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Efficacy of Breathing Retrainer on Retraining Breathing Pattern, Dyspnea and Lung Function in Patients with Copd

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ABSTRACT

In India COPD is the second most common lung disorder. COPD is characterized by progressive dyspnea, cough, sputum, altered breathing pattern, reduced oxygen saturation, respiratory muscle fatigue, reduced lung capacities, limited exercise capacity. Conventional physiotherapy techniques such as pursed lip breathing and diaphragmatic breathing are proved to be helpful in relieving dyspnea, reducing the work and rate of breathing, assure adequate oxygen to the working muscles, improving the exercise capacity and lung function, 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.

Objectives: To identify the effect of breathing retraining on respiratory rate, I:E ratio and lung function.

Materials and methods: In this study 40 patients with COPD were included (stage I,II, III according to GOLD criteria). These were divided into group I(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, I:E ratio, SpO2 and spirometry.

Results: All the parameters showed statistically significant improvement pre and post within the groups. No difference was found by comparing among the groups.

Conclusion: Breathing retrainer is an effective device to retrain the breathing pattern, reduce dyspnea and to improve lung function in COPD patients. It can be used as a substitute to the therapist.

Keyword: Breathing Retrainer, Pursed Lip Breathing, Diaphragmatic Breathing.

I. INTRODUCTION

In India COPD is the second most frequent lung disorder following pulmonary tuberculosis. Chronic obstructive pulmonary disease (COPD) is an obstructive airway disease characterised by air flow limitation which is not completely reversible. The global initiative for chronic obstructive pulmonary disease (GOLD) has defined COPD as a disease which is characterised by escalating development of chronic airflow limitation which is irreversible and comprises of chronic bronchitis and emphysema. COPD causes obstructed airflow from the lungs, which makes the patient breathless, causes cough with sputum, alters the breathing pattern, reduces the lung function and exercise capacity in patients.[1, 2]

Various techniques are in use to relieve dyspnea, remove secretions, correct the breathing pattern and to improve lung function in COPD patients. These are pursed lip breathing, diaphragmatic breathing, pranayama, active expiration, and ventilation

feedback training. But none of these techniques provide a feed forward to the patient.[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. 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.

DonyKotoky a student of Dr. D.Y. Patil College of Physiotherapy, Pimpri, Pune, in the year 2014 made a new device for training the breathing pattern in patients. The device was found to be an effective and reliable method for breathing retraining.[8]

This new device is designed to provide visual and kinaesthetic stimulation that acts like a feed forward mechanism to retrain the breathing pattern. The new equipment provides proper information at proper timing with visual and kinaesthetic stimulus. The new device reduces the time cost of the therapist and reduces the reliance of patient on the therapist. The productivity or the no. of cases to be treated in a particular time also increases. As the patient gets trained by the device he/she gets motivated to perform the exercises by himself/herself and the repetition of exercise also increases.

Thus this study intends to find weather the equipment based training can reduce the time and efforts of the therapist and can it be a substitute/ supporting device to train breathing pattern and thereby achieve better lung function among COPD patients.

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, I:E ratio, SpO2,spirometry (FEV1, FEV1/ FVC ratio).

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, i:e ratio, SpO2, spirometry.

III. STATISTICAL ANALYSIS

it was done using WinPepi software. Sapiro – wilk test was applied to know if the data was normally distributed. Paired 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). Similarly the p value for I:E ratio within the groups was statistically significant(group 1 p= 0.006 and group 2 p= 0.008). p value for SpO2 was significant within the groups (group 1 p= 0.012 and group 2 p=0.032). p value for FEV1 was found to be significant within the group (group 1 p= 0.006 and group 2 p=0.007). there was a significant difference found in FEV1/ FVC ratio within the groups (group1 p= 0.009 and group 2 p= 0.005) also the time taken for training with the device was significantly less.

V. DISCUSSION

The current study was carried out to investigate the efficacy of breathing retrainer device on retraining the breathing pattern, relieving dyspnea, improving lung function and exercise capacity in COPD patients.

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,]

In the training given to group 1 patients the therapist is needed to supervise and give continuous verbal commands to the patients, so that the breathing technique is correct. On the contrary, the training given to the patients of group 2 requires 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.

There was no significant difference found by comparing the respiratory rate of group 1 and 2. The training given by the therapist and the training given with the help of the breathing retrainer device included similar exercises only the method of administration was different in both the groups.

The results have also shown a significant reduction in I: E ratio in group 1 and group 2 taken pre and post the treatment protocol. This shows that as the rate of respiration is reduced the patient's no more feels the air hunger this gives enough time to breathe in and out. Also the patient is taught pursed lip breathing that allows the trapped air in the alveoli to be expelled due to the back pressure created in the airways that prevents them from collapsing while breathing through mouth with pursed lips.

There was no difference found when the I: E ratio among the two groups was compared. This insignificant result (p value 0.061) shows that the effect of exercise given by the therapist and the device were similar. The training of group 1 done by the therapist requires the therapist to give counts for inspiration and expiration each time the patient performs the exercise or the patient may count themselves, but this method has a disadvantage as the pause between the counts may not be equal, this makes the time dissimilar each time. Whereas, the exercises given with the help of breathing retrainer has an advantage as the time is set in the machine, so each time the patient performs the exercise the time is similar to the previous one. [7, 22]

The results show a significant change in the pulmonary function (FEV1, FEV1/ FVC) in group 1 and 2 recorded pre and post the 5 day treatment protocol. This shows an improvement in patients lung function after exercises training. This is similar to the findings of studies done by JingjuanXu (2017) ,Jeong-I Kang (2016) and Dr, Helen Shaji John Cecily (2013) who found that there was a significant improvement in pulmonary function after breathing exercises in COPD patients. [6, 12, 14]

There was no difference found on comparing the mean values of FEV1 and FEV1/ FVC among both the groups, which shows that the effect of therapist assisted exercises and device assisted exercises, is the same on lung function.

A significant difference was seen in the time that was spent on treatment each day for group 1 and group 2 patients. This shows that the time required to train the patients with the breathing retrainer device is less that therapist assisted training. Once the patient has learnt the technique they can perform the exercises on their own with the help of breathing retrainer device, whereas continuous supervision and command is required when there is one to one training given by the therapist to the patient.

VI. CONCLUSION

The Breathing retrainer was found to be an effective method of treatment for retraining breathing pattern, relieving dyspnea and improving lung function in patients with COPD.

The time spent on treatment of the patients with the help of breathing retrainer was less as compared to the time taken by the therapist to train each patient. Therefore the breathing retrainer is an efficient device to train COPD patient and can be used as a substitute to the therapist, in order to save energy and time of the therapist. However it is advised that the therapist continuously monitors the training at intervals to ensure the patients correct efforts.

VII. APPENDIX

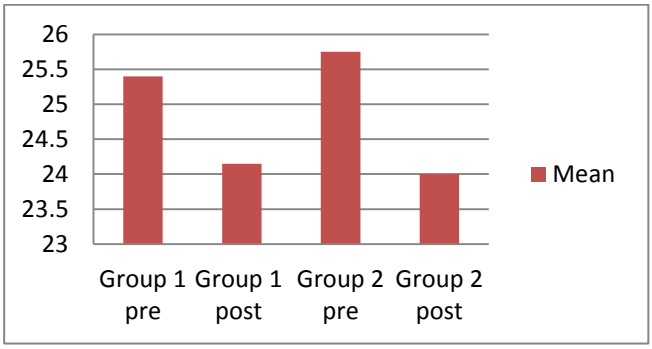
Table 1. shows the pre and post data of both the groups for RR, I:E ratio, SpO2, FEV1,and FEV1/FVC ratio.

		RR	I:E	SpO2	FEV1	FEV1/FVC
Mean ± SD	Group1 pre	25.4 ± 3.01	0.88 ± 0.19	96.1 ±1.80	45.3 ± 17.42	78.65± 26.5
	Group1 post	24.15± 2.68	0.60 ± 0.12	98.95 ±1.23	49.6 ± 18.28	83.35± 19.01
	Group2 pre	25.75± 2.24	0.74 ± 0.24	96.25 ±2.33	47.1 ±15.81	81.25± 19.92
	Group2 post	24± 2.42	0.6 ±0.18	98.8 ±2.26	52.85 ± 14.3	87.5± 14.64
P value	Group1	0.004	0.006	0.012	0.006	0.009
	Group2	0.00	0.00	0.03	0.00	0.005

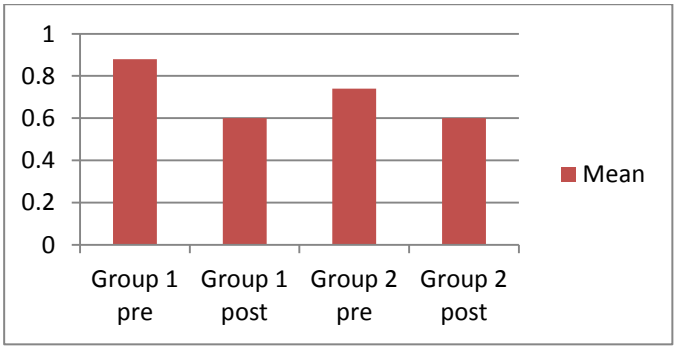
		1	8	2	7	

Table 2. shows the time spent on treatment each day for both the groups.

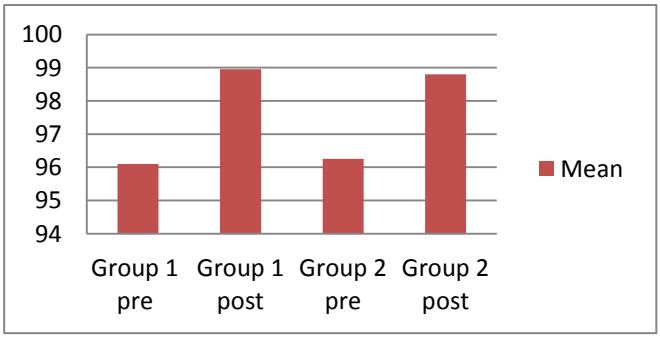
Day	Time (min) group 1	Time (min) group 2
Day 1	30	28.5
Day 2	29	20.45
Day 3	27.45	16
Day 4	25.5	10.8
Day 5	24.95	7.65



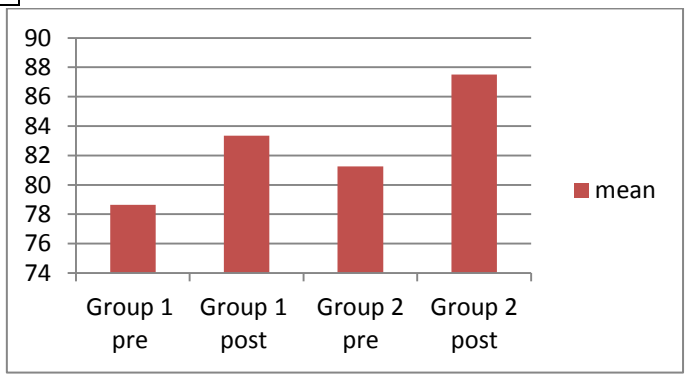
Graph 1. mean difference between pre and post data of respiratory rate.



Graph 2: mean difference between pre and post data of inspiratory : expiratory ratio.



Graph 3: mean difference between pre and post data of oxygen saturation.



Graph 4. mean difference between pre and post data of FEV1/ FVC ratio.

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