Effect Of Breathing Retraining With Breathing Retrainer Device On Functional Capability In Patients With Copd

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Abstract- *The global initiative for chronic obstructive pulmonary disease (GOLD) has defined COPD as a disease which is characterized by escalating development of chronic airflow limitation which is irreversible and comprises of chronic bronchitis and emphysema. In COPD patients, the demand/capacity curve of the inspiratory muscles is skewed in such a way that there is severe overloading of the inspiratory muscles. This disproportion has an effect on the blood flow through limbs during exercise. A further overload is present during exercise by tachypnea. Poor aerobic fitness and peripheral muscle weakness contribute to exercise limitation in COPD. Conventional physiotherapy techniques such as pursed lip breathing and diaphragmatic breathing are proved to be helpful for COPD patients, but these techniques require continuous therapist supervision and verbal commands. The new breathing retrainer device is designed to provide visual and kinesthetic stimulation which acts like a feed forward mechanism.* ***Objective:*** *To find the effect of the breathing retraining with the help of breathing retrainer device on the functional capability of patients with COPD and to find if the device is an effective method of training and can be used as a substitute for the therapist.* ***Methodology:*** *In this study 40 patients with COPD were included. These were divided into groupI (therapist assisted breathing retraining) and group II (device assisted breathing retraining). Both groups underwent treatment for 5 days, twice daily for 30 min. Treatment included diaphragmatic breathing and pursed lip breathing with rest periods. Outcomes were respiratory rate, 6minute walk test and SpO2.* ***Results:*** *All the parameters showed statistically significant improvement pre and post within the groups. No difference was found by comparing among the groups.* ***Conclusion:*** *The functional capability which was measured through 6 minute walk test including the distance and SpO2 was found to be increased post training with breathing retrainer. The Breathing retrainer was found to be an effective method of treatment in patients with COPD.*

Keywords- Breathing retrainer, 6 minute walk test.

I. INTRODUCTION

The respiratory system in humans is a set of organs that is responsible for the process of taking in oxygen and expelling carbon-di-oxide. In order to breathe the lungs must expand;this expansion is brought about by alterations in the surrounding rib cage. The volume of air entering the lungs during inspiration depends on the depth of respiration.[1]Any alteration from the normal breathing mechanics results in inadequate volume of air, reduced expansion of lungs, shortness of breath, increased or decreased respiratory rate, mismatch of the ventilation and perfusion ratio, use of accessory muscles, fatigue of primary muscles of respiration.[1] Chronic obstructive pulmonary disease (COPD) is an obstructive airway disease characterised by air flow limitation which is not completely reversible. In COPD patients, the demand / capacity curve of the inspiratory muscles is skewed in such a way that there is severe overloading of the inspiratory muscles. This disproportion not only has an effect on the blood flow through limbs during exercise, but also a significant contributor to dyspnea via neuromechanical uncoupling.[2]

The inspiratory muscles are further overloaded during exercise by tachypnea(rapid shallow breathing). This rapid shallow breathing pattern is a result of an increase in the ventilatory requirement (V_E).Poor aerobic fitness and peripheral muscle weakness contribute to exercise limitation in COPD, as these factors result in a rapid lactic acidosis and a greater ventilatory demand for exercise.[2] Various techniques are in use to relieve dyspnea, remove secretions, correct the breathing pattern, improve lung function and functional capability in COPD patients. These are pursed lip breathing, diaphragmatic breathing, pranayama, active expiration, and ventilation feedback training.[3, 4, 5, 6, 7]

If a feed forward stimulus is provided to the patients by visual and kinaesthetic stimulation, it may help to retrain the breathing pattern and thereby achieve better lung function

and improve the functional capability. Also the supervision/commands required during therapist guided training increases the time spent per patient by the therapist, this limits the no. of cases treated in a particular time resulting in decreased productivity of the therapist. If a replacement/substitute for the simple regular breathing training is available it will reduce the time spent on each patient, thus increasing the productivity of the therapist. Thus this study aims to find the effect of the breathing retraining with the help of breathing retrainer device on the functional capability of patients with COPD and to find if the device is an effective method of training and can be used as a substitute for the therapist.[8]

II. METHODOLOGY

The study was approved by the ethical, scientific and research committees. The study was an experimental type and the study design was exploratory analysis. The study was conducted in Dr. D.Y. Patil Medical College, Hospital and Research Center, Pimpri, Pune. The target population was patients with COPD who were admitted to the pulmonary medicine ward. The sampling method was purposive. After identification of the samples they were distributed into two groups using a chit method.

Patients who were diagnosed by the pulmonary department, both males and females, conscious and oriented patients were included in the study. Patients with acute exacerbation, dyspnea grade 4(ATS), visual and auditory impairments were excluded. The pre training evaluation of the patients included measurement of respiratory rate, 6 minute walk distance, SpO2 after the exercise.

Group 1 was given therapist assisted breathing training and group 2 was given breathing retrainer assisted training. Both groups included 20 samples each. The breathing training was done for 5 days, twice daily for 30 minutes interspersed with rest period. Both the groups were given diaphragmatic breathing in sitting position with back supported and one hand over the abdomen, pursed lip breathing in sitting position, inspiratory holds.

For training with the breathing retrainer the machine was plugged in and kept on a table right in front of the patients' chair. The machine was kept at a height so that it was at the eye level of the patient. It was made sure that the patient is able to see the LED from the distance between the patient and the machine. The machine was started and the time for inspiration, inspiratory hold and expiration was set.With the green LED turning on, the patient was asked to do inspiration. The inspiration was done slowly and for as long as the green light moves in upward direction.As the red LED turns on the patient was asked ask to do expiration. Expiration was continued for as long as the red light moves downwards.Also a vibration sensor was held by the patient which vibrates just before the inspiration and expiration each time.

After 5 days again the measurements were recorded for respiratory rate, 6 minute walk distance, SpO2 after the exercise.

III. STATISTICAL ANALYSIS

It was done using WinPepi software. Sapiro – wilk test was applied to know if the data was normally distributed.Ppaired and unpaired t test was applied for normally distributed data and Wilcoxon and Mann Whitney U test was applied for the data which was not normally distributed.

IV. RESULTS

There was a significant improvement in the respiratory rate pre and post the treatment within the groups (group 1 p=0.004 and group 2 p=0.001). P value was also significant for 6 min walk distance within the groups (group 1 p= 0.004 and group2 p= 0.005). p value for SpO2 was significant within the groups (group 1 p= 0.012 and group 2 p=0.032)

V. DISCUSSION

The current study was carried out to investigate the effect of breathing retraining with the help of breathing retrainer on functional capability in patients with COPD.

The results of the current study shows that the mean respiratory rate in group 1 and group 2 patient's taken pre and post the treatment protocol has significantly reduced. This proves that the treatment protocol including therapist assisted and breathing retrainer assisted diaphragmatic breathing and pursed lip breathing is effective in relieving dyspnea in COPD patients. These observations are similar to the results found in the previous studies by Holland AE, Hill CJ et al (2012) and Margret A Nield, Guy W SooHoo et al(2008). These studies proved that diaphragmatic breathing and pursed lip breathing show improvement indyspnea.[5, 9,] As diaphragmatic breathing relaxes the accessory muscle use and recruits the primary muscle of inspiration. This helps in relaxation and the work of breathing is reduces leading to a decreased respiratory rate. Also pursed lip breathing helps in emptying of lung by prolong expiration which reduces the air hunger and therefore the rate of respiration reduces.[5, 9]

There was no significant difference found by comparing the respiratory rate of group 1 and 2. The p valuei.e. 0.604 is not statistically significant. The training given by the therapist and the training given with the help of the breathing retrainer device included similar exercises i.e. diaphragmatic breathing and pursed lip breathing with inspiratory holds. Only the method of administration was different in both the groups.

In the training given to group 1 patients the therapist only assists the patient, the therapist motivates and helps in learning the correct breathing pattern, but the therapist is needed to supervise and give continuous verbal commands to the patients, so that the breathing technique is correct. Counts are given during pursed lip breathing to ensure a prolong expiration and for inspiration and inspiratory hold time. Therefore, the time spent by the therapist on each patient is approximately 20- 25 minutes per session, including the time for preparation, explanation and execution, this results in approximately 500 minutes (8 hours 30 minutes) required to treat 20 patients in a day, as the treatment was given twice daily there is much more time required. On the contrary, the training given to the patients of group 2 required the therapist only to teach the patients how to perform the exercise with the help of the device. All the efforts are to be put by the patient themselves. Time is required to teach the patient how to synchronize his breathe with the breathing retrainer. Once the patient has learnt the technique they can perform the exercises on their own. This shows that the training given by breathing retrainer has an advantage over the training given by the therapist.

There was a significant difference found in 6 minute walk test (distance, SpO2) in group 1 and 2 performed pre and post the 5 day treatment protocol. The p value i.e. 0.004 for group 1 and 0.005 for group 2 was statistically significant. This shows there was improvement in patient's functional capabilities after the exercise sessions. The results of this study are similar to the findings of studies conducted by JingjuanXu et al(2017), AnamariaFleig Mayer et al(2017), Faager G (2008) and AntoanetaDimitrova et al (2017) who found that pursed lip breathing and abdominal breathing improves the physical tolerance/exercise performance/ exercise capacity and oxygen saturation in patients with COPD. The exercises given to the patient help in better ventilation and perfusion of the lungs, which leads to better oxygen supply to the demand of peripheral muscles while performing activities. As the demand is fulfilled the exercise capacity is improved. Also the inspiratory holds given are beneficial as they improve the ventilation through collateral channels i.e. pores of Kohn, channels of martini and channels of lambert. As the ventilation through these channels is increased the saturation of oxygen is improved. [8, 10, 11, 12]

There was no significant difference was seen when both groups were compared (p value 0.92). This proves that there is an improvement in functional capability in COPD patients after performing pursed lip breathing and diaphragmatic breathing irrespective of the training method. Therefore, the effect of breathing retraining through the breathing retrainer device is as effective as the exercise training given by the therapist.

VI. CONCLUSION

The Breathing retrainer was found to be an effective method of treatment in patients with COPD.

The functional capability which was measured through 6 minute walk test including the distance and SpO2 was found to be increased post training with breathing retrainer.

The respiratory rate was also found to be reduced after training.

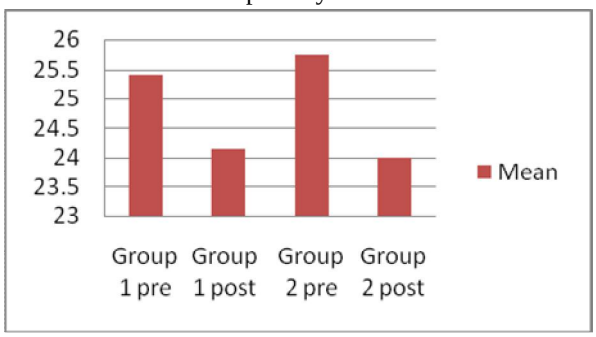
This study proves that the breathing retrainer can be helpful to retrain the breathing pattern in COPD patients. However it is advised that the therapist continuously monitors the training at intervals to ensure the patients correct efforts.

VIII. APPENDIX

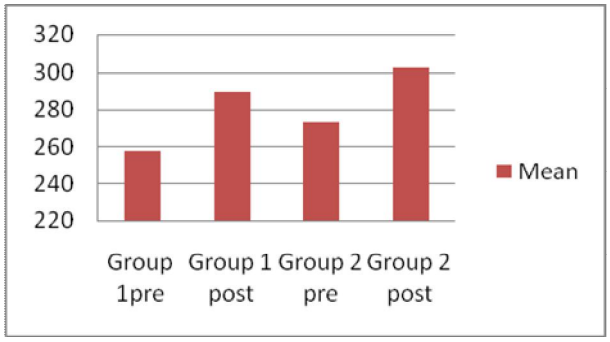
Table no. 1 shows the pre and post data of both the groups for RR, 6MWT, and SpO2.

		RR	6MWT	SpO2
Mean ±SD	Group1pre	25.4± 3.01	257.3± 79.2	96.1 ±1.80
	Group1post	24.15± 2.68	288.8± 82.66	98.95 ±1.23
	Group2pre	25.75± 2.24	272.8± 80.53	96.25 ±2.33
	Group2post	24± 2.42	302.7± 85.41	98.8 ±2.26
P value	Group1	0.004	0.004	0.012
	Group2	0.001	0.005	0.032

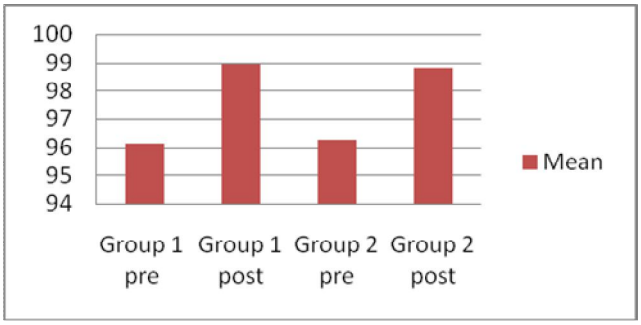
Graph 1: mean difference between pre and post data of respiratory rate.



Graph 3: mean difference between pre and post data of 6 minute walk distance.



Graph 4: mean difference between pre and post data of oxygen saturation.



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