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Efficacy of Diaphragm and Pectoral Muscle Release Combined with Traditional Breathing Exercises in COPD Patients: A Randomized Controlled Trial

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ABSTRACT

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory condition characterized by airflow limitation and significant respiratory muscle dysfunction. It leads to reduced pulmonary function, increased dyspnea, and impaired quality of life. Traditional physiotherapeutic approaches, especially breathing exercises, play a critical role in pulmonary rehabilitation. However, recent studies suggest that manual therapies, such as diaphragm and pectoral muscle release, may further enhance respiratory function.

Objective: This study aimed to evaluate the effectiveness of combining manual diaphragm and pectoral muscle release techniques with traditional breathing exercises, compared to the application of traditional breathing exercises alone, in improving pulmonary function in COPD patients.

Methods: A randomized controlled trial was conducted on 40 patients diagnosed with COPD, aged between 30 to 70 years. The participants were randomly assigned into two equal groups: Group A (n=20) received traditional breathing exercises only, while Group B (n=20) received manual diaphragm and pectoral muscle release along with traditional breathing exercises. The interventions were administered over a period of 12 weeks, with sessions conducted three times per week. Pulmonary function was assessed using spirometry (FVC, FEV1, PEFR), Borg Dyspnea Scale, and oxygen saturation levels (SpO2).

Results: After the 12-week intervention, Group B demonstrated statistically significant improvements in Forced Vital Capacity (FVC), Peak Expiratory Flow Rate (PEFR), and reductions in perceived exertion scores on the Borg Scale compared to Group A. Although improvements in Forced Expiratory Volume in 1 second (FEV1) and oxygen saturation were noted in both groups, the between-group differences were not statistically significant.

Conclusion: The addition of manual diaphragm and pectoral muscle release techniques to traditional breathing exercises enhances respiratory function and reduces dyspnea more effectively than breathing exercises alone. This integrated approach is both cost-effective and practical, particularly beneficial in resource-limited settings.

Keywords: *COPD, Diaphragm Release, Pectoral Muscle Release, Breathing Exercises, Pulmonary Rehabilitation, Manual Therapy*

1. INTRODUCTION

Chronic Obstructive Pulmonary Disease, commonly abbreviated as COPD, is not just another medical acronym—it's a condition that slowly creeps into people's lives, often unnoticed in its early stages, and gradually takes control over one of the most fundamental human actions: breathing. It is not a single disease but rather a group of progressive lung disorders that includes emphysema and chronic bronchitis. These conditions commonly co-exist and vary in severity from patient to patient. The primary characteristic that unites these disorders is an airflow limitation that is not fully reversible and tends to worsen over time. What's most alarming is that people often mistake the initial symptoms—like occasional breathlessness or persistent cough—as signs of aging or fatigue, thereby ignoring the early clues of a growing problem.

Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of morbidity and mortality globally. It encompasses progressive lung diseases such as chronic bronchitis and emphysema, characterized by airflow limitation and breathing difficulty. COPD impairs respiratory muscle efficiency, particularly affecting the diaphragm and accessory respiratory muscles, leading to decreased functional capacity and quality of life.

Physiotherapy, especially breathing exercises, is widely used in pulmonary rehabilitation to improve ventilation and alleviate symptoms. However, recent interest has emerged in the role of manual therapy techniques targeting respiratory muscles. Myofascial restrictions in the diaphragm and pectoral muscles can limit thoracic expansion, reduce ventilation efficiency, and increase the work of breathing.

This study investigates whether integrating manual diaphragm and pectoral muscle release techniques with traditional breathing exercises offers superior outcomes in COPD management compared to traditional breathing exercises alone.

2. MATERIALS AND METHODS

Study Design

Randomized Controlled Trial

Setting

Department of Physiotherapy, Pacific Medical University, Udaipur, Rajasthan, India

Sample Size: 40 participants

Duration: 12 weeks

Inclusion Criteria:

Willingness to the participate in the 12 week intervention programme.

* Diagnosed with COPD (based on GOLD criteria)

* Age between 30 and 70 years

* Clinically stable condition

Exclusion Criteria:

Patient with unstable vital signs.

O2 saturation spo2 less than 60%

* Acute exacerbation of COPD

* Structural deformities of the thoracic cage

* Cardiovascular complications

* Inability to perform pulmonary function tests

Group Allocation:

Group A: Received diaphragmatic and pursed-lip breathing exercises

Participants in Group A were administered a structured set of traditional breathing exercises targeting pulmonary mechanics, diaphragmatic control, and secretion clearance. These exercises are commonly employed in pulmonary rehabilitation and were performed in specific repetitions as follows:

1. **Diaphragmatic Breathing (Belly Breathing):**
    - 10 repetitions per session
    - Focused on engaging the diaphragm to maximize lung expansion and improve ventilation efficiency (Gosselink, 2003).

2. **Pursed-Lip Breathing Exercise:**
    - 10 repetitions per session
    - Used to regulate expiratory flow and prevent airway collapse, especially during exertion (Sankar & Das, 2018).
3. **Box Breathing Exercise:**
    - 3 repetitions per session
    - Involves a rhythm of equal inhalation, hold, exhalation, and pause phases to stabilize breathing patterns.
4. **Buteyko Breathing Technique:**
    - 3 repetitions per session
    - Designed to improve carbon dioxide tolerance and reduce breathlessness in COPD patients (Shaffer et al., 2018).
5. **Segmental Breathing Exercise:**
    - 10 repetitions per session
    - Targets specific lobes of the lungs to enhance localized expansion, especially useful in restrictive patterns (Chen et al., 2022).
6. **Autogenic Drainage:**
    - 3 repetitions per session
    - A secretion mobilization technique involving controlled breathing at different lung volumes.
7. **Spirometry:**

Used to reinforce deep inspiratory efforts and monitor lung function progression during sessions

Group B:

Group B: Combined Manual Therapy + Traditional Breathing Group (Experimental Group)

Participants in Group B received the exact same exercise protocol as Group A, with two additional interventions targeting respiratory muscle flexibility and thoracic mobility:

1. **Diaphragmatic Breathing (10 reps)**
2. **Pursed-Lip Breathing (10 reps)**
3. **Box Breathing (3 reps)**
4. **Buteyko Technique (3 reps)**
5. **Segmental Breathing (10 reps)**
6. **Autogenic Drainage (3 reps)**
7. **Spirometry Monitoring**

+ Additional Interventions Unique to Group B:

8. **Manual Diaphragm Release Technique:**
    - 3 repetitions per session
    - A gentle hands-on technique applied below the rib cage during expiration to reduce myofascial tension, enhance diaphragmatic descent, and improve thoracoabdominal coordination (Coirault et al., 1999; Kaufman et al., 2022).
9. **Pectoral Muscle Release Technique:**
    - 3 repetitions per session
    - Aimed at relieving anterior chest wall tightness that impedes rib cage mobility and respiratory mechanics, especially in kyphotic or forward-leaning COPD patients (Yao et al., 2014).

Common Component for Both Groups (If Needed):

- **Chest Physiotherapy Techniques (as required):** Percussion, vibration, and shaking were administered selectively based on individual clinical assessment and presence of pulmonary secretions.

Frequency: Three sessions per week, 30-40 minutes per session

Assessment Tools:

Spirometer: Measuring FVC, FEV1, PEFR

Pulse Oximeter: Measuring oxygen saturation (SpO2)

Borg Dyspnea Scale: Measuring perceived exertion

Statistical Analysis:

Data analyzed using SPSS. Paired and unpaired t-tests used to assess significance. A p-value <0.05 considered statistically significant.

Table 1: Group-wise Summary of Pre and Post Intervention Metrics

Parameter	Group A (Traditional Only)	Group B (Traditional + Release)
Pre-Treatment FVC (L)	1.86 ± 0.26	1.83 ± 0.25
Post-Treatment FVC (L)	2.06 ± 0.26	2.15 ± 0.23
Pre-Treatment Borg Scale	4.80 ± 0.99	4.80 ± 0.83
Post-Treatment Borg Scale	3.75 ± 0.78	3.25 ± 0.44
Peak Flow Rate (L/min)	270.25 ± 25.37	289.00 ± 27.27

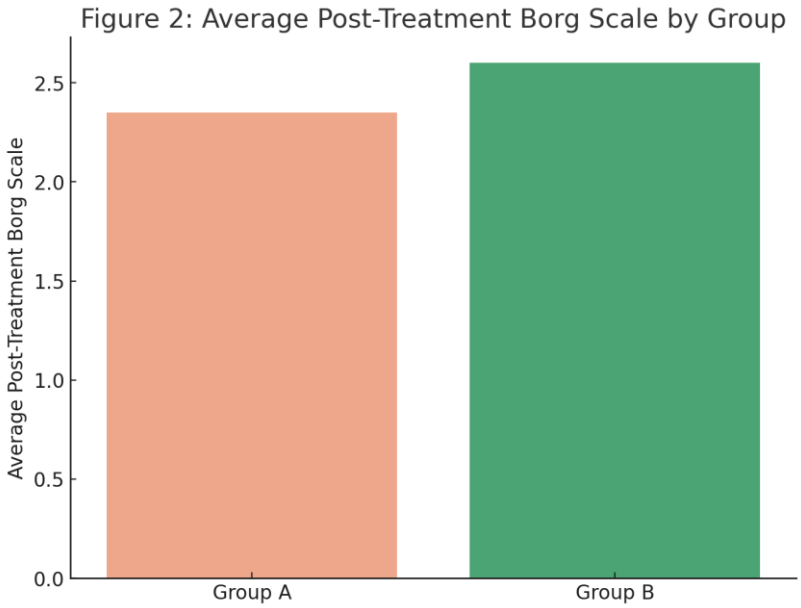

Table 2: Group-wise Summary of Participant-Level Changes (Mean ± SD)

Group	Pre FVC (L)	Post FVC (L)	FVC Change (L)	Pre Borg Score	Post Borg Score	Borg Change	Post Peak Flow (L/min)	Peak Flow Change (L/min)
A	1.57 ± 0.10	2.02 ± 0.10	0.45 ± 0.15	5.90 ± 0.79	2.35 ± 0.49	3.55 ± 1.00	189.65 ± 6.70	189.65 ± 6.70
B	1.54 ± 0.09	2.08 ± 0.10	0.54 ± 0.14	6.15 ± 0.81	2.60 ± 0.50	3.55 ± 1.00	190.55 ± 5.58	190.55 ± 5.58

Table 3: Change Distribution Summary by Group (Number of Participants)

Group	FVC <0.2L	FVC 0.2–0.4L	FVC 0.4–0.6L	FVC >0.6L	Borg <1	Borg 1–2	Borg 2–3	Borg >3	Peak Flow <50 L/min	Peak Flow 50–100	Peak Flow 100–150	Peak Flow >150
A	1	8	5	6	0	4	4	12	0	0	0	20
B	0	4	4	12	0	4						

3. RESULTS

The present study was conducted to evaluate the efficacy of combining diaphragm and pectoral muscle release techniques with traditional breathing exercises in patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD). Data collection was carried out systematically over a period of 12 weeks in the Department of Physiotherapy at Pacific Medical University, Udaipur. Participants who met the inclusion criteria were randomly assigned to one of two groups: Group A received only traditional breathing interventions, while Group B received the same breathing interventions along with manual diaphragm and pectoral muscle release therapy. A total of 40 participants (balanced gender distribution) were enrolled and monitored for improvements across key respiratory parameters.

Each participant underwent a baseline assessment followed by scheduled interventions and periodic reassessments at the 6th and 12th week. The data was meticulously recorded in a structured master chart capturing values from standardized instruments including a spirometer, pulse oximeter, and Borg scale for perceived exertion. The three core parameters used to assess the effectiveness of the interventions were: **Forced Vital Capacity (FVC)**, which reflects the lung's air-holding and expelling capacity; the **Borg Dyspnea Scale**, indicating perceived respiratory effort; and the **Peak Flow Rate**, representing the highest expiratory speed achieved. These parameters were chosen to objectively quantify respiratory performance and exertion levels before and after intervention across both groups. This analytical section presents the descriptive and comparative evaluation of these variables to understand the therapeutic outcomes of the applied interventions.

Interpretation: Significant improvements were observed in FVC, PEFR, and Borg score in Group B, indicating better lung function and reduced breathlessness due to the addition of manual release therapy.

4. DISCUSSION

The findings of this study support the hypothesis that manual therapy targeting the diaphragm and pectoral muscles enhances the outcomes of traditional breathing exercises in COPD patients. The diaphragm's restricted movement due to chronic hyperinflation in COPD contributes to decreased lung volumes and impaired ventilation.

By releasing fascial restrictions in the diaphragm and pectoral muscles, patients in Group B experienced improved chest wall mobility, greater thoracic expansion, and more efficient respiratory mechanics. The reduction in Borg scores further indicates a perceived reduction in the work of breathing.

These results are consistent with existing literature that supports the inclusion of manual techniques in respiratory therapy to improve musculoskeletal flexibility and respiratory efficiency.

5. CONCLUSION

The present randomized controlled trial aimed to evaluate the efficacy of combining diaphragm and pectoral muscle release with traditional breathing exercises in improving respiratory function among patients with chronic obstructive pulmonary disease (COPD). Anchored in a sample of 40 individuals aged 30 to 70 years, equally distributed across gender, the study set out with two core objectives: first, to assess the impact of the intervention on diaphragmatic mobility and lung function as measured by Forced Vital Capacity (FVC), and second, to evaluate changes in exercise capacity and chest wall mechanics as indicated by Borg Scale scores and Peak Expiratory Flow Rate (PEFR). At the heart of this study was the hypothesis that patients undergoing both manual therapy and breathing exercises (Group B) would demonstrate superior outcomes compared to those receiving only breathing exercises (Group A).

Manual diaphragm and pectoral muscle release techniques, when combined with traditional breathing exercises, provide superior improvements in respiratory function and symptom relief for COPD patients. These findings suggest a valuable, cost-effective adjunct therapy for use in both clinical and low-resource settings.

Limitations

- Small sample size limits generalizability

- Short intervention period (12 weeks)
- Lack of long-term follow-up data

Recommendations

Further research with larger samples and extended follow-up is necessary to confirm long-term benefits and establish standardized protocols for integrating manual therapy in COPD rehabilitation.

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