



International Journal of Medical and Exercise Science

(Multidisciplinary, Peer Reviewed and Indexed Journal)

ORIGINAL ARTICLE

EFFICACY OF MANUAL DIAPHRAGM RELEASE TECHNIQUE TO IMPROVE VITAL CAPACITY AND EXERCISE TOLERANCE IN PATIENTS WITH CHRONIC ASTHMA	Search engine: www.ijmaes.org
--	--

Bini Sebastian^{*1}, Binitta Cherian², Prathibha Janardhanan³

Authors:

¹Associate Professor, Dept of Physiotherapy, CPAS School of Medical Education, Angamaly, Kerala

²Associate professor, Dept of Physiotherapy, CPAS School of Medical Education, Angamaly, Kerala

³Assistant Professor, Dept of Physiotherapy, CPAS School of Medical Education, Gandhinagar, Kottayam, Kerala, India

Corresponding Author:

^{*1}Associate Professor, Dept of physiotherapy, CPAS School of Medical Education, Angamaly,

Email id: binitelson32@gmail.com

ABSTRACT

Background of the Study: Asthma is a chronic inflammatory disorder of the airways, always associated with airway hyper responsiveness. Aim of the study is to determine the efficacy of manual diaphragm release technique when used to improve vital capacity and exercise tolerance in patients with chronic asthma. Objectives of the Study is to find out the efficacy of manual diaphragm release as an adjunct to conventional therapy to improve vital capacity and exercise tolerance in patients with chronic asthma. **Methodology:** The study was experimental study design with 30 patients of chronic asthma satisfying inclusion criteria and referred to the physical therapy department. The patients were selected by convenient sampling method and assigned to control group and experimental group of 15 each. The experimental group (Group B) received Manual diaphragm release technique along with conventional physiotherapy treatment and the control group (Group A) received conventional physical therapy including, Relaxation positions, Pursed lip breathing, Thoracic mobility exercises and Forced expiratory technique. Outcomes were measured using spirometer and six minute walk test. Treatment duration for control group is 25 minutes and experimental group was 45 minutes. For both groups, treatment was given for 6 days per week for a period of 3weeks. **Result:** The result of the present study demonstrated that both group showed significant improvement in vital capacity and exercise tolerance. But the experimental group who received manual diaphragm release technique had more significant level of improvement. **Conclusion:** The present study proves that manual diaphragm release technique when given as an adjunct to conventional treatment is effective in improving vital capacity and exercise tolerance in chronic asthma patients.

Keywords: Chronic Asthma, Diaphragm Release Technique, Forced Expiratory Technique, Pursed Lip Breathing, Thoracic Mobility Exercises

Received on 10th May 2024; Revised on 24th May 2024; Accepted on 29th May 2024

DOI:10.36678/IJMAES.2024.V10I02.009

INTRODUCTION

Asthma is a chronic inflammatory disorder of the airways, always associated with airway hyper responsiveness. Aim of the study is to determine the efficacy of manual diaphragm release technique when used to improve vital capacity and exercise tolerance in patients with chronic asthma. Objectives of the Study is to find out the efficacy of manual diaphragm release as an adjunct to conventional therapy to improve vital capacity and exercise tolerance in patients with chronic asthma¹⁻⁴.

Physiotherapy plays a major role in controlling the symptoms of asthma, to help the patient get rid of respiratory and musculoskeletal complications and in improving the overall functions and exercise tolerance of patients (Bravata et al, 2009). Breathing exercises, relaxation positions, forced expiratory techniques; thoracic mobility exercises are the conventional methods to improve condition of the patient⁵⁻⁸.

As the respiratory function is closely related with proper functioning of musculoskeletal system, we use many manual techniques in pulmonary rehabilitation. Manual diaphragm release technique is a manual technique which elongates the shortened diaphragm. So diaphragm can work efficiently, improving chest wall kinematics. Thereby this study focuses on use of Manual diaphragm release technique in improving respiratory function of asthma patient⁹⁻¹¹.

METHODOLOGY

The study was experimental study design with 30 patients of chronic asthma satisfying inclusion criteria and referred to the physical

therapy department. The patients were selected by convenient sampling method and assigned to control group and experimental group of 15 each. The experimental group (Group B) received Manual diaphragm release technique along with conventional physiotherapy treatment.

The control group (Group A) received conventional physical therapy including, Relaxation positions, Pursed lip breathing, Thoracic mobility exercises and Forced expiratory technique. Outcomes were measured using spirometer and six minute walk test. Treatment duration for control group is 25 minutes and experimental group was 45 minutes. For both groups, treatment was given for 6 days per week for a period of 3weeks.

Procedure for the Study: Thirty subjects who fulfill the inclusion criteria will be recruited using non probability convenient sampling and will be allocated into two groups namely control group (group A) and (experimental group B)

Each group contains 15 patients each

GROUP A -receives conventional physiotherapy
GROUP B-receives conventional physiotherapy and manual diaphragm release technique

Treatment Protocol

Group –A (Control Group)

Conventional Chest Physiotherapy Including

1. Relaxation Positions

Educate the patients regarding the relaxed positions to be adopted during an attack of breathlessness. The relaxation positions for a breathless patient are

High side – lying, Forward lean sitting, relaxed sitting, Forward lean standing, relaxed standing

2. Breathing Exercises: Pursed lip breathing- Patient in half lying position. Instruct the patient to inhale through the nose and exhale slowly through the pursed lips. Encourage the patient to use pursed lip breathing especially during dyspnoeic episodes to reduce the difficulty of breathing. The same is repeated 5 times per session¹².

3. Thoracic Mobility Exercises: a. The patient is positioned in relaxed sitting in a chair with no arm rest. Patient is instructed to laterally bend the trunk to either side with the opposite side arm raised so as to provide a stretch to thorax. The same is repeated for 4 times per session¹³.

b. Patient is positioned in half lying with hands clasped behind the head. The patient is asked to horizontally abduct the arms during a deep inspiration. Then patient is asked to bring elbows together and bend forward during expiration. The same is repeated for 4 times per session.

4. Forced Expiratory Technique. With patient in relaxed sitting position with the hands placed on the abdomen. The patient is then asked to make three huffs with expiration to feel the contraction of abdominals followed by three coughs with expiration. The same is repeated for three sets with a rest of one minute between sets¹⁴.

The conventional physiotherapy regime will comprise of 25 minutes.

Group B (Experimental Group)

All the patients in the experimental group will receive manual diaphragm release technique along with conventional physiotherapy for 6 days daily for 3 weeks.

Manual Diaphragm Release Technique

Patient Position

- Half Lying on a plinth with legs relaxed
- Patient's arms are kept at the sides.

Therapist position:

- Standing behind the head of the patient
- Stand close to the patient

Hand placement:

Therapist places both his hands over costal margin with pisiform, hypothenar area and ulnar aspect of medial three fingers, such that the fingers extend upto the inner aspect of 7th to 10th costal cartilages. Therapists forearm should be aligned towards the patients' shoulders¹⁵.

Technique:

Ask the patient to breathe in. During inspiration, therapist gently pulls the points of contact in the direction of head (cranially) and slightly laterally with both hands following the elevatory movement of ribs.

Then ask the patient to breathe out. During expiration, therapist deepens the contact toward the underside of the costal cartilage maintaining resistance. Gradually increase the point of contact.

Manual diaphragm release is performed like two sets of five repetitions with five minutes rest in between.

Repetition:

Manual diaphragm release is done along with conventional physiotherapy daily for six days in a week for 3 weeks without any repetition.

Treatment Duration

Control group was given treatment for 25 minutes/day, for 6 days in a week, for a period of 3 weeks.

Experimental group was given treatment for 45 minutes/day, for 6 days in a week for a period of 3 weeks.

Data Analysis and Interpretation

The study was designed as pre test, post test experimental group, control group study design. Experimental group was treated with

manual diaphragm release technique along with conventional physiotherapy. Control group was treated with conventional physiotherapy alone. The aim of the study was to find out the effectiveness of Manual diaphragm release technique to improve vital capacity and exercise tolerance in patients with Chronic Asthma.

Table-1. Comparison of Ages of Control and Experimental Group Using Two Sample T Test

Group	N	Age in years		T	df	Significance level
		Mean	Sd			
Group A	15	43.47	2.386	0.831	28	0.413
Group B	15	44.27	2.865			

For the control group mean value is 43.47 and the standard deviation is 2.386. The mean value of experimental group is 44.27 and SD is 2.865. The value of 't' statistics 0.831, which is

not significant at 5 % level. That is there is no significant difference between the ages of two groups at 5% level of significance.

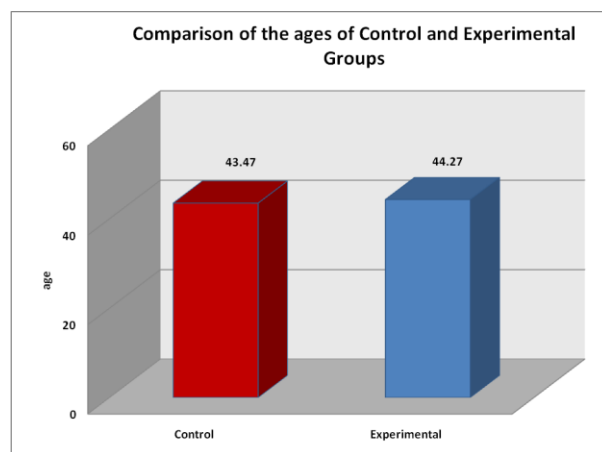
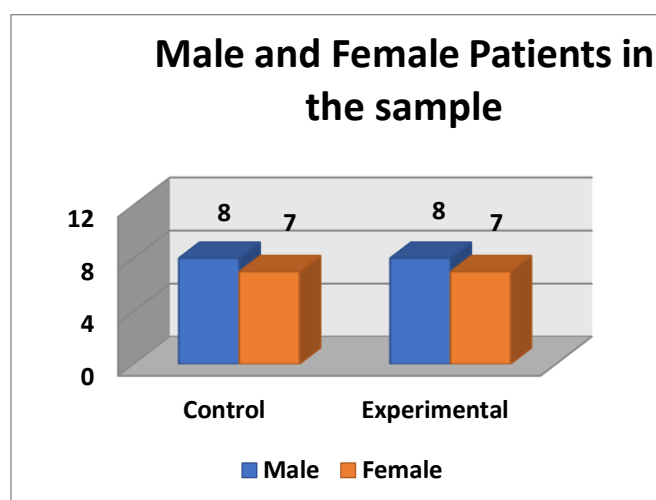


Figure 1. Shows age wise comparison of two groups. No significant difference between the ages of two groups.

Table-2. Analysis of Gender of the Sample Respondents

	Male	Female	Total
Control	8	7	15
Experimental	8	7	15
Total	16	14	30

**Figure 2.** Male and Female ratio of experimental and control group**Table-3:** Comparison of BMI of control and experimental group using two sample 't' test

Group	N	Age in years		T	df	Significance level
		Mean	Sd			
Group A	15	24	3.215	0.633	28	0.532

For the control group mean value is 24 and the standard deviation is 3.215. The mean value of experimental group is 24.63 and sd is 2.092.

The value of 't' statistics 0.633, which is not significant at 5 % level. That is there is no significant difference between the BMI of two groups at 5% level of significance

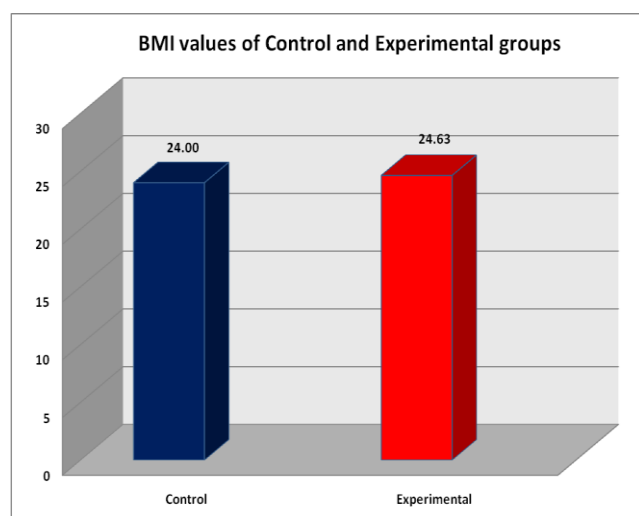


Figure -3. BMI Values of Control and Experimental Group

Table-4 Analysis of pre test FVC values of the control and experimental group using two sample 't' test

Group	N	Pre –Test		T	df	Significance level
		Mean	Sd			
Group A	15	2.1713	0.359	.343	28	0.734
Group B	15	2.1153	0.5195			

For the control group mean value is 2.1713 and standard deviation .35924 for the experimental group the mean value is 2.1153 and standard deviation is .51950. The 't' value

is .343 and the significance is .734 which is not significant at 5% level. That is there is no significant difference between the FVC scores of two groups at 5% level of significance.

Table-5. Analysis of post test FVC value of control and experimental group using two sample 't' test

Group	N	Post test		T	df	Significance level
		Mean	Sd			
Group A	15	2.254	0.359	2.590	28	0.015
Group B	15	2.658	0.486			

For the control group mean value is 2.2540 and standard deviation is .35910. For experimental group mean value is 2.6580 and sd is 0.486. The 't' value is 2.590 and the significance is .015 which is significant at 5% level. That is there is significant difference between the post test FVC scores of two groups at 5% level of

significance .Post FVC scores of the experimental group are greater than that of the control group. This might be due to the cumulative effect of Manual diaphragm release technique along with conventional physiotherapy.

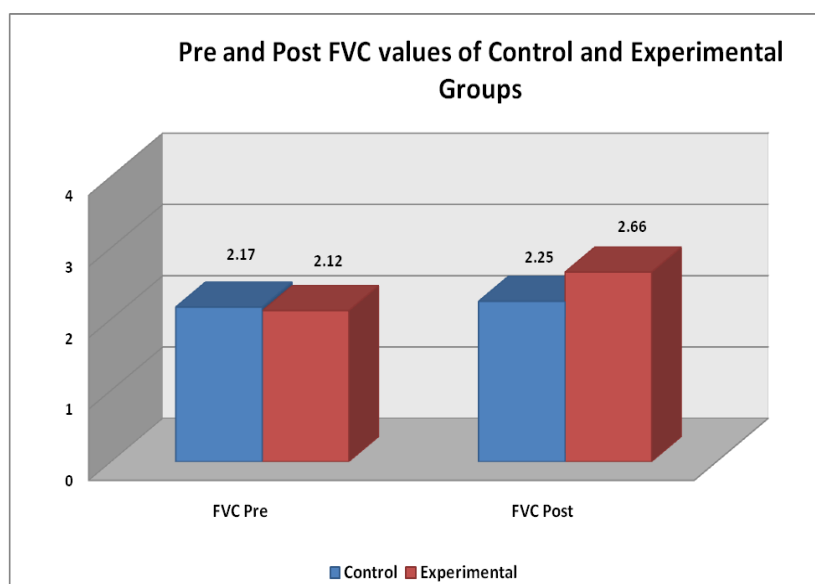


Figure-4. Shows the comparison of FVC scores of both groups'. The pre test score of control group is 2.1713 and post test score is 2.2540. Post test score of experimental group is 2.1153 and post test score is 2.6580.

Table -6: Analysis of the pre fev1 scores of control and experimental group using the two sample 't' test

Group	N	Pre test		T	df	Significance
		Mean	Sd			
Group A	15	1.540	0.2613	0.334	28	0.741
Group B	15	1.503	0.3453			

For control group mean value is 1.5407 and standard deviation is .26133. For the experimental group mean value is 1.5033 and standard deviation is .34533. The 't' value is

.334 which is not significant at 5% level. That is there is no significant difference between the pre fev1 scores of the two groups at 5% level.

Table -7. Analysis of post FEV1 scores of control and experimental using the two sample't' test

Group	N	Post Test		T	df	Significance
		Mean	Sd			
Group A	15	1.6273	0.277	2.882	28	.007
Group B	15	1.9507	0.334			

For control group mean value 1.6273 and standard deviation is .27727. For the experimental group mean value is 1.9507 and standard deviation is .33448. The 't' value is 2.882 which is significant at 5% level. That is there is significant difference the post FEV1

measurement scores of the two groups at 5% level of significance. This might be due to cumulative effect of manual diaphragm release technique along with conventional physiotherapy.

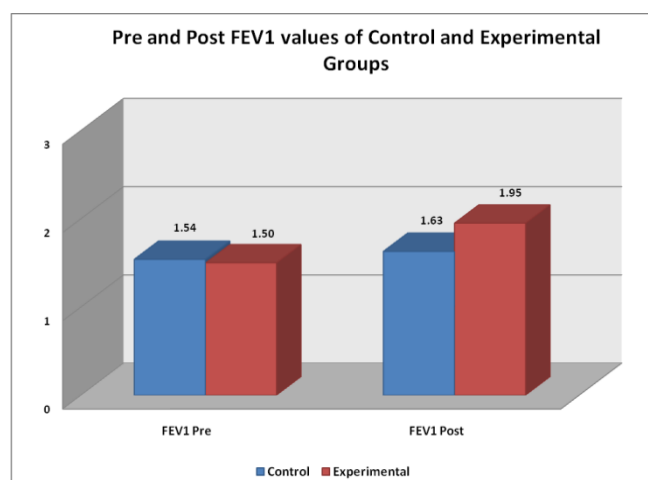


Figure 5 Shows that the comparison of FEV1 scores of both groups. The pre test of control group is 1.54 and post test score is 1.63 and pre test score of experimental group is 1.50 and post test score is 1.95

Table-8. Analysis of pre six minute walk test scores of control and experimental group using the two sample't' test

Group	N	Pre Test		T	df	Significance
		Mean	Sd			
Group A	15	216.00	28.501	0.067	28	.947
Group B	15	216.67	25.961			

For control group mean value 216.00 and standard deviation is 28.501 for the experimental group mean value is 216.67 and standard deviation is 25.961. The 't' value is

0.067 which is not significant at 5% level. That is there is no significant difference between the pre 6MWT scores of the two groups at 5% level

Table -9. Analysis of post six minute walk test scores of control and experimental using the two sample 't' test

Group	N	Post Test		T	df	Significance
		Mean	Sd			
Group A	15	250.00	27.074	2.331	28	.027
Group B	15	274.87	31.199			

For control group mean value 250.00 and standard deviation is 27.07397. For the experimental group mean value is 274.87 and standard deviation is 31.19951. The 't' value is 2.331 which is significant at 5% level. That is

there is significant difference the post 6MWT scores of the two groups at 5% level of significance. This might be due to cumulative effect of manual diaphragm release technique along with conventional physiotherapy.

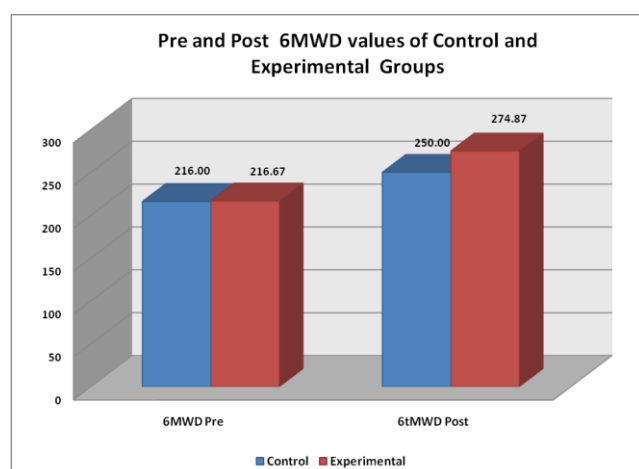


Figure 6. Shows the comparison of 6 MWT scores of both groups. The pre test of control group is 216.00 and post test score is 250.00 and pre test score of experimental group is 216.67 and post test score is 274.87

Effectiveness of Conventional Treatment

Table-10. Analysis of FVC scores of control group using paired 't' test

	Mean	N	Sd	T	df	significance
PRE FVC	2.1713	15	0.359	14.224	14	0.000
POST FVC	2.2540	15	0.359			

The 't' value for the control group is 14.224 which is significant at 5% level. The POST FVC values are significantly greater than the PRE FVC value. Data analysis shows improvement

in vital capacity. This might be due to cumulative effect of conventional physiotherapy.

Table-11: Analysis of FEV1 scores of control group using Paired 't' test

	Mean	N	Sd	T	df	significance
PRE FEV1	1.541	15	0.261	3.514	14	0.003
POST FEV1	1.627	15	0.277			

The 't' value for the control group is 3.514 which is significant at 5% level. The POST FVC values are significantly greater than the PRE

FVC value. Data analysis shows significant improvement in vital capacity. This might be due to cumulative effect of conventional physiotherapy.

Table-12. Analysis of 6mwt scores of control group using paired 't' test

	Mean	N	Sd	T	df	significance
PRE 6MWD	216.00	15	28.501	22.035	14	.000
POST MWD	250.00	15	27.074			

The 't' value for the control group is 22.035, which is significant at 5% level. The POST 6MWT values are significantly greater than the PRE 6MWT value. Data analysis shows

significant improvement in improving vital capacity and increase exercise tolerance. This might be due to cumulative effect of conventional physiotherapy.

Effectiveness of Manual Diaphragm Release Technique

Table-13. Analysis of FVC scores of experimental group using paired 't' test

	Mean	N	Sd	T	df	significance
PRE FVC	2.1153	15	0.519	3.426	14	.004
POST FVC	2.6580	15	0.486			

The 't' value is 3.426 which is significant at 5% level. That is there is significant difference between the pre and post FVC values at 5% level of significance. The post FVC values are greater than the pre FVC values. Data analysis

shows significant improvement in vital capacity and exercise tolerance. This might be due to the effect of manual diaphragm release technique.

Table-14. Analysis of FEV1 Scores Of Experimental Group Using Paired 'T' Test

	Mean	N	Sd	T	df	significance
PRE FEV1	1.503	15	0.345	4.008	14	0.001
POST FEV1	1.950	15	0.335			

The 't' value is 4.008 which is significant at 5% level. That is there is significant difference between the pre and post FEV1 values at 5% level of significance. The post FEV1 values are greater than the pre FEV1 values. Data analysis

shows significant improvement in vital capacity and exercise tolerance. This might be due to the effect of manual diaphragm release technique.

Table -15 Analysis of Six minute walk test Scores of Experimental Group Using Paired 'T' Test

	Mean	N	Sd	T	df	Significance
PRE 6MWT	216.67	15	25.961	26.692	14	0.000
POST 6MWT	274.87	15	31.199			

The 't' value is 26.692 which is significant at 5% level. That there is significant difference between the pre and post 6MWT values at 5% level of significance. The post 6MWT values are greater than the pre 6MWT values. This might be due to the effect of manual diaphragm release technique.

improvement in vital capacity. This may be the cumulative effect of manual diaphragm release technique along with conventional physiotherapy.

DISCUSSION

Airflow obstruction in chronic asthma is often associated with hyperinflation of lungs, where air gets trapped in the lungs. This leads to shortening of diaphragm with decreased dome curvature and reduction in zone of opposition. This leads to reduced inspiratory action of diaphragm on rib cage, ie; cannot lift and widen lower rib cage to create negative pressure to force air into thoracic cavity during inspiration^{15,16}. Airflow obstruction and hyperinflation leads to increased work of breathing and it exacerbate dyspnea and reduce exercise tolerance. Because of this patient easily get fatigue even with mild activity (Hans Lindgren; 2011).

Dysfunction of diaphragm has many health consequences including reduction in health

RESULT

The result of the present study demonstrated that both group showed significant improvement in vital capacity and exercise tolerance. But the experimental group who received manual diaphragm release technique had more significant level of improvement.

Hence the discussion can be summarized as manual diaphragm release technique along with conventional physiotherapy was effective in improving vital capacity and exercise tolerance in patients with chronic asthma. From these finding it can be stated that experimental group performed better than control group and there is significant

and quality of life (Kuchera and Kuchera; 1994). Because of the interdependent relationship between respiratory system and musculoskeletal components, various manual techniques have been using for the treatment of pulmonary disorders ¹⁷. They all have the common goal of increasing mobility of thoracic structures involved in respiratory mechanics. Manual Diaphragm release is such a manual technique which has capacity to induce direct effect on diaphragm and consequently on respiratory system. This technique lengthens the fibers allowing the rib cage to achieve greater amplitude during respiration (Chaitlow L et al; 2002).

In Manual diaphragm release technique, manual action underside the last four costal cartilages, allows the traction of lower rib cage in cranial direction and that manual compression of the tissues in the area of insertion of the anterior costal diaphragm fibres lengthens the diaphragm in its insertional zone(Tactiono rocha et al;2015).

Like skeletal muscles, the diaphragm responds to elongation by the mechanism of visco-elastic deformation, plastic deformation, increased length of sarcomeres in the series, neuromuscular relaxation (Weppeler & Magnusson, 2010) The diaphragm contains muscle spindles. These muscle spindles are sensory and respond to elongation¹⁸.

As the muscle is elongated a signal is sent to the spinal cord and the spinal cord recruits more fibres to contract. This increases the strength of the contraction of the muscle. This may be useful when there is decreased compliance or increased airway resistance. And stretching the diaphragm and ribs may activate this stretch reflex and help a patient

take a deeper breath (Frownfelter & Dean, 2006).

Stretching of diaphragm can improve contractile properties and pulmonary function. This can be proved by measuring the pulmonary function variables like FVC and FEV1 (Francisco Jose Gonzalez et al;2014). The cumulative effects in pulmonary function improve the exercise capacity ¹⁹.

Ethical clearance: Ethical clearance has obtained from the Institutional ethical committee, CPAS School of Medical Education, Gandhinagar, Kottayam.

Conflicts of Interest: There is no conflict of interest to conduct and to publish this study.

Fund for the study: This was a self funded study.

CONCLUSION

Asthma is a chronic condition leading to disability and illness which prevent patients from doing day to day activities which other people can easily do. The present study proves that manual diaphragm release technique when given as an adjunct to conventional treatment is effective in improving vital capacity and exercise tolerance in chronic asthma patients.

In this context manual diaphragm release technique can be used in association with other treatment protocols to improve respiratory function and functional capacity of chronic asthma patients. This technique is also cost effective and easy to apply. Hence manual diaphragm release should be included as a part of treatment in the management of Chronic Asthma.

REFERENCES

1. AARC (1992) Clinical Practice Guideline: exercise testing for evaluation of hypoxaemia. *Respir. Care*, 37, 907-912.
2. AARC (1993a) Clinical Practice Guideline: intermittent positive pressure breathing. *Respir. Care*, 38, 1189-1194.
3. AARC (1993b) Clinical Practice Guideline: directed cough. *Respir. Care*, 38, 495-499.
4. Abbott J., Dodd, M. and Bilton, D. (1994) Treatment compliance in adults with CF. *Thorax*, 49, 115-120. Abelson, J. L. (1996) Respiratory psychophysiology and anxiety. *Psychosomatic Med.* 58, 302-313.
5. Aboussouan, L. S. (1997) Effect of noninvasive positive-pressure ventilation on survival in amyotrophic lateral sclerosis. *Ann. Intern. Med.* 127, 450-454.
6. ACCP/AACVPR (1997) Pulmonary rehabilitation: joint ACCP/AACVPR evidence-based guidelines. *Chest*, 112, 1363-1396.
7. Acosta, F. (1988) Biofeedback and progressive relaxation in weaning the anxious patient. *Heart Lung*, 17, 299-301.
8. Ahmedzai, S. (1988) Respiratory distress in the terminally ill patient. *Respir. Dis. Pract.*, 5 (5), 20-26.
9. Ahmedzai, S. (1997) Palliation in non-malignant disease, in *Practical Pulmonary Rehabilitation*, (eds M. Morgan and S. Singh), Chapman & Hall, London.
10. Ahmedzai, S. and Davis, C. (1997) Nebulised drugs in palliative care. *Thorax*, 52(suppl. 2), S75-S77.
11. Ahrens, T. (1999a) Continuous mixed venous monitoring. *Crit. Care Nurs. Clin. North Am.*, 11 (1), 33-48.
12. Ahrens, T. (1999b) Pulse oximetry. *Crit. Care Nurs. Clin. North Am.*, 11(1), 87-98.
13. Aiping, J. (1994) Analysis of therapeutic effects of acupuncture on abstinence from smoking. *J. Trad. Chinese Med.*, 14, 56-63.
14. Aitkenhead, A. R. (1989) Analgesia and sedation in intensive care. *Br. J. Anaesth.*, 63, 196-206. 482
15. Akyiiz, G. (1993) Transcutaneous nerve stimulation in the treatment of pain and prevention of paralytic ileus. *Clin. Rehabil.*, 7, 218-221.
16. Albelda, M. (1983) Ventilator-induced subpleural air cysts. *Am. Rev. Respir. Dis.*, 127, 360-365. Alderson, J. D. (1999) Spinal cord injuries. *Care Crit. Ill*, 15, 48-52.
17. Alessi, C. L. (1999) A randomised trial of a combined physical activity and environmental intervention in nursing home residents. *J. Am. Geriatr. Soc.*, 47, 784-791.
18. Alison, J. A., Donnelly, P. M. and Lennon, M. (1994) The effect of a comprehensive intensive inpatient treatment program on lung function and exercise capacity in patients with CF. *Phys. Ther.*, 74, 583-593.
19. Allan, A. J. (1998) Permissive hypercapnia. *Care Crit. Ill*, 14, 233-236. Allen, J. K. (1990) Physical and psychosocial outcomes after coronary artery bypass graft surgery. *Heart Lung*, 19, 49-54.

Bini Sebastian, Binitta Cherian, Prathibha Janardhanan (2024). Efficacy of Manual Diaphragm Release Technique To Improve Vital Capacity And Exercise Tolerance In Patients With Chronic Asthma , *ijmaes*; 10(2); 1848-1860.