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Effect of chest mobility exercises and myofascial release on chest expansion and dyspnoea in subjects with chronic obstructive pulmonary disease

M Swapna, Roopa HV and Priya Somasundari

Abstract
Background: Chronic Obstructive Pulmonary Disease (COPD) by airflow limitation that is not fully reversible, the airflow is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles (or) gases.
Aim/Objective of the study: To know the effect of chest wall mobility exercise's and myofascial release of pectoralis major on chest expansion and dyspnoea in COPD Subjects.
Methodology: 30 patients' were diagnosed COPD of ageing from 40 to 70 years using pre/post test experimental design on day 0 1st (i.e. pre and post test treatment), Patients were measured chest expansion by inch tape. Dyspnoea measured by (MRC) medical research council breathlessness scale using measuring tape. Experimental group subject were treated with myofascial release therapy and chest mobility exercise for a period of 8 weeks control group were treated with conventional physiotherapy i.e. chest mobility exercises.
Results: The data showed that with the use of eight weeks protocol there was a significance difference ($p< 0.05$) between pre and post test values of MRC breathlessness scale both experimental and control group in Male and female patient subjects. The study shows that there was non significance difference between post treatment value of chest mobility exercise only.
Conclusion: The findings of the study conclude that adding a technique like myofascial release for Pectoralis major muscle to chest mobility exercises did not show any added advantage and significant difference e in improving chest expansion and dyspnoea when compared with chest mobilization exercise only.

Keywords: COPD, Dypsnoea, MRC, Myofascial release, Chest mobility, chest expansion

Introduction
GOLD defines COPD as "a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases [1].
Chronic COPD is a major cause of health care burden worldwide and the only leading cause of death that is increasing in prevalence. Globally, COPD by 2020, is expected to rise to the 3rd position as a cause of death and 5th position as the cause of disability according to the baseline projections made in the Global Burden of Disease Study (GBDS) [3].
Prevalence rates varying from about 2 to 22 percent in men and from 1.2 to 19 percent in women. The main components of COPD are chronic bronchitis and emphysema. The symptoms characterizing the natural history of COPD are cough, phlegm and effort dyspnoea. Tobacco smoking is the major risk factor for the development of copd. Active cigarette smoking is consistently associated with an increased risk for cough, phlegm, wheezing and dyspnea [2].
In chronic obstructive pulmonary disease (COPD) the level of physical activity reported by patients is related to lung function decline. Marked postural changes are observed which includes elevated protracted or abducted scapulae with medially rotated humerus and kyphotic spinal deformities [4].
It is suggested that individual typically first experiences some activity limitation because of dyspnoea when FEV_1 falls below 50%. When FEV_1 reaches a level of 30-40% of predicted

there would be significant reduced upper limb activity which may lead to muscle tightness and stiffness around the muscle quadrant, there by further increasing chest wall resistance which can be disabling [24].

Over recent years investigators and clinicians have increasingly recognized the role of skeletal muscle dysfunction as an indicator of advanced stages of copd. The hyper inflated lungs displaces the diaphragm downwards and is unable to contract efficiently. Further more, the chest wall is enlarged making accessory breathing muscles (Trapezius muscle, Levator scapulae muscles, pectoralis major and minor muscles, sternocleidomastoid muscle) in a shortened position which leads to increase in resistance of chest wall.

These changes contribute to shortness of breath [6]. Kriel and Achamat stated that the hyper inflated lungs places the pectoralis major in a shortened position which leads to increase in resistace of chest wall to expand this causes a decrease in exercise capacity and pulmonary function.

The non contracting muscle in a stiffened chest elicits an increase in muscle spindle firing and leads to dyspnoea. This increased firing from the non contracting muscles is decreased after physical exercise. So, the physical exercise component has therefore become a cornerstone of respiratory rehabilitation [19].

Many of the rehabilitation techniques have been used for treating copd like postural drainage, ACBT (Active cycle of breathing technique), breathing exercises, Chest mobility exercises, thoracic expansion exercises, spirometry exercises and relaxed postions to reduce dyspnea [21].

A novel technique known as myofascial release therapy (MFR) along with chest mobility exercises are used to stretch the shortened pectoralis major muscle to increase the chest expansion and decrease dyspnoea. MFR therapy is a soft tissue therapy for the treatment of skeletal muscle immobility. Myofascial Release (MFR) therapy focuses on releasing muscular shortness and tightness. It is one of the methods of osteopathic manipulative technique. Chest mobility exercises are aimed to improve thoracic mobility at the middle or lower parts of the chest [21].

The purpose of this study is to know the effectiveness of myofascial Release Therapy (MFR) along with chest mobility exercises on chest expansion and dyspnoea in subjects with chronic obstructive pulmonary disease.

The chest expansion and decrease dyspnoea. MFR therapy is a soft tissue therapy for the treatment of skeletal muscle immobility. Myofascial Release (MFR) therapy focuses on releasing muscular shortness and tightness. It is one of the methods of osteopathic manipulative technique. Chest mobility exercises are aimed to improve thoracic mobility at the middle or lower parts of the chest.

The purpose of this study is to know the effectiveness of myofascial Release Therapy (MFR) along with chest mobility exercises on chest expansion and dyspnoea in subjects with chronic obstructive pulmonary disease.

Since there is a lack of researches in chest mobility exercises and myofascial release on COPD, this study with research question does there is difference in effect of chest mobility exercises and myofascial release on chest on chest expansion and reduce dyspnoea compared with conventional physiotherapy with myofascial release and chest mobility exercises to prevent dysponea and improve chest mobility. Hence, the purpose of this study is to compare the effectiveness chest mobility exercises and myofascial myofascial Release Therapy (MFR) along with chest mobility exercises on chest expansion and dyspnoea in subjects with chronic obstructive pulmonary disease. It was null hypothesized that there will be no significant difference in effect of chest mobility exercises and myofascial Release Therapy (MFR) along with chest mobility exercises on chest expansion and dyspnoea in subjects with chronic obstructive pulmonary disease [21].

Aims and objectives

Aim of the study

To know the effect of chest wall mobility exercises and myofascial release of pectoralis major on chest expansion and dyspnoea in chronic obstructive pulmonary disease subjects.

Objectives

To evaluate the effect of myofascial release of pectoralis major and chest wall mobility exercises on chest expansion by using the Inch tape. To evaluate the effect of myofascial release of pectoralis major and chest wall mobility exercises on dyspnoea by using MRC (Medical Research Council) breathlessness scale.

Methodology

An Experimental study design with two groups Group A and Group B. As this study involved in human subjects the ethical clearance was obtained from the ethical committee, Department of physiotherapy, GowriGopal Hospital

Subjects included in study were with age group between 40 to 70 years both male and female subjects, Convenient purposive sampling method in two groups, Group A (Experimental) Group B (Controlled) and 8weeks duration study with 30 subjects nature of work COPD patients diagnosed by physician, patients who have had any episodes of acute exacerbation of chronic obstructive pulmonary disease in the past two months (stable chronic obstructive pulmonary disease patients) Not involved in any upper limb exercises from past one month, predictive FEV1, should be moderate to severe subjects were excluded with Acute exacerbation during or before study, Periarthritis shoulder disability preventing mobility to thorax, back pain, unstable cardiac disease, acute illness, respiratory muscle fatigue.

- Parameters: Chest expansion measured by Inch tape.
- Dyspnoea measured by (MRC) Medical Research council Breathlessness scale. and Tools of evaluation by measuring tape.

Group	Male	Female	Total
Group A (Experimental)	12	3	15
Group B (Controlled)	11	4	15

Study duration: 8 weeks

Parameters

- Chest expansion measured by Inch tape.
- Dyspnoea measured by (MRC) Medical Research council Breathlessness scale.

Tools for evaluation

- Measuring tape
- Measurement of chest excursion with a tape measure is a very simple and quick method for the assessment of chest mobility and this measurement has intertester and intratester reliability (Bockenhauer *et al.*).
- Chair
- Plinth
- MRC breathlessness scale (Appendix – A)

MRC dyspnoea scale is simple to administer as it allows the patients to indicate the extent to which there breathlessness affects their mobility.(J C Bestall *et al*, Thorax 1999, vol;54, pg 581-586.)

- Spirometry.
- Unstable cardiac disease.
- Corpulmonale.
- Acute illness.
- Respiratory Muscle fatigue.

Procedure

A total of 30 Subjects fulfilling inclusion criteria were selected for the study. All the subjects were informed of the objectives of the study. The purpose of this study was clearly explained to all the subjects in their own language. All the subjects have informed consent and they were asked to follow the therapist suggestions.

Each subject underwent formal evaluation and who met inclusion criteria were divided into two groups; groupA (n=15) and group B (n=15).

Experimental group subjects were treated with myofascial release therapy and chest mobility exercises for a period of 8 weeks. Control group were treated with conventional physiotherapy i.e chest mobility exercises.

Thoracic expansion is assessed with Inch tape at axillary, nipple and xiphoid levels and dyspnoea by MRC Breathlessness scale.

Myofascial Release for Pectoralis Major

Position of the patient; supine lying

Procedure

Therapist places the hand across the sternum towards the lateral aspect. Ask the subject to move his arm in abduction and lateral rotation.

Therapist takes the reinforcement of other hand while the subject is performing abduction and lateral rotation. Therapist slowly proceeds the hand towards the armpit and holds the muscle.

The therapist holds the pectoralis major with pads of the fingers sinking into the soft tissue to cont to 5 minutes then dragging the fascia across the surface elongating the muscle in stretched position. 3-5 minutes 5 days per week for total duration of 8 weeks.

Now the subject is asked to do adduction and medial rotation simultaneously followed by abduction and lateral rotation. This releases the tightness of pectoralis major.

Exercises to mobilize the chest

Chest mobility exercises are designed to maintain or improve mobility of the chestwall, trunk and shoulders girdles when it effects ventilation or postural alignment. Chest mobilization exercises are also used to reinforce or emphasize the depth of inspiration or controlled expiration.

To mobilize lateral Side of the Chest

Position of the patient; sitting

The patient is asked to bend away from the tight side to lengthen hypomobile structures and expand the chest during inspiration. Then have the patient push the fisted hand into the lateral aspect of the chest, as he bends toward the tightside and breathes out.

REP's; 1-5 repetitions per day

To mobilize the upper chest and stretch the pectoralis muscles: Position of the patient; sitting the patient is asked to clasp the hands behind the head and horizontally abduct the arms elongating the pectoralis major during a deep inspiration. Then instruct the patient to bring the elbows together and bend forward during expiration.

REP's; 1-5 repetitions per day.

Position of the patient; sitting

The patient is asked to lift both the arms overhead (180 degrees bilateral shoulder flexion and slight abduction) during inspiration. Then during expiration the patient is asked to bend forward at the hips by reaching the arms towards the floor.

REP; 1-5 repetitions per day. MYOFASCIAL RELEASE OF PECTORALIS MAJOR

Fig 1: Myofascial Release of Pectoralis Major

Fig 2: Myofascial Release of Pectoralis Major

Fig 3 or 4: Inch Tape Measurement of Chest Expansion


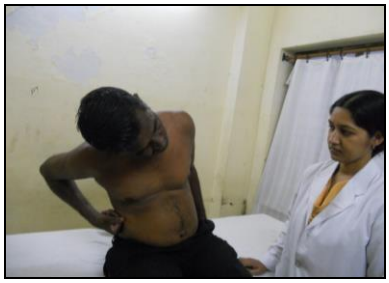

Fig 5 or 6: To Mobilize Lateral Side of the Chest

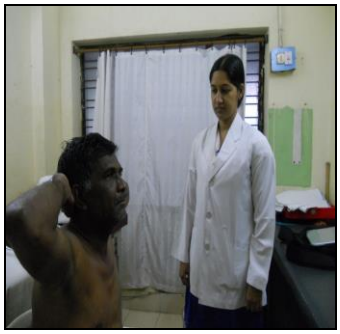


Fig 7 or 8: To Stretch the Pectoralis Muscle

Data Analysis

Paired t test has been used to compare the pre and post intervention scores of chest expansion and dyspnoea with in the groups (Group - A) and (group - B).

Unpaired t test has been used to copare pre and post intervention scores between both groups (group A) and (group B).

Table 1: Inter Group Comparison of Pre Treatment Scores of Chest Expansion

	Pre					
	A		B		t Value	P Value
	Mean	SD	Mean	SD		
L1	2.864667	0.870327	2.685333	0.916272	0.549605	0.58694757 NS
L2	2.284667	0.497018	1.945333	0.630576	1.636851	0.11285387 NS
L3	2.888	0.971032	3.396667	0.91528	1.476355	0.15100767 NS

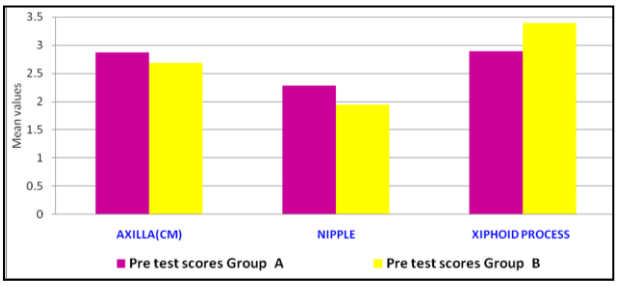

Fig 9: Paired t test has been used to compare the pre and post intervention scores of chest expansion and dyspnoea with in the groups (Group - A) and (group - B)

Table 2: Inter Group Comparison of Post Treatment Scores of Chest Expansion

	Post					
	A		B		t Value	P Value
	Mean	SD	Mean	SD		
L1	3.340667	1.101521	3.542667	1.093013	0.50416	0.61809496 NS
L2	2.726667	0.55514	2.626666	0.576809	1.657864	0.2058647 NS
L3	3.364667	1.105641	4.032667	0.225729	1.946101	0.06174175 NS

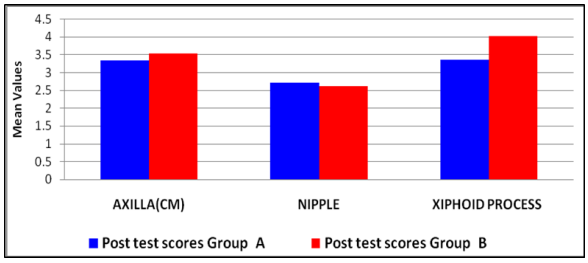

Fig 10: Show the compare the pre and post intervention scores (Group - A) and (group - B)

Table 3: Intra group comparison of pre & post treatment scores of chest expansion (group – A experimental)

	Group A					
	Pre		Post		t Value	P Value
	Mean	SD	Mean	SD		
L1	2.864667	0.870327	3.340667	1.101521	3.8091	0.0019160847 Sig
L2	2.284667	0.497018	2.726667	0.55514	5.495557	0.000001 Sig
L3	2.888	0.971032	3.364667	1.105641	3.35084	0.0047560015 Sig

Table 4: Intra group comparison of pre & post treatment scores of chest expansion (Group – B Control)

	Group B					
	Pre		Post		t Value	P Value
	Mean	SD	Mean	SD		
L1	2.685333	0.916272	3.542667	1.093013	5.18326	0.000138771 Sig
L2	1.945333	0.630576	2.626666	0.576809	1.85321	0.04942116 Sig
L3	3.396667	0.91528	4.032667	0.225729	8.212811	0.000001 Sig

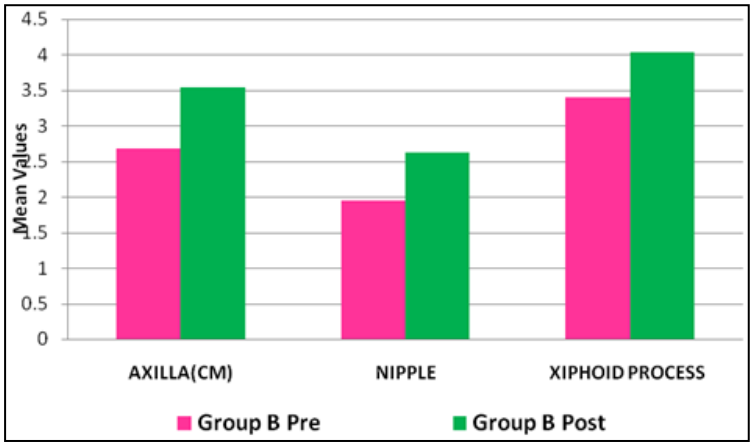

Fig 11: Different of Pre Treatment Scores

Table 5: Inter Group Comparison of Pre Treatment Scores of Dysponea (Group – A & B)

	Pre					
	A		B		t Value	P Value
	Mean	SD	Mean	SD		
Dys	3.66667	0.72375	3.86667	0.74322	0.746674	0.461484 NS

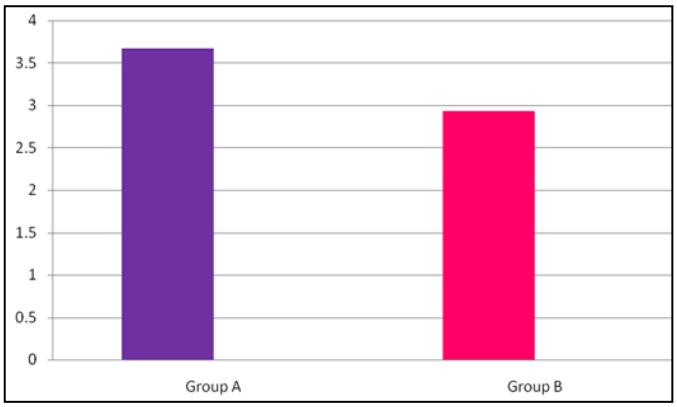

Fig 12: Dyspnea pre values

Table 6: Inter Group Comparison of Post Treatment Scores of Dysponea (Group – A & B)

	Post					
	A		B		t Value	P Value
	Mean	SD	Mean	SD		
Dys	2.93333	0.703731	2.733333	0.883715	0.685674	0.498556 NS

Table 7: Intra Group Comparison of Pre & Post Treatment Scores of Dysponea (Group – A)

	A					
	Pre		Post		t Value	P Value
	Mean	SD	Mean	SD		
Dys	3.66667	0.72375	2.93333	0.703731	3.21391	0.006245 Sig

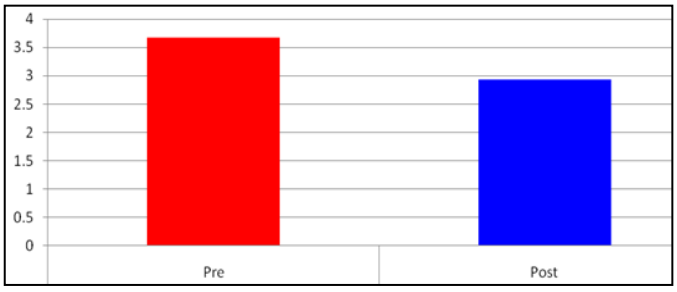

Fig 13: Dyspnoea group A

Table 8: Intra Group Comparison of Pre & Post Treatment Scores of Dysponea (Group – B)

	B					
	Pre		Post		t Value	P Value
	Mean	SD	Mean	SD		
Dys	3.86667	0.74322	2.73333	0.88371	5.26425	0.00011970 Sig

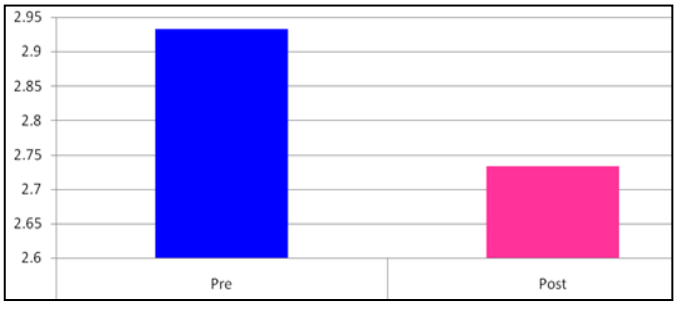

Fig 13: Dyspnoea group B

Discussion

The results of the study proved that there was no additional advantage in adding myofascial release technique for pectoralis major to the chest mobility exercises in improving chest expansion and dyspnoea.

The purpose of the study was to find out the effect of chest mobility exercises and myofascial release of pectoralis major in subjects with copd. The subjects showed improvement in both the groups (experimental & control) after the treatment. Analysis of chest expansion and dyspnoea scores of before and after treament in experimental group (group A) patients reveal that there was no significant improvement of chest expansion and dyspnoea when compared to the control group.

The patients were assessed with MRC breathlessness scale and inch tape before baseline treatment and after 8 weeks of treatment.

In a study conducted by Katerina Burianova *et al*, applied soft tissue techniques to release the muscles and fascia(trapezius muscle, levator scapulae muscle, pectoralis major and minor muscles and pectoral fascia) and concluded that there is siginificant improvement in chest mobility and respiratory muscle strength.

In another study conducted by Jennifer and Prasad (2008) explained about conventional chest physical therapy(Chest mobilisation exercises) for increasing chest wall mobility and improving ventilation.

Vibekk 1991 used chest mobilisation exercises in chronic lung disease which has a tendency to cause poor posture, ri Lee, 2002; Rodrigues& Watchie, 2010 studied about the thoracic mobility exercises that will improve thoracic mobility at upper middle and lower parts of the chest. These techniques can be used to minimise dyspnoea and should be applied in sitting, forward leaning and high side lying positions.

Measurement of chest excursion is a very simple and quick method for the assessment of chest mobility and this measurement has high intertester and intratester reliability (Bockenhaves *et al.* 2000).

Measurement of dyspnoea is difficult to quantify but it is necessary to do that here. The symptoms of a particular group are to be summarized and compared with others. Flecther and co-workers addressed this problem when studying the respiratory problems of welsh coal miners at the medical research council pneumoconiosis unit in 1940s.They advised a short questionnarie that allowed a numeric value to be placed on each subject's exercise capacity. The questions were first published in 1952 and rapidly developed into breathlessness scale. The MRC dyspnoea scale is simple to measure perceived respiratory disability and allows the patients to indicate extent to which breathlessness affects their mobility.

In our study we have considered myofascial release therapy only for pectoralis major in experimental group and other muscles like trapezius, levator scapulae and pectoralis minor muscle which are also shortened in copd were not considered for myofascial release technique. In further studies we recommend to consider these muscles for MFR technique and see whether there is significant difference between both the groups. gidity lack of thoracic spine and ribcage movements

Conclusion

The findings of the study conclude that adding a technique like myofascial release for pectoralis major muscle to chest mobilization exercises did not show any added advantage and significant difference in improving chest expansion and dyspnoea when compared with chest mobilization exercises only.

The study shows that there is no significant improvement in experimental group when compared with control group. Therefore null hypothesis is accepted.

Inch tape and MRC breathlessness scale are very useful in interpretation of chest

Expansion and dyspnoea.

Limitations and Further Recommendations

a. The sample size is small and large sample size may be considered in further studies.
b. The study duration is short and long term studies are recommended.
c. In these study we considered myofascial release therapy only for pectoralis major muscle in experimental group and other muscles like trapezius, levator scapulae, pectoralis minor in which are also shortened in copd may be consisdered in further studies along with the pectoralis major.

APPENDIX-A

Table 9: The MRC Breathlessness scale

Grade	Degree of breathlessness related to activities
1	Not troubled by breathlessness except on strenuous exercise
2	Short of breath when hurrying on the level or walking up a slight hill
3	Walks slower than most people on the level, stops after a mile or so, or stops after 15 minutes walking at own pace
4	Stops for breath after walking about 100 yds or after a few minutes on level ground
5	Too breathless to leave the house, or breathless when undressing

Table 10: APPENDIX – B MASTER CHART

PRE-TEST SCORES									
GROUP – A					GROUP-B				
S.NO	AXILLA(CM)	NIPPLE	XIPHOID PROCESS	DYSPNOEA	S.NO	AXILLA(CM)	NIPPLE	XIPHOID PROCESS	DYSPNOEA
1	2.75	2.16	3.07	3	1	1.46	1	4.58	5
2	2.65	2.16	1.61	3	2	2.32	2	3.48	4
3	2.34	2.26	1.76	3	3	4.25	3.42	5.25	3
4	3.42	2.13	2.15	4	4	1.67	1.9	2	5
5	2.28	2.28	1.95	3	5	2.28	1.93	3.34	4
6	1.95	2.48	2.57	3	6	3.34	2.13	3.45	3
7	3.08	2.65	2.6	4	7	2.25	2	2.94	3
8	3.6	2.34	2.1	4	8	1.67	1.52	2	5
9	2.65	2.5	5	3	9	2.15	1.82	3	4
10	4	2.98	3.48	3	10	3.08	2.54	4.25	4
11	3.2	2	3	5	11	3.64	1.92	3.12	4
12	1.9	1.52	2.85	5	12	3.65	2	4	3
13	2	1.85	3.25	4	13	4.12	2.72	3.95	3
14	5	3.42	4.58	4	14	2.28	1.19	2.34	4
15	2.15	1.54	3.35	4	15	2.12	1.09	3.25	4
POST -TEST SCORES									
GROUP – A					GROUP-B				
S.NO	AXILLA(CM)	NIPPLE	XIPHOID PROCESS	DYSPNOEA	S.NO	AXILLA(CM)	NIPPLE	XIPHOID PROCESS	DYSPNOEA
1	3.45	2.95	4	2	1	2	1.86	5	2
2	3	2.54	2	3	2	3.24	2.62	4	3
3	2	2.26	2	3	3	5	4	6	2
4	4	2.13	3.25	3	4	1.67	1.9	2.75	5
5	2.86	3	2	3	5	2.28	3.96	4.25	2
6	2.18	2.95	3	3	6	4	3	4	3
7	3.64	3	3.45	2	7	3.62	3.84	3	3
8	3.6	2.34	2.1	4	8	2	3	3	4
9	3	3	4.25	3	9	3.89	2.45	4	3
10	5.82	3.46	4.25	3	10	4.75	3	5	2
11	3.42	2.65	3.92	4	11	3.64	4.82	4	3
12	2	2	3	3	12	4.62	4	4.25	2
13	2.72	2	3.25	4	13	4.75	3	4.12	2
14	5.42	4	6	2	14	3.68	2.85	3	2
15	3	2.62	4	2	15	4	3	4.12	3

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