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'A Study to find out the effect of Accessory Inspiratory Muscle Energy Technique on Chest Expansion and Pulmonary Function in an Elderly Male'

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ABSTRACT

Aging brings anatomical changes in lung tissue affecting function of lungs leading to reduction in pulmonary function &chest expansion. Muscle energy technique(MET) used to stretch tight muscles, strengthen weak musculature & mobilize joint restrictions. Thus, study was conducted to find out effect of accessory inspiratory MET on chest expansion (CE) & pulmonary function testing (PFT) in elderly male.30 male subjects who fulfilled criteria were selected for study with age group 65-75 years. All subjects were assigned into 2 groups, Group A(n=15) received Chest mobility exercise (CME) as conventional treatment, Group B(n=15) received MET & CME. Pre & post evaluation of CE & PFT were taken on 1st day & at end of 3rddayof intervention & results were compared.

The result shows a significant difference in Group A for pre & post PFT value of FEV_1(t=-6.25), FVC(t=-7.14)& CE value at axillary(t=-13.22), xiphisternal(t=-7.12), but not significant change in FEV_1/FVC(t=-0.91). The result of Group B showed significant difference for pre & post PFT value ofFEV_1(t=-11.24),FVC(t=-9.06)& CE value at axillary(t=-16.14), xiphisternal(t=-11.45), but not significant change inFEV_1/FVC(t=1.645).Inter Group comparison suggested that there was significant difference inFEV_1(t=-4.93),FVC(t =-5.64), axillary level(t =-5.20) &xiphisternal level(t=-5.02)& no significant difference between FEV_1/FVC(t=-1.25).&concluded that combined accessory inspiratory MET with CME showed more significant effect on PFT parameters like FEV_1&FVC as well CE at axillary &xiphisternal level than alone chest mobility exercise.

KEY WORDS: Accessory inspiratory MET, PFT, CE.

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INTRODUCTION

Rapid increase in the number of older people is a global phenomenon. Developing countries are greying as the elderly population is growing much faster than expected. An unprecedented increase in human longevity was one of the most spectacular events of the 20th century. The resultant population aging with all its ramifications, are more evident in most parts of the world.[1]

Aging is associated with a significant decrease in chest wall compliance that includes decrease in compliance of rib cage (upper thorax) and compliance of the diaphragm-abdomen compartment (lower thorax).The compliance can be referred as change in volume relative to change in pressure. Compliance of the respiratory system is 20% less in a 60-year-old geriatric subject compared with a 20-year-old adult.[2]

As age increases musculoskeletal deterioration also increases, postural and skeletal changes that occur over time causes overuse of upper chest breathing patterns reducing lower rib expansion and reducing efficient pattern of diaphragmatic breathing. Overall, there is a decrease in the elastic recoil and an increase in pulmonary compliance.[3] Because the resting position of the thorax depends on the balance between the elastic recoil properties of the lungs pulling the ribs inwardly and the outward pull of the bones, cartilage, and muscles, the reduced recoil property of the lung tissue allows the thorax to rest with an increased A-P diameter (a relatively increased inspiratory position).[4]

The result of these skeletal and tissue changes is an increase in the amount of air remaining in the lungs after a normal exhalation (i.e., an increase in functional residual capacity). If the lungs retain more air at the end of exhalation, there will be a decrease in inspiratory capacity of the thorax. Suitable lengthening of soft tissue around the chest wall and respiratory muscles is required for efficiency of contraction force of respiratory muscles and chest movement. Conventionally, to increase flexibility of muscles, techniques such as passive stretching, PNF stretching, self-stretching, passive mobilization of joints, chest/thorax mobility exercises and massage are recommended.[2]

Chest mobility exercisesis one of many techniques and very important in conventional chest physiotherapy for increasing chest wall mobility and improving ventilation. These techniques are divided into passive and active chest mobilization.[2] Use this of technique depends on the patient's condition.

Muscle energy techniques are a class of soft tissue osteopathic (originally) manipulation methodsthat incorporate precisely directed and controlled, patient initiated, isometric and/or isotonic contractions, designed to improve musculoskeletal function and reduce pain.[5]The origin of muscle energy is credited to Dr Fred Mitchell Sr., an osteopathic physician, who described thetechnique in the 1950s.[5]

Post-Isometric Relaxationrefers to the subsequent reduction in tone of the agonist muscle after isometric contraction. This occurs due to stretch receptors called Golgi tendon organs that are located in the tendon of the agonist muscle.[5]These receptors react to overstretching of the muscle by inhibiting further muscle contraction.

Chest expansionmeasurement are used to evaluate a patient's base line status, treatment effectiveness, and progression of disease with regard to chest mobility and respiratory muscle function.The reliability of this technique shows an interclass correlation coefficient of 0.81 to 0.91 proving it reliable in clinical setting.[2]

By knowing the role of short duration MET on chest expansion and pulmonary function, MET can be used in various exercise prescription protocol for elderly subjects who are more prone for age related decline in chest expansion and pulmonary function.In elder population, no study has been found indicating effect of MET on chest expansion and pulmonary function, so there is a need to find out effect of accessory inspiratory MET on chest expansion in elder population.

Thus, aim of this study is to find out the effect of accessory inspiratory muscle energy technique on chest expansion and pulmonary function in elderly male.

Pulmonary function tests are performed to assess lung function, to determine the degree of damage to the lungs, diagnosis of certain types of lung disease and to analyze whether exposure to contaminants at work affects lung function.The three most important measures are performed during spirometry are: Forced vital capacity (FVC), forced expiratory volume in first second (FEV_1), percentage of ratio between FEV_1 and FVC (FEV_1/FVC%).[6]

OBJECTIVES OF THE STUDY:

- To find out an effect of accessory inspiratory muscle energy technique on chest expansion in elderly male.
- To find out an effect of accessory inspiratory muscle energy technique on pulmonary function (FEV_1, FVC and FEV_1/FVC ratio) in elderly male.

HYPOTHESIS

Null hypothesis:

- There is no significant effect of accessory inspiratory muscle energy technique on chest expansion and pulmonary function in elderly male.

Experimental hypothesis:

- There is significant effect of accessory inspiratory muscle energy technique on chest expansion and pulmonary function in elderly male.

METHODOLOGY

Study design: Experimental study.

The proposed title and procedure were approved by ethical committee members and written consent was taken from subjects at Shri K.K Sheth Physiotherapy College, Rajkot. After fulfilling the inclusion and exclusion criteria all the participants were divided into two groups.

GROUP A:15subjects conventional chest mobility exercise.

GROUP B: 15subjects muscle energy technique as well as chest mobility exercise.

CRITERIA FOR SELECTION

Inclusion criteria[2,3]

- Subject with age group between 65-75 years.
- Elderly male subjects.
- Ability to communicate, follow commands and who has independent mobility.[5]
- With no previous diagnosis of respiratory conditions.[2]

Exclusion criteria[2,3]

- Subjects with musculoskeletal disorders affecting upper limb.
- Pathological condition affecting muscle, joint and bone such as rheumatoid arthritis, severe osteoporosis.
- Cardiovascular dysfunction (eg, ischemic heart disease, uncontrolled hypertension), associated conditions restricting chest expansion. (eg, obesity, severe scoliosis, ankylosing spondylitis).
- Recent chest or abdominal surgery.[3]
- Elderly people with neurological and/or psychiatric conditions.
- Symptoms of a cold at time of evaluation.
- Alcohol consumers and smokers.[2]

Materials used for the study:(fig: 4.1)

- Spirometer (RMS, Helios 401, version- 3.1.39)
- Pen
- Paper
- Weighing machine
- Inch tape
- Stadiometer
- Cotton

- Spirit
- Mouth piece
- Nose clip
- Couch
- Table
- Pillow
- Assessment form
- Consent form

Testing procedure:

- The selection of subjects was done by purposive sampling. A total number of 30 male subjects were selected from Rajkot city for the study and assigned to group A and group B according to order of appearance.
- **Group A**:15 subjects were given chest mobility exercise for 3 consecutive daysto find changes in PFT and chest wall expansion in male elderly subjects.
- **Group B:**15 subjects were given muscle energy technique (MET) to accessory inspiratory muscles along with chest mobility exercise for 3 consecutive days to find changes in PFT and chest wall expansion in male elderly subjects.

Assessment:

- On the first visit, a complete physical therapy assessment was done. Subjects who fulfilled inclusion and exclusion criteria for the participation in the study were explained about the procedure and were requested to sign consent form.
- Subjects were permitted to administer medical treatment (drugs) according to physician's advice during the intervention period of the trial.

Measurement procedure:

1. **PFT (Pulmonary Function Test- FEV_1,FVC, FEV_1/FVC)[6]:**

- Pulmonary function test was taken pre and post training as per the standard outline by American Thoracic Society[6] as shown in fig 1.

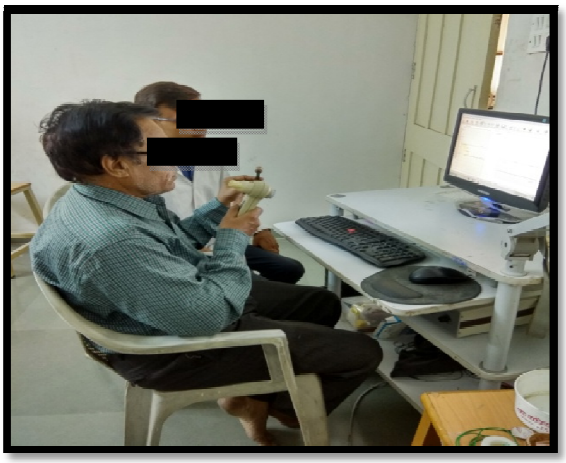

Fig: 1 Patient performing spirometer for the study

2. Chest expansion: [2]

- This method consisted of measuring the subject's chest circumference in standing at 2 levels of thorax: the axillary and the xiphisternal level as shown in fig 2 and 3.

Fig: 2 Axillary level

Fig: 3Xiphisternal level

GROUP A:-[7]

- Subjects of Group-A performed chest mobility exercise as a conventional physiotherapy.

Chest Mobilization Techniques:[7]

Techniques: Patients were asked to perform the different exercises in proper position with proper breathing pattern. These techniques were following as mentioned below.

1. Rib rotation:

- **Procedure:** Therapist stretches right side of chest placing hands on one side of rib cage and giving opposite directional forces and same technique was performed on other side as shown in fig 4.

Fig:4Rib rotation

2. Chest wall rotation:

- **Procedure:** Therapistasked the patient to do trunk rotation on oneside during inspiration and neutral during expiration on both the side as shown in fig 5.

Fig: 5 Chest wall rotation

3. Lateral flexion of chest wall:

- **Procedure:** Therapist asked the patient to move trunk laterally on oneside actively during inspiration and neutral during expiration on both the sides actively as shown in fig 6.

Fig:6Lateral flexion of chest wall

4. Chest wall extension:

- **Procedure:**Therapistasked the patient to move his/her neck and upper trunk backward during inspiration and returns neutral during expiration actively as shown in fig 7.

Fig: 7 Chest wall extension

5. Pectoralis major muscle stretching:

Fig: 8Pectoralis major stretching

- **Repetition of the exercise:** 5 Repetitions of each maneuver was done in one session which was performed bilaterally.

GROUP B:-[8]

- Participants of Group B performed Muscle Energy Technique (MET) with chest mobility exercise.

Muscle Energy Technique (MET):-[8]

MET FOR PECTORALS:-

- Patient was asked to lie prone and shoulder abducted to 90°& elbows flexed to 90°& palm facing to floor.
- Therapist stood at the waist-level of patient, facing towards head of patient.**(Fig: 9).**

Fig: 9 MET for Pectoralis major

MET FOR SCALENES:-

- The patient was asked to lie supine with a folded towel under the upper thoracic area with head facing towards opposite side.
- For posterior fibers head was placed in full contra-lateral rotation**(Fig:10).**
- For middle fibershead was placed in 45^{o} contralateral rotation**(Fig: 11).**
- For anterior fibers of scalene head was placed in slight contra lateral rotation**(Fig: 12).**

Fig:10 and 11 MET for posterior and middlefibers of Scalene

Fig: 12MET for anterior fibers of Scalene

MET FOR STERNOCLEIDOMASTOID:-

- The patient was asked to lie supine with the head supported in neutral position by one hand of the therapist and the shoulder rested on a folded towel so that the head is placed in a slight extension. **(Fig: 13)**

Fig:13 MET for Sternocleidomastoid

MET was applied bilaterally and 3 repetitions were given. Along with that rest period was kept 30 seconds and 3 sessions were given in one time.

Along with that Chest mobility exercise was given as a conventional treatment and 5 repetitions were given which was performed bilaterally.[7]

STATISTICAL ANALYSIS

The statistical software named SPSS 20.00 was used for data analysis. Microsoft Excel and Word were used to generate graphs and tables. . As the variable follows normal distribution parametric test paired t-testwas used to compare the pulmonary function and chest expansion pre & post values and unpaired t-test was used to compare the result between Group A and B at 0.05 level of significant with 95% of confidence interval.

TABLES

Table: 1 Distribution of different age group in years

Age(years)	Frequency
65-68	19
69-71	09
72-75	02
Total	30

Interpretation: The above table shows the different age groups were taken in the study and frequency of each subject in each age group.

Table:2Between Group comparison of FEV_1, FVC and FEV_1/FVC of Group A and Group B.

Parameters	Mean ± Std. Deviation		t	p	Result
	Group A	Group B			
FEV_1(l)	0.14 ± 0.08	0.37±0.16	-4.934	0.003	S
FVC(l)	0.16 ± 0.09	0.41 ± 0.14	-5.647	0.005	
FEV_1/FVC(%)	0.04 ± 2.07	0.92 ± 2.16	-1.251	0.221	NS

Where, S = significant, NS-not significant.

Interpretation: The above table shows a significant difference in the FEV_1**(t=-4.934, p<0.05),** FVC(**t=-5.647,p<0.05)** andFEV_1/FVC**(t=-1.251,p>0.05)** score in both the groups .

Table: 3Between group comparison of chest expansion in Group A and Group B.

Parameters	Mean ± Std. Deviation		t	p	Result
	Group A	Group B			
Axillary Level(cm)	0.1 ± 0.1	0.29±0.07	-5.206	0.001	S
Xiphisternal Level (cm)	0.2 ± 0.00	0.32 ± 0.10	-5.002	0.002	

Where, S = significant, NS-not significant.

Interpretation: The above table shows a significant difference in the Chest expansion value at Axillary level **(t=-5.206, p<0.05),** and Xiphisternal level **(t=-5.002, p<0.05)** value in both the groups but more significant improvement was found in Group B compared to Group A.

DISCUSSION

This study was conducted to determine the efficacy of Chest mobility exercise versus Muscle energy Technique with Chest Mobility exercise for elderly Subjects to enhance pulmonary function as well as chest expansion.

The result showed that the pulmonary functions and chest expansionof group A (CME) and group B (MET+CME) improve significantly after 3 day of treatment in elderly male subjects. But FEV_1/FVC ratio was not significantly improved. After comparing group A and group B there is more improvement found in Group B were MET along with CME given which shows more impact on pulmonary functions and chest expansion of elderly male.

Thus, the results of the present study rejects the null hypothesis and supports the experimental hypothesis i.e. there is significant difference between accessory inspiratory muscle energy technique with chest mobility exercise than only chest mobility exercise.

Aging is associated with a significant decrease in chest wall compliance that includes decrease in compliance of rib cage (upper thorax) and compliance of the diaphragm-abdomen compartment (lower thorax).[2]

An increased kyphosis is often observed in older individuals, which decreases the mobility not only of the thoracic spine but also of the rib cage.[4] Thekyphotic curvature of the spine and the anteroposterior diameter of the chest increase with aging. Thus, curvature of the diaphragm and its force-generating capacity decreases.[4]

In this study both group has been given chest mobility so, the improvement in outcome measures could be due to increase in shoulder quadrant muscles lengthening, and intercostal muscle lengthening.According to the theory of Laplace's law suggests that the length of muscle relates to the maximal force of either diaphragm or intercostal muscles, which affect ventilation in the lung.Chest mobilizations help to increase chest wall mobility, flexibility, and thoracic compliance, so improved mobility allows an individual to breathe more effectively and deeply.[2]

So, this study found significant pre and post improvement in FEV_1 and FVC as well as chest expansion at axillary and xiphisternal level in both groups.Post-Isometric Relaxation of METrefers to the subsequent reduction in tone of the agonist muscle after isometric contraction.[8] This occurs due to stretch receptors called Golgi tendon organs that are located in the tendon of the agonist muscle. These receptors react to overstretching of the muscle by inhibiting further muscle contraction.

Stretching involves the application of manual or mechanical force to elongate (lengthen) structures that have adaptively shortened and are hypomobile.[6] Principle of MET is to stretch and facilitate specific muscles or joint.[9] So in Group B shows more positive effect over the pulmonary function and chest expansion along with chest mobility exercise.

So, that between group comparison shown Group B (MET with CME) shown more improvement in pulmonary function parameters like FEV_1 and FVC as well as chest expansion at axillary and xiphisternal level due to additively used accessory inspiratory muscles energy technique.[9]

Hence, this study suggest combined application ofaccessory inspiratory muscle energy technique with chest mobility exercises showed more significant improvement in pulmonary function test such as forced expiratory volume and forced vital capacity and chest expansion at axillary level as well as xiphisternal level than only chest mobility exercise for elderly male subjects.

CLINICAL IMPLICATION

Reduction in pulmonary function as well as chest expansion after age of 60 is common. Thus MET with CME are prescribed in elder population for improvement and maintenance of pulmonary function as well as chest expansion. It can be also prescribed for restrictive disease as well as obstructive disease with restrictive changes to target enhancement in pulmonary function and chest expansion.

LIMITATIONS OF THE STUDY

- Sample size was relatively small.
- Study duration of the treatment protocol was short.
- Study included only male subjects.
- Follow up period was not considered.
- Kyphotic curvature was not measured.

FURTHER RECOMMENDATIONS

- Study can be done with larger sample size.
- Study can be done by includingmale and femalepopulation .
- Study can be done by considering kyphotic curvature.
- Study can be done with other ventilatory parameters like MVV and PEFR.
- Study can be done with comparison of other techniques like breathing exercise, incentive spirometer etc.
- Study can be done by considering follow up period.

CONCLUSION

From this study, it can be concluded thatthree days of combined accessory inspiratory muscle energy technique with chest mobility exercises showed more significant improvement in pulmonary function test such as forced expiratory volume and forced vital capacity as well as chest expansion than chest mobility exercise for elderly male subjects

REFERENCES

1. Husseincairo. A strategy for active, healthy ageing and old age care. 1st ed.Eastern Mediterranean.2006–2015,01.06/10002006;1-70.
2. Mehta Gopi,Akalwadi Akshata.Combined effect of PNF stretching with chest mobility exercise on chest expansion and pulmonary functions for elderly.International Journal of Physiotherapy. June-2015;2(3):563-71.

3. Lenehan K, Fryer G, McLaughlin P.The effect of muscle energy technique on gross trunk range of motion.Journal of Osteopathic Medicine.2003;6(1):13-18.
4. Multani K, Verma S.Principles of Geriatric Physiotherapy. 1st ed. 2007;Ch.(1)P:1-2.
5. Hertling D Kessler. Management of common musculoskeletal disorders physical therapy. 3rd edition. Philadelphia: Lippincott and Wilkins:1996.
6. Bhatt S, Guleria R, T.K. Luqman A, GuptaA, Mohan A, Nanda S.Effect of Tripod Position on Objective Parameters of Respiratory Function in Stable Chronic Obstructive Pulmonary Disease.Indian J Chest Dis Allied Sci. 2009;(51):83-85.
7. Parmar Dharmesh, Anjali B. The immediate effect of chest mobilization technique on chest expansion in patients of COPD with restrictive impairment.International journal of science and research.2015-11;(2):134-141.
8. Leon Chaitow. Muscle energy technique. 2nd edition Churchill livingstone. 2001;Ch.(4) P:167-79.
9. Akanksha A, Ravinder N, GirishS.Accessory Inspiratory Muscles Energy Technique effect on Pulmonary Function in COPD Subjects.Indian journal of physiotherapy & occupational therapy.Sep-2013:7(3):192-7.