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Effectiveness of Spencer Muscle Energy Technique on Pain and Shoulder Range of Motion among Post Modified Radical Mastectomy Patient - An Experimental Study

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ABSTRACT

Introduction-Modified radical mastectomy is a type of mastectomy surgery performed in breast cancer that involves removal of pectoralis minor muscle along with other breast tissue. Causing decrease in range of motion of the shoulder range on the involved side specifically abduction of shoulder. Spencer muscle energy technique is a manipulation technique of shoulder joint which works to decrease pain and increase shoulder ROM.

Aim- To check the effectiveness of Spencer MET on shoulder pain and ROM among the patients of post modified radical mastectomy.

Method- 9 post modified radical mastectomy patients were selected meeting inclusion and exclusion criteria. Shoulder pain and ROM were taken on post-operative day 2 using NPRS and goniometer. Spencer MET given three times a week for 4 weeks. Post reading after 4 weeks recorded.

Result- After 4 weeks of intervention there was significant decrease in pain and increased ROM ($p<0.05$, paired t-test).

Conclusion- The application of Spencer MET has yielded the positive result among the patients of post modified radical mastectomy with the aim of improving pain and shoulder ROM. Hence it can be clinically applied for the same along with conservative therapy.

Keywords: Spencer MET, Modified Radical Mastectomy, Shoulder ROM, Pain.

INTRODUCTION

Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other parts of body. Normally, human cells grow and multiply to form new cells, when cells get old or become damaged, they die, and new cells take their place. Sometimes this orderly process breaks down, and abnormal or damaged cell grow and multiply when they shouldn't, then these cells form cancer. Tumor can be malignant or benign. [1] Breast cancer is the most common cancer diagnosed in women, accounting for more than 1 in 10 new cancer diagnoses each year, and accounting for 9%-12%. It is the second most common cause of death from cancer among women in the world. The incidence rate of breast cancer increases with age, from 1.5 cases per 100,000 in women 20 to 24 years of age to a peak of 421.3 cases per 100,000 in women 75 to 79 years of age; 95% of new cases occur in women aged 40 years or older. The median age of women at the time

of breast cancer diagnosis is 61 years. [2] Anatomically, the breast has milk producing gland in front of chest wall. They lie on pectoralis major muscle, and there are ligaments supporting the breast and attach it to the chest wall. [3]

Extent of breast superiorly approaches from second or third rib and inferiorly to inframammary fold laterally to midaxillary line. Posteriorly, approximately 2/3 of breast overlies the pectoralis major muscle; the remaining portion overlies the serratus anterior and upper portion of the oblique abdominal muscle. The portion of upper breast that extends superior laterally towards axilla is often referred to as the axillary tail of Spence. [3]

The majority of breast lies in upper outer quadrant, including the axillary tail of Spence. As a result, it is most common location for breast cancer. [3]

Lymph nodes located laterally to or below the lower border of pectoralis minor are called Level-1 which includes the external mammary, axillary vein and scapular lymph node groups. Level-2 lymph nodes are located deep to pectoralis minor muscle which includes central lymph node group. Level-3 is medial or superior to the upper border of pectoralis minor muscle including the sub clavicular lymph nodes. [3]

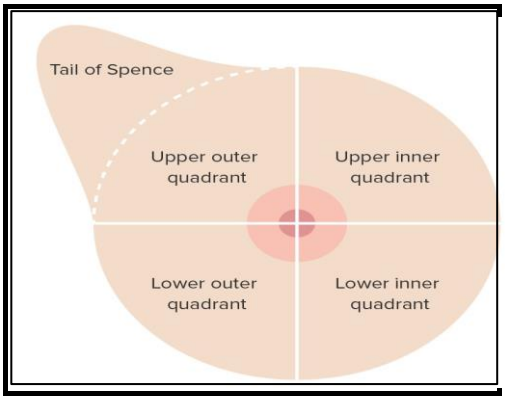


Fig.1. Quadrants of breast

When surgically treating the patient with cancer, a doctor's primary goal is to remove as much of the cancer as possible. The mastectomy is the so-called procedure in which the surgical removal of breast tissue is done as a way to treat or prevent breast cancer**.**

There are various types of mastectomy procedure, of which modified radical mastectomy (MRM) is one. An MRM is a procedure in which there is removal of entire breast – including the skin, breast, areola, and nipple along with the axillary lymph nodes. [4]

There are two types of MRM:

- **Patey's** operation- In this type pectoralis major muscle is intact but the pectoralis minor muscle is sacrificed to remove level 1, 2, 3 of lymph nodes. [4]
- **Auchincloss**' operation- In this both the pectoralis major and minor are maintained. [4]

MRM is usually indicated in patients in whom the cancer has already spread to axillary lymph node. [4] In this study patient that has undergone Patey's type of MRM surgery has taken into consideration. The Spencer technique is a standardized series of shoulder treatments with broad application in diagnosis, treatment, and prognosis. It was developed by Spencer in 1916. This approach is a well-known osteopathic manipulative technique that focuses on mobilization of glenohumeral and scapulothoracic joints. It is a articulatory technique with seven different procedures, in this technique passive, smooth, rhythmic motion of shoulder joint is done by the therapist to stretch contracted muscle, ligaments and capsule. This technique increases pain free range of motion through stretching the tissues, enhancing the lymphatic flow and stimulating increased joint circulation. [5]

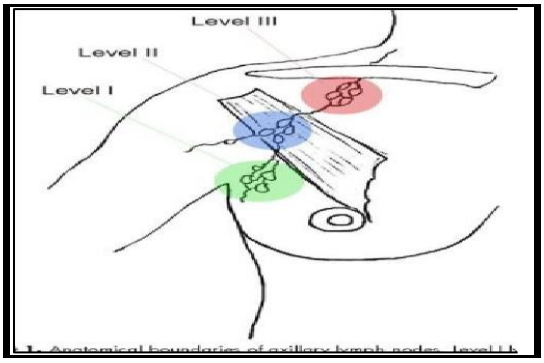


Fig.2. Levels of axillary lymph nodes

After the MRM surgery of Patey's type is done there is removal of pectoralis minor muscle to assess the axillary lymph node. Due to this the range of motion of shoulder is reduced. The action performed by this particular muscle is-

- Abduction of shoulder. -46%
- Internal rotation of shoulder
- Depression of scapula can normally be carried out by gravity alone, however when additional force is required, this muscle aids the action.
- Together with serratus anterior it acts as a protractor of the scapula. [6]

In this surgery the pectoralis major muscle on the affected side is also retracted as it is a superficial muscle of the chest. This leads to affection of the pectoralis major muscle weakness and the range of motion is affected. According to study 67% of patient experiences shoulder functional impairment including decreased range of motion. The actions performed by pectoralis major muscle are:

- Horizontal adduction, internal rotation when the origins are fixed.
- Flexion via clavicular head. -36% to -18% post operation.
- Extension back to anatomical position of arm via sternocostal head. -27% to -16%. [6]

The immobilization period after the surgery in which the muscle remains unused further adds up for the decreased range of motion of shoulder of affected side. .[7] Spencer muscle energy technique involves taking shoulder joint into various positions and works on the tissue in and around the joint, which is known to subsequent increase in range of motion of the affected side. Hence my study will focus on the effects of this particular technique on range of motion of action performed by pectoralis major and minor muscle. [7]

The aim of this study to check the effectiveness of Spencer muscle energy technique on pain and shoulder range of motion among post modified radical mastectomy patient.

MATERIALS & METHODS

1. Study design: Pre-post Experimental study
2. Study population: Females post MRM surgery of Patey's type
3. Study setting: Hospitals in and around Pune
4. Sample size: 15
5. Sample type: purposive sampling
6. Study duration: 6 months
7. Intervention Duration: 30 mins/session, 3 days/week, 4 weeks.

Inclusion criteria:

1. Gender: Female
2. Age: 40-65 years old.
3. Patient undergone modified radical mastectomy of Patey's type.
4. Surgery performed only on one side.
5. Active range of motion post immobilization period: Flexion-Abduction: < 60 degree; Internal rotation:< 20 degrees
6. NPRS= 4-10.

Exclusion criteria:

1. A history of major shoulder injury or surgery in 1 year.
2. History of previous mastectomy surgery (6 months).
3. Other disorders possibly influencing existing shoulder symptoms e.g. cervical neuropathy.
4. Paralysis or neurological changes of the affected upper limb.
5. Degenerative, inflammatory, or infectious arthritis.
6. Patients unable to comprehend the technique.
7. Patient having diabetes.

Procedure:

The participants were selected according to the selection criteria. A written consent form was signed. The preintervention ranges and NPRS reading of each subject was recorded. Patients were then subjected to intervention 3 times a week for 4weeks. At the end of 4 weeks the final ranges of motion and NPRS reading was taken and conclusion drawn.

Outcome measure:

Numerical pain rating scale:

The respondent selects the whole number on the scale which best reflects the intensity of their pain.
Reliability of NPRS-Excellent, ICC- 0.95
Goniometer:
The art and science of measuring the joint ranges in each plane of joint are called goniometry and goniometer is a device which is used to measure this ranges.
In this study Universal goniometer will be used to record pre and post effect of Spencer's muscle energy technique on shoulder range of motion. Reliability- Excellent Intraclass
Correlation Coefficient (ICC)- >0.94
Validity- Good 0.85

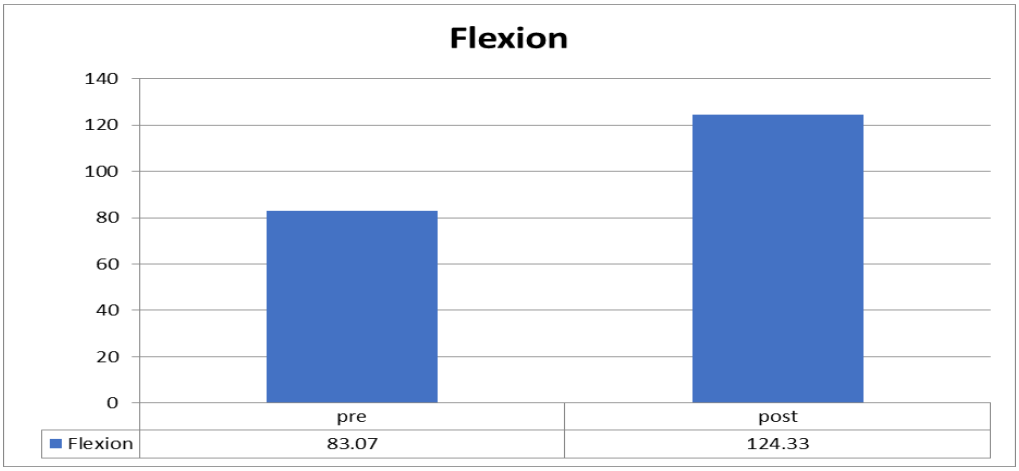
Protocol:

Patient in side lying position with upper side being affected one.
Step1- The patient's elbow is flexed and the arm is carried in horizontal flexion and then extension.
Step2- The patient's elbow is extended, and carried into full flexion in horizontal plane so the patient's arm lies over ear.
Step3- The patient's elbow is flexed, and the arm/shoulder is carried to abduction up to right angle with the body. The elbow is carried in circles clockwise and counter-clockwise so that first it makes smaller circles and then bigger ones.
Step4- With patient's elbow extended step 3 is repeated.
Step5- The patient's elbow is flexed, so that the hand rests on the operator's arm holding the shoulder of patient. With gentle upward pressure exerted on patients' elbow, the physicians swing toward the patient's head balancing weight from one foot to other to get an easy rhythmic swing backwards and forward. This step work on abduction and internal rotation component of shoulder joint.
Step6- The patient's elbow is flexed, the hand is placed just in the back of the lower ribs, and the shoulder is abducted. The operator with one hand draws the shoulder forward against the resistance of the other hand in front of the shoulder.
At the end of each action the patient is asked to contract the muscle actively and hold the contraction for 6-8 secs against the slight resistance offered by operators.

RESULT

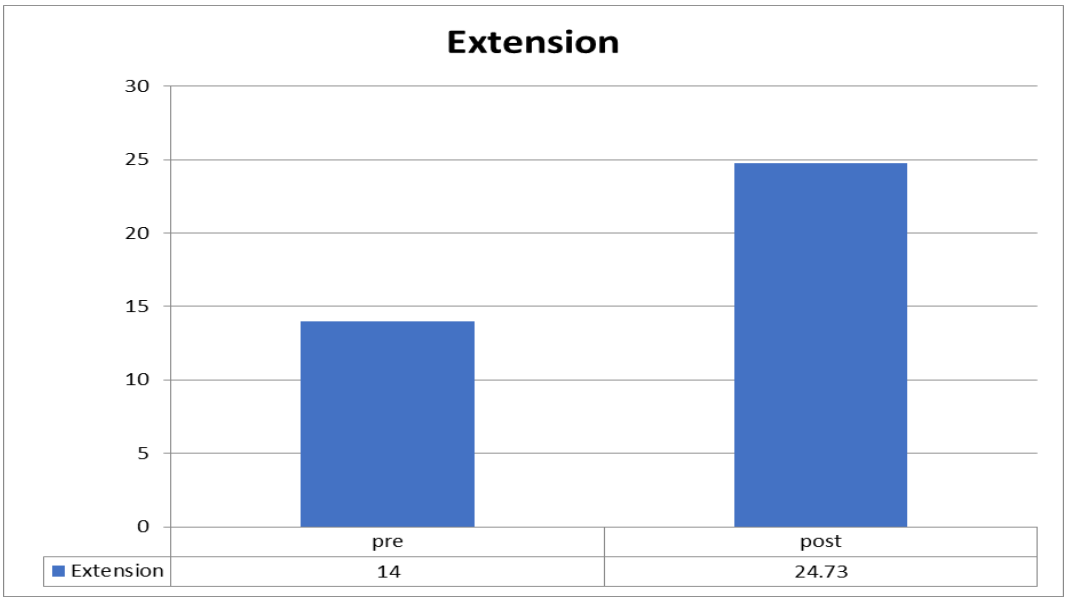
Pre and post shoulder range of motion on the operated side and NPRS for pain was calculated.
Data analysis of flexion:

Range of motion	Preintervention mean ± SD (degree)	Postintervention mean ± SD (degree)	t value	P value	Result
Flexion	83.07±22.75	124.33±27.39	11.3728	<0.0001	Highly significant



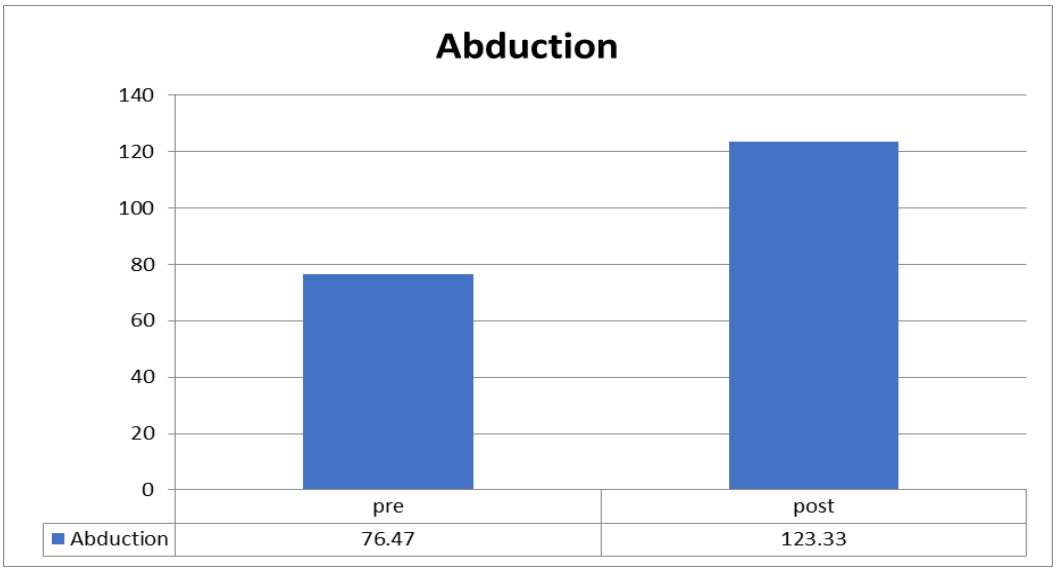
Data analysis of extension:

Range of motion	Preintervention mean ± SD (degree)	Postintervention mean ± SD (degree)	t value	P value	Result
Extension	14±6.07	24.73±5.40	12.91	<0.0001	Highly significant



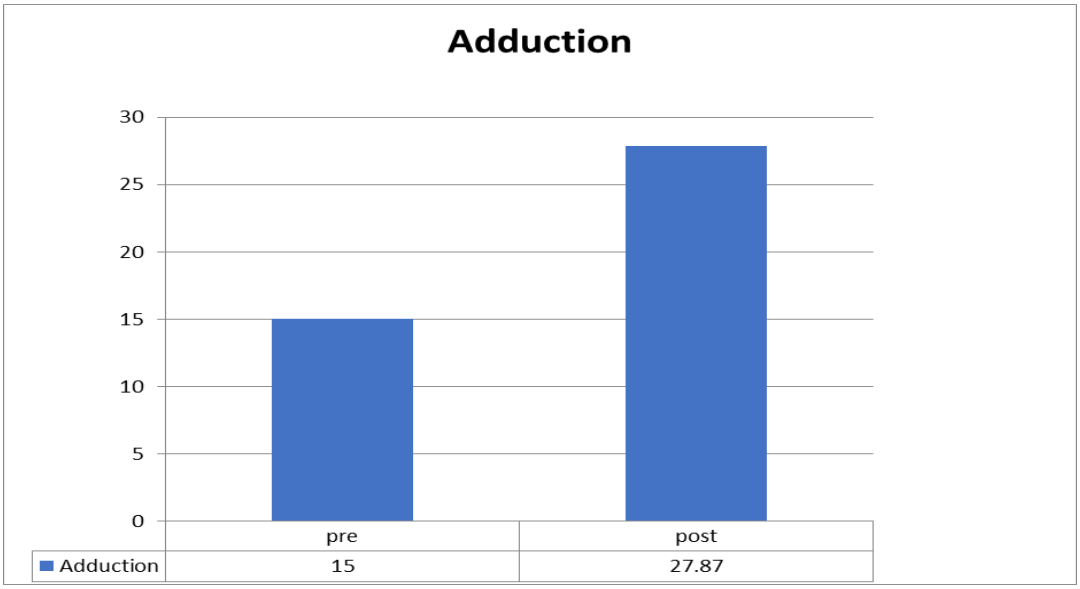
Data analysis of abduction:

Range of motion	Preintervention mean ± SD (degree)	Postintervention mean ± SD (degree)	t value	P value	Result
Abduction	76.47±14.43	123.33±25.68	10.75	<0.0001	Highly significant



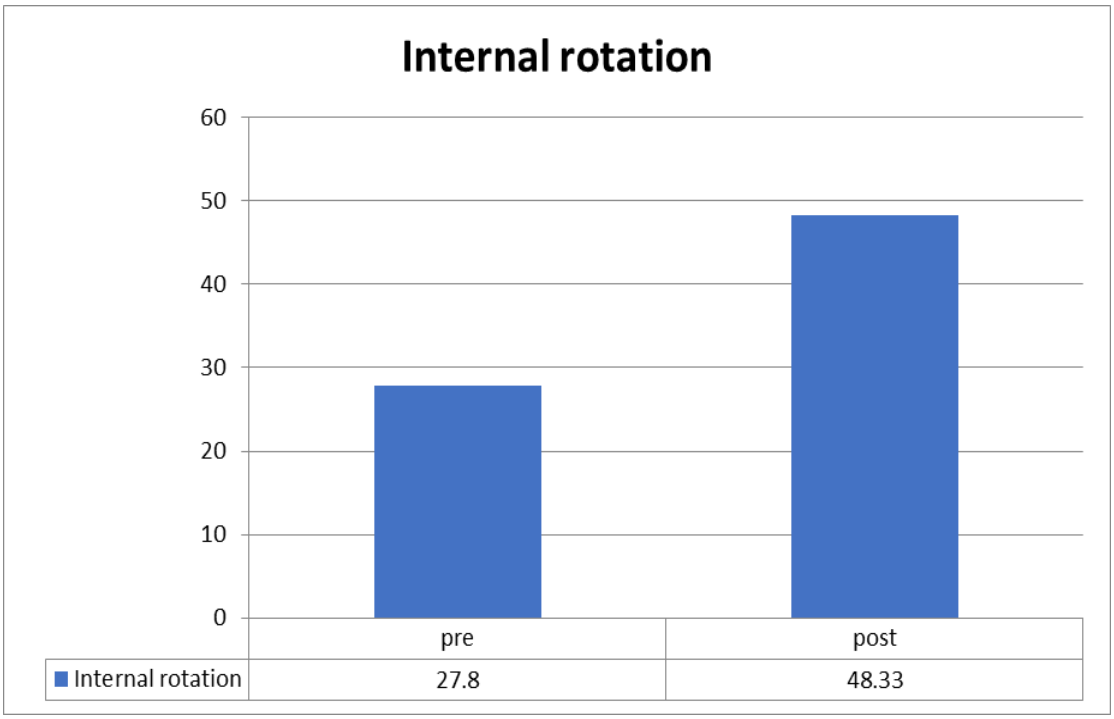
Data analysis of adduction:

Range of motion	Preintervention mean ± SD (degree)	Postintervention mean ± SD (degree)	t value	P value	Result
Adduction	15±3.09	27.87±3.20	18.13	<0.0001	Highly significant



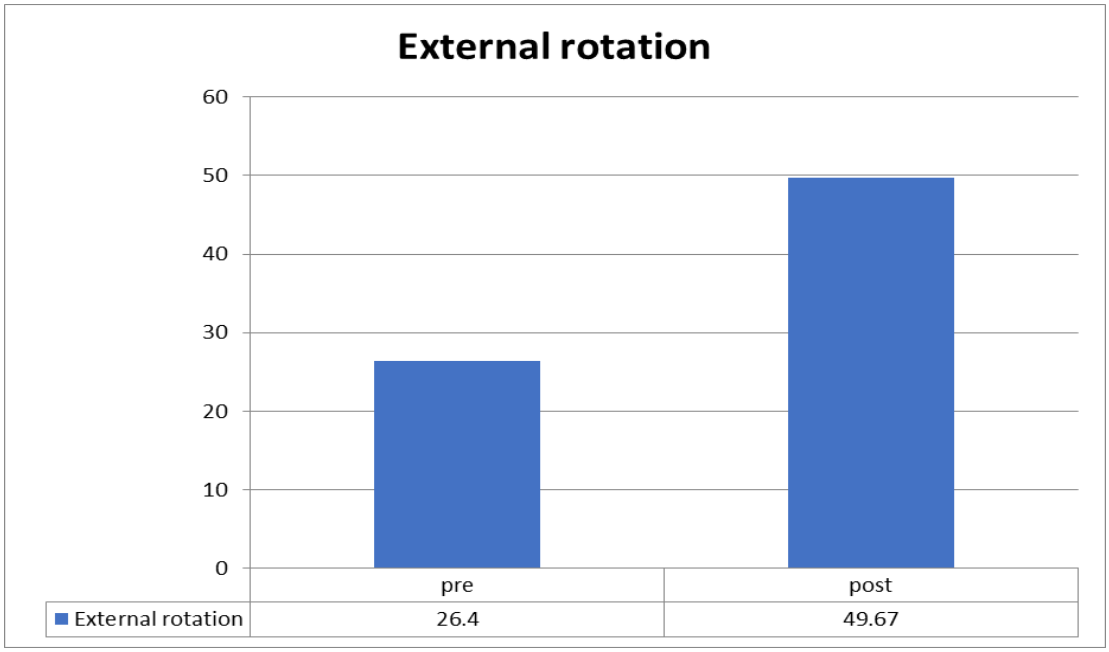
Data analysis of internal rotation:

Range of motion	Preintervention mean ± SD (degree)	Postintervention mean ± SD (degree)	t value	P value	Result
Internal rotation	27.8±5.73	48.33±9.86	14.32	<0.0001	Highly significant



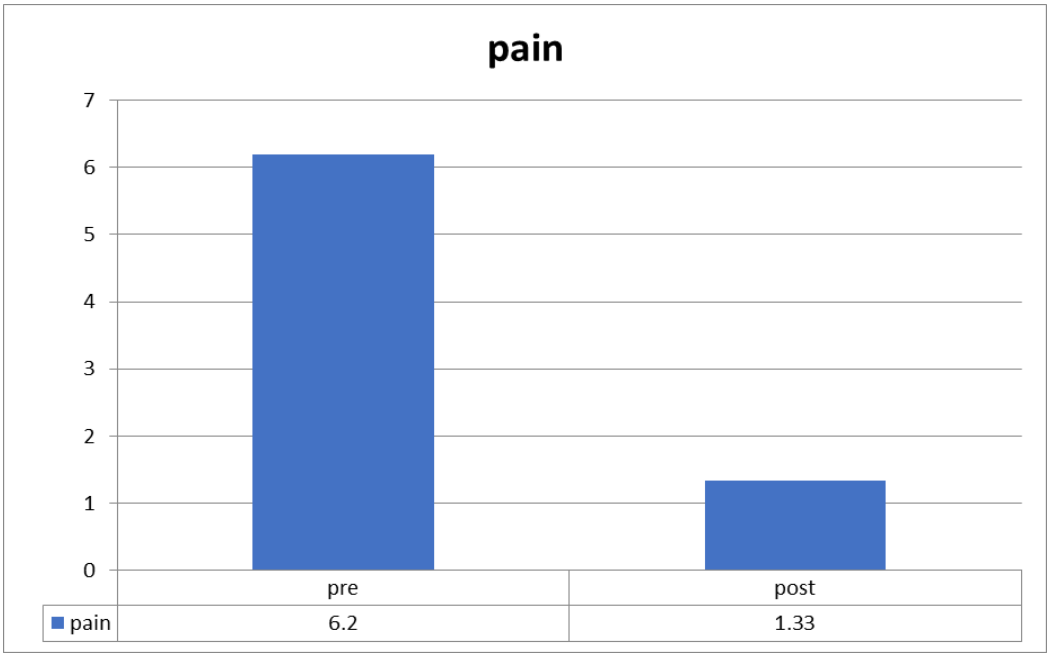
Data analysis of external rotation:

Range of motion	Preintervention mean ± SD (degree)	Postintervention mean ± SD (degree)	t value	P value	Result
External rotation	26.40±7.35	49.67±10.67	16.20	<0.0001	Highly significant



Data analysis of pain:

Pain	Preintervention mean ± SD	Postintervention mean ± SD	t value	P value	Result
	6.20±1.47	1.33±1.05	17.2702	<0.0001	Highly significant



1. The pre and post reading of flexion ROM showed an increase in mean by 41.26°.
2. The pre and post reading of extension ROM showed an increase in mean by 10.73°.
3. The pre and post reading of abduction ROM showed an increase in mean by 46.86°.
4. The pre and post reading of adduction ROM showed an increase in mean by 12.87°.

5. The pre and post reading of internal rotation ROM showed an increase in mean by 20.53°.
6. The pre and post reading of abduction ROM showed an increase in mean by 23.27°.
7. The pre and post reading of pain showed decrease in mean by 4.87

DISCUSSION

In this study, we investigated the effectiveness of spencer muscle energy technique on pain and shoulder range of motion among post modified radical mastectomy patient. We observed significant improvements in range of motion and also the decrease in level of pain at the end of 4-week intervention. Multiple studies were conducted among the post modified radical mastectomy patients where it was concluded that the range of motion on the affected side has decreased significantly. [6]

David A Patriquin et al. Spencer technique of manipulation has different application in diagnosis, treatment and prognosis of shoulder dysfunction. Treatment involves taking the shoulder in different positions which gradually improves the range of motion. Further stating change in the range of motion in 4 weeks of intervention is a good prognosis. This treatment in which the joint is being taken into a series of positions helps in pumping the fluids and stretching the tissues in joint space and surrounding it. [14]

MET also showed better improvement in ROM. Various studies have been done to prove this, of which hypothesis suggested by Taylor *et al.* in their study done in 1997, explains it as MET being a technique which incorporates both contractions and stretching, has been proven to be more effective in producing viscoelastic changes in the tissue than passive stretching alone. The forces in the MET are greater and due to this increased force, the viscoelastic change is also increased along with passive extensibility. [8,9] The aim of application of MET is to increase the myofascial tissue extensibility which also has effect on viscoelastic and plastic tissue property as well as the autonomic-mediated change in extracellular fluid dynamics and fibroblast mechanotransduction. [10]

Lendermanin et al. in his study (1997) suggested that when passive stretching is given to the muscle fibres it elongates the parallel fibres but it has little effect on the 'in series' fibres; however, when MET is performed the isometric contraction places loading on these fibers to produce viscoelastic and plastic changes in the muscle that are otherwise not achieved when only passive stretching is performed. [11] Active contraction of muscle has also shown some neuro-physiological effects which includes reduction in pain that helps in stretching of the tissue for further range of motion. [8]

Stephanie et al. in her study conducted in 2011 titled the immediate effects of MET on post shoulder tightness concluded that a single application of MET provides significant improvement in shoulder adduction and internal rotation ROM. The reduction in the intensity of pain is attributed to its hypoalgesic effects which can be explained by inhibitory golgi tendon reflex which is seen to be actived during the isometric contraction which leads to reflex relaxation of muscle. There is also activation of localized periaqueductal gray matter which leads to release of endorphin the natural opioid of body causing in hypoalgesic effect. Also, the mechanoreceptors present in joint and muscles gets activated leading to sympatho-excitation evoked by somatic afferents. On application of MET, there may be a reduction in proinflammatory cytokines and it may also desensitize the peripheral nociceptors. [12] Due to rhythmic muscle contraction blood and lymphatic flow rates may also be affected and there could be changes in the interstitial pressure and increase in the transcapillary blood flow. There may be a reduction in proinflammatory cytokines also desensitization of the peripheral nociceptors on application of MET. [10] As the

individual's pain perception reduces on application of MET tolerance to stretching increases so the relation is inverse. When the patient is simultaneously subjected to stretching and isometric contraction the muscle and joint mechanoreceptor along with proprioceptors are stimulated more strongly this in turn reduced the sensation of pain and also make the consecutive stretch more tolerable. [11]

The recent superimposition of muscle energy technique on spencer series has greatly enhanced its effectiveness. In each step, muscle energy forces are applied after the parts have been moved against the resistive barrier. The end result is that the patient has more motion with less pain sooner. This addition to the technique increases all ranges of motion by direct influence on shoulder soft tissue components and perhaps through neural connections. [13]

CONCLUSION

- In this study we can observe that there is significant increase in range of motion and decrease in level on pain when the intervention is performed 3 times a week for 4 weeks.
- Thus, it can be concluded that the spencer's muscle energy technique can be incorporated in rehabilitation program of the patients of post modified radical mastectomy to improve the range of motion of shoulder on the affected side and to decrease in level of pain along with conventional therapy used for the same.

Declaration by Authors

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