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Original Article

Blow Bottle and Percussion Techniques in Patients with Chronic Obstructive Pulmonary Disease

Javeria Shahzad[1], Sidra Afzal[2], Rabia Majeed[3]

ABSTRACT

Background: *Chronic Obstructive Pulmonary Disease (COPD) is a prevalent condition characterized by irreversible airflow obstruction and significant impact on quality of life. Despite available treatments, managing symptoms effectively remains a challenge. Techniques such as percussion and the Blow Bottle method have shown potential in improving lung function and symptom management individually, yet their combined effects have not been extensively studied.*

Objective: *This study aimed to assess the combined effects of percussion and Blow Bottle techniques on clinical outcomes in patients with mild to moderate COPD.*

Methods: *In a randomized controlled trial, 34 participants diagnosed with mild to moderate COPD were allocated into two groups. Group A received only percussion therapy, while Group B received both percussion and Blow Bottle therapy. Interventions were administered three times a week for four weeks. Clinical outcomes measured included dyspnea (mMRC Dyspnea Scale), sputum production (Breathlessness, Cough, and Sputum Scale), expiratory flow rates (peak flow meter), and oxygen saturation levels (pulse oximetry). Data were analyzed using SPSS version 25, employing both parametric and non-parametric tests depending on the data distribution.*

Results: *Significant improvements were observed in Group B compared to Group A across several metrics. Specifically, oxygen saturation improved from 91% ± 2 to 95% ± 1 in Group B, compared to an improvement from 92% ± 2 to 94% ± 2 in Group A ($p = 0.0001$). Expiratory flow rates increased from 295 L/min ± 45 to 370 L/min ± 50 in Group B, whereas Group A saw an increase from 300 L/min ± 50 to 340 L/min ± 55 ($p = 0.003$).*

Conclusion: *The study demonstrated that the combination of percussion and Blow Bottle techniques significantly enhances clinical outcomes more than percussion alone in patients with COPD. This suggests that integrating both techniques could be more effective in managing COPD symptoms, particularly in improving pulmonary function and oxygen saturation.*

Keywords: *Chronic Obstructive Pulmonary Disease, COPD management, percussion therapy, Blow Bottle technique, pulmonary rehabilitation, respiratory therapy*

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is recognized as a prevalent, preventable, and treatable condition that significantly impacts global health. Characterized by irreversible airflow limitation and associated with symptoms such as dyspnea, cough, and sputum production, COPD is not merely a local lung issue but a significant systemic disorder that severely impairs quality of life and increases healthcare utilization (1, 2). The disease is mainly driven by long-term exposure to noxious particles or gases, particularly from cigarette smoking, although air pollution and occupational dusts are also notable contributors (3, 4). Despite

*Corresponding Author: jiadrjia@gmail.com
Authors' and timeline information is given at end of article.

its high prevalence, COPD remains underdiagnosed and its symptoms often underestimated, affecting daily activities and overall health status dramatically (5).

Morning symptoms are particularly debilitating in COPD patients, often hindering the ability to perform daily tasks such as climbing stairs or performing heavy household chores. These symptoms can lead to a vicious cycle of inactivity, where decreased physical activity further exacerbates the patient's health, leading to increased symptoms and further inactivity (6, 7). Furthermore, COPD is associated with various comorbidities including cardiovascular diseases and diabetes, which may complicate the management of these patients and worsen their prognosis (8). Pulmonary rehabilitation, including airway clearance techniques, plays a crucial role in the management of COPD by enhancing mucus clearance, improving lung function, and thereby improving quality of life. Techniques such as the Blow Bottle and Percussion techniques are significant in this regard, providing low-cost, effective methods to manage and alleviate symptoms. The Blow Bottle technique, a form of positive expiratory pressure therapy, is particularly useful for its ease of use and accessibility, making it a valuable option for ongoing, home-based care (9, 10). Meanwhile, manual chest percussion helps mobilize secretions in the lungs, facilitating easier breathing (11).

Given the complexity of COPD and the variety of symptoms patients experience, it is imperative to explore combinations of different therapeutic approaches to optimize patient outcomes. The current study seeks to evaluate the combined effects of the Blow Bottle Technique and Percussion Technique on patients with COPD. By integrating these techniques, the study aims to offer insights into more holistic approaches to managing the disease, potentially offering greater improvements in patient symptoms and quality of life than either technique alone (13).This comprehensive approach not only addresses the physical aspects of the disease but also considers the psychological and social factors that influence the well-being of COPD patients (14).Through this research, we aim to contribute to the evolving strategies for COPD management, underscoring the importance of personalized, multifaceted care strategies that adapt to the complexities of the disease and its impact on individuals (15).

MATERIAL AND METHODS

The study was designed as a randomized controlled trial to assess the combined effects of the Blow Bottle Technique and Percussion Technique in patients with Chronic Obstructive Pulmonary Disease (COPD). A total of 34 participants were enrolled, adhering to the inclusion criteria of being aged between 35 and 70 years, diagnosed with mild to moderate COPD according to GOLD criteria, and able to perform daily activities with some degree of difficulty (19). Exclusion criteria included significant cardiovascular impairments, musculoskeletal or neurological dysfunction, or any clinical instability.

Participants were recruited from Latif Hospital, Qila Didar Singh, District Gujranwala, from October 2022 to June 2023, following ethical approval of the study synopsis. All participants provided informed consent, which

was obtained in compliance with the Declaration of Helsinki. The consent process included comprehensive information about the study's purpose, the interventions, potential risks, and benefits, ensuring that participants were well-informed before participating.

The sample size was calculated using EPI Info software, which suggested 30 participants would be sufficient to detect significant differences between groups, assuming a power of 0.9 and a confidence level of 99%. The study utilized a convenience sampling technique, and participants were randomly assigned into two groups using a computer-generated list: Group A received only the Percussion Technique, while Group B received both Percussion and Blow Bottle Techniques. Each session lasted for 30 minutes, and treatments were administered three times per week over a period of four weeks.

Data collection involved initial and final assessments using the Modified Medical Research Council (mMRC) Dyspnea Scale for breathlessness, the Breathlessness, Cough, and Sputum Scale (BCSS) for cough and sputum production, and a peak flow meter for expiratory flow rates. Oxygen saturation and pulse rates were measured using a pulse oximeter. The reliability and validity of these tools have been documented in previous studies.

The data were analyzed using SPSS version 25. Statistical tests were chosen based on the distribution of the data assessed by the Shapiro-Wilk test. For normally distributed data, parametric tests (paired and independent t-tests) were employed, while non-parametric data were analyzed using the Wilcoxon signed-rank test and Mann-Whitney U test. A p-value of less than 0.05 was considered statistically significant for all analyses. This robust analytical approach allowed for comprehensive assessment of the interventions' effects on various clinical outcomes, providing a solid foundation for evaluating the efficacy of combining Blow Bottle and Percussion Techniques in the treatment of COPD.

RESULTS

The study results were structured to provide a clear comparison between the two groups, assessing several key parameters including dyspnea, breathlessness, sputum production, expiratory flow rates,

Table 1 Participant Demographics and Baseline Characteristics

Variable	Group A	Group B
Number of Participants	16	18
Age (years)	55.7 ± 5.6	54.5 ± 6.0
Gender (M/F)	10/6	11/7
Smokers	9	8
Non-smokers	7	10

Table 2 Clinical Outcomes Pre- and Post-Intervention

Outcome Measures	Group A Pre (Mean ± SD)	Group A Post (Mean ± SD)	Group B Pre (Mean ± SD)	Group B Post (Mean ± SD)	P-Value
mMRC Dyspnea Scale	2.8 ± 0.4	2.0 ± 0.5	2.9 ± 0.5	1.5 ± 0.5	0.01
BCSS Score	3.2 ± 1.1	1.8 ± 1.0	3.1 ± 1.2	1.2 ± 0.8	0.02
Peak Flow Meter (L/min)	300 ± 50	340 ± 55	295 ± 45	370 ± 50	0.003
Oxygen Saturation (%)	92 ± 2	94 ± 2	91 ± 2	95 ± 1	0.0001

and oxygen saturation levels. Statistical significance was determined with p-values less than 0.05 indicating significant differences.

The analysis revealed significant improvements in all measured outcomes for Group B, which received both Percussion and Blow Bottle Techniques, compared to Group A, which received only Percussion. Notably, improvements in oxygen saturation and peak expiratory flow rates were markedly better in Group B, demonstrating the added benefit of the Blow Bottle Technique when combined with Percussion.

Improvements within each group were significant, as shown by paired tests, indicating that both interventions were effective in managing COPD symptoms. However, between-group analyses, particularly for oxygen saturation and peak flow rates, underscored more substantial improvements in Group B, thereby suggesting a synergistic effect of combining both techniques.

DISCUSSION

The findings of this study underscored the potential benefits of combining percussion and Blow Bottle techniques in the management of Chronic Obstructive Pulmonary Disease (COPD), highlighting significant improvements in multiple clinical outcomes. The results demonstrated that while both interventions individually contributed to the improvement of symptoms such as dyspnea and breathlessness, the combined approach was particularly effective in enhancing oxygen saturation and expiratory flow rates. This synergy suggests that the simultaneous application of both techniques may produce a more pronounced effect on airway clearance and lung function than either technique alone (16, 17).

Comparative studies have previously reported the individual benefits of percussion and positive expiratory pressure (PEP) techniques like the Blow Bottle in managing COPD symptoms (18, 19). Percussion helps in loosening the mucus from the lung walls, thereby facilitating its removal, while Blow Bottle techniques create a back pressure during expiration, which aids in keeping the airways open during coughing, enhancing mucus clearance (20). The current study's findings align with these reports and further indicate that when these

techniques are employed together, the benefits are amplified, particularly in terms of respiratory mechanics and gas exchange (20).

One of the strengths of this study was the rigorous methodology used, including randomization and the use of validated tools for outcome measurement. However, there were limitations that should be noted. The sample size, while adequate to detect statistical differences, was relatively small, which might limit the generalizability of the findings. Additionally, the study was conducted in a single center, which may influence the broader applicability of the results due to environmental or management factors specific to the setting (

Further research should focus on expanding the sample size and including multiple centers to enhance the generalizability of the findings. Additionally, future studies might explore the long-term effects of these interventions on COPD progression and episodes of exacerbations, which were not covered in this study.

Moreover, considering the practical implications of the findings, it is recommended that clinicians integrate both percussion and Blow Bottle techniques in the routine management of patients with mild to moderate COPD. This integrated approach could be particularly beneficial in resource-limited settings where access to expensive therapeutic devices might be restricted.

CONCLUSION

In conclusion, this study contributes valuable insights into the management of COPD, suggesting that a combined approach involving percussion and Blow Bottle techniques can offer enhanced benefits over individual interventions. It encourages a shift towards more comprehensive physiotherapeutic strategies in the management of chronic respiratory diseases, aiming to improve quality of life and functional outcomes for patients suffering from COPD.

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Authors and Affiliations:

1. **Javeria Shahzad**; Lecturer; jiadrjia@gmail.com; University of Sargodha, Sargodha, Pakistan
2. **Sidra Afzal**; Senior Lecturer; sidra.afzal@riphah.edu.pk; Riphah International University, Lahore, Pakistan
3. **Rabia Majeed**; Assistant Professor; rabia.majeed@umt.edu.pk; University of Management Sciences, Lahore, Pakistan

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