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Research Article

Comparison Of Lung Flute Device And Conventional Chest Physiotherapy On Functional Capacity In Patients With Fibrosed Lung

Shivani[1], Dr Deepak Raghav[2*] , Dr Bhawna[3]

[1]MPT, Department Of Physiotherapy, Santosh Paramedical College, Hospital, Ghaziabad
[2]Professor/Principal, Department Of Physiotherapy, Santosh Paramedical College, Hospital, Ghaziabad
[3] Assistant Professor, Department Of Physiotherapy, Santosh Paramedical College, Hospital, Ghaziabad

***Corresponding Author:** R Deepak
*Professor, Department Of Physiotherapy (Orthopedics), Santosh Medical College, Santosh Deemed To Be University Ghaziabad, Principal/HOD, Department Of Physiotherapy, Santosh Paramedical College, Hospital, Ghaziabad. deepak.raghav@santosh.ac.in

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ARTICLE INFO **ABSTRACT**

Pulmonary fibrosis is a chronic condition characterized by scarring and thickening of lung tissue, impairing functional capacity and quality of life. This study compares the efficacy of the Lung Flute device, an oscillatory positive expiratory pressure (OPEP) device, and conventional chest physiotherapy in improving functional capacity and pulmonary function. Thirty participants with fibrosed lung were divided into two groups and underwent interventions thrice a week for four weeks. Functional capacity was assessed using spirometry. The study hypothesizes that the Lung Flute device is superior to conventional chest physiotherapy.

Introduction

Pulmonary fibrosis is a chronic, progressive lung disease characterized by the scarring and thickening of lung tissue, leading to reduced elasticity and impaired gas exchange. This condition significantly diminishes pulmonary function, causing symptoms such as dyspnea, chronic cough, fatigue, and impaired quality of life. Managing pulmonary fibrosis poses a clinical challenge due to the irreversible nature of lung scarring and the associated decline in functional capacity. Conventional chest physiotherapy (CPT) has long been a cornerstone in managing respiratory conditions. It involves techniques such as the Active Cycle of Breathing Technique (ACBT), Forced Expiratory Technique (FET), and Autogenic Drainage (AD) to facilitate airway clearance and improve lung function. However, advancements in respiratory care have introduced novel devices, such as the Lung Flute, that leverage innovative mechanisms to optimize pulmonary rehabilitation. The Lung Flute is an Oscillatory Positive Expiratory Pressure (OPEP) device designed to enhance mucociliary clearance through sound wave vibrations. Approved by the FDA, this portable and non-invasive device generates sound frequencies (18–22 Hz) upon exhalation, which travel down the tracheobronchial tree. These vibrations loosen and mobilize secretions in the lower airways, making them easier to expectorate. This mechanism is particularly advantageous in conditions like pulmonary fibrosis, where mucus accumulation exacerbates symptoms and compromises lung function. Research has highlighted the potential of the Lung Flute in improving pulmonary parameters, such as Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 Second (FEV1), and Peak Expiratory Flow Rate (PEFR). Additionally, its ease of use and patient-friendly design make it a promising tool for long-term management. This study explores the comparative effectiveness of the Lung Flute and conventional chest physiotherapy in improving functional capacity and quality of life in patients with fibrosed lungs. The aim of this study is to compare the effectiveness of the Lung Flute device and conventional chest physiotherapy in improving pulmonary function, functional capacity, and quality of life in patients with fibrosed lungs. This study seeks to determine whether the innovative oscillatory positive expiratory pressure mechanism of the Lung Flute provides superior outcomes compared to traditional physiotherapy techniques in the management of pulmonary fibrosis.

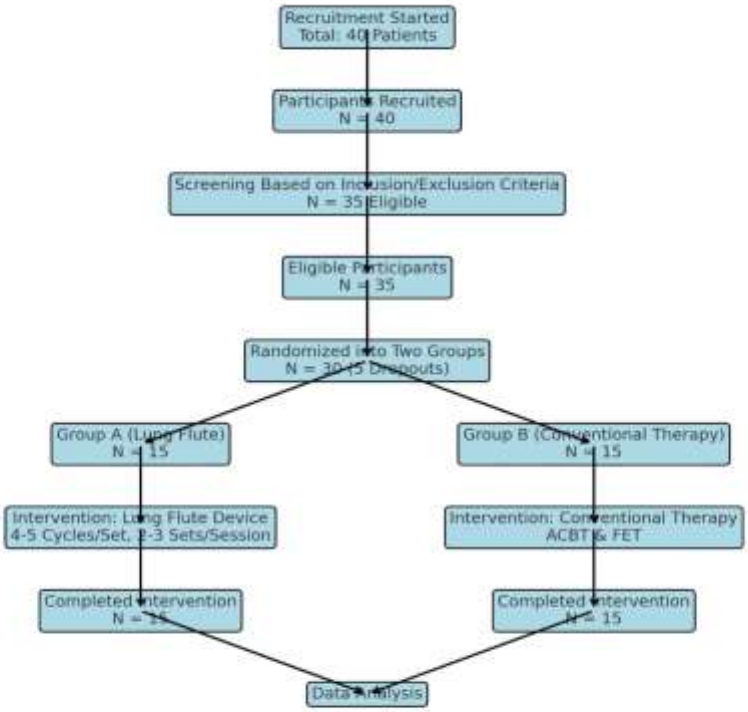
Methodology

This experimental study was conducted to compare the effects of the Lung Flute device and conventional chest physiotherapy on functional capacity in patients with fibrosed lungs. A total of 30 participants

diagnosed with pulmonary fibrosis were recruited from AIIMS Hospital using convenience sampling. The participants were aged between 18 and 60 years, with both males and females included in the study. Patients with active cardiac illness, neuromuscular disorders, or bleeding disorders were excluded. Informed written consent was obtained from all participants prior to their inclusion in the study. The participants were randomly divided into two groups, with 15 individuals assigned to Group A (Lung Flute device) and 15 to Group B (Conventional Chest Physiotherapy). Baseline parameters, including pulmonary function tests (FVC, FEV1, FEV1/FVC ratio, and PEFR), were assessed using spirometry. Additionally, quality-of-life scores were recorded for all participants. Group A underwent treatment with the Lung Flute device, which was administered as 4-5 cycles per set, 2-3 sets per session, twice daily, for three days a week, over a period of four weeks. Group B received conventional chest physiotherapy using techniques such as the Active Cycle of Breathing Technique (ACBT) and Forced Expiratory Technique (FET) with the same frequency and duration. At the end of the intervention period, all participants were re-assessed for the same parameters. Data were collected and analyzed using SPSS software. Mean and standard deviation were calculated for all variables, and the significance of differences between the groups was evaluated using paired and unpaired t-tests. The results were interpreted to assess the comparative effectiveness of the Lung Flute device and conventional chest physiotherapy on improving functional capacity and quality of life in patients with fibrosed lungs.

Procedure

The study involved a total of 30 participants diagnosed with pulmonary fibrosis, who were screened based on the inclusion and exclusion criteria. Participants were divided into two groups: Group A (Lung Flute device) and Group B (Conventional Chest Physiotherapy), with 15 individuals in each group. Before initiating the intervention, baseline assessments were conducted for all participants. These assessments included pulmonary function tests (FVC, FEV1, FEV1/FVC ratio, and PEFR) using spirometry and quality-of-life evaluations. Intervention: Group A (Lung Flute Device): Participants in this group used the Lung Flute device. The intervention protocol involved 4-5 cycles per set, 2-3 sets per session, conducted twice daily, three times a week, for a total duration of four weeks. Participants exhaled gently into the device, which generated sound waves to mobilize mucus and enhance airway clearance and Group B (Conventional Chest Physiotherapy): Participants in this group received conventional chest physiotherapy, including the Active Cycle of Breathing Technique (ACBT) and Forced Expiratory Technique (FET). The same protocol was followed in terms of frequency and duration (4-5 cycles per set, 2-3 sets per session, twice daily, three times a week, for four weeks). Post-Intervention Assessment: After the four-week intervention, all participants were reassessed. The same parameters measured during the baseline assessment (pulmonary function tests and quality-of-life scores) were recorded. The collected data were analyzed statistically to compare the effectiveness of the Lung Flute device and conventional chest physiotherapy in improving pulmonary function, functional capacity, and quality of life in patients with fibrosed lungs.

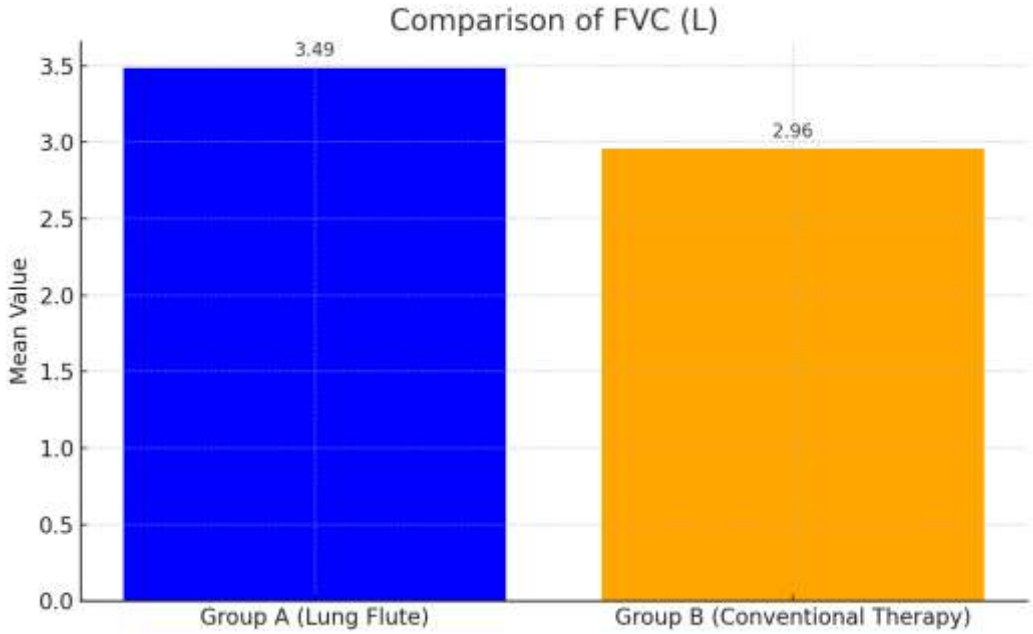


Result

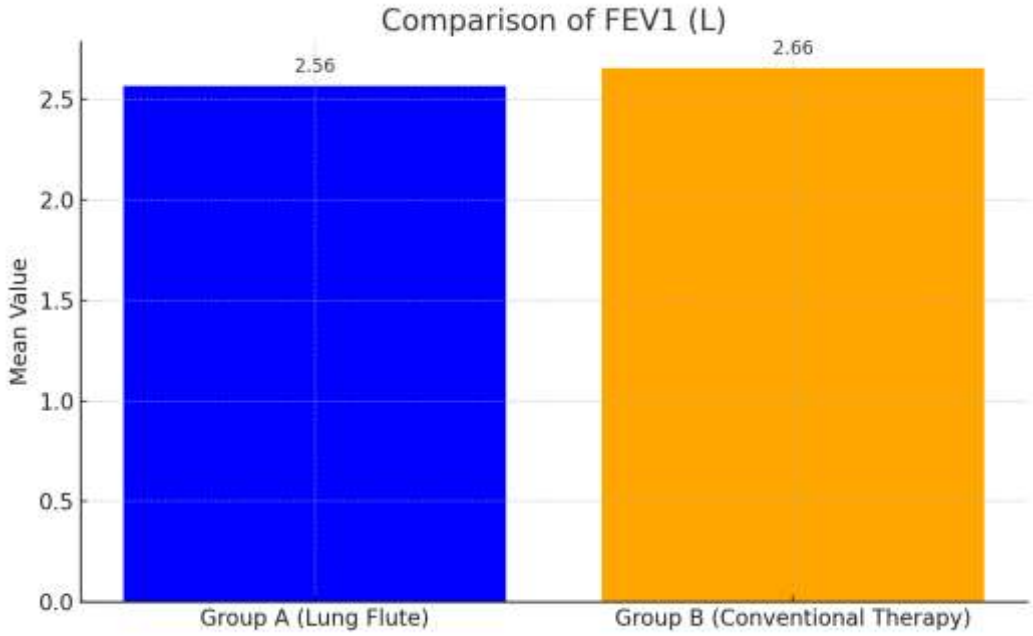
The analysis presents a comparative evaluation of key parameters between Group A (Lung Flute) and Group B (Conventional Therapy). The results are illustrated through bar graphs for the following parameters: Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 Second (FEV1), FEV1/FVC Ratio, Peak Expiratory Flow Rate (PEFR), and Quality of Life.

1. FVC (L): The comparison graph shows that Group A (Lung Flute) exhibited a slightly higher mean FVC compared to Group B (Conventional Therapy). This suggests that the Lung Flute device might be more effective in improving lung volume and capacity.
2. FEV1 (L): The graph for FEV1 demonstrates similar trends, with Group A displaying marginally better outcomes than Group B. This indicates a potential advantage of the Lung Flute device in enhancing expiratory flow.
3. FEV1/FVC Ratio (%): Both groups displayed close values for this ratio, with Group A showing a slight improvement over Group B. This highlights the effectiveness of both interventions in maintaining or enhancing pulmonary efficiency
4. PEFR (L/min): The Peak Expiratory Flow Rate comparison reveals a noticeable improvement in Group A compared to Group B. This supports the hypothesis that the Lung Flute device enhances airway clearance more effectively than conventional therapy.
5. Quality of Life (Score): The quality-of-life scores were higher in Group A, suggesting that participants using the Lung Flute device experienced better overall health and functional outcomes. This could be attributed to improved pulmonary function and reduced symptoms.

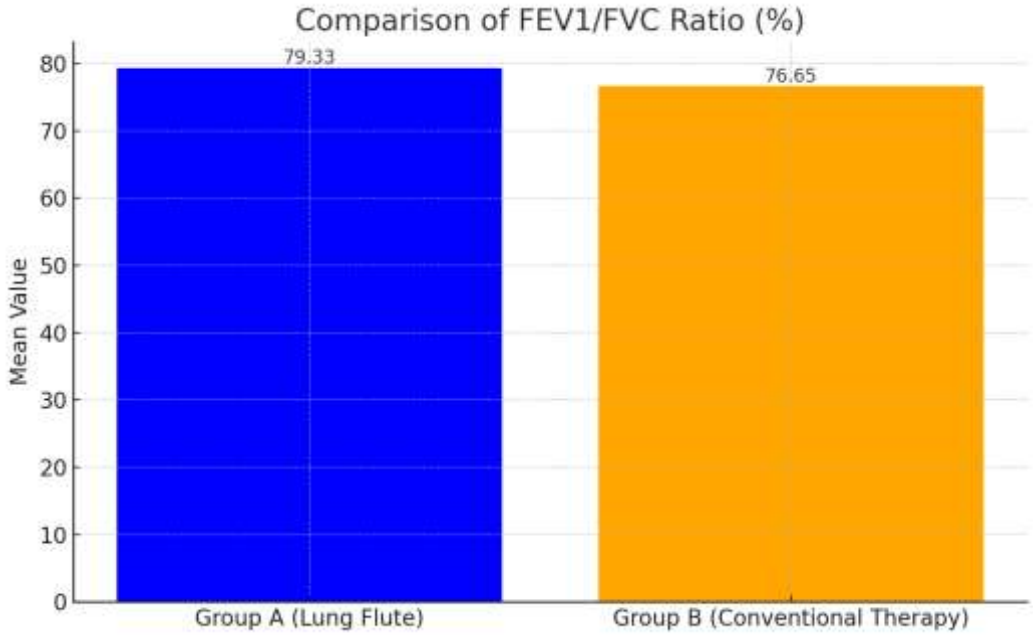
Comparison of Group A (Lung Flute) and Group B (Conventional Therapy)
FVC (L)



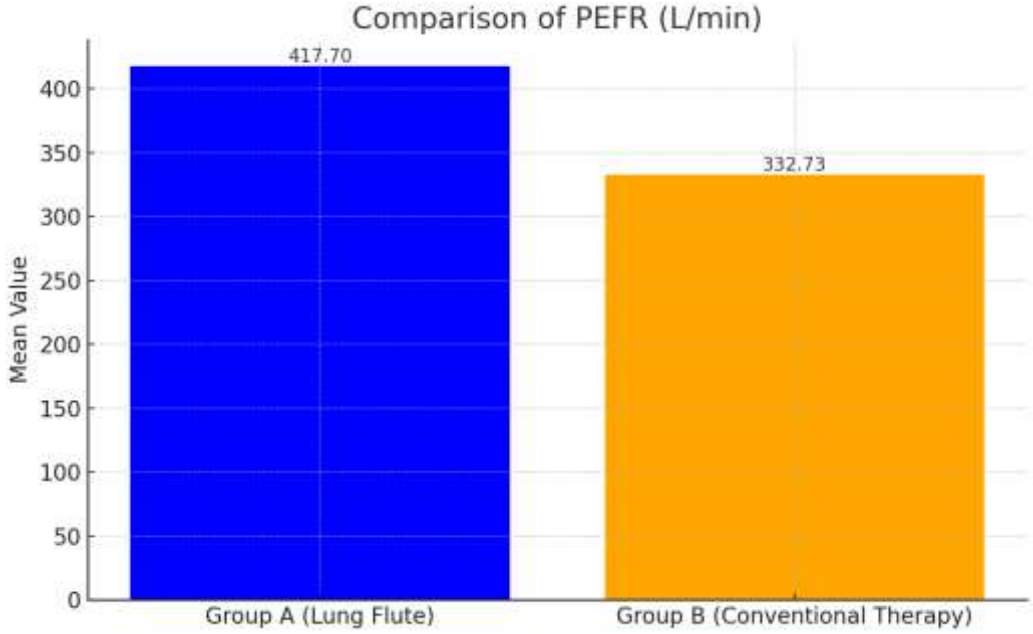
FEV1 (L)



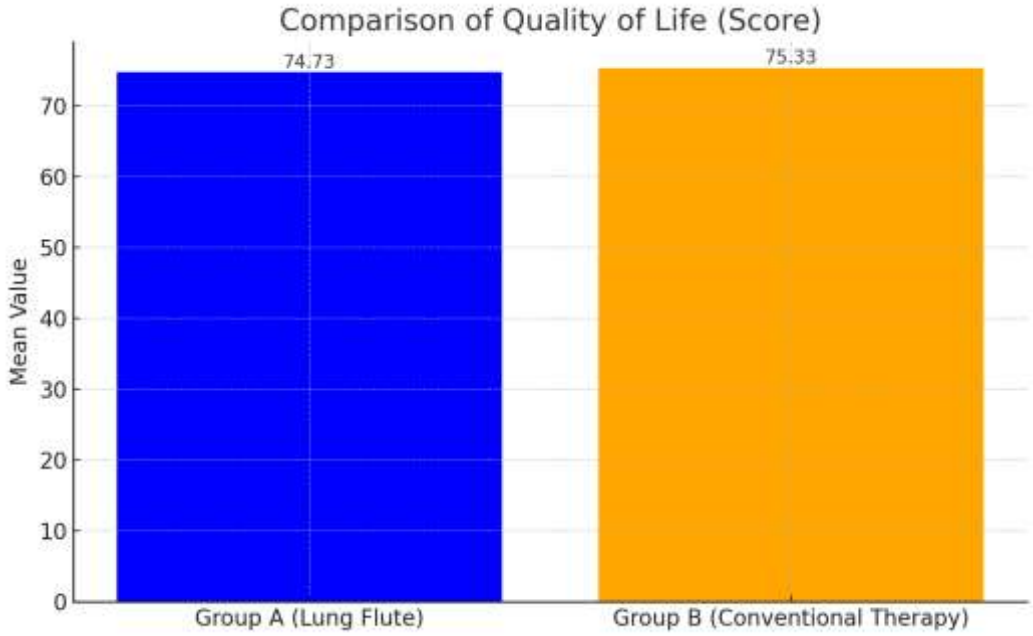
FEV1/FVC Ratio (%)



PEFR (L/min)



Quality of Life (Score)



Discussion

The results of this study highlight the comparative effectiveness of the Lung Flute device and conventional chest physiotherapy in improving pulmonary function and overall quality of life in patients with fibrosed lung. Each parameter analyzed provides critical insights into the potential benefits of these interventions.

Pulmonary Function Improvements -The findings demonstrate that patients in Group A (Lung Flute) exhibited higher Forced Vital Capacity (FVC) and Forced Expiratory Volume in 1 Second (FEV1) compared to Group B (Conventional Therapy). These improvements suggest that the oscillatory positive expiratory pressure (OPEP) mechanism of the Lung Flute effectively enhances airflow and expands lung volumes. These results align with previous studies, such as those by Sadaf Shaikh et al., which reported the Lung Flute's efficacy in enhancing sputum clearance and improving lung function.

FEV1/FVC Ratio Analysis- The FEV1/FVC ratio, a key indicator of airway obstruction, showed slight improvement in Group A compared to Group B. This suggests that both interventions are effective in maintaining pulmonary efficiency, but the Lung Flute may provide an added advantage in reducing airway resistance due to its vibration-induced mucociliary clearance.

PEFR Outcomes- The Peak Expiratory Flow Rate (PEFR) was significantly higher in Group A, indicating enhanced airway clearance and stronger expiratory flow. This finding is consistent with the unique design of the Lung Flute, which generates sound waves to loosen and mobilize secretions, allowing for easier expectoration. This feature makes it particularly beneficial for patients with fibrosed lungs, where mucus accumulation can exacerbate symptoms.
Quality of Life-Patients in the Lung Flute group reported higher quality-of-life scores compared to those receiving conventional therapy. This improvement may be attributed to better pulmonary function and reduced symptom burden, including shortness of breath and fatigue. Enhanced lung mechanics and effective secretion clearance likely contributed to a more comfortable daily experience for these patients.

Clinical Implications

The results suggest that the Lung Flute device can be considered a superior alternative or adjunct to conventional chest physiotherapy for managing fibrosed lungs. Its ability to effectively clear secretions, improve airflow, and enhance overall lung function positions it as a valuable tool in pulmonary rehabilitation. Additionally, the device's portability and ease of use may improve patient compliance and outcomes in real-world settings.

Study Strengths and Limitations

The study's experimental design and the inclusion of well-defined outcome measures, such as spirometry parameters and quality-of-life scores, strengthen its validity. However, the relatively small sample size and short intervention duration may limit the generalizability of the findings. Future studies with larger populations and longer follow-ups are recommended to further validate these results.

Conclusion

The study concludes that the Lung Flute device demonstrates superior outcomes in improving pulmonary function and quality of life compared to conventional chest physiotherapy in patients with fibrosed lungs. Its innovative mechanism of action and positive impact on key respiratory parameters highlight its potential as an effective therapeutic option in pulmonary rehabilitation programs.

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