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Short Term Effect of Active Cycle Breathing Technique and Mechanical Vibration among the Patients with Chronic Bronchitis

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ABSTRACT

Objective: The purpose of this study was to evaluate the effect of ACBT and Mechanical Vibration on chest expansion among the patients with chronic bronchitis.

Methodology: It was a pre and post experimental design study. The patients diagnosed with chronic bronchitis which shows signs and symptoms and were requested to participate in study. The total number of patients 30 was enrolled in this study but on the basis of inclusion and exclusion criteria. Patients were equally divided into two groups, group A and group B respectively. Group A received ACBT and group B received mechanical vibration. Purpose of this study was explained to the patients. An informed consent was taken from each patient prior to participate in this study. This study was conducted at respiratory medicine ward and intensive care unit, CSS Hospital, Swami Vivekanand Subharti University, Meerut India.

Result: In both groups, p-value was significant i.e., $p<0.10$ with Chest expansion score (0.0000), (0.0000) and (0.0000). The 10 days protocol of ACBT and mechanical vibration showed difference in both group individually in improving chest expansion but group B, Mechanical vibration technique showed statistically more significant difference in improving chest expansion from 1st to 10th day.

Conclusion: 10 days, both chest physiotherapy techniques resulted in significant effect in both groups individually in improving chest expansion but group B received mechanical vibration technique showed statistically more significant difference in pre to post chest expansion score on consecutive day of protocol.

Keywords: .

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INTRODUCTION

Chronic bronchitis is a disease characterized by cough producing sputum for at least 3 months and for 2 consecutive years. Pathological changes include and increase the size of the tracheobronchial mucous glands and goblet cell hyperplasia. Chronic bronchitis results from long-term irritation of the tracheobronchial tree.[1] This is more common in middle to late adult life and in men more than women (ratio 5:1). Atmospheric pollution (e.g. cigarette smoking or coal dust) will predispose to the developmental of the disease and is more common in urban areas than rural areas.[2] The most common cause of irritation is cigarette smoking. Inhaled smoke stimulates the goblet cells and mucous glands to secrete excessive mucus. Other factors that have been implicated are air pollution certain occupational environments, and recurrent bronchial infections.[3]

The main clinical features are vesicular breathing with prolonged

expiration, inspiratory and expiratory rhonchi and crackles at the bases of lungs and later on six minutes walking test will give the disability.[4] On examination, sputum for culture and sensitivity and chest x-ray may be normal but some cases show increased bronchovascular marking.[5] FEV1 is reduced, FEV1/VC is subnormal, PEF is reduced, lungs volumes are normal except with emphysema and diffused lung capacity is normal while performing some specific tests.[6] In later stage, there will be chance of some complications such as type-l respiratory failure and type-ll respiratory failure, pulmonary arterial hypertension and cor pulmonale, secondary infections and Secondary polycythemia.

There are various approaches to handle the sign and symptoms of this condition. There are antibiotics, corticosteroids, bronchodilators, mucolytic agents, and oxygen therapy[7] etc. that help to minimize the severity of symptoms and improve the quality of life of patients. Chest physiotherapy is the term for a group of treatment designed to improve respiratory efficiency promote expansion of the lung, strengthen respiratory muscles, and eliminate secretions from the respiratory system.[8] Chest physiotherapy may be good option in terms in improving the lung as well as cardiopulmonary function.

Active Cycle Breathing Technique (ACBT) includes cycle of breathing control, thoracic expansion exercise, and forced expiratory technique. Diaphragmatic breathing is intended to help in using the diaphragm correctly while breathing strengthen the diaphragm, decrease the work of breathing by slowing the breathing rate and decrease the oxygen demand so that one can use less effort and energy to breathe.[9] The purpose of this study was to find out the comparative effect between ACBT and mechanical vibration among the patients with chronic bronchitis.

HYPOTHESIS

Experimental Hypothesis

There will be significant difference between the effect of ACBT and mechanical vibration among the patients with chronic bronchitis.

Null Hypothesis

There will be no significant difference between the effect of ACBT and mechanical vibration among the patients with chronic bronchitis.

METHODOLOGY

It was a pre and post experimental design study. The patients diagnosed with chronic bronchitis which shows signs and symptoms and were requested to participate in study. The total number of patients 30 was enrolled in this study but on the basis of inclusion and exclusion criteria. Patients were equally divided into two groups, group A and group B respectively. Group A received ACBT and group B received mechanical vibration. Purpose of this study was explained to the patients. An informed consent was taken from each patient prior to participate in this study. This study was conducted at respiratory medicine ward and intensive care unit, CSS Hospital, Swami Vivekanand Subharti University, Meerut India.

Selection criteria

Age between 40-70 year, gender both male and female, environmental and occupational pollution, presence of cough with expectoration, dyspnea, passive smoking, chest pain, chest tightness were included. Chest trauma, thoracic surgery, chest deformity, restricted lung disease, active smoking were excluded in this study.

Protocol

Mechanical Vibration

Mechanical chest vibrator is available to administrate the treatment and is useful for patient to clear the airway. The mechanical chest vibrator may be used on patient to the thoracic wall. Mechanical chest vibrator is proposed from to enhance mucocilliary transport from the periphery of the lung fields to the large airways.

Since vibration is used in conjunction to the effect of rate of secretion clearance and sputum production are increases. A mechanical vibrator are used most commonly respiratory condition patients, may be preferred by a caregiver to deliver long-term airway clearance. Treatment was given under the supervision, given twice a day. Treatment duration 20 to 30 sec for 1 time on a regular sessions such as 1st to 3rd day – 12 to 10 times per session, on 4th to 6th day - 8 to 6 times per session and on 7th to 10th day - 6 to 4 times per session.

Fig. 1: Performing mechanical chest vibration.

Active cycle of breathing techniques (ACBT)

Patient was in a relaxed, sitting, or reclined position on bed. Do several minutes of relaxed diaphragmatic breathing (breathing control). Take 3–4 active deep inspirations with passive relaxed exhalation (Thoracic expansion exercises). Do relaxed diaphragmatic breathing (breathing control). As you feel secretions entering the larger central airway, do 2–3 huffs (forced exhalation technique) starting at low volume, followed by 2–3 huffs at higher volume, followed by relaxed breathing control. Repeat the cycle 2–4 times, as tolerated.

Fig. 2: Patient performing active cycle breathing technique.

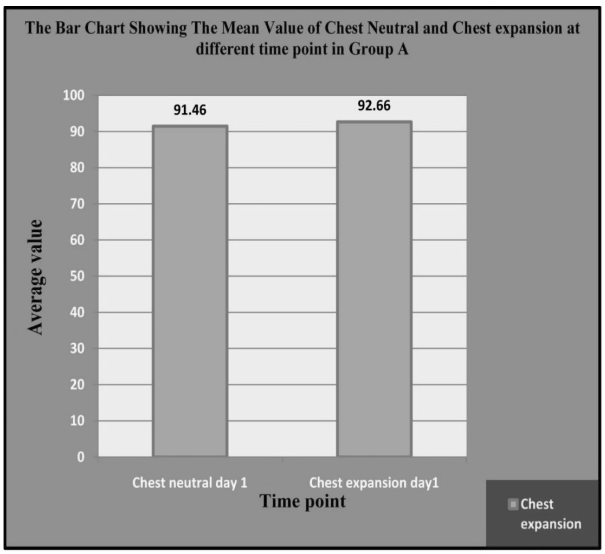
Data analysis

All analysis was obtained using SPSS version 20.0. All the values of airway clearance and chest expansion at different time points for Group A and Group B are expressed in terms of mean ± S D respectively. The paired "t" test was applied to test the significant difference between (1st and 10th day) for chest expansion in Group A, Group B and Group A versus Group B respectively, which show significant difference at $\alpha = .10$ level of significance. i.e. ($P<.10$).

Results

Table 1: showing mean, S.D comparison between the chest expansion and chest neutral day on 1st day and probability of "t" (paired) value of group A.

Outcome Measure	(Mean ± SD)	"t" (paired)	P-value
Chest Neutral on 1st day	91.46 ± 7.22	–	–
Chest Expansion on 1st day	92.66 ± 7.33	0.1	P<0.655

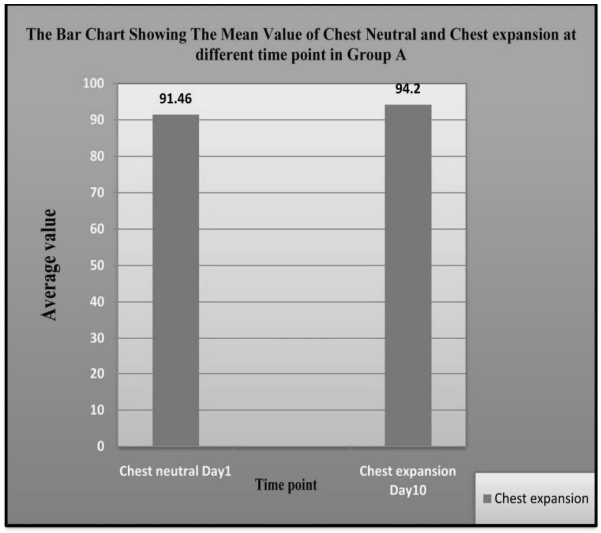


A 1 (a)

The graph shows significant improvement in chest expansion at neutral day after 1st day of treatment, which is approximately 1.30% as compared to its normal value 10%.

Table 2: showing mean, S.D, Comparison between the chest neutral and chest expansion at 1st day and 10th day treatment successive time point and probability of "t" (paired) value of group A

Outcome Measure	(Mean ± SD)	Probability of "t" (paired)	P-value
Chest neutral on 1st day	91.46 ± 7.22	–	–
Chest expansion on 10th day	94.20 ± 7.38	0.1	P<0.3128

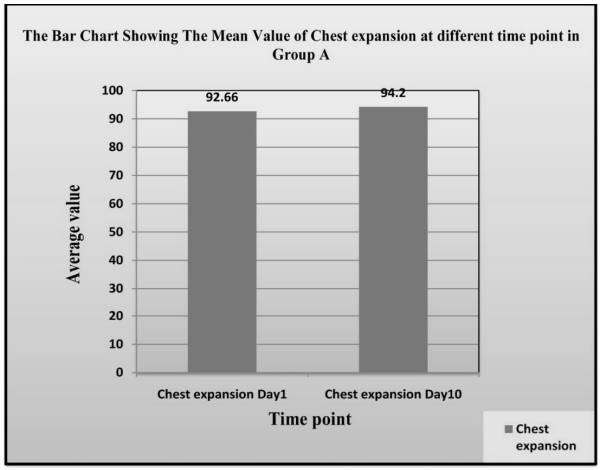


A 2 (a)

The graph shows significant improvement in chest expansion at neutral day after 10th day of treatment, which is approximately 2.90% as compared to its normal value 10%.

Table 3: showing mean, S.D, comparison between the chest expansion day 1st and 10th day treatment successive time point and probability of "t" (paired) value of group A.

Outcome Measures	(Mean ± SD)	Probability of "t" (paired)	P-value
Chest expansion on 1st day	92.66 ± 7.33	0.1	P<0.655
Chest expansion 10th day	94.20 ± 7.38	0.1	P<0.3128

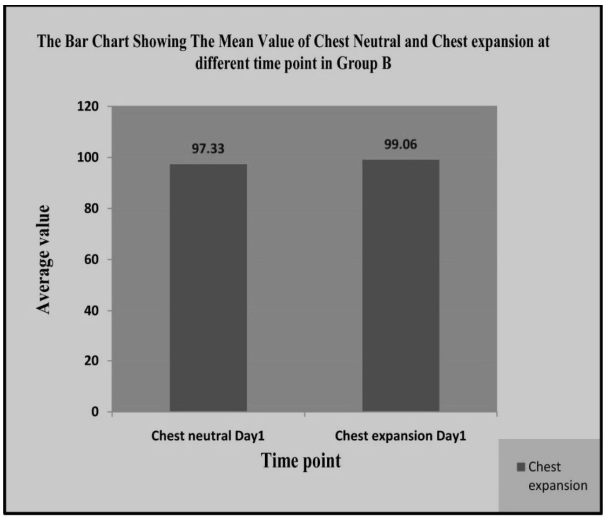


A 3 (a)

The graph shows significant improvement in chest expansion at 1st day and 10th day of treatment, which is approximately 1.65% as compared to its normal value 10%.

Table 4: showing mean, S.D, comparison between the chest expansion at neutral day and 1st day of treatment successive time point and probability of "t" (paired) value of group B.

Outcome Measures	(Mean ± SD)	Probability of "t" (paired)	P-value
Chest neutral on 1st day	97.33 ± 7.33	–	–
Chest expansion on 1st day	99.06 ± 7.52	0.1	P<0.538

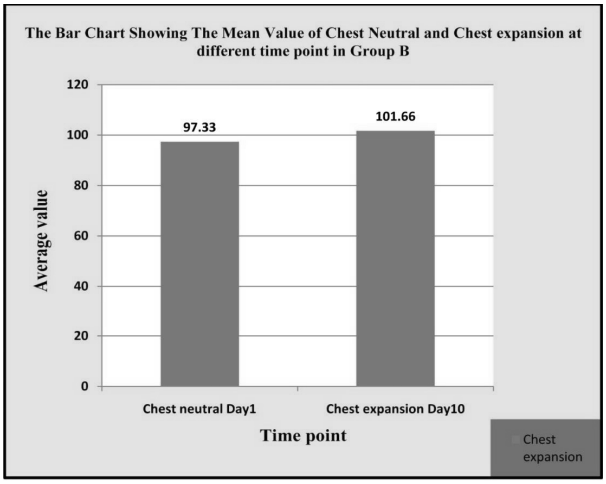


B 1 (b)

The graph shows significant improvement in chest expansion at neutral day after 1st day of treatment, which is approximately 1.75% as compared to its normal value 10%.

Table 5: showing mean, S.D comparison between the chest expansion and chest neutral on 1st day and 10th day treatment successive time point and probability of "t" (paired) value of group B

Outcome Measures	(Mean ± SD)	Probability of "t" (paired)	P-value
Chest neutral on 1st day	97.33 ± 7.73	–	–
Chest expansion on 10th day	101.66 ± 7.62	0.1	P<0.133

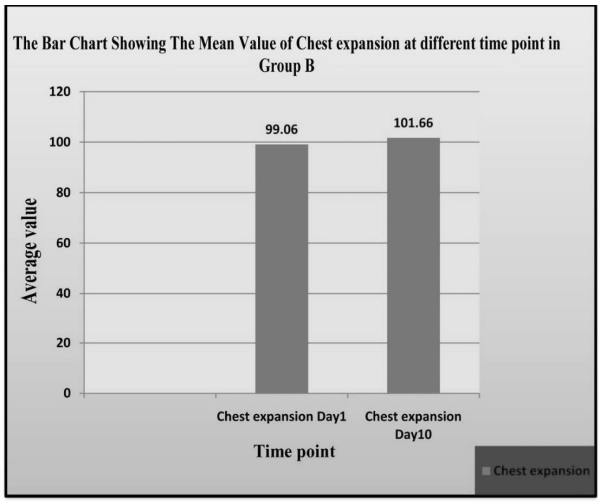


B 2 (b)

The graph shows significant improvement in chest expansion at neutral day after 10th day of treatment, which is approximately 4.26% as compared to its normal value 10%.

Table 6: showing mean, S.D comparison between the chest expansion 1st day and 10th day treatment successive time point and probability of "t" (paired) value of group B.

Outcome Measures	(Mean ± SD)	Probability of "t" (paired)	P-value
Chest expansion on 1st day	99.06 ± 7.51	0.1	P<0.538
Chest expansion on 10th day	101.66 ± 7.62	0.1	P<0.3547

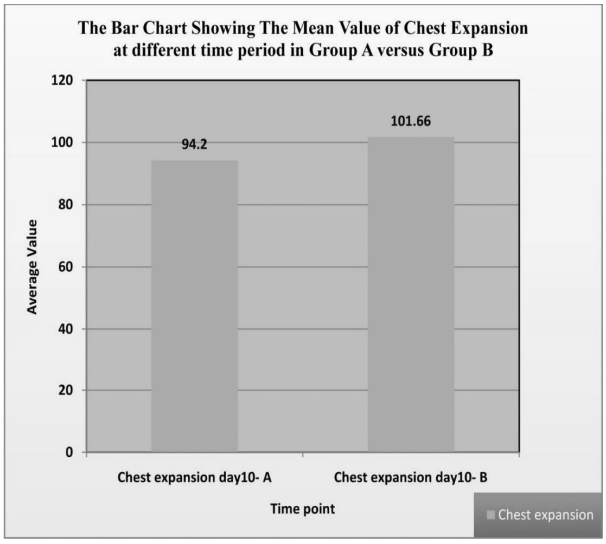


B 3 (b)

The graph shows significant improvement in chest expansion at 1st day and 10th day of treatment, which is approximately 2.56% as compared to its normal value 10%.

Table 7: Showing mean, S.D comparison between the group A versus Group B chest expansion on 10th day treatment successive time point and probability of "t" (paired) value.

Outcome Measure	(Mean ± SD)	Probability of "t" (paired)	P-value
Chest expansion on 10th day Group-A	94.20 ± 7.39	0.1	P<0.0110
Chest expansion on 10th day Group-B	101.66 ± 7.62	0.1	P<0.0110



A 3 B 3 (b)

The graph shows significant improvement in chest expansion at Group A versus Group B 10th day of treatment which is approximately 7.34% as compared to its normal value 10%.

DISCUSSION

Significant improvement was found in chest expansion values of both groups A and B. Group A which received manual chest physiotherapy (Active cycle of breathing techniques) shows P value of chest expansion as P<.10 approximately 1.65% after 10 days of treatment. Group B which received mechanical chest physiotherapy (mechanical chest vibration) shows P value of chest expansion as P<.10 approximately 2.56% after 10 days of treatment.

After comparison of both groups, Group B has shown near normal value of 2.56% which is highly significant than Group A. Hence, the result of the study revealed that using mechanical chest vibrator along with chest physiotherapy for 10 days treatment reduces the symptoms and improves the chest expansion. Previous studies have been conducted on the effect of chest physiotherapy in various cardiopulmonary conditions.

Bott J et. al did study on effectiveness of the chest physiotherapy in manual techniques include percussion (chest clapping) over the chest wall and shaking or mechanical vibration, with loosening secretion of cough with expectoration. Their study concluded that the chest physiotherapy is effective in terms of removal of congestion and improving breathing.[10]

McCarren et al did study on mechanical vibrator techniques are used as an airway clearance technique for effectiveness chronic bronchitis. The technique is interpretation of compliance of the chest wall and applying appropriate forces. The purpose of their study to assess consistency of forces used during vibrations and shaking incorporating a method measuring forces via a force platform. This technique was effective in terms of improving breathing pattern and quality of life of patients.[11]

Our study support the experimental hypothesis as mechanical vibration is more effective than ACBT in improving chest expansion on consecutive day among the patients with chronic bronchitis.

CONCLUSION

The above statistical data of prognosis of the patient lead to following conclusion though Active cycle of breathing techniques and Mechanical chest vibration both increases the chest expansion, and clear the lungs field hence reduces the risk of respiratory failure and pulmonary complication. But now it is very clear that treatment of Chronic bronchitis through Mechanical chest vibration is much more effective as compared to Manual chest physiotherapy (Active cycle of breathing techniques).

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