

An Evaluation of two Approaches to Exercise Conditioning in Pulmonary Rehabilitation for Copd Patients: A Comparative Study

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ABSTRACT

Study objectives: To compare the effectiveness of two forms of exercise training in pulmonary rehabilitation for COPD patients. **Design:** A prospective, randomized Eight-week study. **Setting:** A hospital-based outpatient pulmonary rehabilitation program. **Patients:** Thirty patients (15 patients in each group) with COPD who were referred for pulmonary rehabilitation. **Interventions:** We compared the short-term effectiveness of a high-intensity shuttle-walking-endurance program with a low-intensity, multicomponent calisthenics program for the rehabilitation of patients with COPD. The high-intensity group trained using the shuttle walking. The low-intensity group performed classroom exercises for approximately 30 minutes per session. For both groups, twice-weekly sessions were held for eight weeks. The primary outcome measure was Quality of Life, measured using the Clinical COPD questionnaire and rate of perceived exertion using Borg Scale. **Measurements and results:** Both groups showed significant post rehabilitation improvement in exertional and overall dyspnea, functional performance, and health status. Patients in the low-intensity group showed greater increase in endurance and greater reduction in exertional dyspnea, whereas those in the high-intensity group showed moderate increase in endurance and exertional dyspnea. **Conclusions:** It has been concluded that both the high-intensity training and low intensity training showed improvement in quality of life, but low-intensity training showed marked improvement in terms of exertional dyspnea and quality of life as this training is easy to perform and less expensive.

Key words: COPD; Shuttle walking pulmonary rehabilitation.

INTRODUCTION

Pulmonary rehabilitation is a multidisciplinary program of care for patients with chronic respiratory impairment that is individually tailored and de-

signed to optimize physical and social performance and autonomy stated by the Committee of American Thoracic Society. The most successful rehabilitation programs are those in which services are provided by a variety of healthcare professionals to coordinate complex medical services. For example, a respiratory or physical therapist, a nurse, a doctor, a psychologist, a social worker, and a dietician are often needed. Most people are enrolled in the program for about 8 to 12 weeks.

Chronic obstructive pulmonary disease (COPD) is a disorder characterized by reduced maximum

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expiratory flow and slow forced emptying of the lungs. The clinical manifestation may be irreversible in some cases and there may be reduced exercise endurance and tolerance. (The American Thoracic Society and the European Respiratory Society).

COPD is the fourth leading cause of death in the United States and its prevalence is increasing. Annually, upto \$40 billion is spent in the care of COPD patients. COPD is one of the most prevalent conditions in India and causes 1.5% of death annually. It tends to affect men (average prevalence 3.7%) more than women (2.8%)(S.K.JUIDAL,DBECHERA 2003)

It is the most common lung disease and the major inclusive criteria for the development of pulmonary rehabilitation program for the past 25 years. The pulmonary rehabilitation program is the most important component for the management of COPD patients (BARTOLONE R.CELLI).

The rehabilitation program mainly focuses on the following goals:

- Training in breathing techniques and energy conservation.
- Lessons in how to monitor the symptoms of the disease.
- Lessons in how best to use medications.
- To improve exercise tolerance.
- Patient education and dietary counseling.
- Vocational and psycho-social counseling.

Conventional chest physical therapy is referred to as a combination of postural drainage with airway clearance techniques such as percussion, clapping, vibration and shaking in acute cases to improve breathing and specific endurance exercise to improve exercise tolerance. In a pulmonary rehabilitation program the exercise may be of high and low intensity to improve maximal oxygen uptake, to increase exercise ability in chronic COPD patients, and to improve quality of life.

In this regard, exercises may be high intensity and low intensity exercises focusing mainly on improving the exercise endurance by giving exercises to lower extremity muscles and, thereby, recruiting slow oxidative fibers (SO fibers).The literature sources available favor the two approaches to exercise conditioning in COPD patients in aspects of improvement of quality of life, dyspnea and other symptoms and also show that low-intensity training is effective than high-intensity training in aspects of exertional dyspnea nevertheless, this study was It is done in the background of the null hypothesis, which could be stated as:

“There is no significant difference noted between the two approaches to exercise conditioning in pulmonary rehabilitation for COPD patients in aspects of dyspnea and quality of life and other symptoms”.

METHODOLOGY

The study aimed to use two approaches to exercise conditioning in pulmonary Rehabilitation for COPD patients namely high-intensity exercise and Low-intensity exercise.

The following tools were used to evaluate the patient's responses:

1. A baseline evaluation chart.
2. Stethoscope.
3. Sphygmomanometer.
4. Two cones.
5. Stereo Cassette Player.
6. Shuttle walk tape.
7. Chair.

This was an experimental study in which the samples were randomly selected through a chit method and allocated into two groups: -Group I -patients who underwent low-intensity training program; and Group II -patients who underwent high-

intensity training program The study was carried out in the Department of Pulmonology and Critical Care, Sri Ramakrishna Hospital, Coimbatore, Tamilnadu, India from July 2004-June 2005.

Informed consent was obtained and the patients were treated after prior referral from the physician. Before commencing with the recording and treatment, self - demonstration was performed and ensured that the patients understood it. The patients were evaluated twice weekly for eight weeks and were instructed to do the exercises at home also.

Inclusion

Patients referred to physiotherapy through the Department of Pulmology and Critical Care, Sri Ramakrishna Hospital, Coimbatore with diagnosis of chronic obstructive pulmonary disease with stable clinical signs, forced expiratory volume in 1 second (FEV1) = 30 - 49% predicted and stated as moderate COPD were considered for ranged between the study and allocated to both groups. Both male and female patients age 40 - 50 years.

Exclusion

Patients with pulmonary hypertension, left ventricular dysfunction, infectious diseases and severe dyspnea, patients underwent CABG, patients with acute exacerbations were not considered and also no formal Pulmonary Rehabilitation with the past 12 months.

The following parameters were assessed for the outcome.

- Dyspnea grade using Borg scale of rate of perceived exertion (RPE).
- Quality of life using Clinical COPD Questionnaire(CCQ)

Exercise Training

If the exercise training intensity is of 90% of HRmax, then it may be considered as high intensity. An exercise heart rate of 70% maximum represents exercises with little or no discomfort may be designated low intensity exercise or calisthenics.

In this study, shuttle walking is considered as high intensity training for 30 minutes and chair exercises for 30 minutes are considered as low intensity training or calisthenics.

DISCUSSION

By reviewing the clinical presentation of COPD patients, they had decreased exercise tolerance, breathlessness on exertion and also during various activities. These may lead to functional impairment and reduced health status. To overcome this, these patients were included in a pulmonary rehabilitation program to modify their quality of life and to reduce breathlessness during various activities.

In the pulmonary rehabilitation program, both the high and low intensity trainings incorporated. These two exercise training was focused towards the improvement of exercise endurance and reduce breathlessness during rest and activities. The two methods of training showed improvements in parameters of dyspnea and quality of life, but low-intensity training produced better result in perception of dyspnea clinically and statistically than high-intensity training.

Inspite of the proper instructions in training and education in aspects of smoking cessation, some of the patients smoked during the training period. This might have interfered with the improvement. However the 't' value (independent and dependent) for parameters of dyspnea and quality of

TABLE - 1 DEPENDENT t TEST-CCQ Score

| GROUP | MEAN | t value |
|---------|------|---------|
| Group 1 | 6.2 | 7.88 |
| Group 2 | 3.6 | 4.90 |

TABLE - 2 DEPENDENT 't' TEST- RPE SCORE

| GROUP | MEAN | t value |
|---------|------|---------|
| Group 1 | 3.8 | 11.65 |
| Group 2 | 2.4 | 7.5 |

TABLE -3 INDEPENDENT t TEST-RPE SCORE (Group1 and Group 2)

| S.D. | t value |
|------|---------|
| 1.31 | 2.917 |

TABLE-4 INDEPENDENT t TEST-CCQ Score (Group1 and Group 2)

| S.D. | t value |
|------|---------|
| 2.97 | 2.389 |

life, using RPE Score and CCQ Score respectively has been quite significant at $p=0.05$, indicating that the significance is not at the value of $p=0.01$ and that the 't' value is higher than the table value for both the groups in dependent and independent 't' test. Moreover, the patients performed these exercises with more dyspnea initially and, after intervention, the perception of dyspnea was reduced significantly in both the groups. But the low-intensity training group patients had greater ease than high-intensity training because these exercises are performed at sub-maximal intensity. Quality of life was improved both clinically and statistically in both the groups, and all the patients had no discomfort while doing functional activities. This study mainly focused on outpatient pulmonary rehabilitation and so there was less cost to the patient. These exercises are performed easily without any need of equipment and

hence these two methods are cost effective and economical.

CONCLUSION

The outcome of the statistical analysis and literature review reveals that the two exercise training programs improve exercise reconditioning in COPD patients. These two training programs reduce breathlessness and improve health status.

Hence, based on the outcome of the dependent 't' test and independent 't' test and their values being higher than the table value at $p=0.05$, it is concluded that the null hypothesis is excluded, thereby accepting the experimental hypothesis. Thus, the study is stated in the light of experimental hypothesis be

“ There is significant improvement in dyspnea and quality of life in COPD patients using two ex-

ercise training programs. Low-intensity training is effective in aspect of decreased exertional dyspnea than high-intensity training.”

LIMITATIONS AND RECOMMENDATIONS

1. Older age people were excluded but may be included in further studies.
2. Gender specific factors can also be considered because most of the male patients had a smoking habit and some had withdrawn during the study period. This might have altered the study.
3. This was a time-bound, small group, and a cost-effective study. Further studies could be achieved by taking a larger sample with more parameters and a follow-up of one year.
4. In spite of these barriers, the pulmonary rehabilitation program has got its own value and efficacy in modifying the quality of life and health status in COPD patients.
5. Based on this study, we recommend that Exercise Training may improve the endurance and exercise tolerance and reduce breathlessness in COPD patients, provided they can be taken along with other chest physical therapy techniques.
6. In developing countries like India, the pulmonary rehabilitation program may also be included in the treatment regimen to improve exercise conditioning for COPD patients.

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Calculate CCQ scores

Symptom Score

CLINICAL COPD QUESTIONNAIRE FOR MEASURING QUALITY OF LIFE

Name : _____ **Date :** _____

I.D.No: _____

Age : _____ **Sex:** _____

Please check the number of the response that best describes how you have been feeling during the past week.
(Only one response for each question.)

| On Average, during the past week, how often did you feel: (symptom score) | Never | Hardly ever | A few times | Several times | Many times | A great many times | Almost all the time |
|---|-------|-------------|-------------|---------------|------------|--------------------|---------------------|
| 1. Breathlessness at Rest? | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2. Breathlessness doing physical activities? | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 3. Concerned about getting a cold or your breathing getting worse? | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 4. Depressed (down) because of your breathing problems? | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

| On average during the past weeks how limited were you in these activities because of your breathing problems (Functional score) | Never | Hardly ever | A few times | Several times | Many times | A great many times | Almost all the time |
|---|-------|-------------|-------------|---------------|------------|--------------------|---------------------|
| 5. Daily activities such as washing yourself, dressing. | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6. Minimal activities such as gardening, upper limb & lower limb exercises, cleaning house. | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 7. Moderate physical activities, such as carrying weights, climbing stairs. | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. Strenuous activities such as cycling, jogging, shuttle walking | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

Functional state score

APPENDIX II

Chair exercises:

1. Head up and down (chin to chest)
2. Turn head to right and then left
3. Ear to shoulder (right and left)
4. Biceps curls (arms over side of chair with palms facing forward, bend elbow and raise hands up)
5. Shoulder circles (arms over side of chair, circle shoulders front and back)
6. More circles (hands on shoulders, circle front and back)
7. Arm stretch (arm straight up, then reach for center of back, right and left)
8. Wrist circles
9. Ankle circles (with leg extended)
10. Flex and point the toes (with leg extended)
11. Chest press

- 4 Shoulder exercise (arms over the side of a chair, with arms extended raise them up and down)
- 5 Arm exercise (arms in front extended, raise them up and down)
- 6 Arms beautiful (standing, elbows in, weights to shoulders, press back then bring back up to shoulders)

Sticks
River dance (raise sticks up, over to the side [rotating right and left], back up and down on lap for 2 min)

Standing exercises:

- Weights
- 1 Biceps curls (elbows in toward body, palms facing forward, raise arms up)
 - 2 Wrist curls (with arms over the sides of a chair)
 - 3 Triceps exercise (using both hands bring weight over head then to the back)
1. Circle torso over top of legs
 2. Bend forward (back straight) then back
 3. Crescent stretch (reach over head to side with right arm, then left)
 4. Shoulder/chest stretch (clench hands in back, then bring shoulders back)

5. Clench hands in front, turn toward right then left
6. Calf raises
7. Quarter knee bends
8. Leg lifts to side
9. Lunge stretch (both heels on ground, front knee bent)
10. Reach for stars
11. March in place with fingertip taps (30 s)