



## To Study the Efficacy of Soft Tissue Release Manual Therapy Techniques in Patients with Moderate COPD.

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**Abstract:** Apart from pulmonary manifestations Chronic Obstructive Pulmonary Disease (COPD) includes extra pulmonary manifestation like altered chest wall mechanics and musculoskeletal dysfunction. There are many studies that have described the effect of manual therapy in musculoskeletal structural changes in isolation among people with COPD, although the influence of soft tissue manual therapy techniques on chest expansion and pulmonary function remains largely unclear. Therefore, the study was proposed with combined soft tissue protocol to address the involved soft tissue structure in COPD. To find the effectiveness of soft tissue release manual therapy techniques (STRMTT) on improvement of chest expansion and Pulmonary function- FEV1/FEV6 in patients with moderate COPD. This is a comparative study design with two groups- Experimental Group and Control Group, conducted on a total 20 subjects, 10 in each group. The Experimental group subjects were treated with soft tissue release manual therapy techniques along with conventional treatment whereas control group subjects were treated with only conventional exercises. Both the group subjects received treatment twice in a week for a period of eight weeks. The outcome measures Chest expansion and pulmonary function FEV1/FEV6 was measured at before intervention and after 8 weeks of intervention. Comparative analysis of post intervention means using Independent 't' test between the groups found statistically significant difference ( $p < 0.05$ ) in Chest expansion at Auxiliary level and Xiphisternum level and in FEV1/FEV6 between the groups. It is found from our pilot study that soft tissue release manual therapy techniques addressing the soft tissue structure in subjects with moderate COPD who was treated for a period of 8 weeks along with conventional treatment showed statistically significant effect in improving chest expansion and FEV1/FEV6 when compared with the only conventional exercises.

**Keywords:** Moderate COPD, Soft tissue manual therapy techniques, chest expansion, Pulmonary function, FEV/FEV6.

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## 1. INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable respiratory disorder characterized by progressive airflow limitation, partially reversible airway obstruction and lung hyperinflation associated with an abnormal inflammatory response of the lung to noxious particles or gases with some significant extra pulmonary effects that may contribute to increasing frequency and severity of exacerbations in individual patients.<sup>1</sup> COPD is a major cause of morbidity and mortality worldwide and is becoming more prevalent.<sup>1</sup> COPD is characterized by dyspnoea and fatigue, which are linked to reduced exercise tolerance and impaired health-related quality of life (HRQOL).<sup>2</sup> An extra pulmonary manifestation of this condition includes altered chest wall mechanics and musculoskeletal dysfunction. The cervico thoracic fascia surrounding the chest wall contracts producing postural changes, such as anterior projection of the head, neck hyperextension, increased thoracic kyphosis and internal rotation of shoulders. These changes contribute to an increase in chest tightness, a decrease in the ability to generate inspiratory pressures and volumes and an increase in the amount of effort required to breathe.<sup>3,4</sup> The respiratory muscle alterations are largely influenced by the development of pulmonary hyperinflation which forces the diaphragm to operate at non-optimal lengths. This results in a reduced contractile force relative to lung volume.<sup>5</sup> Hyperinflation is believed to impose a passive increase in chest wall rigidity and to alter chest wall mechanics with reduced chest wall compliance. In addition, the increase in airway resistance and airflow limitation encourages greater recruitment of the accessory muscles of respiration. This contributes to increased respiratory muscle tightening, joint stiffness and increased work of breathing.<sup>6</sup> These changes in chest wall rigidity and muscular function may be linked to the postural alterations and changes in rib cage configuration noted in COPD.<sup>7,8</sup> Changes in chest wall mechanics have been linked to exercise-limiting dyspnoea in COPD.<sup>3</sup> Previous studies reported that reduction in thoracic spine mobility was linked to lower lung function, with decreases in forced vital capacity (FVC) and forced expiratory volume in one second (FEV<sub>1</sub>).<sup>9</sup> Kaneko H, Shiranita S, Horie J, Hayashi S studied 51 elderly male subjects with COPD, they found in their study that the majority of subjects with COPD had reduced chest and abdominal wall mobility, which was independently associated with FVC. Even though abdominal wall mobility was relatively preserved compared with chest wall mobility, it was also independently associated with 6-min walk distance (6MWD).<sup>10</sup> Thus, improving postural alignment and mobility of the chest wall, spine, and shoulders is now part of the recommendations for comprehensive pulmonary rehabilitation programs.<sup>11</sup> However, the possible effect of such interventions in patients with COPD is uncertain because little is known about the interaction between pulmonary function, posture, and mobility of the upper body quadrant (i.e. head, cervical and thoracic spines, thorax, and upper limb).<sup>12</sup> 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). 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.<sup>11</sup> 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 (Roger M.Engel, SubramanyamVemulpad investigated a hypothesis Progression to chronic obstructive pulmonary disease (COPD): Could it be prevented by manual therapy and exercise during the 'at risk' stage)? Since then a number of small studies have reported medium term improvements in lung function and exercise capacity following repeated applications of MT intervention.<sup>13,14</sup> There are many studies that have described the effect of manual therapy in musculoskeletal structural changes in isolation among people with COPD, although the influence of soft tissue manual therapy techniques on chest expansion and pulmonary function remains largely unclear Gul Deniz 2016<sup>29</sup>. There are studies that studied the effectiveness of soft tissue release manual therapy techniques (STRMTT) addressing the diaphragm, anterior and posterior thoracic Myofascial structure, but there are no studies that addressed the combination of soft tissue manual therapy techniques on chest expansion and pulmonary function FEV<sub>1</sub>/FEV<sub>6</sub> in subjects with moderate COPD. Therefore, the pilot study was proposed to find the combination of soft tissue release techniques to address the involved soft tissue structure in COPD.

## 2. METHODOLOGY

A comparative study design with two groups- Experimental Group and Control Group. As this study involved human subjects the Ethical Clearance was obtained from Assam down Town University Ethical Committee (AdtU/Ethics/2016/026, dated 20.10.2016 & dth/IEC/MS/2017/043 A). The subjects have been selected for the study from Down Town Hospital, Guwahati, referred by Pulmonologist or the physician diagnosed with moderate COPD based on spirometry test. The study was conducted at Down Town Hospital. Subjects included in the study were with age group between 45-60 years, Physician diagnosed COPD According to GOLD Criteria Moderate: FEV<sub>1</sub>/FVC<sub>6</sub> = <0.70, 50 % ≤ FEV<sub>1</sub><80% Predicted.<sup>15</sup> Be medically stable with no exacerbations in the preceding 2 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.<sup>10</sup> Subjects were excluded with history of asthma (defined as a ≥ 25% change in FEV<sub>1</sub> 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. The purpose of the study was explained to the subjects and the informed consent was obtained from the subjects in both groups. Subjects who met inclusion criteria were allotted into Experimental and Control group by simple random sampling method.

### 2.1 Procedure of Treatment for Control Group:<sup>16-23</sup>

The control group subjects were given conventional treatment

without soft tissue release manual therapy techniques. The supervised conventional treatment was given for 2 days in a week and rest of the days subjects performed the exercises at their home, the total duration of treatment was for 8 weeks. Conventional treatment consists of a 60 minutes rehabilitation program with adequate rest period includes Breathing Exercises - 5-10 minutes, Upper and Lower extremity Strength Training- The amount of resistance based on patient's ability to complete 10-15 repetitions. Progression includes increased resistance and number of sets. Social and Psychological Social support was provided through lectures. Patients were called in group in a seminar hall. The classes were conducted on relaxation techniques classes, self-management education in group and individual counseling was given to each patient.

## 2.2 Procedure of Treatment for Experimental group

The subjects were treated with soft tissue release manual therapy techniques (STRMTT)<sup>24-28</sup> in addition to conventional treatment. Treatment regimens were applied twice weekly for 8 weeks. The STRMTT consist of a predetermined set of following techniques 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 a deep and quiet breathing pattern as possible throughout the sessions. They were 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 (Figure-1) and sitting (Figure-2), Re-Doming of the diaphragm in supine (Figure-3)-3 sets of 4 repetitions per each session, with 2 minutes' rest between sets. Costal/ Rib manipulative procedures include Rib rising in supine and sitting: 3 sets of 4 repetitions per each session, with 2 minutes' rest between sets. Anterior cervical myofascial (Figure-4) 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 (Figure-5) 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

## 2.3 Continuous conventional treatment for both the groups subjects

Patients were trained for conventional exercises under supervision during visiting days and advised to perform the same exercise twice a day at home during non visiting days and shall do four days in a week and one day rest. The patient was given a note book that contains the instructions that the patient shall do at home along with a number of repetitions. Patients were advised to report in case they miss any exercises or session to report and any adverse events during the study period.

## 2.4 Outcome measures

The outcome measures such as Chest expansion, pulmonary function FEV1/FEV6 and Quality of life were measured before intervention and after 8 weeks of intervention, all the outcome measures used were found to be reliable and valid tools. The assessment of Chest expansion<sup>29-31</sup> was measured using measurement tape at two levels of thorax 1. the axillary (Figure-6) and 2. the xiphisternal level (Figure-7). Pulmonary function- FEV1/FEV6 was evaluated using device Vitalograph COPD-6 (Figure-8) and collected according to the standards and procedures outlined by the American Thoracic Society<sup>32-35</sup>



Figure-6: Chest Expansion measurement at Axillary level

Figure-7: Chest Expansion measurement at Xiphisternal level

Figure-8: Measuring FEV1/FEV6 using Vitalograph

### 3. STATISTICAL ANALYSIS

All analyses were obtained using SPSS version 21. Significance was assessed at 5 % level of significance with p value was set at 0.05 less than this is considered as a statistically significant difference. Paired 't' have been used to analyze the variables pre-intervention. Independent 't' test have been used to compare the means of variables between two groups.

### 4. RESULTS

The pilot study was conducted total on 20 subjects (Table-1). In the experimental group there were 10 subjects with mean

age 54.10 years and there were 10 males and no females were included in the study. In the Control Group, there were 10 subjects with mean age 54.50 years and 8 males and 2 females were included in the study. There is no significant difference in mean ages between the groups. The pre to post intervention analysis (Table-2 & 3) within the groups shows that means of Chest expansion at Auxiliary level and Xiphisternum level and FEV1/FEV6, The comparative analysis (Table-3) of post intervention means between the groups found statistically significant difference ( $p < 0.05$ ) in Chest expansion at Auxiliary level and Xiphisternum level and FEV1/FEV6, between the groups

**Table-1 Basic Characteristics of the subjects studied**

Basic Characteristics of the subjects d studied		Experimental Group		Control Group		Between the groups Significance
Number of subjects studied (n)		10		10		--
Age in years (Mean $\pm$ SD)		54.10 $\pm$ 1.46 (48-60)		54.50 $\pm$ 1.39 (45 -60)		$p = -.194$ (NS)
BMI (Mean $\pm$ SD)(Min-Max)		26.43 $\pm$ 2.44 (22.89-30.08)		25.74 $\pm$ 3.78 (18.59 - 32.00)		$p = 0.490$ (NS)
Gender	Males	10	100%	8	80%	--
	Females	0	20%	2	20%	

**Table-2 Analysis of means of Chest expansion & FEV1/FEV6 Pre and post measurements within the experimental group**

Experimental Group	Pre Mean $\pm$ SD (min-max)	Post Mean $\pm$ SD (min-max)	Percentage of Change	t value <sup>a</sup> ( Parametric)	Significance P value
Chest expansion- Auxiliary level	1.78 $\pm$ 0.50 (1.00- 2.50)	4.43 $\pm$ 0.71 (3.30- 5.50)	4.35%	-15.821	$p = 0.000^{**}$
Chest expansion- Xiphisternum level	2.82 $\pm$ 0.65 (2.00-4.00)	6.52 $\pm$ 0.38 (6.00-7.0)	4.68%	-17.335	$p = 0.000^{**}$
FEV1/FEV6	0.49 $\pm$ .06 (.40 - .60)	.83 $\pm$ .06 (.70- .95)	23.96%	-9.350	$p = 0.000^{**}$

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

**Table-3 Analysis of means of Chest expansion & FEV1/FEV6- Pre and post measurements within the Control group**

Experimental Group	Pre Mean $\pm$ SD (min-max)	Post Mean $\pm$ SD (min-max)	Percentage of Change	t value <sup>a</sup> ( Parametric)	df	Significance P value
Chest expansion- Axillary level	1.62 $\pm$ 0.40 (1.20- 2.50)	2.96 $\pm$ 0.60 (2.00-4.00)	2.41%	-7.565	9	$p = 0.000^{**}$
Chest expansion- Xiphisternum	2.77 $\pm$ 0.40	5.00 $\pm$ 0.70	4%	-10.909	9	$p = 0.000^{**}$



level	(2.20-3.50)	(4.00-6.00)				
FEV1/FEV6	0.55±.04 (.45-.60)	0.75±.07 (.65-.85)	1.66%	-9.585	9	p=0.000**

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

**Table-4 Pre and Post Intervention Comparative Analysis: means of Chest expansion & FEV1/FEV6- between experimental and Control group**

	Pre Intervention			Post Intervention		
	Percentage of difference	t value <sup>a</sup> (Parametric)	Significance P value	Percentage of difference	t value <sup>a</sup> (Parametric)	Significance P value
Chest expansion-Axillary level	0.91%	0.786	p=0.442	-82.64%	4.954	p=0.000**
Chest expansion-Xiphisternum level	2.09%	0.206	p=0.839	-73.93%	5.969	p=0.000**
FEV1/FEV6	-5.61%	-2.492	p=0.023	-70.49%	2.449	P<0.025**

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

## 5. DISCUSSION

It is found from the analysis that subjects with moderate COPD who were treated with 16 sessions of soft tissue release manual therapy techniques (STRMTT) for a period of 8 weeks along with conventional treatment shown statistically significant effect in improving chest expansion and FEV1/FEV6 when compared with the only conventional exercises. The experimental group who received soft tissue release manual therapy techniques along with conventional treatment showed statistically significant improvement in Chest expansion at Auxiliary level and Xiphisternum level, FEV1/FEV6. When these improvements were compared with control groups who received only conventional treatment there was a significant difference with greater percentage of improvement in Chest expansion and FEV1/FEV6. The improvement may be attributed due to the effect of soft tissue manual therapy techniques. Many studies have shown the effectiveness of soft tissue release manual therapy techniques in improvement of outcome measures in subjects with COPD. Rocha T, Souza H, Brandão DC, Rattes C, Ribeiro L, Campos SL, Aliverti A, De Andrade AD., 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.<sup>24</sup> Yelvar GD Yilmaz, Çirak Y, Demir YP, Dalkılıç M, Bozkurt B., investigated the immediate effect of manual therapy (MT) on respiratory functions and inspiratory muscle strength following single session of MT in patients with COPD. The lung function, respiratory muscle strength, Heart rate, breathing frequency, and oxygen saturation, fatigue and dyspnea perception were measured before and immediately after the first MT session. 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. MT should be added to

pulmonary rehabilitation treatment as a new alternative that is fast acting and motivating in patients with COPD.<sup>25</sup> Putt MT, Watson M, Seale HE, Paratz JD., they performed the hold and relax stretching technique of the pectoralis major and a sham technique each for 2 days. They concluded that the hold and relax technique produces short term benefits in patients with COPD. There have been studies which have compared the effects of either soft tissue therapy alone; in combination with spinal manipulation; or soft tissue therapy, spinal manipulation and exercise therapy. Compared to the uniform approach to treatment applied in previous studies, it is possible that by basing a treatment on assessment findings, this may enable a more directed treatment that is appropriate for each individual, and may account for improvement in this patient related outcome of exercise capacity. In contrast to manual therapies focused on the thoracic spine and rib cage, an alternative focus is muscle release techniques. Diaphragm release techniques in people with clinically stable COPD have been investigated over a series of six sessions. Depth of contact is increased in subsequent breaths. It is hypothesised that this contact allows cranial-directed traction of the ribs, along with lengthening of the diaphragm near its insertion around the anterior costal margin, produced by the compression of the diaphragm fibres in this area. The lengthening of the diaphragm, in combination with the therapist-facilitated movement of the ribs, is thought to improve the mobility of the diaphragm. The results found a cumulative increase in diaphragm mobility (measured by ultrasound) by 18 mm, and an improvement in inspiratory capacity. In addition, functional exercise capacity measured by the 6 min walk distance (6MWD) improved by 15 m with diaphragmatic release, compared to a deterioration of 6 m in the control group.<sup>9</sup> The control group who received soft tissue release manual therapy techniques and conventional treatment showed statistically significant improvement in Chest expansion at Auxiliary level and Xiphisternum level and FEV1/FEV6. This finding may be attributed due to the effect of conventional treatment. Individuals with COPD may have dynamic hyperinflation, which limits their exercise capacity. Breathing exercises performed by the patients in this pilot study focuses on slowing the respiratory rate, primarily through prolonged expiration, it may be beneficial in reducing dyspnea via reducing exercise induced dynamic hyperinflation. Spruit MA, Singh SJ et al studied and concluded that individuals who undergo breathing training are able to adopt a slower,

deeper pattern of breathing. Pursed-lips breathing was successful in reducing dyspnea after a 6-minute walk, and computer-aided breathing feedback was successful in reducing dynamic hyperinflation.<sup>11</sup> Resistance exercises training given in this study includes local muscle groups trained by repetitive lifting of relatively heavy loads. Resistance training is considered important for adults to promote healthy aging and also appears to be indicated in individuals with chronic respiratory disease, such as those with COPD, who have reduced muscle mass and strength of their peripheral muscles, relative to healthy control subjects. Optimizing muscle strength is likely to be an important goal of rehabilitation in this population. Moreover, strength training results in less dyspnea during the exercise period, thereby making this strategy easier to tolerate than endurance constant-load training. Clinical trials in COPD have compared resistance training with no training and with endurance training. Lower limb resistance training consistently confers gains in muscle force and mass compared with no exercise training.<sup>11</sup>

## 6. CONCLUSION

It is found from our pilot study that soft tissue release manual therapy techniques addressing the soft tissue structure in subjects with moderate COPD who were treated with 16 sessions of soft tissue release manual therapy techniques for a period of 8 weeks along with conventional treatment shown statistically significant effect in improving chest expansion and FEV1/FEV6 when compared with the only conventional exercises.

## 7. LIMITATIONS OF THE STUDY

1. Other respiratory muscles involved in both ventilatory and non-ventilatory activities (e.g. sternocleidomastoid, scalene) may also influence pulmonary function were not considered in the techniques
2. Subjects with small range age group between 40 to 60 years of age and small sample size were considered

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for the study, thus results cannot be generalized to all the groups.

3. No follow-up was done after eight week of intervention that would have helped to find further improvement and the maintenance of the improved outcome measures.
4. The influence of Soft tissue release manual therapy techniques on dyspnoea, functional exercise capacity, psychological symptoms were not measured.
5. The severity, duration and degree of chest wall rigidity; postural abnormalities were not considered in the study.

## 8. FUTURE RECOMMENDATIONS AND INTERVENTIONS

1. In patients with airflow limitation, bronchodilators may reduce dyspnea and improve exercise tolerance. These beneficial effects may be mediated not only through reducing airway resistance but also through the reduction of resting and dynamic hyperinflation. Thus, the effectiveness of bronchodilators and soft tissue release manual therapy techniques need to be compared on improvement of chest expansion and FEV1/FEV6.
2. The effectiveness of soft tissue release manual therapy techniques using biomarkers need to be studied.
3. The long term effect of soft tissue release manual therapy techniques in subjects with COPD along with follow-up studies are needed.
4. The soft tissue release manual therapy techniques need to be studied on specific population with different respiratory diseases, in different severity of COPD subjects and in subjects associated with chest mobility restricted conditions.

## 9. CONFLICTS OF INTEREST

Conflict of interest declared none.

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