Biomedical & Pharmacology Journal, September 2019. Vol. **12**(3), p. 1345-1351

Effect of Graded Thera-band Exercises on Shoulder Muscle Strength and Activities of Daily Life in Modified Radical Mastectomy Subjects

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http://dx.doi.org/10.13005/bpj/1763

(Received: 22 February 2019; accepted: 24 August 2019)

Modified radical mastectomy leads to dissection of muscles and soft tissue structures and chemotherapy causes weakness of the muscles involved resulting in functional limitations that affects the activities of daily life. Graded resistance exercise is effective in improving muscle strength, functional capacity and activities of daily life. To find the effect of graded thera-band exercises on shoulder muscle strength and activities of daily life in modified radical mastectomy patients. A total of 40 females who underwent mastectomy procedure along with chemotherapy or radiotherapy for breast carcinoma were included based on inclusion criteria. Group A received conventional strengthening program with weights and group B received thera-band exercises for five days per week for eight weeks and pre and post assessment was done with Disabilities of Arm, Shoulder and Hand(DASH)Questionnaire and Manual Muscle Testing(MMT). Statistical results within group values for Conventional strengthening program for DASH (p = <0.0001) and mean difference(MD) was 2.58, MMT for Shoulder flexion (p=0.867),MD=-0.15 and extension(p=0.046),MD=-2, abduction (p=0.775),MD=-0.3, internal rotation (p=0.701),MD=-0.35 and external rotation (p=0.039),MD= -1.65. The within group statistical results for experimental group for DASH (p=<0.0001),MD=4.98 , MMT for Shoulder flexion (p=0.012),MD= -2.05, extension (p=0.0007),MD= -2.1 and external rotation(p=0.036),MD= -2.2, abduction (p=0.055),MD= -1.65 and internal rotation (p=0.051),MD= -1.4.The results conclude that strengthening with thera-band showed more better effect compared to conventional strengthening program. Strengthening exercise program with thera-band showed significant improvement in the outcome variables on strength and activities of daily life involving shoulder, arm and hand.

Keywords: Thera-band, DASH,MMT, breast carcinoma, muscle strength.

Cancer is an abnormal growth of cells which tend to proliferate in an uncontrolled way and in some cases, to metastasize.[1] When cancer cells metastasize to nearby tissues or to distant areas of the body it is known as malignant tumor.[2] When cancer grows but does not spread it is known as benign tumor.[3]

Prevalence of breast cancer in India is 25.8 per 100000.[4] Due to alterations in dietary habits, reproductive risk factors and increasing life expectancy there is a rapid rise in incidence of breast cancer. Most breast cancers start in the duct cells and only some in cells of lobules and other tissues. Breast cancer can be invasive carcinoma(malignant) or non-invasive carcinoma(benign). Invasive carcinoma is further divided into invasive ductal carcinoma, invasive lobular carcinoma, tubular carcinoma, medullary

carcinoma. Non-invasive carcinoma includes ductal carcinoma and lobular carcinoma.[5]

Surgical treatment of breast cancer is classified into two categories:- Mastectomy and breast conserving surgery.[5] Radical mastectomy includes removal of entire breast, axillary lymph nodes and pectoral muscles. Once very common, this surgery is now only performed for large tumors invading the pectoral muscles. Modified radical mastectomy includes removal of entire breast along with axillary lymph nodes.[6]

Complications after surgery for breast carcinoma are pain, reduced or total loss of movement amplitude, muscle strength of shoulder, lymphedema of the upper limb, postural changes, compromised respiratory capacity, scarring complications, sensitivity alterations, fibrosis,hemorrhage.[7]

Lower mortality risk and a higher quality of life are associated with higher levels of muscle strength.[8] 18-23% of breast cancer survivors have muscle weakness of upper limb.[9]Pectoralis major, serratus anterior, upper trapezius, rhomboid muscles, latissimusdorsi are involved in management of breast cancer (that is these muscles are either cut during surgery or exposed to radiation during radiotherapy)which causes difficulty in flexion, abduction, internal rotation, scapular elevation, protraction and retraction.[10]Anthracyclines used in chemotherapy cause oxidative stress by two mechanisms: interaction with mitochondrial respiratory chain and through a non enzymatic reaction with ferric iron. Anthracycline based chemotherapy negatively affects non cancerous tissues along with striated muscles, which causes muscle fatigue and weakness in patients.[11]

Breast cancer survivors are benefited by graded resistance training as it is effective in increasing muscle strength.[8] Positive muscle adaptations are induced due to graded resistance training. Regular exercise can be used as for treatment as it minimizes treatment side effects and improves quality of life, it can be done along with use of free weights.[8] Graded resistance exercise is effective in reducing fatigue levels, increasing functional capacity and muscle strength.[8] Progressive strength training is quite potent in reducing sarcopenia. Strength training increases muscle strength by increasing muscle mass and by improving recruitment of motor units and their firing rate.[12]Thera-band is beneficial in improving strength, mobility and function and thereby reducing joint pain. They are cost effective, portable and versatile.[13]

MATERIALS AND METHODOLOGY

Study design

This study was an Interventional study.

Place of study

The study was conducted in the Oncology department in Krishna Hospital, Karad,

Sample size

The sample size was 40 subjects.

Sampling method

The subjects were allocated bysimple random sampling using odd and even numbers.

Study duration

The duration of the study was 6 months

Treatment duration

The treatment was given for 30 minutes per day and 5 days/week.

Inclusion criteria were as follows:1. Females between 40-55 years 2.Subjects who underwent modified radical mastectomy procedure along with chemotherapy or radiotherapy for breast carcinoma 3.Absence of systemic metastasis 4.Unilateral carcinoma of breast 5.Not involved in any other type of exercise protocol 6.Subjects who are interested to participate in the study.

Exclusion criteria were as follows: 1.Infection in axillary area 2.Open wounds 3.Plan or intention to undergo a reconstructive surgery with in intervention period 4.Previous history of trauma to shoulder, surgery, untreated pathology or dysfunction 5.Current or previous cervical neuropathy.

Materials used were: 1.Thera-band 2.Weights 3.DASH Questionnaire

Thera-band Colour	Resistance Level	Workout Level
Yellow	Thin	Beginner
Red	Medium	Beginner/Intermediate
Green	Heavy	Intermediate

Thera-band Exercises -Shoulder flexion, extension, abduction, internal rotation and external rotation. Exercises are started with 2-3 sets of 10-15

repetitions. Gradual progression to next colour is made to the next colour when individual is able to easily complete 3 sets of 10-15 repetitions.[13]

Outcome Measures

1)Disabilities of Arm Shoulder and Hand(DASH) questionnaire - It is a 30-item questionnaire designed to measure physical function and symptoms in people with any of several musculoskeletal disorders of the upper limb. The questionnaire rates their function without regard to which hand/arm they use to perform the task. Assigned values are summed and averaged, producing a score out of 5. A higher DASH score indicates a greater level of disability.

2)Manual Muscle testing(MMT)- It is an integral part of physical examination as it provides information which is useful in differential prognosis and treatment of musculoskeletal and neuromuscular disorders. It is used to evaluate contractile units and their ability to generate forces. Muscle testing is an important evaluative tool to assess impairments and deficits in muscle performance, including strength, power and endurance. It is graded from 0 to 5 which is determined by the patients ability to move the tested body part depending on muscle contractility, gravity assisting and antigravity positions.

Procedure

This study was conducted to find the Effect of graded thera-band exercises on shoulder muscle strength and activities of daily life in modified radical mastectomy subjects. Protocol and Ethical clearance was done. Ethical consent was taken from the Institutional ethics committee of Krishna Institute of Medical Sciences "Deemed To Be University", Karad. The subjects were divided into 2 groups based on the inclusion and exclusion criteria using simple random sampling (by means of odd and even numbers). Informed consent was taken from the subjects. Subjects were assessed for disabilities of shoulder function, and strength prior intervening with the treatment. Subjects were explained about the procedure of the study.

Group A was conventional group and group B was experimental group.

Group A received conventional strengthening exercises with medications. Shoulder flexion, extension, abduction, internal and external rotation was performed using weights, initiated with 2-3 sets of 10-15 repetitions. Exercises were started with weight of 0.5kg and progressed to 0.75, and1kg. Progression to next higher weight was considered when individual was able to easily complete 3 sets of 10-15 repetitions. The intervention was done 5 times a week for eight weeks.

Group B received graded thera-band exercises with medications. Shoulder flexion, extension, abduction, internal and external rotation was performed using theraband. Above exercises were started with 2-3 sets of 10-15 repetitions. The exercises were started with the yellow colour and progressed to red and then green. Progression to next colour was considered when individual was able to easily complete 3 sets of 10-15 repetitions. The intervention was done 5 times a week for eight weeks.

After eight weeks the post treatment assessment for disabilities of shoulder function and strength was taken with the help of assessment tools (DASH Questionnaire, shoulder MMT). Pre and post treatment scores of disabilities of shoulder function and strength with help of DASH Questionnaire and Shoulder MMT of both the groups was taken for statistical analysis. The interpretation of the study was done on the basis of comparing pre test and post test assessment of DASH Questionnaire and Shoulder MMT. The study was concluded by statistical analysis of all the outcome measures.

Statistical analysis

Statistical analysis was done manually and by using Instatsoftware(version 3.1) to verify the derived results. Within group analysis was done using paired t test and between group analysis was done using unpaired t test.

RESULTS

Age distribution

Table 1. Age distribution

Age	Frequency	Percentage
40-45	4	10
46-50	18	45
51-55	18	45
TOTAL	40	100

Within the group comparison

DASH

Interpretation

The above table shows pre and post comparison within the group. Post treatment there was significant improvement noted in shoulder and arm mobility.

Table 2. DASH (Group A)

Parameter (Group A)	Pre	Post	Mean diff	t value	p value
DASH	62.04±10.68	59.46±10.18	2.58	13.08	<0.0001**

**- statistically significant

Shoulder MMT

Interpretation

The above table shows pre and post comparison within the group. Post treatment there was no significant improvement noted in strength in shoulder flexion, abduction and internal rotation and significant improvement in shoulder extension and external rotation according to p values.

Table 3. Shoulder MMT(Group A)

Parameter (Group A)	Pre	Post	Mean diff	t value	p value
SHD Flex	0.35±2.32	0.5±3.18	-0.15	0.168	0.867^{+}
SHD EXT	0.25±2.44	2.25±2.98	-2	2.13	0.046**
SHD Abduction	0.1±2.29	0.4±2.98	-0.3	0.28	0.775^{+}
SHD IR	0.4±2.37	0.75±3.007	-0.35	0.38	0.701^{+}
SHD ER	0.25±2.33	1.90±2.84	-1.65	2.20	0.039**

+- not significant **-significant

DASH

Interpretation

The above table shows pre and post comparison within the group. Post treatment there wassignificant improvement noted in shoulder and arm mobility in group B according to the p values.

Table 4. DASH(Group B)

Parameter (Group B)	Pre	Post	Mean diff	t value	p value
DASH	57.68±10.58	52.70±10.17	4.98	12.42	<0.0001**

**- statistically significant

Shoulder MMT

Interpretation

The above table shows pre and post comparison within the group. Post treatment there was significant improvement noted in shoulder strength in shoulder flexion, extension and external rotation and not quite significant improvement in shoulder abduction and internal rotation according to the p values.

Table 5. Shoulder MMT(Group B)

Parameter (Group B)	Pre	Post	Mean diff	t value	p value
SHD FLEX	0.50±2.46	2.55±2.58	-2.05	2.77	0.012**
SHD EXT	1.55±2.25	3.65±0.58	-2.1	4.01	0.0007**
SHD ABD	0.45±2.41	2.10±2.80	-1.65	2.04	0.055*
SHD IR	0.85±2.30	2.25±2.51	-1.4	2.076	0.051*
SHD ER	1.20±2.30	3.40±1.56	-2.2	3.317	0.036**

**- statistically significant *- not quite significant

Between the group comparison

DASH

Interpretation

The above table shows post comparison between the groups. Post treatment there was significant improvement noted in group B as compared to group A according to the p values.

Table 6. DASH

Parameter	Group A	Group B	t value	p value
DASH	59.46±10.18	52.70±10.17	2.09	0.042**

**- statistically significant

Shoulder MMT

Interpretation

The above table shows post comparison between the groups. Post treatment there was significant improvement noted in group B as compared to group A according to the p values.

Table 7. Shoulder MMT

Parameters	Group A	Group B	t value	p value
SHD FLEX	0.5±3.18	2.55±2.58	2.23	0.031**
SHD EXT	2.25±2.98	3.65±0.58	2.05	0.046**
SHD ABD	0.4±2.98	2.10±2.80	1.85	0.071*
SHD IR	0.75±3.007	2.25±2.51	1.71	0.094*
SHD ER	1.90±2.84	3.40±1.56	2.06	0.045**

**- statistically significant *-not quite significant

DISCUSSION

This study on "Effect of graded thera-band exercises on shoulder muscle strength and activities of daily life in modified radical mastectomy subjects" was conducted to find the effect of conventional strengthening with weights and strengthening with thera-band, and find the efficiency on shoulder muscle strength and functional mobility of shoulder and arm. Breast cancer survivors are benefited by free exercises to shoulder progressed to resistance training as it is effective in reducing fatigue levels, increasing functional capacity and muscle strength.

Conventional strengthening program showed improvement in DASH scores ($p = <0.0001$) with mean difference(MD=2.58), but did not exhibit good results in strength for all

shoulder activities, MMT for Shoulder flexion (p=0.867),MD= -0.15 and extension(p=0.046),MD= -2, abduction (p=0.775),MD= -0.3, internal rotation (p=0.701),MD= -0.35 and external rotation (p=0.039),MD= -1.65. Experimental group showed improvement in DASH scores (p=<0.0001),MD=4.98, and also exhibited better increase in shoulder strength, MMT for Shoulder flexion (p=0.012),MD= -2.05, extension (p=0.0007),MD= -2.1 and external rotation(p=0.036),MD= -2.2, abduction (p=0.055),MD= -1.65 and internal rotation (p=0.051),MD= -1.4 . The between group values for DASH was (d=0.664), MMT for shoulder flexion(d=0.707) and extension(d=0.6521), shoulder abduction(d=0.587), and shoulder internal rotation(d=0.5423) and external rotation(0.6546). The results conclude that strengthening with thera-band showed more better effect compared to conventional strengthening program.

Elastic resistance strengthening exercises have been shown to be feasible alternative to heavy weights. Resistance bands are easily accessible in hospitals and clinic and findings add to evidence indicating that regular upper arm resistance exercise with moderate loads is safe for women with arm lymphedema when appropriately prescribed.[14]

J.H. Do, W. Kim, Y.K Cho *et al*.[14] concluded that resistance training exercise group achieved improvement in more items including physical and cognitive functioning, pain and breast symptoms, muscular strength and DASH score. Where in our study which focused on strengthening , muscle strength of flexors, extensors, external rotators improved significantly while abduction and internal rotation has improved but not quite significant.

Cornie *et al*.[14] stated that moderate to high intensity resistance exercise significantly improved muscle strength, muscle endurance and QOL in women with breast cancer related lymphedema. In the present study the strengthening program is started earlier in both the groups, there is no formation of lymphedema and thus without any complications strengthening program is carried out and progressive resistance improved the strength without much of fatigue and pain.

Hagstrom*et al*.[8] stated that progressive exercise group had improved muscle strength and activities of daily life. In this study the values of DASH were reduced which indicates that ability of the shoulder, arm and hand functions are improved in the performance of activities daily life. Graded strengthening exercises with thera-band showed significant improvement in the outcome variables concluding that it improves shoulder, arm and hand strength and activities of daily life.

When body systems are initially exposed to a greater than usual but appropriate level of resistance, they react with a number of acute physiological responses and later adapt to the newly imposed physical demands. Ina resistance training program, the rapid gain in tension generating capacity of skeletal muscle is largely attributed to neural responses and not adaptive muscle changes itself. Neural adaptations are credited to motor learning and improved coordination and include increased recruitment in the number of motor firing units as well as an increased rate and synchronization of firing, which is caused by a decrease in the inhibitory function of central nervous system, decreased golgi tendon organ sensitivity or changes in myoneural junction of the motor unit.[15] Allthese reasons might have contributed in improvement in DASH scores as improvement in motor coordination and neural adaptations assist in achieveing functional goals.

As research suggests, there might have been atransition of type II B to type IIA muscle fibres with strength and endurance training making them more resistant to fatigue leading to an increase in their adapting capability and muscle strength[15],causing an increase in the MMT values.

Also, strength training causes hypertrophy of muscle fibres, due to increase in protein(actin and myosin)synthesis and a decrease in protein degradation. It also leads to possible hyperplasia of muscle fibres due to moderate resistance exercises, and also increase in ATP and PC(phosphocreatine) and myoglobin storage and increased creatinephosphokinase and myokinase. It also increases tensile strength of tendons, ligaments and connective tissue in muscle with resistance training designed to improve strength of muscles, this would again add up to an increase in MMT values.[15]

Comparably high levels of muscle activation during exercises are achieved in resistance training with elastic products than

weights, and it is a feasible alternative to training with machines and free weights.[15]

Also, resistance training with theraband is a subjective force as the subjects might stretch minimally or as tolerated the initial few days and as neural and muscle adaptation occurs may stretch more to experience more resistance which will eventually add to increase in flexibility and strength, which isn't the case in traditional weights as the weight is constant hence resistance cannot be altered. This could be a possible reason for better results in the interventional group. Other limitations were that the study was limited to a small geographic area and the study duration was short and sample size was small.

CONCLUSION

The present study with the statistical results concluded that the thera-band exercise group improved better than the conventional group with greater improvements inflexion, abduction and rotation activities which promotes all the activities of daily life and that is confirmed again with the improvement of values in DASH scale. .

ACKNOWLEDGEMENT

We acknowledge the guidance and support from faculty of physiotherapy.

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