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To compare the effect of upper limb induced breathing exercise in reverse pattern v/s breathing exercise in normal pattern on dyspnea, pulmonary function and quality of life in COPD

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is the most common chronic lung disease. Patient mainly complain of dyspnea, tiredness, decreased exercise tolerance and decreased physical activity (PA), which leads to a poorer health-related quality of life (HRQOL). Upper limb exercises with breathing maneuver improves dyspnea, lung functions and quality of life. Upper limb induced breathing exercise in reverse pattern may also have a positive effect on dyspnea, lung functions and quality of life.

Objective: The main aim of this clinical study is to find out the effect of upper limb induced breathing exercise in reverse pattern on dyspnea, pulmonary function and quality of life in COPD patients.

Settings and Study Design: An experimental study conducted on COPD patients, selected from out-patient department of respiratory medicine, MYH Hospital, Indore (M.P.)

Materials and Methods: 49 COPD patients were participated in the experimental study, underwent treatment duration for 6 weeks after giving their informed consent. The age range 40- 50 years were allocated in two groups – group A and group B, in group A there were 26 patients participated and group B there were 23 patients participated in the study. Group A patients received upper limb induced breathing exercise in reverse pattern and group B patients received upper limb induced breathing exercise in normal pattern. Both groups received conventional physiotherapy. The pre and post evaluation were measured between inter and intra group and compared the groups with each other.

Data Analysis: Statistical package for social sciences (SPSS) version 25.0 was used for data analysis in this study. Data with p-value below 0.05 were considered to be significant. Independent, paired t-test were used to analyse the variance between pre and post training period.

Result: After 6 weeks intervention, there is a significant effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on quality of life in COPD patients and the result shows that the quality of life significantly improves in Group A but it was insignificant in group B. Mean value of quality of life in post evaluation of Group A is 1.04 and Group B is 1.28. There is a significant difference between mean. Calculated t-value is 2.13 which is significant at degree of freedom 47 and 0.05 level of significance because calculated t-value is greater than tabulated t-value 2.05. However, the FEV1 and FVC both significantly improves in both groups but more improved in group B. Dyspnea and FEV1/FVC ratio was insignificant in both groups.

Conclusion: The result indicates Upper limb induced breathing exercise in reverse pattern with conventional physiotherapy is more effective than breathing exercise in normal pattern with conventional physiotherapy on Quality of life in COPD patients. The other parameters like FEV1 and FVC significantly improved in both groups. There was no significant improvement on dyspnea and FEV1/FVC ratio. So, it could be considered as a good strategy to improve quality of life in COPD.

Keywords: Chronic obstructive pulmonary disease (COPD), HRQOL, SPSS

Introduction

Chronic obstructive pulmonary disease (COPD) is the most common chronic lung disease which is preventable and treatable but not fully reversible. It is mainly characterized by airflow limitation, which is usually persistent and progressive [1]. Inflammation of airways like bronchitis, bronchiolitis and damage in alveoli like emphysema.

This abnormality causes airflow obstruction which is progressive and persistent. The symptoms include Breathlessness (dyspnea), Cough with or without expectoration, and they may experience acute events which are characterized by acute exacerbations and respiratory issues that may affect their health and need specific preventive and therapeutic measures.

COPD occurs due to gene (G)- environment (E) interactivity occurring over the course of lifetime (T) (GET omics). This can damage and alter the lung function and its normal development [3]. The main environmental exposed factors those who leads to COPD are tobacco smoking, toxic particles and gases which are inhaled from surrounding environment like outdoor and household air pollution which can also contribute to it.3 The most documented genetic risk factor identified in COPD patients is mutations in SERPINA1 gene, which is hereditary and it will leads to α -1 antitrypsin deficiency, people who are suffering from this are at risk of COPD [5]. Although only a small part of the world's population of COPD are relevant to α -1 antitrypsin deficiency (AATD) deficiency, it demonstrated that the interaction between genes and environmental exposures are the predisposing factor of an individual to COPD.

According to WHO, COPD will become the 3rd leading cause of death and the 5th commonest cause of illness in the world by 20307 and 90% of deaths happens in low and middle economic countries. In India the prevalence of COPD is 7.4%. There are number of evidence based on systemic reviews and meta- analysis provides the prevalence of COPD considerably higher in active smokers and ex-smokers when it compares to non- smokers, and according to age the prevalence rate is higher and ≥ 40 years of age and higher in men compared to women.

Need of study

COPD is the main concern of chronic morbidity and mortality to those who suffer from this disease for years and dies too early because of it or its complications. Globally, the burden of COPD is estimated to increase over the next decade because of constant exposure to the risk factors and ageing of the population. The commonest symptom of COPD is decreased physical exercise capacity compared with healthy people. Those patients who have severe symptoms can relate to major difficulty during activities especially when they do unsupported upper limb activities.45 Upper limb exercises are frequently used in respiratory physiotherapy, with UL elevation and controlled inspiratory timing but at the time of flexion, the accessory muscles are engaged to sustain the shoulder girdle. So, it cannot participate in the inspiration which leads to diaphragm overloading and will cause premature dyspnea and muscle fatigue.

Previously various approaches and techniques were used to treat the COPD. There are very little evidences and research showing that the upper limb-induced breathing exercise in the reverse pattern is helpful in COPD. Hence, there is a need for a study to determine the effectiveness of upper limb-induced breathing exercises in a reverse pattern along with conventional physiotherapy on dyspnea, pulmonary function and quality of life in COPD patients.

Significance of the study

The finding of the present experimental study will explain the effect of upper limb induced breathing exercise in

reverse pattern on dyspnea, pulmonary functions like FEV1, FVC and FEV1 /FVC and quality of life in patients with COPD. The researcher can find the more effective physiotherapy management for COPD. It can be adjunct to the standard conventional treatment modes currently available, thereby facilitating better management of the condition.

Materials and Methods

Study design: Experimental study

Study Setting: The study was conducted at Maharaja Yashwant Rao Govt. Hospital, Outpatient department of Respiratory Medicine and outpatient department of physiotherapy, Indore (Madhya Pradesh, India).

Sample Size - 60 (N=60)

Study tools

1. Paper and pen, pencil
2. Couch
3. PFT Machine

Study participants

Based on the inclusion and exclusion criteria N=60 patients were selected for the study. Further, the patients were randomized into two groups, thirty in each group. Group A patients were assigned for upper limb induced breathing exercise in reverse pattern with conventional physiotherapy and Group B patients were assigned for upper limb induced breathing exercise in normal pattern with conventional physiotherapy, respectively. The procedure, risks, contraindication and benefits of the study and their rights were clearly explained to the participants included in this study. Prior to conducting the study, the patients were asked to fill and sign the consent form. In addition, the patients were also requested to notify in case of any discomfort.

Inclusion criteria

- Both Male and female
- Age between 40-50 years
- Mild: FEV1 $\geq 80\%$ predicted. (Post bronchodilator)
- Moderate: $50\% \leq$ FEV1 $< 80\%$ predicted (post bronchodilator)
- Patients who have signed the consent form

Exclusion criteria

- Active smokers
- Uncontrolled pulmonary hypertension
- Patients with pneumothorax or rib fracture
- Incapacity to follow a standard rehabilitation program (locomotor deficits, acute cardiac failure, osteoporosis, lung cancer, acute exacerbation of COPD at the beginning of the program.

Study Duration

The study was conducted for a period of one year.

Sampling Method

The patients were already diagnosed with COPD by the consultant doctor, the purposive sampling method was used for selection of the samples.

Study Variables

Following are the variables that were examined to achieve the objectives of the present study:

Independent Variables

Upper limb induced breathing exercise, pursed lip breathing, diaphragmatic breathing, forced expiratory technique (huff).

Dependent Variables: Pulmonary function test, Modified Medical Research Council Dyspnea scale, Clinical COPD questionnaire.

Outcome Measures

Pulmonary Function Test: Pulmonary function tests (PFT's) are breathing tests to find out how well move air in and out of your lungs and how well oxygen enters to blood stream. The most common PFT's are spirometry, diffusion studies, and body plethysmography. Sometimes only one test is done, Spirometry is one of the most commonly ordered tests of lung function.

Modified Medical Research Council Dyspnea Scale: The modified Medical Research Council (mMRC) scale is a five-level rating scale based on the patient's perception of dyspnoea in daily activities.

Clinical COPD Questionnaire: The Clinical COPD Questionnaire (CCQ) measures health status and can be

used to assess health-related quality of life (HRQL). The CCQ consists of 10 items (each scored between 0 and 6), divided into three domains (symptoms, functional, mental). The total score is calculated by summing the scores of the individual items and dividing by 10 (the number of individual items) giving a total score between 0 and 6 with higher scores representing worse HRQOL.

Observation and Result

Table 1: Comparison of BMI of Group A and Group B.

Group	N	Mean	S.D.	t-value	p-value
A	26	23.28	1.89	1.16	0.25>0.05
B	23	23.85	1.45		

Table no. 1 shows the results of Comparison of BMI of group A and group B. Mean value of BMI of group A and group B are 23.28 and 23.85. There is no significant difference between mean. Calculated t-value is 1.16 which is not significant at degree of freedom 47 and 0.05 level of significance because calculated t-value is less tabulated t-value 2.05.

So according to the analysis BIM of both Group are same.

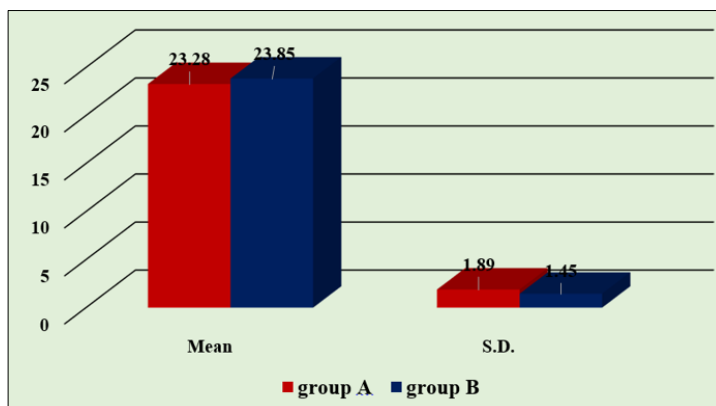


Fig 1: Shows the result of comparison the BMI of Group A & Group B

Table 2: Comparison of Age of Group A and Group B.

AGE	Mean	S.D.
Group A	46.3	9.6
Group B	46.6	2.5

Table no. 2 shows the results of Comparison of Age of group A and group B. Mean value of Age of group A and group B are 46.3 and 46.6 and standard deviation are 9.6 and 2.5 respectively. There is no clinically difference between mean.

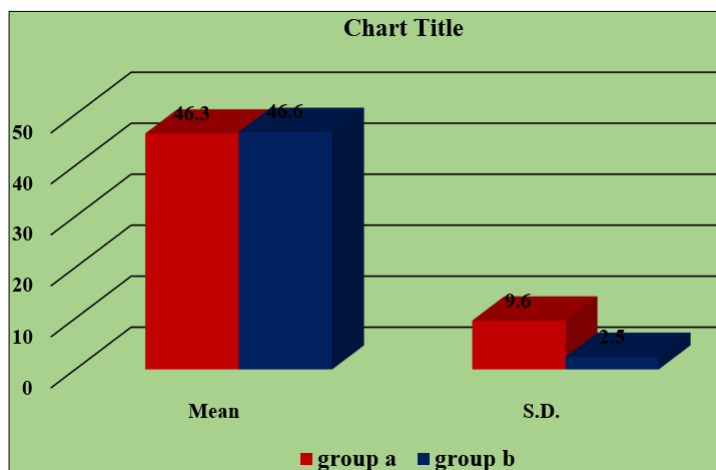


Fig 2: shows the results of Comparison of Age of group A and group B. Mean value of Age of group A and group B are 46.3 and 46.6 and standard deviation are 9.6 and 2.5 respectively.

Table 3: Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Dyspnea in COPD patients.

GROUP	N	Mean	S.D.	t-value	p-value
A Pre	26	2.08	0.98	1.23	0.22>0.05
A Post	26	1.77	0.81		

Table no. 3 shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on dyspnea in COPD patients”.

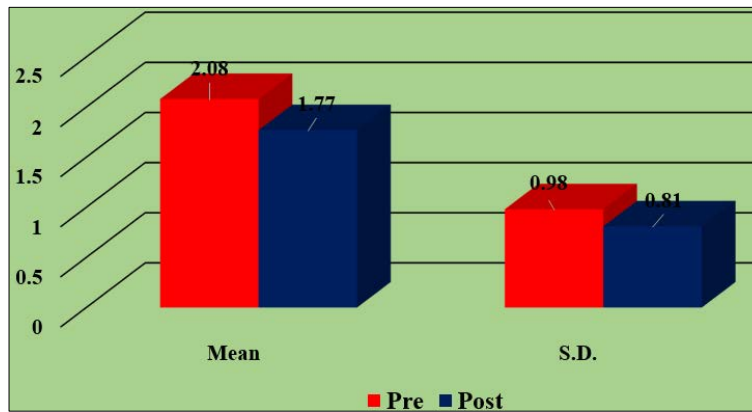


Fig 3: shows the effect shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on dyspnea in COPD patients

Table 4: Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Forced Expiratory Volume (FEV1) in COPD patients

GROUP	N	Mean	S.D.	t-value	p-value
A Pre	26	1.24	0.42	2.07	.04<0.05
A Post	26	1.46	0.36		

Table no. 4 shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Forced Expiratory Volume (FEV1) in COPD patients”. Mean value of Forced

Mean value of dyspnea scale in pre and post condition of group A are 2.08 and 1.77. There is no significant difference between mean. Calculated t- value is 1.23 which is not significant at degree of freedom and 0.05 level of significance because calculated t-value is less tabulated t-value 2.05.

So according to the analysis there is no significant effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on dyspnea in COPD patients.

Expiratory Volume in one sec. (FEV1) in pre and post condition of Group A are 1.24 and 1.46. There is a significant difference between mean. Calculated t-value is 2.07 which is significant at degree of freedom 50 and 0.05 level of significance because calculated t-value is greater than tabulated t-value 2.05.

So, there is a significant effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Forced Expiratory Volume in one second (FEV1) in COPD patients.

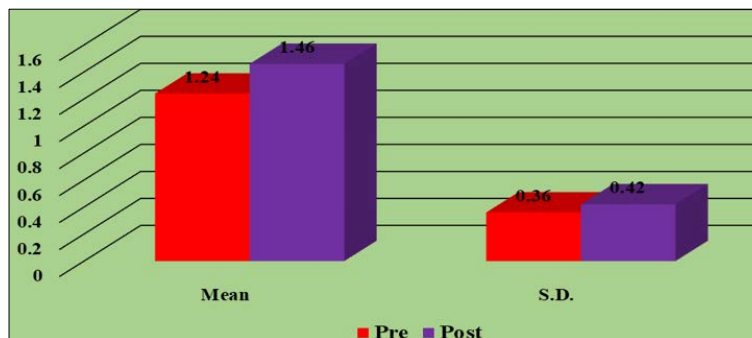


Fig 4: shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Forced Expiratory Volume (FEV1) in COPD patients

Table 5: Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Force Vital Capacity (FVC) in COPD patients.

GROUP	N	Mean	S.D.	t-value	p-value
A Pre	26	2.25	0.54	2.98	.004<0.05
A Post	26	2.77	0.73		

Table no. 5 shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Force Vital Capacity (FVC) in COPD patient.

in COPD patients”. Mean value of Force Vital Capacity (FVC) in pre and post condition of Group A are 2.25 and 2.77. There is a significant difference between mean. Calculated t-value is 2.98 which is significant at degree of freedom 50 and 0.05 level of significance because calculated t-value is greater than tabulated t-value 2.05.

So, there is a significant effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Force Vital Capacity (FVC) in COPD patient.

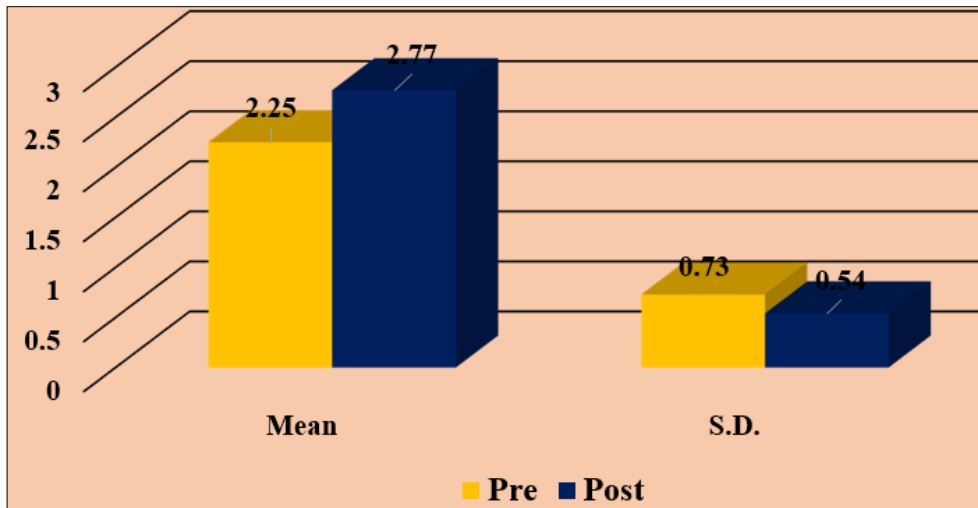


Fig 5: Shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on Force Vital Capacity (FVC) in COPD patients.

Table 6: Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on (FEV1)/ (FVC) ratio in COPD patients.

GROUP	N	Mean	S.D.	t-value	p-value
A Pre	26	53.49	8.69	1.55	.12>0.05
A Post	26	57.11	8.12		

Table no. 6 shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on (FEV1) /(FVC) ratio in

COPD patients”. Mean value of (FEV1)/(FVC) ratio in pre and post condition of Group A are 53.49 and 57.11. There is no significant difference between mean. Calculated t-value is 1.55 which is not significant at degree of freedom and 0.05 level of significance because calculated t-value is less tabulated t-value 2.05.

So, there is no significant effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on (FEV1) /(FVC) ratio in COPD patients

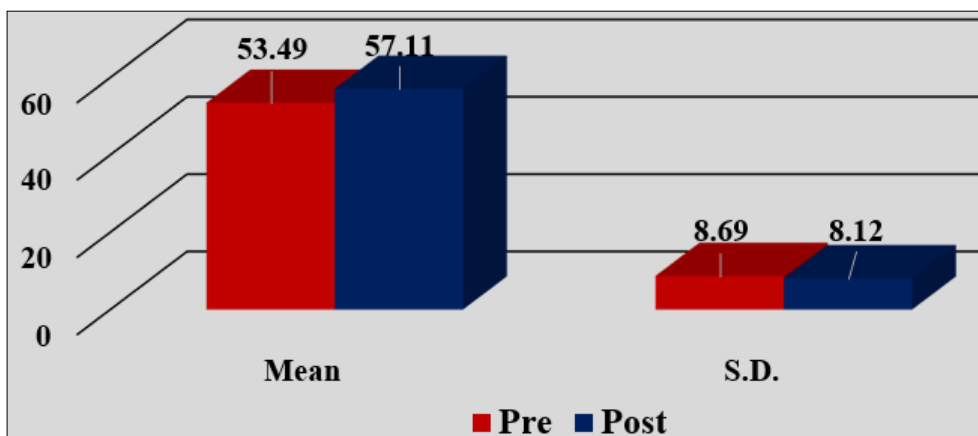


Fig 6: shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on (FEV1) /(FVC) ratio in COPD patients”.

Table 7: Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on quality of life in COPD patients

Condition	N	Mean	S.D.	t-value	p-value
Group A Pre	26	1.84	0.54	6.54	.00001<0.05
Group A Post	26	1.04	0.30		

Table no. 7 shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on quality of life in COPD

patients”. Mean value of quality of life in pre and post condition of Group A are 1.84 and 1.24. There is a significant difference between mean. Calculated t-value is 6.54 which is significant at degree of freedom 50 and 0.05 level of significance because calculated t-value is greater than tabulated t-value 2.05.

So, there is a significant effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on quality of life in COPD patients.

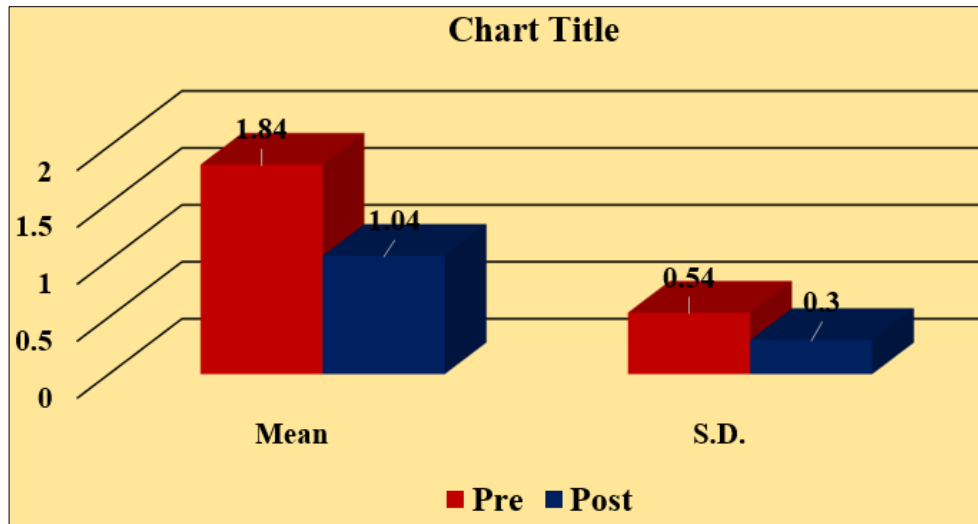


Fig 7: shows the results of “Effect of upper limb induced breathing exercise in reverse pattern with conventional physiotherapy on quality of life in COPD patients

Discussion

The findings of the study revealed that the upper limb induced breathing exercise in reverse pattern (Group A) showed significant improvement in Quality of life ($p=0.0001$) and pulmonary parameters like FEV1 ($p=0.04$), FVC ($p=0.004$). Similarly, Group B showed improvement in pulmonary parameters like FEV1 ($p=0.00052$), FVC ($p=0.03$). There was statically significant difference in quality of life ($p<0.03$) and pulmonary parameters like FEV1 ($p<0.03$) and FVC ($p<0.03$). While there was no statically significant difference in FEV1/FVC ratio and dyspnea on comparison between the two group results. This suggests that upper limb induced breathing exercise in reverse pattern is more effective in improvement of quality of life than upper limb induced breathing exercise in normal pattern in COPD patients.

HRQOL is very important parameter that measures the effect of a disease on functioning of patients in day-to-day life. In the current study researcher used Clinical COPD Questionnaire which evaluates severity of symptom, functional status as well as mental status. the thoracoabdominal asynchrony was seen in COPD patients which was arising due to inefficient work of respiratory muscle during upper limb movement, because of that the quality of life of COPD patient was compromised but upper limb induced breathing exercise in reverse pattern minimize the asynchrony and avoid the diaphragmatic overloading, so that patient can not feel discomfort during daily living activities such as combing hair, brushing, bathing etc. Similarly in the present study the researcher included upper limb induced breathing exercise in reverse pattern and the results shown significant improvement in quality of life. So, according to the present study it can improves quality of life.

Conclusion

The result concluded that, there was significant effect of upper limb induced breathing exercise in reverse pattern in COPD patients on CCQ (Quality of life), which represent better result. The statistical analysis suggested that the measurement value of FEV1, FVC shows improvement in both groups and dyspnea was not significantly improved in both the groups. So, the study suggests implementation of the upper limb induced breathing exercise in reverse pattern

could be beneficial for COPD patients to improve their quality of life.

Limitations

1. The sample size was small
2. Male and female COPD patients were not equally distributed in the study.
3. The rehabilitation program was a short period of only 6 weeks.
4. Gender wise evaluation was not done.
- 5- Exercises was done only once in a day
5. There was only three parameters FEV1, FVC, FEV1/FVC ratio were taken in pulmonary function test.
6. Only two stages of COPD were taken in the study.

Suggestion and future recommendations

1. For further studies, it may be suggested that the rehabilitation program could be more than 6 weeks, so that proper results would be evaluated
2. If the study will be done for more than 6 weeks, then perhaps the improvement can be seen in dyspnea and FEV1/FVC ratio
3. For further studies, it may be suggested that the sample size should be large for better results
4. The weightage of male and female should be equal so that the result will not be bias.
5. This study was conducted on both male and female, but future studies can be conducted on gender basis for specific results.
6. Only two stages were included in the study, so to get more specific results work can be done on all stages of GOLD criteria of COPD individually

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