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Correlation Between Hand Grip Strength and Scapular Muscle Strength of Affected Upper Extremity in Female Breast Cancer Survivors Post Modified Radical Mastectomy

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ABSTRACT

Background: Proximal joint stability is required to perform distal movements. Good grip strength might require adequate shoulder stability which will be dependent upon its musculature.
Purpose: To find the relation of hand grip strength with scapular muscle strength in breast cancer survivors post modified radical mastectomy (MRM).
Methodology: An observational cross sectional study was conducted in a tertiary care hospital. A total of 33 breast cancer survivors who underwent MRM before 6 months or more were included. Their affected side hand grip strength along with serratus anterior muscle strength and strength of upper, middle and lower fibers of trapezius was measured using hand held dynamometer.
Results: Karl Pearson's correlation coefficient was used to find the correlation between hand grip strength and scapular muscle strength. Strong positive correlation was found between hand grip strength and serratus anterior muscle ($r = 0.848$) as well as lower trapezius ($r = 0.868$) strength. Whereas moderate positive correlation was found between hand grip strength and upper trapezius ($r = 0.665$) as well as middle trapezius ($r = 0.444$) muscle strength which was statistically significant ($p<0.05$).
Conclusion: Hand grip strength was significantly correlated with the scapular muscle strength in breast cancer survivors post MRM.

Keywords: Breast cancer survivors, hand grip strength, hand held dynamometer, Modified Radical Mastectomy, Scapular muscle.

INTRODUCTION

Cancer describes the abnormal growth of cells that results in a large mass known as a tumour. Worldwide, Breast Cancer (BC) is the most common cancer in women, other than non melanoma skin cancer. Over 100,000 new breast cancer subjects are estimated to be diagnosed annually in India.[1] Over the last 10 years or so, breast cancer has been rising steadily.

Most women with early-stage breast cancer have 3 surgical options: (1) breast-conserving therapy (BCT), (2) mastectomy, or (3) mastectomy with breast reconstruction (immediate or delayed).[1]

There are no survival differences between BCT followed by radiation therapy or mastectomy alone. However, the number of women electing mastectomy is increasing with an estimated 39% mastectomy rate in women with early stage breast cancer [2,3,4].

Mastectomy is a surgery to remove one or both breasts; there are many types of mastectomy, such as simple mastectomy, subcutaneous mastectomy, skin-sparing mastectomy, nipple-sparing mastectomy,

radical mastectomy and modified radical mastectomy.[5-7] Modified radical mastectomy is the most common treatment of invasive breast cancer and it is the removal of all breast tissue from the affected breast with removal of lymph nodes from the armpit in the affected side of the body.[5]

The human hand is designed to perform various kinds of skilled movements in the daily activities, known as 'Prehension activities'.[8] It involve the grasping or taking hold of an object between any two surfaces of hands; the thumb participates in almost all prehension tasks. These activities can be categorized as either power grip (full hand prehension) or precision handling (finger-thumb prehension).[8] Proximal joint stability is required to perform distal movements.[8] The hand being the distal component, a good grip might require adequate shoulder stability which will be dependent upon its musculature.[8]

According to the study done by C Jack et al. to check the effect of mastectomy on shoulder and spinal kinematics during bilateral upper limb movement, it is concluded that scapular rotations are affected more compared to other movements.[9] The muscles responsible for rotation are serratus anterior, trapezius, levator scapulae and rhomboids. Among these the upper, Middle and lower trapezius and serratus anterior are stabilizers of the scapula.

Breast cancer survivors have side effects from surgical treatment and adjuvant radiotherapy that may acutely or chronically compromise the musculoskeletal system, resulting in loss of muscle strength.[10] In women undergoing unilateral mastectomy associated with axillary lymph node dissection for the treatment of breast cancer, there is a greater occurrence of muscle involvement in the arm, shoulder and shoulder girdle.[11,12]

Prospective studies involving women before and after the treatment of breast cancer report complaints of pain, loss of strength and function of the affected limb and the handgrip, even after years of surgery and restricted activities involving the affected limb.[13-15]

The decrease in strength may be related to postoperative surgical treatment. Due to the presence of scar and drain placement, women are encouraged not to raise the upper limb above their head in order to avoid the formation of seroma and scar dehiscence.[15] Even after this period some women are discouraged from using the upper limb affected by lymphedema concern, and fear is also reported in using the affected upper limb and restriction of this in their activities.[15]

Thus, it is already proven fact that hand grip will be affected in breast cancer survivors and scapular dyskinesia will be present, which can affect the shoulder function.[16] Even though they are not directly connected to each other it will be of clinical importance to study their correlation so as to design an effective treatment programme.

There are not many studies which highlight the importance of these two components in relation to each other in breast cancer survivors.

Hence this study was conducted to find out if there is any correlation between grip strength and scapular muscle strength in breast cancer survivors.

METHODOLOGY

Design and setting

An observational cross-sectional study was conducted in a tertiary care hospital.

Participants

Female breast cancer survivors aged between 18 to 55 years who underwent MRM before 6 months or more for breast cancer stage 0 to III were included. The female who diagnosed with another carcinoma after MRM, had any history of shoulder injury before MRM, had any trauma or diseases affecting muscles and joints such as rheumatoid arthritis, skin grafting on or around the shoulder or any previous history of chronic illness such as

diabetes, osteoporosis, renal failure, heart disease, pulmonary diseases, neurological dysfunction and females underwent any neck surgery and who refused to sign consent form were excluded.

Procedure and outcome measure

Each female participated in a single session in which hand grip strength and scapular muscle including serratus anterior, upper, middle and lower trapezius strength of affected side was measured with hand held dynamometer.

Outcome measures

1. Hand grip strength:

It was measured using hydraulic hand held dynamometer (HHD). Subject was in sitting position with adducted and neutrally shoulder rotated, elbow flexed at 90°, forearm in neutral pronation-supination and the wrist joint between 0 and 30 degree extension. The subject was instructed to perform maximal isometric contraction with HHD in hand, sustained for six seconds during exhalation. It was performed three times, with one-minute intervals between tests.

2. Scapular muscle strength:

Scapular muscle strength was measured using Push Pull dynamometer (PPD).

- Procedure to measure strength of upper trapezius:

Subject was in sitting position. The PPD was placed over the superior scapula. Force was applied directly downward (inferior) through the HHD in the direction of scapular depression. Subject was asked to shrug the shoulder.

- Procedure to measure strength of middle trapezius:

Subject was in prone lying position. The PPD was placed to the spine of the scapula midway between the acromial process and the root of the spine in the lateral direction to the long axis of the humerus, which was placed in 90 degree of abduction. Subject was asked to do the scapular retraction.

- Procedure to measure strength of lower trapezius:

Subject was in prone lying position. The PPD was placed to the spine of the scapula midway between the acromial process and the root of the spine in the superior and lateral direction parallel to the long axis of humerus, which was at 140 degree of elevation. The subject was asked to adduct and depress the scapula.

- Procedure to measure strength of serratus anterior:

Subject was sitting on a stool without back support with feet on the floor and knees at 90° of flexion. The back and head were supported on a wall and the contralateral arm was positioned on the leg. The PPD was placed at examiner's trunk and subject's palmer surface.

Subject was asked to provide maximal strength like punching against the dynamometer.

Statistical analysis

Descriptive statistics was used for demographic data such as age, weight, height and BMI which was analysed by SPSS ver.20. Karl Pearson's correlation coefficient was used to find relation of grip strength with scapular muscle strength. $P<0.05$ was set as level of significance.

RESULTS

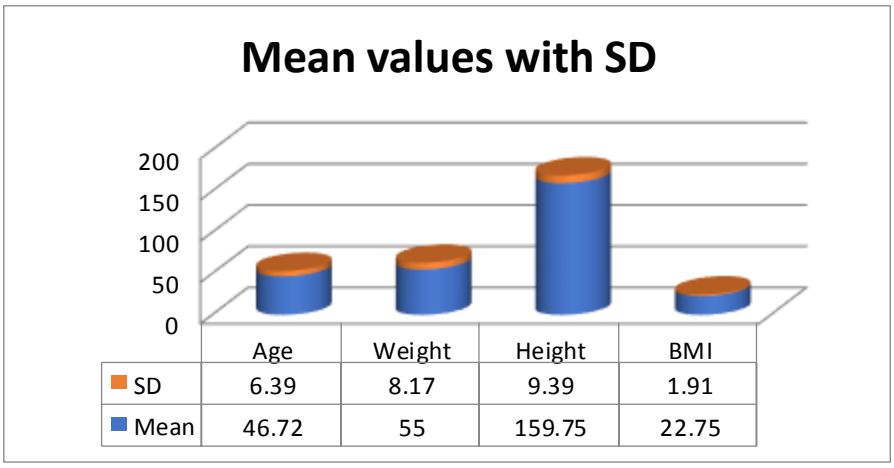

Figure 1: Graphical representation of demographic data with mean value and standard deviation

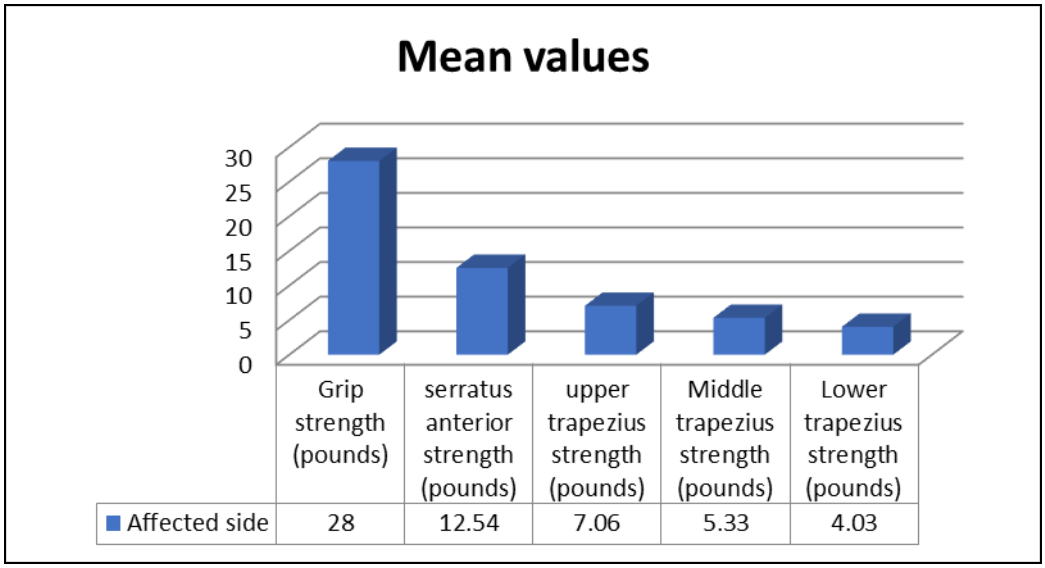

Figure 2: Graphical representation of mean values of grip strength and scapular muscle strength.

		Serratus anterior strength	Upper trapezius strength	Middle trapezius strength	Lower trapezius strength
Grip strength	r value	0.848	0.665	0.444	0.868
	P	0.000	0.000	0.010	0.000

Table 1: A strong positive correlation was found between hand grip strength with serratus anterior strength and lower trapezius strength and moderate positive correlation was found between hand grip strength with upper and middle trapezius strength which was also statistically significant.

DISCUSSION

A cross sectional study was conducted to find the correlation between hand grip strength and scapular muscle strength of affected side in breast cancer survivors posts MRM. Total 33 subjects were included in the study.

Grip strength is used to assess the overall functional capacity of the upper extremity. Thus in upper extremity rehabilitation, grip strength is used as one of the parameters to check the progress or effectiveness of the training.[8]

According to statistical analysis, the results suggest that there is a statistically significant correlation between scapular muscle strength and grip strength.

The strength of the fingers when holding something is known as grip strength and it is an important index in the evaluation of the motor function of the hand[17]. Since grip strength is strongly positive correlated with muscular strength[18], grip strength can be used to evaluate changes in muscular strength effectively. Grip strength has been used in a lot of studies because of its simple measurement[19,20] Grip strength is not simply the force generated by the fingers and wrist joint, it is also intimately connected with the muscular strength of forearm and shoulder joints.

In present study the affected side grip strength was reduced which is supported by the study done by JS Rietman et al to determine Impairments, disabilities and health related quality of life after treatment for breast cancer: a follow up study 2.7 years after surgery and they concluded that pain and loss of grip strength are the most frequent impairments.

Based on the result of previous studies, the appropriate position of the scapula is essential for optimal grip strength[21]. The optimum position of the scapula is maintained by the muscles attached. The Trapezius muscles and Serratus anterior muscle control the stability of the scapula. Thus these muscles were assessed in this study to find out the correlation of their strength with grip strength.

In the present study it was found that affected side scapular muscle strength also reduced. This may result in a scapular dyskinesia. This result is supported by the study done by C Sayaca et al to check the scapular dyskinesia after modified radical mastectomy surgery and breast conserving surgery and they concluded that Scapular dyskinesia is seen after MRM which can be develop as a result of many factors including shoulder pain, reduced muscle strength, decreased muscle activity etc.

Cho[22] also studied how positioning the scapula in an ideal position through passive protraction affected the function of the upper extremity and ADL of chronic stroke subjects and concluded that when the scapula is in its ideal position, upper extremity function has improved. It works better when the stability of the scapula is secured. A study conducted with grip strength measurement with scapula in protracted position showed that when the scapula was placed in an ideal position through active scapular protraction, the muscle activations of the muscles surrounding the shoulder joint were increased, demonstrating the effectiveness of scapular protraction at improving the function of the upper extremity.

Study limitations

- Sample size was small. Thus, further confirmation of these results must be done in larger size population.
- Breast cancer survivors who had undergone MRM before 6 months and more were included in the study. Further study can be done with the definite time period.

CONCLUSION

In breast cancer survivors post MRM, grip strength is significantly correlated with the scapular muscle strength.

This result will be helpful in planning the effective rehabilitation programme for breast cancer survivors. Scapular muscle strengthening exercises and gripping exercises are recommended to be added in the exercise protocol.

Acknowledgement: None

Conflict of Interest: None

ABBREVIATIONS

WHO - World Health Organization, BC- Breast Cancer, BCT- Breast Conserving Treatment, MRM- Modified Radical Mastectomy, HHD- Hand Held Dynamometer, PPD- Push Pull Dynamometer.

Source of Funding: None

Ethical Approval: Present study was approved by the Institutional Ethical Committee.

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