion

Goniometer was utilized to assess flexion of the shoulder, abduction of the shoulder and eternal rotation of the shoulder. The patient was instructed to move the joint through its range of motion just after the goniometer was adjusted to zero. Greater the value of range of motion more is the range of motion.

Subjects in group A (control Group) received conventional Physiotherapy treatment which include

active range of motion, pectoral stretching, free movements of shoulders, shoulder joint mobilization, posterior capsular stretch, .To mobilize the shoulder joint, distraction of the glenohumeral joint, posterior glide and caudal glide were performed to the patient in supine position at a frequency of two to three oscillations/second for one to two minutes. In posterior capsular stretching each stretch was repeated ten times for 20 seconds, between each stretching 30 seconds break was given. Pendulum exercises was demonstrated to the patient at first, then they performed it in the forward- backward direction, side to side direction and circular pattern, for two to three minutes in each direction. Suggestions on work equipment modifications and task organization were given to subjects if required.

Subjects in Group B (Study Group) received scapular strengthening exercises along with conventional exercises. Scapular strengthening exercises include scapular stabilization exercises, diagonal two (D2) flexion pattern, the subject raises her contralateral side of the waist to her ipsilateral side of the head, the combined glenohumeral flexion, abduction, and external rotation movement aim to augment the upper, middle, lower, and serratus anterior muscle activity level. To activate upper trapezius muscle, shoulder shrug exercises was used. To activate serratus anterior muscle, wall slide exercises was used. Scapular retraction exercises for rhomboids and middle trapezius activation was done. Strengthening exercises performed using weights were initiated with two sets of ten repetitions, beginning with a weight of 0.5kg and progressed to 0.75 and then 1 kg.

Statistical analysis

Statistical analysis of the recorded data was done by using the software Instat. Mean and standard deviation for each outcome measure were calculated. Ms Excel was used for drawing various graphs with given frequencies and for master chart. Paired t test was used to compare results of pre and posttest.

Results

The patients who finished a complete session for them analysis was made and on whom complete pre and post assessments were performed. Group A and Group B both consisted of 43 subjects each. The Pain intensity significantly decreased in group B post-treatment. The mean decrease in pain scores was significantly higher in group B than in group A (77.116± 5.798vs 82.837 ± 3.860). Moreover, there was an extremely significant difference detected between both groups regarding pain scores post-treatment, being extremely significantly low in group B (Table 1).

In Table 2, Functional disability scores showed a significant decrease in group B post-treatment indicating decrease in functional disability. The mean decrease in functional disability score was higher in group B than in group A (70.326±5.281vs 77.791± 5.102). However, an extremely significant difference was detected between both the groups regarding functional disability scores post treatment.

In Table 3, the flexion range of motion increase in both groups post-treatment. The mean increase in flexion score was higher in group B than in group A (167.98±8.230vs 107.05±8.018). However, there was significant difference detected between both the groups regarding flexion scores post treatment.

In Table 4, the abduction range of motion increase in both groups post-treatment. The mean increase in abduction score was higher in group B than in group A (156.91±8.230vs 107.63±8.230). However, there was significant difference detected between both the groups regarding abduction range of motion scores post treatment.

In Table 5, the external rotation range of motion increase in both groups post-treatment. The mean increase in external rotation score was higher in group B than in

Table 1. Comparison of Mean Score of Pain within and between Both the Groups

Pain	Pre	Post	p-value	t-value	Inference
Group A	84.605± 3.965	82.837± 3.860	0.0016	3.367	Considered very Significant
Group B	83.535± 5.869	77.116± 5.798	<0.0001	8.134	Extremely significant
Inference	Not significant	Extremely significant			

Table 2. Comparison of Mean Score of Functional Disability within and between Both the Groups

Functional disability	Pre	Post	p-value	t-value	Inference
Group A	81.488± 5.404	77.791 ± 5.102	0.0014	3.43	Considered very significant
Group B	79.535 ± 5.561	70.326 ± 5.281	<0.0001	8.256	Extremely significant
Inference	Not significant	Extremely significant			

Table 3. Comparison of Mean Score of Shoulder Flexion Range of Motion within and between Both the Groups

Flexion	Pre	Post	p-value	t-value	Inference
Group A	101.14 ± 8.149	107.05 ± 8.018	<0.0001	6.889	Extremely significant
Group B	103.81 ± 8.376	167.98 ± 8.230	<0.0001	34.272	Extremely significant
Inference	Not significant	Extremely significant			

Table 4. Comparison of Mean Score of Shoulder Abduction Range of Motion within and between Both the Groups

Abduction	Pre	Post	p-value	t-value	Inference
Group A	98.000± 8.477	107.63± 8.252	<0.0001	6.821	Extremely significant
Group B	100.86± 9.031	156.91± 8.280	<0.0001	27.915	Extremely significant
Inference	Not significant	Extremely significant			

Table 5. Comparison of Mean Score of Shoulder External Range of Motion within and between Both the Groups

External Rotation	Pre	Post	p Value	t Value	Inference
Group A	39.761 ± 6.924	41.907 ± 6.771	0.011	2.659	Consider significant
Group B	38.465 ± 7.688	62.372 ± 7.007	<0.0001	16.543	Extremely significant
Inference	Not significant	Extremely significant			

group A (62.372±7.007vs 41.907±6.771). However, an extreme significant difference was detected between both the groups regarding external rotation range of motion scores post treatment.

Discussion

The study "Effectiveness of scapular strengthening exercises on shoulder dysfunction for pain and functional disability after modified radical mastectomy" was conducted to determine effect of scapular strengthening exercise programme on shoulder pain, functional disability after modified radical mastectomy. Females who had a modified radical mastectomy surgeries had a slightly increased prevalence of shoulder dysfunction such as shoulder pain, functional disability and decrease in range of motion (Ewertz and Jensen, 2011). Modified radical mastectomy surgery cause scar tissue formation, fibrosis, and shortening of soft tissues such as pectoral muscle which results in shoulder pain and restriction of shoulder upward motion, abduction and external rotation of shoulder (Loh and Musa, 2015). Post-operative patients, scapular and shoulder kinematics are frequently altered, causing them to struggle with activity of daily living leading to shoulder stiffness and pain. (Rett et al., 2017).

Physiotherapy in the post-operative period of mastectomy allowed significant improvement in shoulder range of motion, decrease in pain and improve in functional disability and also plays an important role in the prevention, early detection and treatment of complications in the postoperative period of breast cancer (De Greof et al., 2015).

Many studies were conducted for effect of Physiotherapy in breast cancer survivors. According to Khurana (2022), she studied a case report on the impact of Physiotherapy on shoulder function in breast cancer patients undergoing surgery. She demonstrated an exercise program for 15 days under supervision. In this study she concluded that Physiotherapy is more beneficial in reducing shoulder range of motion after a modified radical mastectomy.

Other study was done by Arsh et al., (2019), he studied about shoulder pain and disability among post mastectomy patients in 127 participants, he concluded that post mastectomy patients suffer from shoulder pain and disability and physical therapy after mastectomy can help in preventing pain and disability.

Other study was done by Salwa et al., (2016), he studied functional status in women after breast cancer surgery in 60 participants. In this study two groups were made, intervention group and control group. In intervention group, participants received exercises bi- day / per two month at 30 minutes. And in control group the patients does not receive exercise intervention. He concluded that exercise intervention group can be effective in the management of breast cancer symptoms.

The present study included total 86 participants and were divided into two groups. These subjects were then selected and were divided into two equal groups using sequences of random numbers. Both group A (Control group) and group B (Study group) had 43 individuals each. Control group was given conventional exercises and experimental group was given scapular strengthening exercises along with conventional exercises.The intervention program should performed exercises 3 times per week for 4 months. Each session lasted for 45 to 50 minutes. The group which was given scapular strengthening exercises shown significant changes in pain, functional disability and in external rotation of shoulder than in the controlled group, whereas, significant changes were seen in shoulder flexion and abduction range of motion in both of the groups. According to this study, scapular strengthening exercises when added to conventional group can reduce shoulder pain, improve shoulder range of motion, and also reduce disability as scapular strengthening exercises provides more efficient recruitment of trapezius, serratus anterior, rhomboids muscles and more maximizing the activity of these muscles to repair the biomechanics of scapular imbalance thus, lead to improvement in shoulder joint function.

Hence, this study showed significant effect of scapular strengthening exercises for pain, functional disability, and shoulder flexion, abduction and external rotation range of motion after radical modified mastectomy.

In conclusion, the current study concluded that, scapular strengthening exercises along with conventional treatment proved beneficial and effective rather than only conventional treatment on shoulder dysfunction for pain and functional disability after modified radical

mastectomy.

Author Contribution Statement

Prajwalraje Mohite prepared the introduction of the study. He was actively involved in collection of data. Results and graphs were prepared by him. Dr Suraj Kanase, framed the entire manuscript and analysed the data. Both authors participated in prescribing the treatment. The final manuscript was prepared and approved by both of them..

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Ethical Committee

This study was approved by institutional ethical committee of Krishna institute of medical sciences deemed to be university, Karad.

Statement of Conflict Of Interest:

We claim that there is no conflict of interest in the content of this study.

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