"EFFICACY OF ACBT WITH AND WITHOUT INCENTIVESPIROMETRY ON OXYGEN SATURATION ON ROOM AIR AND RATE OF PERCIEVED EXCERTION IN COPD INDIVIDUALS - A COMPARATIVE STUDY."

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ABSTRACT:

TITLE OF THE STUDY: Efficacy of ACBT with and without incentive spirometry on spo2 on room air and RPE in COPD individuals –a comparative study

OBJECTIVE: The purpose of the study was to determine the efficacy of ACBT with and without incentive spirometry on RPE and SPO2 on room air in known COPD individuals. 30 patients according to the inclusion and exclusion criteria were selected.

METHODOLOGY: Participants were randomly allocated into two groups. The two groups were as follows:
GROUP A: (ACTIVE CYCLE OF BREATHING TECHNIQUES) Had 15 individuals who received 10-15 minutes of ACBT.
GROUP B: (ACBT WITH INCENTIVE SPIROMETRY) Had 15 individuals who received ACBT with incentive spirometry, 5-10 sets per session.

PROCEDURE: Intervention program for 2 weeks in which Group-A received active cycle of breathing technique and Group-B received ACBT with incentive spirometry. After the 2 weeks intervention posttest assessment was taken by using outcome measures of Borg scale.

RESULTS: Statistical analysis of the data showed both the groups A and B showed significant difference from pre to post intervention. But on comparing mean values of Group A & B, Group B (ACBT with incentive spirometry) showed more improvement than Group A (only Active cycle of breathing technique).

CONCLUSION: The findings suggest that ACBT with incentive spirometry is more effective in improving the Inspiratory volumes and Oxygen saturation levels and airflow limitation.

INTRODUCTION:
COPD is a long-term respiratory condition characterized by airflow obstruction that is not fully reversible. The air flow obstruction does not change markedly over several months and is usually progressive. COPD is predominantly caused by smoking, other factors, particularly occupational exposures such as harmful dust and chemicals, may also contribute to developing COPD[19].

In the normal lung, secretions protect the airway from inhaled irritants, in a blanket that is constantly in motion. Mucociliary activity, normal breathing cycles, and cough are the primary mechanisms of removing secretions from the lung. In disease, increased secretion viscosity and volume, dyskinesia of the cilia, and ineffective cough combine to reduce the ability to clear secretions, and may increase exacerbations and infections[9].COPD is the presence of a chronic productive cough for 3 months in each of two successive years. Airway obstruction is caused by inflammation and the non-specific bronchial hyper reactivity associated with chronic bronchitis. Emphysema which is defined in anatomical terms is the obstruction of the alveolar walls and permanent enlargement of the air spaces distal to the terminal bronchioles[14].
The ensuing loss of lung elastic recoil and intra luminal pressure in the terminal airways causes small airways to lose their patency, especially during forced expiratory maneuvers. The collapse of these airways causes airflow limitation independent of exertion. The air sacs in the lungs (alveoli) are damaged. Over time, the inner walls of the air sacs weaken and rupture- creating larger air spaces instead of many small ones. This reduces the surface area of the lungs and, in turn, the amount of oxygen that reaches your bloodstream. When you exhale, the damaged alveoli don't work properly and old air becomes trapped, leaving no room fresh, oxygen-rich air to enter.
Bronchiectasis is a disease state defined by localized, irreversible dilatation of part of the bronchial tree caused by destruction of the muscle and elastic tissue. Bronchial dilatation is associated with destructive and inflammatory changes in the walls of the

medium sized airways. It is usually due to a post infectious or systemic disorder is often complicated by gram – negative of mycobacterial infection and is more common in women than in men.
Bronchiectasis most frequently involves both the lower lobes, when the involvement is unilateral it affects the terminal bronchi and bronchioles and is more frequently seen on the left lingual and right middle lobe. Clinical manifestation includes productive cough, fever, shortness of breath, purulent voluminous expectoration with a fetid odor and occasional hemoptysis.
Patient typically present with persistent or recurrent cough and purulent sputum production patients with bronchiectasis can fill 240 ml (8 oz) glasses with their daily sputum production. People with COPD often have exacerbations, when there is a rapid and sustained worsening of symptoms beyond their usual day to day variations[28.]
People with the following conditions are considered to have risk factors for bronchiectasis such as Cystic fibrosis and chronic and inflammatory lung disease, severe lung infections, like tuberculosis, non-tuberculous mycobacteria (NTM) or pneumonia and repeated aspiration of things other than air, such as food particles, that causes damage to the lungs.
In the global burden of disease study conducted under the auspices of the WHO and the world bank , the worldwide prevalence of COPD in 1990 was estimated to be 9.34\1000 in men and 7.33\1000 in women. COPD is currently the fourth leading cause of death in the world. Other recent studies in patients with COPD with all GOLD (Global initiative for chronic obstructive lung disease) stages of disease showed bronchiectasis rates of 27% in 75 UK patients and 4% in 2,164 subjects in the multinational evaluation of COPD longitudinally to identify predictive surrogate endpoints (ECLIPSE) cohort[30.]

AIM OF THE STUDY:
Aim of the study is to compare the effects of ACBT versus ACBT with incentive spirometry on oxygen saturation on room air and rate of perceived exacerbation in known COPD patients.

OBJECTIVES OF THE STUDY:

To evaluate changes in oxygen saturation and generalized functions and inspiratory volumes in patients with COPD following a 2 weeks active cycle of breathing technique only.

To evaluate changes in oxygen saturation and functions and inspiratory volumes in patients with COPD following a 2 weeks ACBT along with incentive spirometry.

NEED FOR THE STUDY: Chronic obstructive pulmonary disease was investigated in previous studies with specific therapeutic interventions utilizing pulmonary rehabilitation techniques such as the breathing control, thoracic expansion exercises and the forced expiratory technique. However, the diagnostic categories for therapeutic interventions are often non-specific (or) poorly defined. Pulmonary symptoms were reported to have recurrence with following treatment: the results of therapeutic interventions may be improved on identifying the probable predominant source of symptoms. Few studies with specific criteria for diagnosing moderate COPD have utilized. The incentive spirometer is a physiotherapeutic intervention and demonstrated better reduction in symptoms with improved function as outcome.
Conventional treatments i.e active cycle of breathing technique for managing chronic obstructive pulmonary disease included pulmonary therapeutic techniques like breathing control, thoracic expansion exercises and forced expiratory techniques. Incentive spirometry systematically utilize component movements of respiratory muscles (inspiratory muscles) provocative testing in order to provide graded functional outcome the primary objective of this technique in to attempt to restore the dynamic balance between relative movement of the inspiratory respiratory muscles.
And surrounding mechanical interfaces thereby allowing respiratory muscle for strength promoting optimum physiological function Problem implementation of intended therapy may reduce the frequency of adverse response. Appropriate outcome measure Investigating pulmonary Physiological parameters may provide information on relative benefit and having with the incentive spirometry and determine the overall safety of the mode of intervention this aspect need to be explained as there is a death in literature for studies investigating the effects of incentive spirometer.
In the view of a live presented in the existing literature able diagnoses study with implementing interventions and intervening the role of incorporating remote pulmonary rehabilitation maneuver in chronic obstructive pulmonary disease a presentation is needed on adopting prognotive attitude developing of the intervention Will be flexible As in regular practice this helps to determine the Usefulness of a given intervention in regular are given clinical practice scenario Outcome select will be really went to Participants and health care professional The results obtained through this approach will have a direct relieve and to practice in a term of decision making and choosing among treatment options in setting where intervention are implemented. There are studies comparing active cycle of breathing technique and incentive spirometry with other forms of pulmonary rehabilitation like 6 minute walk test and autogenic drainage but there are no enough studies comparing ACBT with incentive spirometry to see whether incentive spirometry has any advantages over the active cycle of breathing techniques especially in patients with the RPE andSpO_2 values in COPD individuals hence this study is pursued to find out the efficacy of active cycle of breathing technique alone and ACBT combined with incentive spirometry in patients with COPD[15]

MATERIALS & METHODOLOGY:

Materials used:
- Flow oriented Incentive spirometer
- Pulse-oximeter

- Borge scale

Methodology:

sample size : 30 patients
sampling method : randomized sampling method
study type : experimental study
study population : males between ages 40 to 60 years
study period : 6 months
study area : Physiotherapy outpatient department, MNR medical hospital, Sangareddy.

Measurement procedure:

- The outcome measures were measured by an independent assessor who remains blinded to the treatment allocation.
- SPO2 and Rate of perceived exertion (RPE) were measured at the baseline and at the end of treatment of 2 weeks.

OUTCOME MEASURES:

Outcome measures were checked prior to the starting of the intervention program and after the end of the intervention program i.e., after the 2 weeks. The outcome measures used for this study were:

1. The borg scale is used to measure the intensity of breathlessness. A patient is asked to indicate his/her perceived breathlessness intensity along a 6 to 20 rating scale. Six is no exertion at all and 20 is maximal exertion2.
2. Pulse oximetry is used to measure the oxygen saturation

INCLUSION CRITERIA:

30 volunteers male and female patients of 40-60 years of age with Mild -moderate COPD were included in this study (coexistence of chronic disease, smoking habits)

EXCLUSION CRITERIA:

- Subjects with any cardiovascular impairments
- Musculoskeletal dysfunctions
- Neurological diseases
- Non- cooperative patients were excluded.

PROCEDURE:

The study proposal was reviewed and approved by concerned authorities and ethics committee. Then thirty patients were recruited from outpatient department of Sanjeevani college of physiotherapy, Sangareddy. The subjects were screened for inclusion and exclusion criteria and those who fulfilled the criteria were included for the study. An informed consent was taken from each participant. Patients were randomly assigned into two groups: - in which 15 subjects were allocated to Group-A and 15 subjects were allocated to Group-B, respectively. Subjects in Group-A received Active cycle of breathing technique and subjects in Group-B received ACBT with incentive spirometry as described for previous group. Total duration of the intervention was for two weeks with five sessions per week.

GROUP-A: Active Cycle of Breathing Technique

The Active Cycle of Breathing Technique includes Breathing control, Thoracic expansion exercise and Forced Expiratory Technique.

Breathing control

- Prepare the patient in a relaxed and comfortable position in which gravity assists the diaphragm, such as a semi-Fowlers position.
- The patient initiates the breathing pattern with the accessory muscles of inspiration (shoulders and neck musculature), start instruction by teaching the patient how to relax those muscles (shoulder rolls or shoulder shrugs coupled with relaxation).
- Diaphragmatic breathing enhance diaphragmatic descent during inspiration and diaphragmatic ascent during expiration.
- Physiotherapist assist diaphragmatic ascent by directing the patient to allow the abdomen to retract gradually during exhalation or by contracting abdominal muscles actively.
- Diaphragmatic descent is assisted by directing the patient to protract the abdomen gradually during inhalation.

Thoracic expansion exercise

These are also known as deep breathing exercises. The aim of these exercises is to get the air behind the sputum in the smaller airways.

- The subject were placed in a comfortable position and supported half lying position.
- Relax your chest and shoulders.
- Take a long, slow, deep breath in through your nose if you can
- Feel your ribs expanding as you breathe in.

- Breathe out gently like a sigh.
- Repeat 3-4 deep breaths. If you feel light headed go back to relaxed breathing.

Some people find it helpful to hold their breath for about 2-3 seconds at the end of breath in, before breathing out. Try the deep breathing exercises both with and without holding your breath. It was combined with chest shaking, vibration or chest clapping.

Forced Expiratory Technique (FET)

This technique consists of huffing and must be combined with breathing control. It helps to move secretions from the smaller to the larger airways from where they can be cleared more easily.

- The subjects were placed comfortably in relaxed half lying position or high sitting position.
- The patient is asked to perform two forced expiration (huffs) and period of breathing control.
- Breathing control given for 2 to 3 seconds was followed by expiration with open glottis.
- A medium sized breath is followed by a forced, but not violent, breath out. It should be made by squeezing the abdominal/tummy muscles while keeping the mouth and throat open.
- Coughing or huffing was performed according to the patient comfort[5].

GROUP B: Active Cycle of Breathing Technique along with flow-oriented incentive spirometry

In this group Active Cycle of Breathing Technique were provided as described above and flow-oriented incentive spirometry on SPO2 and RPE on room air in COPD patients.

INCENTIVE SPIROMETRY:

An incentive spirometer is a device that will expands the lungs by helping the patient to breathe more deeply and fully. This will help keep your lungs active throughout the patient recovery and prevents other complications.

- The subject was placed in a high sitting position or half lying position.
- Hold the incentive spirometer at eye level.
- After a quiet expiration, they were encouraged to take slow maximal inspiration through the mouthpiece of the device and to hold each breath for as long as possible.
- Corresponding to the inspiratory flow, the balls were lifted and kept suspended by the sustained inspiratory flow.
- The balls served as visible feedback of the inspiratory flow.
- The indicator doesn't stay between the arrows, patients are breathing either too fast or too slow.
- The patient was encouraged to use this flow-oriented incentive spirometer for 5-10 sets.
- After each set of 10 breaths, try to cough, coughing will help loosen or clear any mucus in your lungs[32].

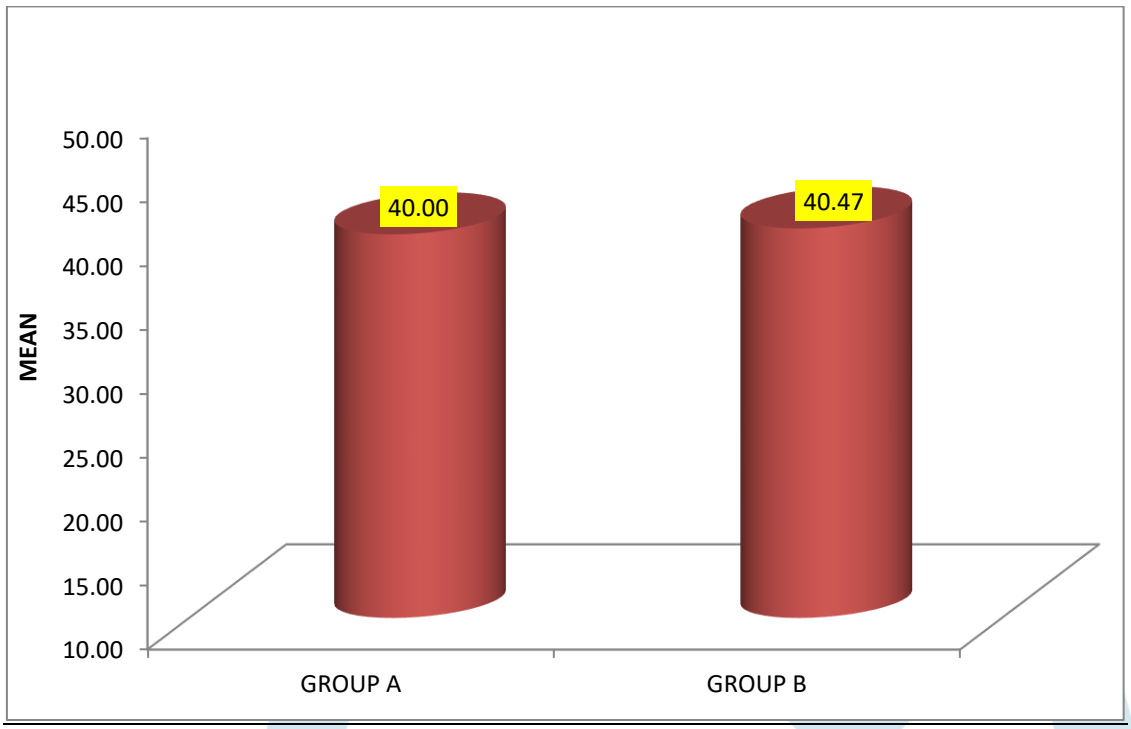
STATISTICAL ANALYSIS: All statistical analysis in this study was done using SPSS ver16.0. The general characteristics of the participants were expressed in terms of mean and standard deviation by using descriptive analysis. To comparison for within the group between pre and post intervention, paired t-tests were performed. And independent t-test was used for comparing differences between the groups. The statistical significance level was set at equal to or less than 0.05 for all tests.

AGE:

AGE	N	MEAN	STD.DEVIATION	STD.ERROR MEAN
GROUP A	15	40	8.15913	2.10668
GROUP B	15	40.4667	8.12287	2.09731

T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower Upper
AGE-.157	28	.876	-.46667	2.97268	-6.55593 5.6225

p> 0.05 no significant difference in the age between two groups.



BAR GRAPH SHOWING MEAN VALUES OF AGE BETWEEN GROUP A AND GROUP B

GROUP A

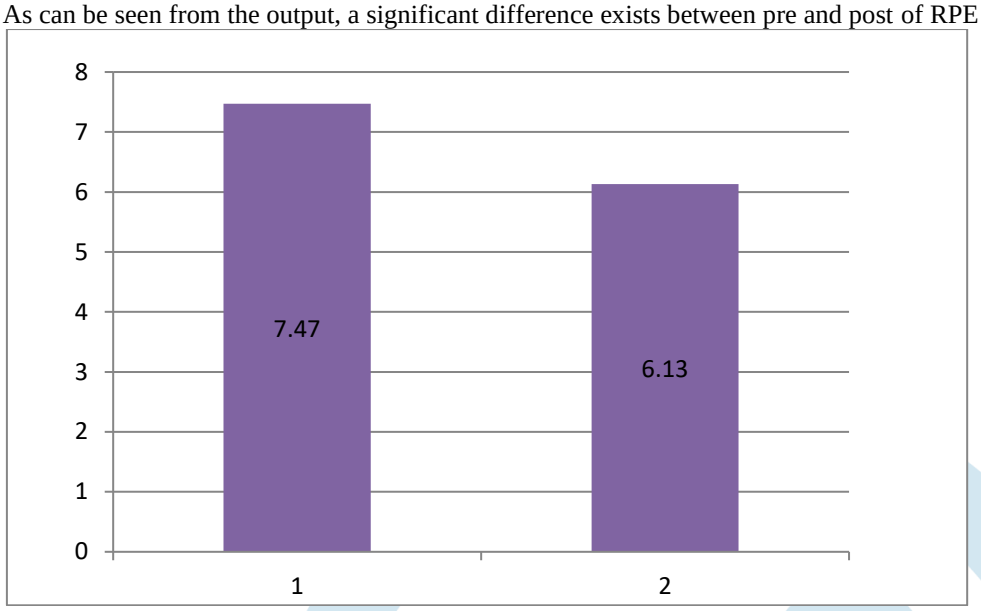
Paired sample statistics

GROUP A	MEAN	N	STD.DEVIATION	STD.ERROR MEAN
RPE PRE TEST	7.47	15	1.19	0.31
RPE POSTTEST	6.13	15	0.35	0.09
SPO2 PRETEST	89.8	15	1.47	0.33
SPO2POSTTEST	90.4	15	1.3	0.39

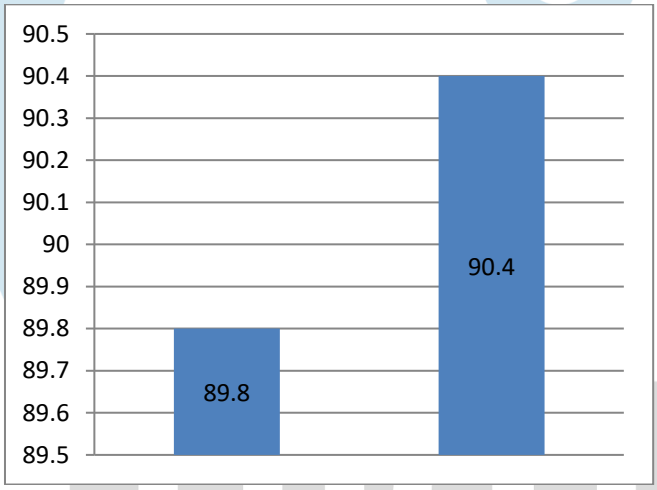
Paired samples test:

Group A	Paired differences					t	df	Sig.(2-tailed)
	Difference of mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
				Lower	Upper			
RPE pre test RPE post test	1.33	0.84	0.273	0.75	1.91	4.9344	0.270	0.0002
SPO2 pre test SPO2 post test	0.6	0.17	0.06	0.02	1.18	2.2014	14	0.0450

As can be seen from the output, a significant difference exists between pre and post of RPE and SPO2 of GROUP A



BAR GRAPH SHOWING PRE AND POST MEAN VALUES OF RPE IN GROUP A



BAR GRAPH SHOWING PRE AND POST MEAN VALUES OF SPO2 OF GROUP A

GROUP B:

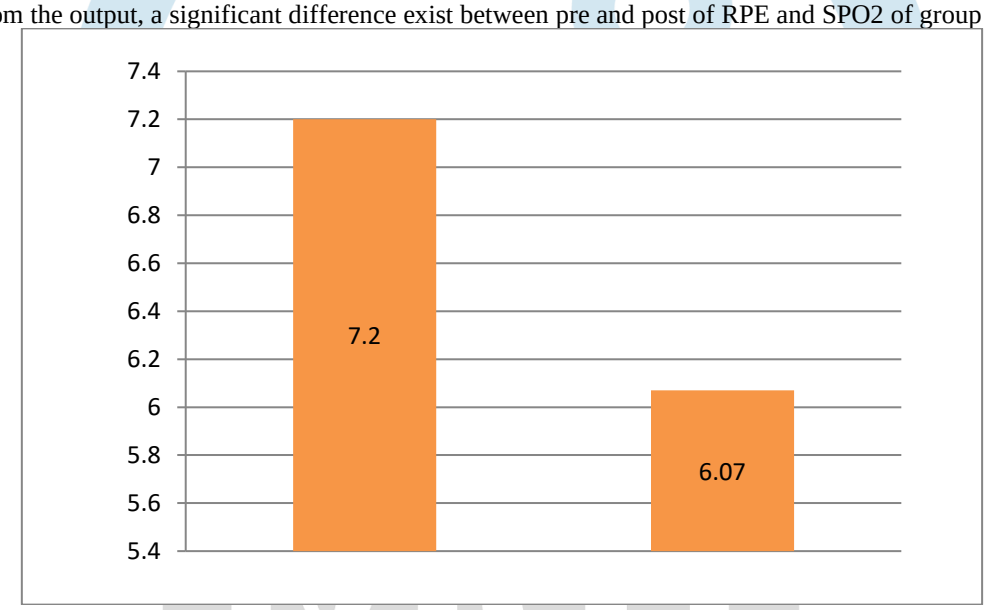
Paired samples statistics

GROUP B	Mean	N	Std.Deviation	Std.Error of Mean
RPE pre test	7.2	15	1.21	0.31
RPE post test	6.07	15	0.26	0.07
SPO2 pre test	90.47	15	1.51	0.39
SPO2 post test	91.8	15	1.79	0.46

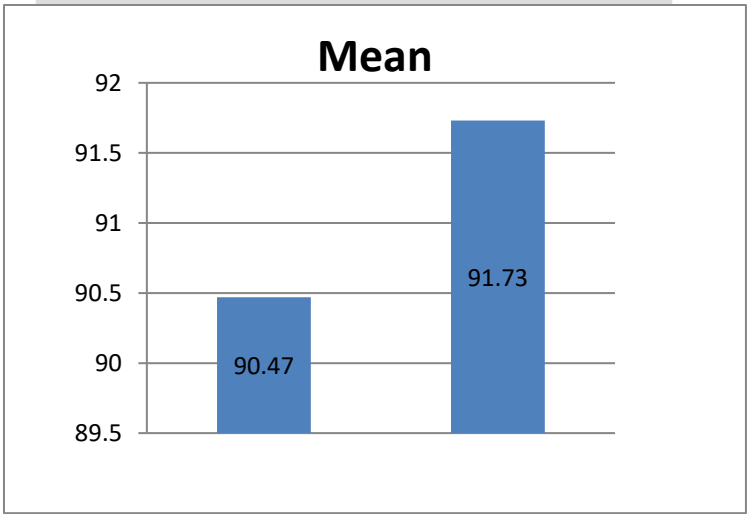
Paired samples test

GROUP B	Paired differences							
	Difference of Mean	Std. deviation	Std. Error mean	95%confidence interval of the difference		T	df	Sig(2-tailed)
				lower	upper			
RPE pre test	1.13	0.95	0.291	0.51	1.76	3.9001	14	0.00092
RPE post test SPO2 pre test SPO2 post test	1.26	0.28	0.300	0.62	1.91	4.2185	14	0.0009

As can be seen from the output, a significant difference exist between pre and post of RPE and SPO2 of group B.



BAR GRAPH SHOWING PRE AND POST MEAN VALUES OF RPE IN GROUP B

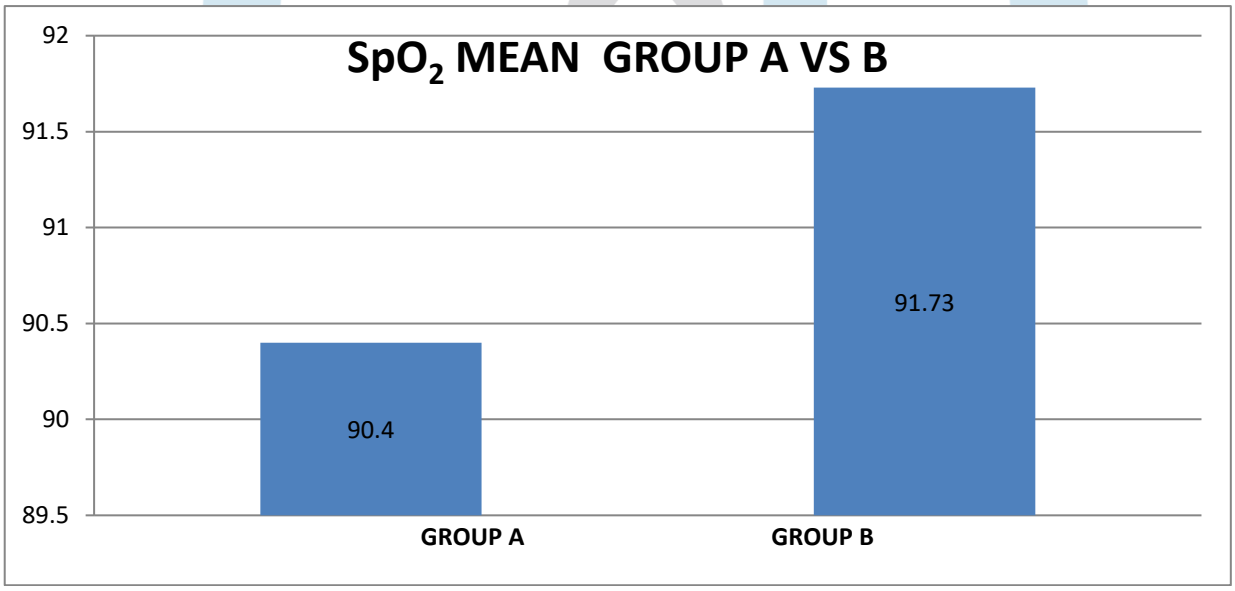


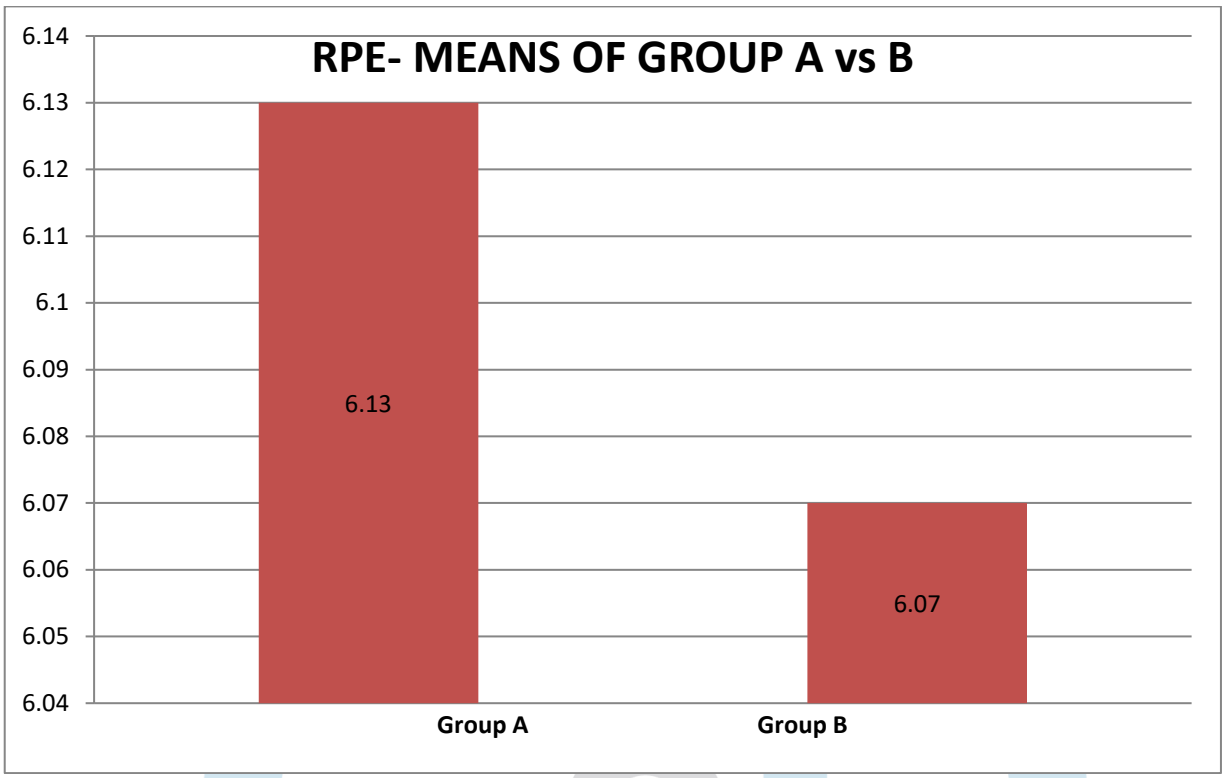
BAR GRAPH SHOWING PRE AND POST MEAN VALUES OF SPO2 IN GROUP B

Group A vs B

GROUP A GROUP B	Paired differences							
	mean	Std. deviation	Std. Error mean	95%confidence interval of the difference		T	df	Sig(2-tailed)
				lower	upper			
RPE								
GROUP A	6.13	0.35	0.09	-0.16	-0.16	0.5916	14	0.5589
GROUP B	6.07	0.26	0.07					
SPO2								
GROUP A	90.4	1.3	0.34					
GROUP B	91.73	1.79	0.46	-2.50	0.30	2.3340	14	0.027

As seen from the output, there is no significant difference exist between pre intervention values of GROUP A AND B of RPE and SPO2.
As seen from the output, there is a significant difference exist between post intervention values of GROUP A &B of RPE and SPO2.





BAR GRAPH SHOWING PAIRED TEST OF GROUP A & B PRE AND POST VALUES OF RPE AND SPO2

Group statistics:

Group	N	Mean	Std.deviation	Std.error mean
RPE pre test: Group A	15	7.46	1.19	0.31
Group B	15	7.2	1.21	0.31
RPE post test: Group A	15	6.13	0.35	0.09
Group B	15	6.07	0.26	0.07
SPO2 pre test: Group A	15	89.8	1.47	0.34
Group B	15	90.46	1.51	0.39
SPO2 post test:Group A	15	90.4	1.3	0.39
Group B	15	91.73	1.79	0.46

Mean values of outcome measures of Group A and B

Mean values	Group A	Group B
RPE pre	7.46	7.2
RPE post	6.13	6.07
SPO2 pre	89.8	90.46
SPO2 post	90.4	91.73

Statistical analysis of the data showed that is no significant difference of age exists between group A and B (p value >0.05). There is homogeneity maintained between the groups regarding the age. Data indicate that there is no significant difference exists between group A and B of RPE and SP02 pre.

There is significant difference exists between the pre and post of RPE and SPO2 of group A. There is significant difference exists between the pre RPE and SPO2 of group B. There is significant difference exists between the pre and post of RPE and SPO2 of GROUP A & B…

Both the groups A and B showed significant difference from pre to post intervention. But on comparing mean values of Group A & B, Group B (active cycle of breathing technique with flow oriented incentive spirometry) showed more improvement than Group A(active cycle of breathing technique).

RESULTS:

Statistical analysis of the data showed both the groups A and B showed significant difference from pre to post intervention. But on comparing mean values of Group A & B, Group B (ACBT with incentive spirometry) showed more improvement than Group A(only Active cycle of breathing technique).

DISCUSSION

This study objective is to determine relative effectiveness of Active Cycle of Breathing Technique(ACBT) when used in conjunction with flow oriented incentive spirometer for managing Chronic Obstructive Pulmonary Disease. Both the groups demonstrated statistically significant within group improvement in inspiratory volumes, dyspnea and health related quality of life. Active cycle of breathing technique in addition to the incentive spirometry was observed to be more advantageous compared to Active Cycle of Breathing technique alone.

The Active cycle of breathing technique for COPD typically includes Breathing control, thoracic expansion exercise(deep breathing exercise) and forced expiratory technique(FET) with open glottis. Incentive spirometer(IS) improves the pulmonary function, PAO2 and health related quality of life according to the previous research, it appeared dyspnea reducing effects and improving the pulmonary functions are seen with applying the Incentive spirometry to the patients who suffer from dyspnea. The effects of IS as an inspiratory muscle training device was evaluated in the present study. IS is designed to mimic natural sighing or yawning by encouraging the patient to take long, slow, deep breaths. Also, patient who have Chronic Obstructive Pulmonary Disease have effect on reducing the respiratory muscle endurance and increasing shortness of breath.

The result of the present study is that is that significant decrease in intensity of breathlessness and a significant increase in inspiratory volumes lowing incentive spirometry for two weeks, when compared to active cycle of breathing technique alone. Alev Atasever et al applied IS to patients with chronic obstructive pulmonary disease, the use of incentive spirometry appears to improve arterial blood gases and health related quality of life. Marie T. Williams applied Active cycle of breathing technique to patients with chronic lung disease, many times and observed that airway clearance to promote secretion movement through changes in thoracic pressure and airway dynamics. They noted that such as improved sputum clearance may lead to improved longer term health outcomes such as improved quality of life or reduced disease progression, after getting treatment. The active cycle of breathing technique is effective techniques in the clearance of mucus and improving the pulmonary function. The result of the present study was similar to that of the previous studies in the literature[21].

Ganeswara Rao Melam et al. reported that ACBT applied to the COPD patients enhanced their lung volumes and removal of secretions. This result indicates that ACBT improves the lung volume mainly FEV1, FVC and PEFR and removal of the secretions. Both the techniques are safe and equally effective in chest clearance and easy to use by the patients. This study used only three tools in detecting the improvement in moderate chronic obstructive pulmonary patients, studies can be done with other parameters like rate of perceived exertion and arterial blood gas analysis. This present study results showed that increased lung volumes. Compared to healthy persons, patients with moderate chronic obstructive pulmonary disease have reduced ability to control respiratory movements because of the weakening of the respiratory muscles[15].

However, in a meta-analysis evaluating the efficacy of IS, deep breathing and intermittent positive pressure breathing in the prevention of the post-operative pulmonary complications, IS and deep breathing exercises have been found to be more effective. Igarashi et al. assessed the effects of IS on pulmonary function and ABG in healthy adults of advanced age and in COPD patients. Both the control subjects and COPD patients showed significant decrease in alveolar-arterial oxygen gradient and increase in pulmonary function parameters and PaO2 values. In the present study, it was also able to be demonstrated that PaCO2 values decreased, while PaO2 and PAO2 values increased after the use of IS, It was concluded that IS improved inspiratory muscle performance and this led to an increase in minute ventilation. The goals of pulmonary rehabilitation programmes are mainly to improve the quality of life of the patients, rather than functional parameters.

Despite the possible benefits from Active Cycle of Breathing Technique, addition of Incentive Spirometry in Group B demonstrated relative treatement advantage which is worth noting. The magnitude of the functional disability and recovery following interventions reported by participants in the current study is much greater than that was reported in the earlier study utilizing Borg scale. Relative acuteness and higher intensity of presenting symptoms could have resulted in greater functional deficits. This is turn might have provided a better scope for recovery in function across groups[22].

LIMITATIONS:

- Limitations of the study are the subjects with wide range group between 40 to 60 years of age were considered for the, and hence results. Cannot be generalized to individual age
- Sample size was small
- There was lack of control group.
- No follow-ups were made after the final the final treatment and due to which the maintenance of the improved outcome or recurrence of the condition could not be assessed.

RECOMMENDATION FOR FURTHER STUDIES:

- Study should be carried out on larger population
- Follow up should be done to rule out the long term effectiveness of the treatment.
- Study can be conducted on different age groups.
- Changes in the treatment protocol can be done

CONCLUSION:

The findings suggest that ACBT with incentive spirometry is more effective in improving the Inspiratory volumes and Oxygen saturation levels and airflow limitation[14].

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