Innovations

Effect of Pulmonary Rehabilitation with Balance Training on Balance, Functional Capacity and Quality of Life in ILD Population

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Abstract

Background*: Interstitial Lung Disease (ILD) is a chronic and progressive respiratory condition associated with impaired balance, reduced functional capacity, and diminished quality of life. Current treatment approaches often focus on pulmonary rehabilitation, but the potential benefits of incorporating balance training into ILD management remain unclear. This study aimed to evaluate the effectiveness of balance training combined with pulmonary rehabilitation in improving balance, functional capacity, and quality of life in patients with ILD.* ***Methods****: An therapeutic group (n = 17) or a control group (n = 17) was randomly allocated to a total of 34 ILD patients. A comprehensive program comprising both pulmonary rehabilitation and balance training was administered to the intervention group, while the control group simply got normal pulmonary rehabilitation. Utilizing the Mini-BESTest (MBT) to assess balance, the 6-minute walk test (6MWT) to examine functional capacity, and the St. George's Respiratory Questionnaire (SGRQ) to measure quality of life were the three main outcome measures. Assessments were done on both groups before and after the intervention.* ***Conclusion****: The study's conclusions suggest that adding balance training to pulmonary rehabilitation can significantly enhance patients with ILD's functional ability, balance, and general quality of life. These results highlight the potential benefits of a comprehensive approach that targets both respiratory and balance impairments in ILD management. Further research and clinical implementation of balance training within ILD rehabilitation programs may enhance the outcomes and well-being of ILD patients.*

Keywords: *Chronic lung disease, Balance impairment, Functional Capacity, Pulmonary rehabilitation, Interstitial lung disease*

Introduction:

The phrase "interstitial lung disease" encompasses about 100 pulmonary disorders that impact the small airways, pulmonary interstitial space, and/or alveolar architecture. Clinical, radiographic, and pathological criteria can all be combined to diagnose ILD. ILD as a symptom of connective tissue disease (CTD),

sarcoidosis, hypersensitivity pneumonitis (HP), drug-induced LD, and pneumoconiosis are among the most common types of ILD.[1,2]. Anyone, especially young children, could be affected by interstitial lung disorders. Some of the variables that can raise the risk of or directly cause ILDs include genetics, particular medications, or medical procedures like chemotherapy or radiation. It is highly recommended that anyone with ILDs stop smoking because it not only exacerbates the condition but also contributes to it. ILD can be diagnosed by combining clinical, radiological, and pathological criteria. The most common types of ILD are drug-induced ILD, pneumoconiosis, sarcoidosis, hypersensitivity pneumonitis (HP), idiopathic pulmonary fibrosis (IPF), and ILD as a symptom of connective tissue disease (CTD). [1,2]

Recent research indicates that lung rehabilitation might provide significant short-term advantages to those with ILD. While respiratory restriction is a hallmark of ILD, patients may also benefit from pulmonary rehabilitation based on symptoms such as dyspnea, muscle dysfunction, exercise intolerance, and reduced quality of life. Short-term improvements in functional exercise tolerance, dyspnea, and quality of life have been observed in randomised controlled studies conducted after pulmonary rehabilitation in individuals with ILDs.[22, 23].There were no long-lasting effects found six months after training [17] and the extent of the benefits was less apparent [18,19].Huppmann and colleagues included 402 individuals with ILD throughout an 11-year period. In the recently released international statement on the care of IPF [20], pulmonary rehabilitation is given a weakly positive recommendation, noting that while it is advised for the majority of IPF patients, it may not be suitable for a minority.

The phrases functional disability, quality of life, health-related quality of life, and symptoms are widely used synonymously and have multiple meanings.[21]According to general conceptions, health status is defined as an all-encompassing notion that encompasses physiological functioning, symptoms, functional disability, and quality of life [22,23]. The concept of quality of life, and specifically the concept of health-related quality, is satisfaction with one's physical and mental well-being. It was recently demonstrated that these regions of health status can be further subdivided into more precise sub domains [24].Although in an ideal world, the health status evaluation used to determine treatment outcomes would be tailored to the unique treatment needs of each patient. Health status and its domains can be measured using a variety of instruments, both general and disease-specific. Even though broad instruments are meant to be less discriminative and sensitive to change, it has been demonstrated that the SF-36 can identify improvement after pulmonary rehabilitation [25]. The two most widely utilized disease-specific questionnaires are the Chronic Respiratory Disease Questionnaire (CRQ) and its self-reported version [26,27] and St. George's Respiratory Questionnaire (SGRQ) [28].Every device is subject to important limitations[29]. Initially, subjective reports of lung symptoms and functional impairment are frequently evaluated using questionnaires tailored to a given

condition. [30]. Patients with ILD receive pulmonary rehabilitation (PR) in a variety of venues and according to various models. PR programmes are often centre-based and have had successful results in individuals with sarcoidosis [31] and pneumoconiosis ·Patients with ILD receive pulmonary rehabilitation (PR) in a variety of venues and according to various models. PR programmes are often centre-based and have had successful results in individuals with sarcoidosis [31] and pneumoconiosis [32]. The majority of eight to twelve week PR programs for ILD patients are intended to greatly enhance functional capacity, quality of life, and dyspnea feeling [30,31-35]. Conversely, brief experiments conducted on sarcoidosis patients hospitalized for rehabilitation demonstrated benefits such decreased fatigue, anxiety, depressive symptoms, and improved quality of life [31]. Reducing symptoms, increasing exercise capacity, strengthening self-management, and raising the quality of life in aspects of wellness constitute every part of the management of pulmonary rehabilitation. There is strong evidence that pulmonary rehabilitation has major benefits for patients with ILD. [2]The outcomes may give vital information on how pulmonary rehabilitation impacts patients .People were found with impaired balance, which is caused by muscle weakening, a decrease in physical activity, and modifications to the mechanisms that affect trunk muscles. Through balancing training and pulmonary rehabilitation, the patient's quality of life is enhanced, including functional exercise capacity, involving strength, endurance, and respiratory muscles, is also increased. [3]
There are numerous articles that are held against cops, mostly men in their 50s and 60s, who smoke more than 5 to 10 packs each year. The incidence demonstrates that after balancing training as well as pulmonary rehabilitation, their Basales significantly improve (0.0001) %, while their TUG, ABS, as well as USD also significantly improve (p.01) and (p.05). [4] We are aware that ILD patients might have decreased lung and limb muscle function. Due to a lack of studies regarding balance training in ILD populations, muscle dysfunction may contribute to dyspnoea, exhaustion, and limitations in function [5]

Materials and Methods:

Study design and Participants:

The patients in this experimental trial were recruited for a period of six months from Metro Hospitals and Heart Institute in Noida, where they were diagnosed with interstitial lung disease. Once the NTCC review Committee of the physiotherapy department at Amity Institute of Allied Health Sciences, Amity University, Noida, India, granted ethical approval, with ethical approval number NTCC/MPT-Cardio/22-23/November2022/16. Based on eligibility requirements, potential participants were told about the protocol, and all participants completed informed consent forms.

Patients with ILD were required for both groups, and inclusion criteria included specific requirements such FVC 50% and FEV1 > 65%[15]. Participants' ages

ranged from 35 to 70yrs[16]. Patients with neurological or musculoskeletal conditions, comorbidities that prevent exercise training, or coexisting conditions like COPD, bronchiectasis, lung carcinoma, pneumothorax, or pulmonary tuberculosis were excluded. Stable patients with a Manual Muscle Testing (MMT) grade of ≥4 [10]for specific lower limb muscle groups were included.

Under the assistance of the pulmonary outpatient program, 34 stable ILD patients were enrolled. Patients who met the criteria for inclusion were assigned at random, using the chit method, to either the rehabilitation or control group. As soon as the participant's name was inscribed on the chit, the allocator opened each one in turn. The outpatient of ILD which contained 18 sessions over six weeks (3 sessions per week), was required of patients who were assigned to the rehabilitation group. Under the direction of a qualified physiotherapist employed by the hospital, the entire exercise regimen prescribed for this study was carried out.

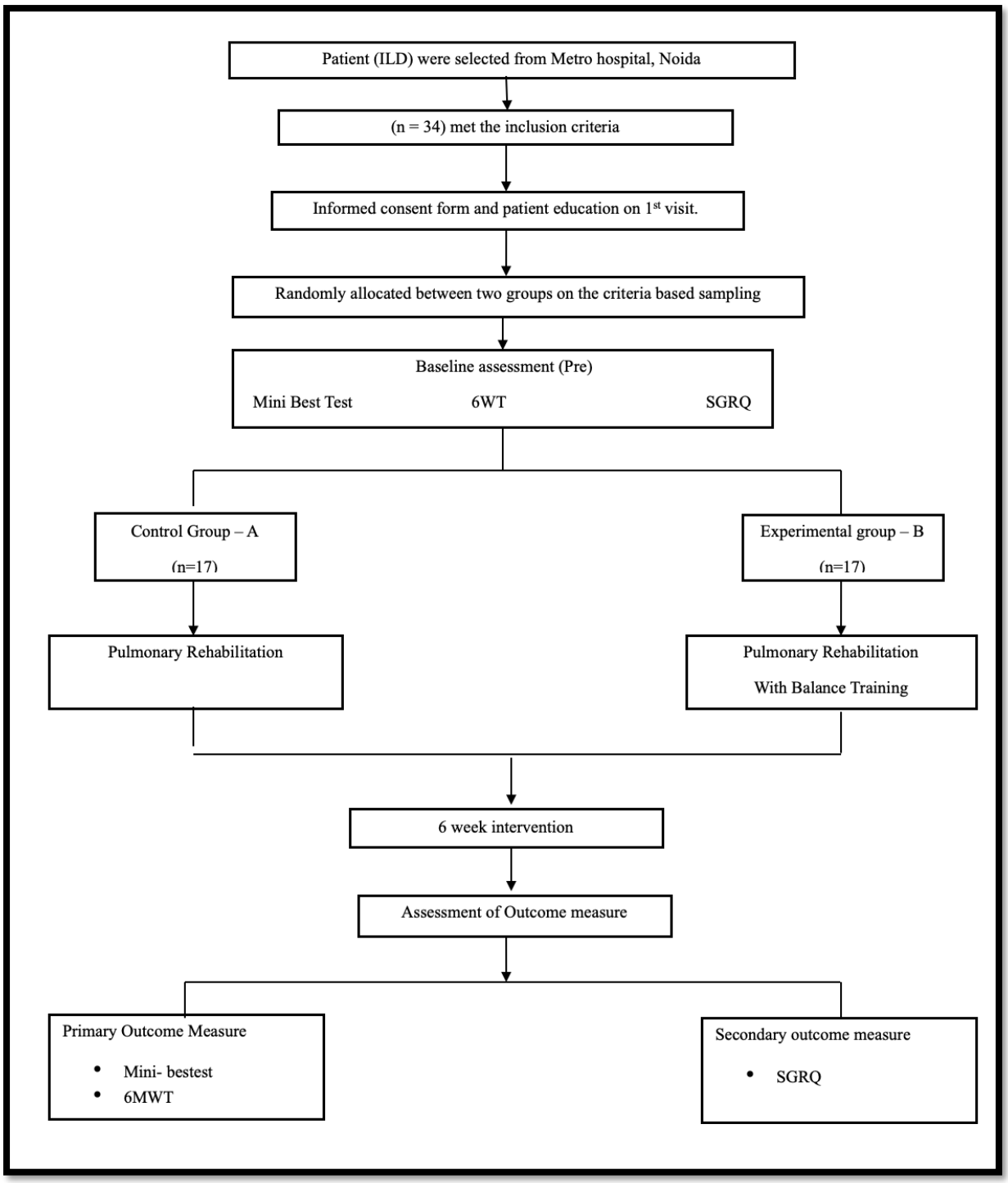

Fig-1 Flowchart of Study Design

Assessment:

All patients were informed of the research procedures and potential risks one week prior to baseline testing. Every patient received tests as well as a physical assessment. The American Thoracic Society and the European Respiratory Society (ATS/ERS) recommended utilizing the modified Medical Research Council (mMRC) participants for baseline dyspnea evaluation. Measurements

were made of the forced vital capacity (FVC), forced expiratory volume (FEV1) in one second, and FEV1/FVC ratio. In compliance with ATS/ERS standards, blood pressure, heart rate, oxygen saturation (SpO2), and dyspnea were measured prior to and following the 6-minute walk test (6MWT). Every patient was urged to walk as far as they could at their own pace for six minutes.. The total distance travelled by the participant was determined in metres . Participants were randomly assigned to the experimental or control group after baseline testing. Participants who were part of the control group had to complete PR for six weeks. Participants in the experimental group, however, were offered to do a PR with balance training for six weeks. After completion of the 6 weeks, outcome measures were reassessed for both the groups.

Interventions:

Both strength training and balance training activities will be included in the exercise programme. During the 6-MWT, the initial walking pace will be set at 80% of the max walking speed. As tolerated, patients will advance from interval training to constant walking. SPO2 (oxygen saturation), heart rate, and dyspnea levels (calculated using the Borg scale) will all be continuously tracked and recorded during the training sessions. Prior to joining the experiment, patients who were already receiving supplemental oxygen therapy will continue to do so during the therapy sessions. To keep the SpO2 at or above 88%, oxygen supplementation will be supplied by a concentrator. Short rest intervals will be offered if oxygen saturation levels fall below 88%. ILD patients are advised to take supplementary oxygen during exercise, according to the ATS/ERS guideline for pulmonary rehabilitation . Under the guidance of a therapist, the experimental group in this study will get exercise instruction. According to each patient's unique capacity, the workout protocol will be modified.

In control group the participants underwent pulmonary rehabilitation. Strength training, breathing exercises, and endurance training are all part of the programme. A 10-minute warm-up walk at 60-80% of the average pace reached during the 6MWT serves as the warm-up for endurance training. SPO2 and HR are monitored while training intensity is modified in accordance with symptoms. 15-20 minute breathing workouts use methods like thoracic expansion and pursed lips breathing[10]. Major muscle groups are worked on during strength training, which starts with 0.5 kg weight cuffs for 2 sets of 10 reps and progresses to 3 sets after 2 weeks. Exercises involving hurdle cones and side walking are also included. This regimen is followed by control group for six weeks, with sessions lasting 40 to 45 minutes.[1]Whereas in experimental group the participants underwent pulmonary rehabilitation with an added emphasis on balance training. The workout routines for breathing, strength, and balance are all part of the programme. A 5- to 10-minute warm-up walk at 60-80% of the average pace reached during the 6MWT is required before endurance training. SPO2 and HR

are monitored while training intensity is modified in accordance with symptoms. 15-20 minute breathing workouts use methods like thoracic expansion and pursed lips breathing. Major muscle groups are worked on during strength training, which starts with 0.5 kg weight cuffs for 2 sets of 10 reps and progresses to 3 sets after 2 weeks. Exercises for narrow stance with the eyes closed or on foam are part of balance training, as are side walking around hurdle cones. Experimental group adheres to this exhaustive protocol for 6 weeks, with sessions lasting 40-45 minutes.[10]

Statical Analysis:

The data was entered into an Excel spreadsheet after being coded. For the analysis, IBM SPSS Statistics Inc., Chicago, Illinois, USA, provided SPSS version 20, a Windows program. In descriptive statistics, the computation of means, standard deviations, and percentages was covered. Prior to statistical analysis, the data were checked for normality using the Kolmogorov-Smirnov test. Quantitative data from two independent observations and from before and after observations were compared using the Mann-Whitney U test and the Wilcoxon signed rank test, respectively. The chi square test was used to compare all of the clinical markers' qualitative data. The chosen significance threshold was P0.05.

Measures	**Parameters**	**Group A (Mean ± SD)**	**Group B (Mean ± SD)**	**t value**	**p value**	**Lower limit**	**Upper limit**
MBT	**MBT(PS)**	**18.82 ± 3.71**	**22.41 ±3.97**	**2.72**	**o.o1o4**	**-6.27**	**-0.9**
6MWT	**6MWT(PS)**	**390.88 ± 91.37**	**383.71 ±20.94**	**0.23**	**0.8199**	**-56.51**	**70.86**
SGRQ	**Symptoms(PS)**	**52.42 ±19.65**	**53.92 ±17.69**	**0.23**	**0.816**	**-14.57**	**11.56**
	Impact	**68.72 ± 19.92**	**48.09 ± 4.86**	**1.01**	**0.3218**	**-21.13**	**62.40**
	Activity	**81.44 ± 30.22**	**68.40 ±19.56**	**1.49**	**0.145**	**-4.74**	**32.82**
	Total	**73.17 ± 10.15**	**55.42 ± 16.36**	**3.80**	**0.0006**	**8.23**	**27.25**

All values expressed in mean ± SD.
6MWT, 6-minute walk test; SGRQ, ST. George's Respiratory Questionnaire ;MBT, Minibest -test; SD, Standard deviation

Table 1 – Post Test Comparison between Control group (A) and Experimental group (B)

Result:
The post-test results for the Control group and the Experimental group were compared using a variety of metrics, as shown in Table No. 1. The experimental group outperformed the control group in terms of MBT values, with a statistically significant mean difference (p value of 0.01) indicating superior results. The 6MWT readings, however, did not show a statistically significant difference between the two groups (p-value of -56.51). The SGRQ questionnaire revealed no statistically significant differences in the activity, impact, and symptom domains between the two groups. The SGRQ questionnaire's overall score did, however, demonstrate a statistically significant improvement in the experimental group as compared to the control group, with a p-value of 0.006.)

Discussion:
The study's goal was to assess how balance training and pulmonary rehabilitation affected the functional ability, quality of life, and balance of people with ILD. The MBT, 6MWT, and SGRQ were included in the study as outcome measures. In comparison to the control group, the experimental group demonstrated statistically significant improvements in the 6MWT and MBT measures. Nevertheless, the experimental group did not see a statistically significant improvement in SGRQ.Patients with ILD frequently experience balance impairment, which can significantly lower their quality of life. Prior research has demonstrated that impaired balance is common in people with ILD and is associated with reduced lung function, weakness in the muscles, and physical inactivity. Programs for pulmonary rehabilitation have been shown to help ILD patients with their mobility, balance, and degree of physical activity. A clinical test called the Mini-Balance Evaluation Systems Test (Mini-BESTest) is used to identify and measure balance abnormalities. In this study, following the intervention, the MBT scores of the experimental group significantly improved, whereas the control group did not. A common functional capacity assessment in clinical research is the 6MWT. In this study, the 6MWT of the experimental group significantly improved following the intervention, but the 6MWT of the control group decreased. A disease-specific questionnaire called the SGRQ is used to evaluate patients' quality of life who suffer from respiratory conditions. While the SGRQ questionnaire did not demonstrate a statistically significant improvement in the experimental group's ratings, it remains a useful and dependable tool for assessing the effect of respiratory symptoms on patients' quality of life.

Overall, the study indicates that pulmonary rehabilitation and balance training may benefit individuals with ILD's balance and functional ability. The influence on SGRQ-measured quality of life, however, was not statistically significant in this investigation. To investigate the possible advantages of these therapies on the quality of life of ILD patients, more research is required.There was no long-term follow-up after the conclusion of the 6-week regimen to establish if the improvements in balance training and function capacity were sustained over time and their relevance with the recurrence of discomfort due to progressive disease. In addition, the study was only conducted in a single centre. The sample size in this study was modest, and higher sample sizes are needed in future investigations to yield more meaningful results.

Conclusion:
ILD patients frequently experience balance problems, and treating these issues may need a multidisciplinary approach that combines pulmonary rehabilitation, exercise training, and balance training. Our results show that balance and functional capacity are more significantly impacted than the somewhat degraded health-related quality of life. Functional capacity and Balance.

Ethics Committee Approval: Ethical committee approval was received from the Institutional NTCC Committee of Amity University, Uttar Pradesh, India, with ethical (Approval number NTCC/MPT-Cardio/22-23/November2022/16)

Informed Consent: Patients who volunteered to participate in the trial provided written informed consent.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – S.R.; Design –M.S.,; Supervision –S.P, S.V.; Materials –S.R.; Data Collection and/ or Processing –S.R; Analysis and/or Interpretation –S.P.; Literature Review – ,S.V ,M.S; Writing –S.R. S.P; Critical Review –M.S, M.S.

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