INVESTIGATION OF EFFECTIVNESS OF CONTROLED DIPHRAGMATIC BREATHING ON PULMONARY FUNCTION & SIX MINUTE WALK DISTANCE IN STABLE COPD PATIENTS

INVESTIGAREA EFICIENŢEI RESPIRAŢIEI DIAFRAGMATICE CONTROLATE ASUPRA FUNCŢIEI PULMONARE ŞI A MERSULUI PE DISTANŢĂ DE ŞASE METRI, LA PACIENŢII CU BPOC STABIL

Sudeep Kale 1, M.Vijayakumar [2]

Key words: breathing exercise, COPD, pulmonary rehabilitation, six minute walk test

Cuvinte cheie: exerciţii de respiraţie, BPOC, recuperare pulmonară, testul de mers 6 minute

Abstract.

Introduction: Pulmonary hyperinflation is critical factor in COPD patients which puts diaphragm at mechanical disadvantage. Shape and geometry of chest wall is altered in patients with COPD, consequently reduces opposing zone of diaphragm. Low, flat diaphragm weakens diaphragm muscle & decreases the diaphragm function. This study was designed to investigate effect of Controlled Diaphragmatic Breathing on pulmonary function & 6Minute Walk Distance in stable mild to moderate severity COPD patients.
Method: Subjects were evaluated at the start of treatment & reevaluated after 3 weeks. 6 MWD & PFT pre & post treatment was done as per Standardized guidelines of ATS. The subjects received breathing retraining six days a week for 20 minutes for 3 weeks.
Result: Subject showed significant improvement in 6 MWD_1 **(**t =2.301 ,P<0.05) . No significant difference noted in the PFT parameters after 3 weeks training.
Conclusion: Controlled Diaphragmatic Breathing has a variable effect on improvement in functional status in COPD patients & hence can be incorporated in pulmonary rehabilitation.

Rezumat.

Introducere: Hiperinflamaţia pulmonară este un factor critic la pacienţii cu bronhopmeumopatie cronică obstructivă (BPOC), ceea ce conferă diafragmului un dezavantaj mecanic. Forma şi geometria peretelui toracic sunt alterate la pacienţii cu BPOC, consecutiv ducând la reducerea zonei de opozabilitate a diafragmului. Un diafragm coborât şi plat, duce la scăderea forţei acestui muşchi şi îi reduce funcţia.
Acest studiu are ca scop investigarea efectului respitraţiei diafragmatice controlate asupra funcţiei pulmonare şi asupra performanţei pacientului la testul de 6 minute de mers, la pacienţii cu BPOC moderat spre sever.
Metodă. Subiecţii au fost evaluaţi la începutul tratamentului şi după 3 săptămâni de tratament, cu ajutorul testului 6 minute de mers şi a parametrilor pulmonari. Subiecţii au urmat reeducare respiratory 6 zile pe săptămână, 20 minute pe zi, timp de 3 săptămâni.
Rezultate. Subiecţii au prezentat îmbunătăţiri semnificative la testul de mers de 6 minute, **(**t=2.301 ,P<0.05). NU s-au înregistrat diferenţe semnificative a parametrilor pulmonary după 3 săptămâni de tratament.
Concluzii. Respiraţia diafragmatică controlată a avut un efect variabil asupra îmbunătăţirii funcţionale la pacienţii cu PBOC, putând fi incluse în recuperarea pulmonară a acestor pacienţi.

[1] Assistant professor, Terna Physiotherapy College, Nerul, Navi Mumbai, INDIA , 400706, M.P.Th (Cardio-respiratory Physiotherapy), Ph.D Candidate (Cardio-respiratory Physiotherapy), M.U.H.S , +91, 9029009901, 022-27709813, sudeepkale@gmail.com,
[2] Professor, Padmashree Dr. D.Y.Patil Physiotherapy College, Pune, INDIA

Introduction

COPD is major cause of death & disability all over the world. As per WHO & World Bank Global Burden of Disease Study Data, worldwide prevalence of COPD is estimated at 9.34 / 1000 in men & 7.33 in women. [1,2]. By 2020, WHO predicts that COPD will become 3rd leading cause of death & 5th leading cause of disability worldwide [2]. In India COPD is recognized as major health problem requiring management from primary health care level on words [1]. Indian prevalence of COPD is 4.4 & 3.4 per 1000 in men & women respectively. [1, 2] As per multicentre studies on epidemiology of COPD, prevalence figures 5 % in men & 3.2 % in women (above age of 35 yrs) across country [1]. Mortality & morbidity due to other diseases has shown to be steady decline for more than a decade now, but that due to COPD are increasing [2, 3]. Hence COPD is growing not only as universal but also as national health concern in India [1].

Pulmonary hyperinflation is critical factor in COPD patients which puts diaphragm at mechanical disadvantage. Shape and geometry of chest wall is altered in patients with COPD, consequently reduces opposing zone of diaphragm. Low, flat diaphragm weakens diaphragm muscle & decreases the diaphragm function

Controlled diaphragmatic breathing (CDB) is most commonly incorporated in rehabilitation program of COPD patients. The primary purpose of these exercises is to promote greater use of diaphragm & to decrease use of accessory muscles of inspiration [4, 5, 6, 7, 8]. Although these exercises have been proved beneficial in improving ventilation, breathing patterns & reliving symptoms, these exercises are challenged by many authors [9, 10]. Along with its positive effects in COPD patients many negative effects are also noted by few researchers [9]. Research results also provide a mixed picture regarding effect of theses exercise on strength & endurance of diaphragm. Many studies show improvement in tidal volume.

Several investigators had examined effect of CDB on ventilatory patterns, arterial blood gases, chest wall kinematics, and breathlessness. All those studies enumerated had focused on acute effects of CDB. No study conducted on investigation of such effects on long-term basis. All the effects achieved by varied authors remained only during exercises & not after exercises. Hence this study was designed to investigate efficiency of CDB in improving pulmonary function & exercise performance in stable COPD patients.

Methodology

30 stable COPD patients visiting to outpatient department (OPD) of Tuberculosis & Chest medicine of Dr.D.Y.Patil Medical College & hospital Pimpri, Pune 18 over a period of 1.5 years were recruited into study. The informed consent was taken from all patients. Diagnosis was confirmed by pulmonary physician after clinical assessment and PFT. After baseline assessment, PFT & 6 Minute Walk Test (6MWT), subjects were assigned in to study. Subjects were evaluated at the start of treatment & reevaluated after 3 weeks. Patient's age (in yrs), weight (kgs), height (cms) was registered prior to test. All the tests, calibrations of equipment & interpretations were done as per Standardized guidelines of American Thoracic Society (ATS).

Intervention

The subjects received physiotherapy six days a week for 20 minutes for 3 weeks, followed on OPD basis. Controlled diaphragmatic breathing exercises were given to the patients in semi fowler's position with Knees bend. After the assessment of the breathing pattern of patient, the proper diaphragmatic breathing exercises were demonstrated to patient. Hand was placed on patient's abdomen in the epigastric region below xipoid process. Then patient instructed to take 2-3 breaths & patient's abdominal movement was followed without interrupting the breathing pattern. With this instructions & demonstration patient's awareness regarding his/her breathing pattern was facilitated.

Then patient was instructed to inhale through nose & raise abdomen against hand. After normal rate at the end of exhalation, a slow inward stretch was given & hand was scooped up under

anterior thorax. Same procedure was followed with each breath. This procedure was repeated for 10 min. 2 sessions were given with 5 mins. gap in between for 3 weeks.

*Inclusion Criteria***:** Clinically diagnosed stable mild to moderate severity COPD patients. FEV1 / FVC < 80% & FEV1 between 40 % to 79 %. (Mild to moderate severity). The stable COPD was defined as per the GOLD

*Exclusion Criteria***:** Patients with acute exacerbation of COPD, cardiac, metabolic & endocrine disorders, thoracic cage deformities, history of cardiac/pulmonary/abdominal surgeries, asthma, pulmonary tuberculosis, neuromuscular disorders current respiratory tract infections. Patients underwent breathing & respiratory muscle training & sever obstruction patients (FEV1 < 40 %).

Materials

Computerized PFT machine (Schiller at-10 med. system), Height stands scale, weighing machine, standardized size chair, standardized size bed.

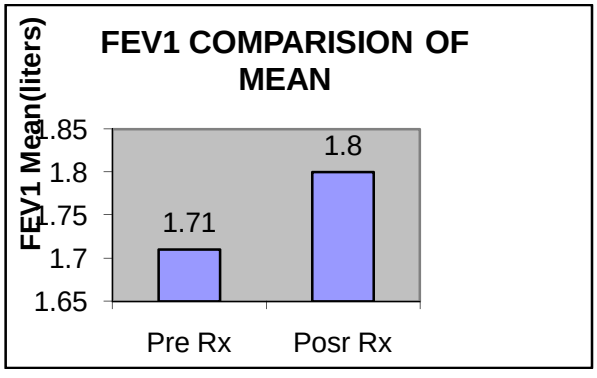
***Outcome Measures*:** FEV1, FVC, PEF25-75%, PEFR, FEV1 / FVC, Six Minute Walk Distance (6MWD)

Data/Observations

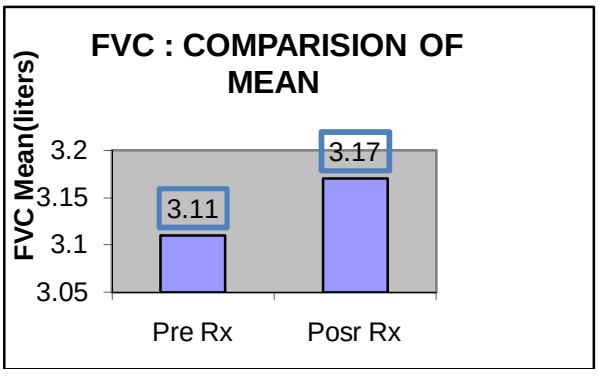
Pre & Post Rx significance was calculated by using *paired t test*. Graph pad software was used for statistical analysis.

Table 1.1 Statistical Presentation

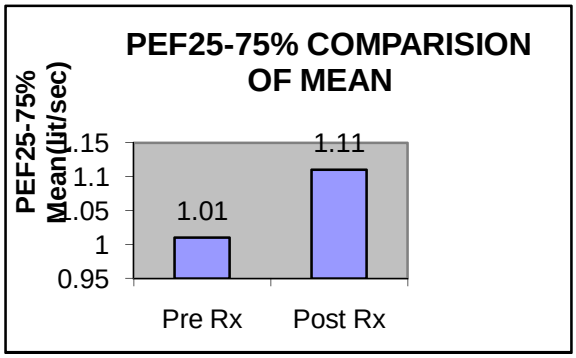
Parameter	Pre-treatment		Post-treatment		Significance	
	Mean	S.D	Mean	S.D		
FEV_1	**1.71**	0.60	**1.80**	0.61	t =0.5299,	p>0.05
FVC	**3.11**	0.76	**3.17**	0.73	t=0.2954,	p>0.05
PEF25-75%	**1.04**	0.50	**1.11**	0.46	t =0.5180 ,	p>0.05
PEFR	**3.35**	0.23	**3.44**	0.23	t= 0.2569 ,	p>0.05
FEV_1/ FVC	**54.63**	12.1	**55.53**	12.3	t= 0.2820 ,	p>0.05
6MWD	**269.1**	68.29	**305.1**	69.64	t= 2.301 **,**	**p<0.05**

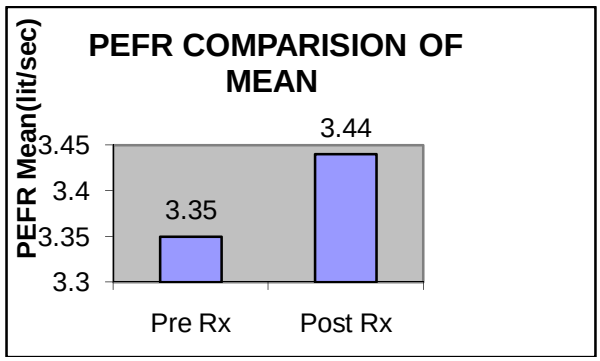


Graph 1: showing pre & post Rx FEV1

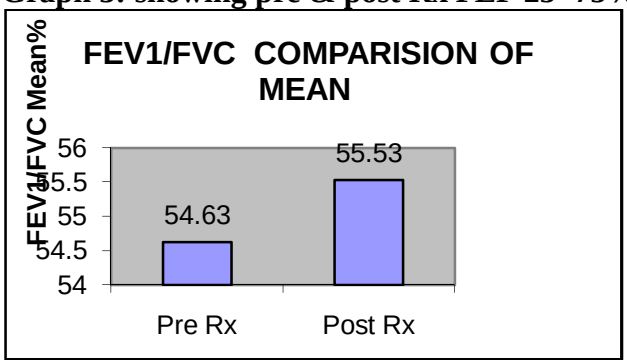


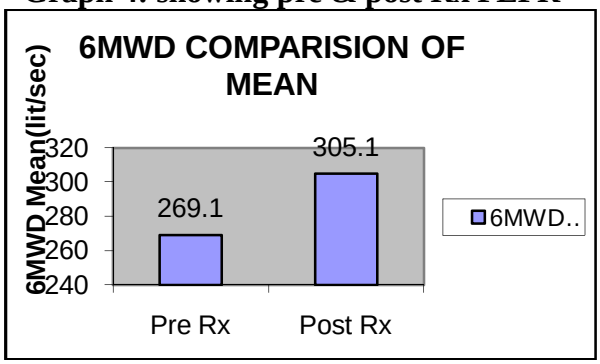
Graph 2: showing pre & post Rx FVC





Graph 3: showing pre & post Rx FEF 25 -75%. **Graph 4: showing pre & post Rx PEFR**





Graph 5: showing pre & post Rx FEV1 / FVC. **Graph 6: showing pre & post Rx 6 MWD**

Result

Subject showed significant improvement in 6 MWD1 ($t = 2.301$, $p<0.05$). No significant difference noted in all PFT parameters after 3 weeks training

Discussion

This study was designed to investigate effect of Controlled Diaphragmatic Breathing on pulmonary function & 6Minute Walk Distance in stable mild to moderate severity COPD patients. The major finding of this study includes the improvement in six minute walk distance in these patients after 3 weeks of the treatment.

Pulmonary hyperinflation is one of the crucial factors which affect the diaphragm. In COPD patients the diaphragm is flatter & lower than normal. These changes reduces piston like axial displacement of diaphragm dome, oppositional action of expanding lower ribs & insertional action of expanding lower lobe. Shape & geometry of chest wall also reduces zone of opposition of diaphragm. Hyperinflation also changes mechanical arrangement of crural & costal parts of diaphragm from series to parallel, further reducing the force generating capacity.

Positions used for training improved Zone of Opposition area of diaphragm. Semi fowler's position with knees flexed & relative posterior tilting of pelvis induced relaxation of abdominal muscles and facilitated diaphragmatic excursion [11]. Also visceral contents are pushed under diaphragm improving oppositional component of diaphragmatic action [11]. Scoop up method facilitated the excursion of diaphragm. CDB improved the recruitment of diaphragm muscle. Also breathing retraining program has improved general condition of patients possibly mediated by improvement in PO2 & PCO2. This might be a contributory factor in obtaining improvement in 6MWD. Furthermore possibility is that breathing retraining acquired a better control over respiratory muscles & reduced the fatigue of accessory muscles and improved their performance [12]. These helped patient to cover more distance in six minute. Reduced dyspnea also helped in improving 6 MWD. The CDB training was given for 3 weeks. Probably this duration is less to bring changes in PFT parameters. Again the underlying pathology also resulted in no improvement in PFT.

Conclusion

Controlled Diaphragmatic Breathing has a variable effect on improvement in functional status in COPD patients. Hence it can be used as one of the physiotherapy technique in order to improve efficacy of diaphragm & functional status in patients with COPD & should be incorporated in rehabilitation of COPD patients.

Limitations

The measures used in this study were relatively simple. Only few parameters of PFT were taken into considerations. Effect of these breathing retraining techniques on tidal volume was not taken in account. Effect of on ABG , dyspnea, as well as effects on patient psychology on PFT performance was not studied.

Suggestions

Further studies incorporating other outcome measures (eg. ABG, Dyspnea) follow up data may help to confirm the observed effects and clarifies its mechanisms, asses its long term validity. A similar replication of this study with larger number of subjects can be carried out.

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