

Immediate Effect of Soft Tissue Release Manual Therapy Techniques on Chest Expansion and FEV1/FEV6 in Subjects with Moderate COPD

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Abstract

Background and Objective:

Patients with COPD often develop changes in chest wall configuration. These changes have been related to airway obstruction, hyperinflation, and mechanical disadvantage of the respiratory muscles. There are many studies have described effect of manual therapy in musculoskeletal structural changes in isolation among people with COPD, although the influence of soft tissue release manual therapy techniques on chest expansion and pulmonary function remains largely unclear. Hence the purpose of the study is to find the immediate effect of soft tissue release manual therapy techniques on chest expansion and pulmonary function-FEV1/FEV6 in subjects with moderate COPD.

Method: A comparative study design with two groups- Experimental Group and Placebo Group. Conducted study on total 30 subjects, 15 in each group. The Experimental group subjects were treated with soft tissue release manual therapy techniques in a single session whereas placebo group subjects were treated with placebo treatment. The outcome measures such as Chest expansion and pulmonary function FEV1/FEV6 were measured at before intervention and immediately after intervention.

Results: Comparative analysis of post intervention means using Independent 't' test between the groups found statistically significant difference between the groups ($p < 0.05$) in Chest expansion at Axillary level and Xiphisternum level and FEV1/FEV6. The placebo group shown no statistically significant difference in improvement, where as Experimental group shown there is a statistically significant improvement.

Conclusion: The present study concludes that single treatment session of soft tissue release manual therapy techniques found to be immediate effect in improving Chest expansion and pulmonary function- FEV1/FEV6 in subjects with moderate COPD and the placebo techniques used in the study shown no statistically significant effect.

KEYWORDS: Moderate COPD, Soft tissue manual release techniques, Manual therapy, chest expansion, Pulmonary function, FEV/FEV6, Placebo treatment.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) which is a common preventable and treatable disease state characterized by persistent airflow limitation that is not fully reversible, associated with an enhanced chronic inflammatory response in the airways and the lung when exposed to noxious particles or gases, associated with exacerbations

and co-morbidities that contributes to overall severity in individual patients.¹ One of the co-morbid is musculoskeletal changes that are prevalent in COPD. Soft tissue around the thorax and its dysfunction is an important systemic consequence of COPD because of its impact on physical activity, exercise tolerance, quality of life, and even survival in this disease.²

Patients with COPD often develop changes in chest wall configuration. These changes have been related to airway obstruction, hyperinflation, and mechanical disadvantage of the respiratory muscles.^{3,4} Individuals with COPD associated with increased inspiratory drive and inefficient expiration can lead to trapping of air in the lungs or hyperinflation. When this occurs the diaphragm becomes shorter and loses its curvature, as it is forced to take a lower resting position in the thorax. This shortening of the diaphragm fibers decreases the power and efficiency of the diaphragm due to the laws of length, tension relationships which apply to all contracting muscles. It is also associated with loss of the curvature or doming of the diaphragm and a reduction of the zone of opposition. In this case the diaphragm fibers, which are attached to the lower 6 ribs, become orientated transversely rather than vertically. When the diaphragm contracts, it is ineffective in lifting and widen the lower rib cage. Instead there is a tendency for the diaphragm to pull the rib the lower lateral rib cage inward, decreasing the transverse diameter of the lower rib cage during inhalation.^{5,6}

Soft tissue structures like muscle and fascia dysfunction can be prevented and improved, in part, with exercise training, but it is clear that novel therapies are needed to better address this problem. Pulmonary rehabilitation has been clearly demonstrated to reduce dyspnea, increase exercise capacity, and improve quality of life in individuals with chronic obstructive pulmonary disease (COPD).⁷ Physiotherapy interventions, such as respiratory muscle stretching; gymnastics; manual therapy techniques such as agonist contraction against resistance, soft tissue release and stretching, passive joint mobilization; and respiratory muscle training, have been used to minimize changes to chest wall configuration.⁴

Manual therapy (MT) has been defined as a therapeutic intervention that uses the hands to provide treatment to the musculoskeletal and/or visceral systems. It includes techniques such as massage, Myofascial release, muscle energy technique, ligament balance, joint mobilization and joint manipulation. The suggestion that MT could deliver long-term benefits to people with COPD was first put forward in 2009. Since then a number of small studies have reported medium term improvements in lung function and exercise capacity following repeated applications of MT intervention.^{8,9}

There are many studies have described effect of manual therapy in musculoskeletal structural changes in isolation among people with COPD, although the influence of soft tissue release manual therapy techniques on chest expansion and pulmonary function remains largely unclear. There are no studies found the effectiveness of soft tissue release manual therapy techniques addressing the diaphragm, anterior and posterior thoracic Myofascial structure in subjects with moderate COPD. Hence the purpose of the study is to find the immediate effect of soft tissue release manual therapy techniques on chest expansion and pulmonary function-FEV1/FEV6 in subjects with moderate COPD.

METHODOLOGY

A comparative study design with two groups an Experimental Group and Placebo Group. As this study involved human subjects the Ethical Clearance was obtained from Assam down Town University Ethical Committee. The subjects recruited and study conducted at Down Town Hospital, Guwahati. Subjects included in the study were with age group between 45-60 years,¹ Physician/Pulmonologist diagnosed subjects with COPD according to GOLD Criteria Moderate: $FEV_1/FVC_6 = <0.70$, $50\% \leq FEV_1 < 80\%$ Predicted.¹⁰ Be medically stable with no exacerbations in the preceding two months. Subjects with chest expansion measured through inch tape <1.5 cms of average of three trial at xiphisternal level and more than 0.5 cms, Subject with decreased with reduced soft tissue flexibility of thoracic muscles, evaluated by physical examination.^{11,12} Subjects were excluded with history of asthma (defined as a $\geq 25\%$ change in FEV_1 post bronchodilator), Patients with acute exacerbation of COPD and supplemental oxygen dependency, history of neuromuscular conditions, history of any Vestibular condition, rheumatoid condition, neuromuscular or musculoskeletal pathology, cognitive disability that could affect their understanding or execution of the assessment tests or intervention protocol. Subjects who met inclusion criteria were allotted into Experimental and Placebo group by simple random sampling method. The purpose of the study was explained to the subjects and the informed consent was obtained from the subjects in both groups.

Procedure of Intervention for Placebo Group: Subjects in this group receive Placebo/Sham soft tissue manual therapy treatment techniques. This placebo technique was delivered to patient in supine position and therapist finger passing multidirectional strokes superficially over the Diaphragm, Intercostals muscles, and Pectoral muscles for total duration of five minutes.

Procedure of Intervention for Experimental Group: Subjects were treated with soft tissue release manual therapy techniques (STRMTT)¹³⁻¹⁶ consist of a pre-determined set of following techniques which was delivered as part of a single treatment session lasting 30 minutes. All techniques were administered in the same order and by a single therapist. All patients were directed to maintain deep and quiet breathing pattern as possible throughout the sessions, closely monitored during the treatment sessions to exclude any signs that may interfere with the continuity of the study. The techniques and their respective durations are: Diaphragmatic manipulation includes- Diaphragmatic release in supine and sitting, Re-Doming of the diaphragm in supine the treatment was given 3 sets of 4 repetitions per each session, with 2 minutes' rest between sets. Costal/ Rib manipulative procedures includes Rib rising in supine and sitting: 3 sets of 4 repetitions per each session, with 2 minutes' rest between sets. Anterior cervical myofascial applied up to 5 minutes until tissue release occurs. Anterior Thoracic Myofascial Release and Sternum Release applied up to 5 minutes until tissue release occurs. Sub occipital release applied up to 5 minutes until tissue release occurs. Costal ligament balance applied up to 5 minutes until tissue release occurs. Thoracic lymphatic pump with activation and without activation this procedure was repeated several times.



Figure-1: Diaphragmatic Release in Supine

Figure-2: Diaphragmatic Release in sitting

Figure-3: Re-Doming of the diaphragm in supine



Figure-4: Anterior cervical myofascial release



Figure-5: Sub occipital release

Outcome measures:

The outcome measures such as Chest expansion and FEV1/FEV6 were measured at baseline measurements, and immediately after the intervention. All the outcome measures used were found reliable and valid tools. The assessment of Chest expansion was measured using measurement tape at two levels of thorax 1. the axillary and 2. the xiphisternal level.¹⁷⁻¹⁹ Pulmonary function- FEV1/FEV6 was evaluated using device Vitalograph COPD-6 and collected according to the standards and procedures outlined by the American Thoracic Society.²⁰⁻²³



Figure-6: Chest Expansion measurement at Axillary level

Figure-7: Chest Expansion measurement at Xiphisternal level

Figure-8: Measuring FEV1/FEV6 using Vitalograph

Statistical Methods

Significance was assessed at 5 % level of significance with p value was set at 0.05 less than this is considered as statistically significant difference. Paired ‘t’ have been used to analysis the variables pre-intervention. Independent ‘t’ test have been used to compare the means of variables between two groups.

Results

The study was conducted on total of 30 subjects (Table-1). In experimental group there were 15 subjects with mean age 54.87 years and there were 15 males and no females were included in the study. In Control Group there were 15 subjects with mean age 53.73 years and there were 15 males and no females were included in the study. There is no significant difference in mean ages between the groups. When means of variables measured for Chest expansion at Axillary level and Xiphisternum level, and FEV1/FEV6 were analyzed, within the Experimental group shown that there is a statistically significant difference. In Placebo group shown that there is no statistically significant difference ($p < 0.05$) between pre-intervention means and post-intervention means. When pre-intervention means of outcome measures were compared (Table-3) between the Experimental and placebo group found that there is no statistically significant difference ($p < 0.05$) between the groups. When post intervention means of outcome measures compared between the Experimental and placebo group found that there is a statistically significant difference ($p < 0.05$) between the groups.

Table 1: Basic Characteristics of the subjects studied

Basic Characteristics of the subjects d studied		Experimental Group		Placebo Group		Between the groups Significance
Number of subjects studied (n)		15		15		--
Age in years (Mean± SD)		54.87± 4.06 (48-59)		53.73± 3.10 (48-60)		p= .446 (NS)
BMI (Mean± SD)(Min-Max)		25.24± 1.69 (21.97-27.89)		25.81± 2.67 (21.86 -3.30)		p= 0.524 (NS)
Gender	Males	15	100%	15	100%	--
	Females	0	20%	0	00%	

Table-2: Analysis of means of Chest expansion, FEV1/FEV6, - Pre and post measurements within the experimental and placebo group

	Pre Mean±SD (min-max)	Post Mean±SD (min-max)	Percentage of Change	t value ^a (Parametric)	df	Significance P value	95% Confidence interval of the difference	
							Lower	Upper
Experimental Group								
Chest expansion-Axillary level	1.59± 0.30 (1.20- 2.00)	2.52± 0.35 (2.00- 3.00)	58.49%	-10.393	14	p=0.000**	-1.11789	-.73544
Chest expansion-Xiphisternum level	2.39± 0.32 (1.90-3.00)	4.10± 0.57 (3.50-5.00)	71.54%	-14.970	14	p=0.000**	-1.95118	-1.46215
FEV1/FEV6	0.45± .05 (0.40 - 0.55)	0.59± 0.06 (0.50- 0.75)	31.11%	-10.846	14	p=0.000**	-.16130	-.10804
Placebo Group								
Chest expansion-Axillary level	1.53± 0.23 (1.20- 2.00)	1.60± 0.22 (1.30- 2.00)	4.57%	-2.092	14	p=0.055 (NS)	-.13503	0.00169
Chest expansion-Xiphisternum level	2.34± 0.27 (1.90-3.00)	2.43± 0.35 (1.80-3.20)	3.84%	-1.573	14	p=0.138 (NS)	-.20482	0.03149
FEV1/FEV6	0.45± 0.05 (0.40 - 0.55)	0.45± 0.48 (0.40- 0.55)	0%	-.544	14	p=0.595 (NS)	-.00989	0.00589

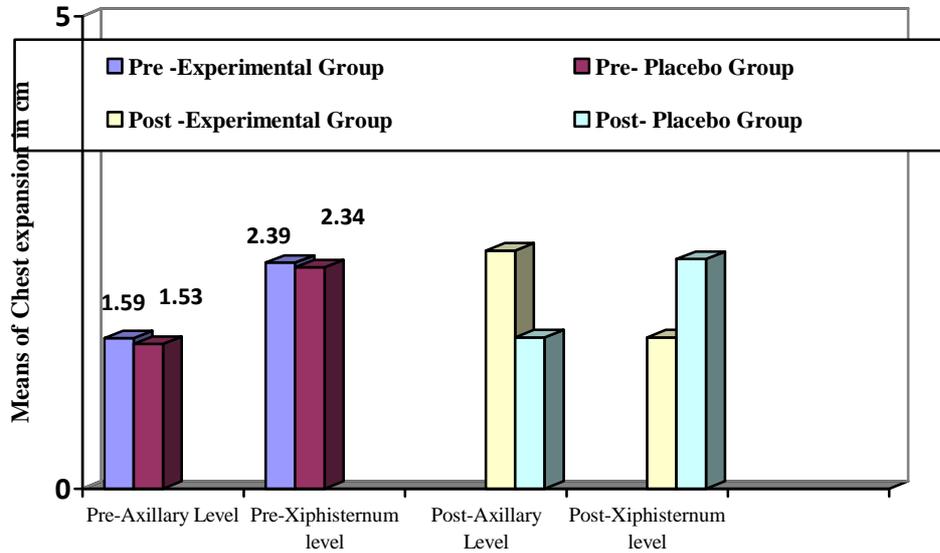
** Statistically Significant difference p<0.05; NS- Not significant; a. Pared t test.

Table-3: Pre to pre and post to post comparative analysis: means of Chest expansion, and FEV1/FEV6 between experimental and Placebo group

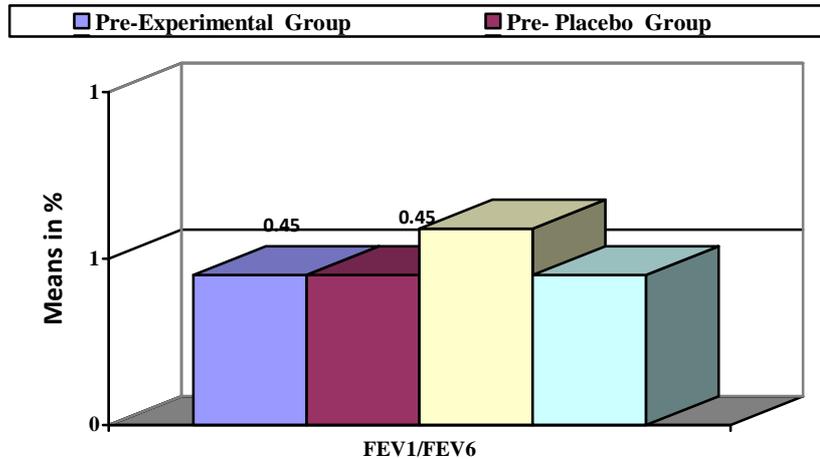
	Experimental Group Mean±SD (min-max)	Placebo Group Mean±SD (min-max)	Percentage of Change	t value ^a (Parametric)	df	Significance P value	95% Confidence interval of the difference	
							Lower	Upper
Pre intervention								
Chest expansion-Axillary level	1.59± 0.30 (1.20- 2.00)	1.53± 0.23 (1.20- 2.00)	-3.84%	0.605	28	p=0.550 (NS)	-0.14301	0.26301
Chest expansion-Xiphisternum level	2.39± 0.32 (1.90-3.00)	2.34± 0.27 (1.90-3.00)	-2.11%	0.427	28	p=0.673 (NS)	-0.17713	0.27046
FEV1/FEV6	0.45± .05 (0.40 - 0.55)	0.45± 0.05 (0.40 - 0.55)	0%	0.459	28	p=0.650 (NS)	-0.02999	0.04732
Post intervention								
Chest expansion-Axillary level	2.52± 0.35 (2.00- 3.00)	1.60± 0.22 (1.30- 2.00)	-45.54%	8.425	28	p=0.000**	0.69632	1.14368
Chest expansion-Xiphisternum level	4.10± 0.57 (3.50-5.00)	2.43± 0.35 (1.80-3.20)	-51.22%	9.582	28	p=0.000**	1.31037	2.02296
FEV1/FEV6	0.59± 0.06 (0.50- 0.75)	0.45± 0.48 (0.40- 0.55)	-26.92%	6.570	28	p=0.000**	0.09727	0.18540

** Statistically Significant difference p<0.05; NS- Not significant a. Independent t test

Graph-1: Pre to pre and post to post intervention comparison of means of Chest expansion between Experimental and Placebo Group



Graph-2: Pre to pre and post to post intervention comparison of means of FEV1/FEV6 between Experimental Group and Placebo Group



Discussion:

The soft tissue release manual therapy techniques used in this study found to be effective in immediate improvement in Chest expansion at Axillary and Xiphisternum level, and improvement in pulmonary function measured based on FEV1/FEV6 when compared to Placebo treatment.

Manual therapy is an effective intervention for some individuals experiencing musculoskeletal pain conditions. Despite the clinical effectiveness, the mechanisms through which manual therapy influences clinical outcomes are unknown. Common clinical practices, including evaluative procedures, are intended to identify hypo-mobile or mal-aligned structures of interest and are followed by the application of specific

techniques meant to 'correct' the observed dysfunction, suggesting a biomechanical mechanism. Rocha T et al., studied to evaluate the effects of the Manual Diaphragm Release Technique on respiratory function of people with COPD. They concluded that Manual Diaphragm Release Technique improves diaphragmatic mobility, inspiratory capacity and exercise capacity, suggesting that it should be considered in the management of people with COPD.⁶ Yelvar GD¹³ et al., investigated the immediate effect of manual therapy (MT) on Heart rate, breathing frequency, respiratory functions, fatigue and dyspnea perception, inspiratory muscle strength in patients with COPD. They found that there was a significant improvement in the forced expiratory volume in the first second, forced vital capacity, and vital capacity values. The maximal inspiratory pressure and maximal expiratory pressure values increased significantly after MT, compared to the pre-MT session. There was a significant decrease in heart rate, respiratory rate, and dyspnea and fatigue perception. They concluded that a single MT session immediately improved pulmonary function, inspiratory muscle strength, and oxygen saturation and reduced dyspnea, fatigue, and heart and respiratory rates in patients with severe COPD.¹³ Putt¹⁴ MT et al., determined if a specific hold and relax stretching technique effect on tight chest wall muscles by increasing chest expansion, vital capacity, and shoulder range of motion and decreasing perceived dyspnea and respiratory rate in persons with chronic obstructive pulmonary disease (COPD). They performed the hold and relax stretching technique of the pectoralis major and a sham technique each for 2 days. They found that the hold and relax technique produces short term benefits in patients with COPD.¹⁴

Noll DR¹⁵ et al., investigated the immediate effects of a single 20 min treatment session, using seven standardized osteopathic manipulative techniques consists of soft tissue therapy to the paraspinal muscles, rib raising, sub-occipital decompression, thoracic inlet myofascial release, and pectoral traction. Thirty minutes following the treatment, respiratory function such as inspiratory capacity, residual volume (RV) and RV as a proportion of total lung capacity (TLC) increased, but forced expiratory flow at 50% and 75% of vital capacity was reduced. This mixed impact on respiratory function makes it difficult to determine the direct benefit or harm of each of the individual techniques.¹⁶ Therefore in our present study we have found the immediate effect of soft tissue release manual therapy techniques in subjects with COPD.

The placebo group also showed 1 to 2 % changes in the outcome measures following the placebo treatment. A placebo response is a physiological occurrence accompanied by specific neurophysiological responses. Placebo hypoalgesia appears related to descending inhibition of pain from the supraspinal structures and functional MRI is beginning to clarify specific brain regions likely involved in placebo hypoalgesia.²⁴ A light touch soft tissue release manual therapy techniques given has placebo treatment might have also elicited effect which similar effects found in two previous studied. Borusiak²⁵ P et al., in their study included participants with headache applied placebo in a single treatment session and they stated that the light touch could have elicited an effect and therefore cannot be regarded as a true placebo.²⁵ Vernon H. T²⁶ et al., and Bove G²⁷ et al., the light touch might not constitute a true placebo, as placebo is usually conceived as an inert treatment.

Limitations of the Study

1. Subjects with small range age group between 40 to 60 years of age and moderate COPD were considered for the study, thus results cannot be generalized to all the groups and other severity of COPD.
2. No follow-up was done after the intervention that would have helped to find further improvement and the maintenance of the improved outcome measures, therefore carryover effect and long term effects cannot be found.

Recommendation for future research

1. Further long term study with follow-up are needed to find the effect of soft tissue release manual therapy techniques in subjects with COPD.
2. Future studies to find immediate effects can be carried with other specific population such as different severity of COPD subjects and other chest mobility restricted conditions.

Conclusion

The present study concludes that single treatment session of soft tissue release manual therapy techniques found to be immediate effect in improving Chest expansion and pulmonary function- FEV1/FEV6 in subjects with moderate COPD and the placebo techniques used in the study shown no statistically significant effect.

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Conflicts of interest: None

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