Original Research Article

Effect of 4-7-8 Breathing Technique on Anxiety and Depression in Moderate Chronic Obstructive Pulmonary Disease Patients

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ABSTRACT

Background: chronic obstructive pulmonary disease (COPD) patients has difficulty in expiration and 4-7-8 breath is a new breathing technique in which the numbers 4-7-8 refers to counts of inspiration, holding the breath and expiration respectively which overcomes the expiratory defect .

Objectives: (1) To determine the effect of conventional breathing technique on anxiety and depression in moderate COPD patients and (2) To determine the effect of 4-7-8 breathing technique on anxiety and depression in moderate COPD patients.

Methods: Ethical clearance was obtained from the Institutional Ethical Committee. A total of 87 patients diagnosed with moderate COPD were selected based on inclusion criteria. Randomization was done by simple random sampling and divided into two groups, Group A (N=43) received conventional therapy which includes nebulization, breathing exercises and chest physiotherapy. Group B (N=44) received 4-7-8 breathing technique along with conventional therapy. The outcome measures for dyspnea and anxiety and depression were assessed by Modified Medical Research Council grading and Hospital Anxiety and Depression Scale. Pretest was assessed on third day of admission and Posttest after 4 days of intervention.

Result: Within group A statistical analysis for MMRC grading (p 0.0034) was significant, for HADS (p 0.0814) it was not significant. Within group B, MMRC grading and HADS (p<0.0001) shows statistically significant. Between group comparison, MMRC and HADS (p<0.0001) which was extremely statistically significant.

Conclusion: 4-7-8 breathing technique focus on time factor of inspiration, hold and expiration is effective in reducing dyspnea, anxiety and depression in moderate chronic obstructive pulmonary disease patients

Key Words: 4-7-8 breathing technique, Chronic Obstructive Pulmonary Disease, Anxiety, Depression

INTRODUCTION

Chronic Obstructive Pulmonary Disease is a severe pulmonary disease in which secondary manifestations like anxiety and depression are more than primary manifestation and they are complicated with morbidity and mortality. The World Health Organization has predicted that COPD will become the third most common cause of death in the world by 2030. [1] In 2015, 3.2 million people died from COPD worldwide, an increase of 11.65% compared with 1990.Prevalence of COPD increased by 44.2% from 1990-2015. [2] In India, the

prevalence of COPD is 4.1% with ratio in male and female is 1.56:1, in smokers and nonsmokers is 2.56:1. [3] The COPD prevalence varied from 3-8% among Indian males whereas 2.5-4.5% among Indian females. [4]

Dyspnea and hyperventilation are symptoms of COPD. Dyspnea and panic attack are the clinical features of hyperventilation syndrome which are been assumed by hyperventilation model. Dysfunctional breathing pattern are experienced by patients with COPD and anxiety that may be associated with hyperventilation. The following hypocapnia responsible for aggravation of symptoms like anxiety and dyspnea. The carbon dioxide hypersensitivity model is based on the finding that lactate can produce panic attacks in patients suffering from panic disorder.

COPD generates hypoxia which leads to neuropsychiatric disturbances like psychomotor slowing ,memory impairment and depression. The mechanism of this ranging from damage to the white matter in the brain to vascular endothelial damage or increase in oxidative stress. [5]

In COPD patients, bronchocons-triction and lung hyperinflation causes shortness of breath due to hyperventilation which in turn increases the breathing frequency. [6]

ANXIETY AND DEPRESSION IN COPD

Psychiatric morbidity has been acknowledged in medically ill patients but there are very few interventions on psychiatric disorders in COPD patients. [5]

Anxiety and depression affect a number of patients with COPD. [7] They co exists frequently in COPD and compound the impact of the disease on quality of life and functional status. Prevalence of anxiety and depression is 28-36% and 19-40% respectively. [3] They are associated with disability and impaired functional status in the areas of general health, emotional roles, physical roles, body pain, social functioning, mental health function and vitality. After controlling for the effects of overall health status, COPD severity and dyspnea, anxiety and depression remain associated with decreased functional status. [10] In COPD, anxiety has been linked to breathlessness, increase frequency of hospital admissions for acute exacerbations and greater disability. [11-13] Prevalence of depression increases with the severity of COPD and patients with severe COPD with depression have a higher likelihood of exacerbation and frequent readmission and worse survival. [14-16] Anxiety and depression increases physical disability, co-morbidity, morbidity and health care utilization. It also interferes with compliance with medical treatment. Depressive patients has been found to have a profound impact on end of life decisions because depressed patients more often opt for do not resuscitate decision. [17] Impact of anxiety and depression on physical and social functioning are reduced exercise capacity, increased physical disability, reduced social interaction dependence on caregivers, emotional liability, loss of social role, decreased cognitive functioning, loss of self esteem. [18]

Conventional physiotherapy

Nebulization-In this, the drug is administered in the form of mist, inhaled into the lungs. This type of drug treatment reduces the severity and number of attacks in COPD patients.

Diaphragmatic breathing- During Diaphragmatic breathing, the patient was told to move the abdominal wall predominantly during inspiration and to reduce the motion of upper rib cage. This aims to improve chest wall motion and distribution of ventilation, improve exercise performance and decrease the energy cost of breathing and dyspnea.

Pursed lip breathing- By requiring active and prolong expiration pursed lip breathing works to improve expiration by preventing airway collapse. The patient is asked to perform moderate active expiration through

half opened lip and the pressure of about 5cm H_2O. [19]

Relaxation exercises-reduces the breathing frequency and increase the tidal volume.

Active expiration-during active expiration abdominal pressure increases due to contraction of abdominal muscles which lengthens the diaphragm and improves diaphragm function. [6]

Chest physiotherapy- It is a technique used to mobilize or loosen the secretions in the lungs and respiratory tract. It includes postural drainage, chest percussion and vibration, shaking, forced expiratory technique administered by hands. [3]

4-7-8 breathing technique

The patient is asked to sit in a comfortable position with hands on lap, press the tip of the tongue on the ridge of tissue behind the top, front teeth and keep it there throughout the breathing cycle, breath in deeply through the nose for 4 counts, hold the breath for 7 counts and then breath out slowly through the mouth for 8 counts and repeat the breathing cycle.

During exacerbation there will be increased dyspnea, resulting in respiratory muscle weakness, which increases dyspnea, reduces physical activity and increases anxiety and depression. Treatment is concerned only to the symptoms like dyspnea, cough and sputum but the secondary manifestations like anxiety, depression, balance, posture, osteoporosis remain untreated or treated in combination therapy which is ineffective. Although the underlying pathology is pulmonary but systemic effects of COPD results in disability. There is lack of treatment for anxiety and depression, which is not bothered by physicians, physiotherapist or nurses. So attention has to been given to the development of newer techniques with evidence based treatment strategies for this subset of patients.

4-7-8 breathing technique which is already proved to increases the GABA which are inhibitory neurotransmitter which reduces cortisol, adrenaline which in turn reduces the HR, RR, reduces the work of breathing by relaxing the tensed respiratory muscles resulting in reduction anxiety and depression. People who experiences anxiety and depression have shallow breathing and will be in a constant state of mild hypoxia or oxygen deprivation. Shallow breathing leads to increase CO_2 in tissue, which contributes to oxidative stress, inflammation and acidification. In COPD patients due to obstruction, expiration is difficult, so prolonged expiration facilitates removal of CO_2 from lungs. In this technique we ask the patients to inhale over a count of 4, so patient take in more oxygen. Next step is holding the breath for a count of 8 which allows as much of that oxygen to saturate into bloodstream as possible. In 4-7-8 breathing technique, by exhaling for a count of 8, patient expelled more CO_2 from lungs and it is reduces anxiety and depression. [21]

MATERIALS AND METHODOLOGY
Methodology

Type of study: Experimental study

Study design: Pre and post test

Place of study: Pulmonology department, KIMS Hospital, Karad

Sample size: 84

Sampling method: Simple random sampling (lottery method)

Study duration: 3 months

Frequency: 3 sets (10 times)/session, 4 session/day for 4 days.

Inclusion Criteria
- Age between 40-55 years
- Both sex
- Self report of shortness of breath
- A diagnosis of moderate COPD on GOLD classification ($FEV_1/FVC < 0.70$, $50\% < FEV_1 < 80\%$)
- HADS minimal score of 10
- Ability to provide informed consent.

Exclusion Criteria
- Received tricyclic anti depressive drugs or anti psychotic drugs
- Symptomatic cardio-vascular problems

- Individuals with spinal deformities and respiratory muscle dysfunction
- Patients with other systemic failure
- Carcinoma.

Materials Used

Pen, Paper
Hospital anxiety and depression scale
Dyspnea scale (MMRC grading)

Outcome Measures

Hospital anxiety and depression scale (HADS)
Dyspnea scale (MMRC grading)

PROCEDURE

After approval from institutional protocol and ethical committee, 100 patients diagnosed with moderate COPD were assessed for eligibility for the study. Out of which only 87 were selected for the study as 5 patients were not meeting the inclusion and exclusion criteria, 5 were not interested to participate and 3 dropped out due to other reasons. Simple random sampling (Lottery method) was used for randomization of the sample selected.87 covers with information regarding treatment were prepared and the patients themselves selected the cover the no of participants in group A (N= 43) and B (N= 44) . Based on the protocol in the cover they were explained about the study and informed consent was taken prior to study. Pre test for MMRC grading and HADS were taken before the study started and post test was done after 4 days.

Group A received only conventional therapy which includes nebulization, breathing exercises (diaphragmatic breathing, pursed lip breathing) and chest physiotherapy. Group B received 4-7-8 breathing technique and conventional physiotherapy.

During the study in group A, 1 individual dropped out due to frequent exacerbation. In group B, 2 individuals were dropped out as they were shifted to ICU .Totally 84 moderate COPD patients completed the treatment protocol and were taken for analysis in study.

Treatment given-

Table no.1-Treatment protocol

GROUP A	GROUP B
1.Nebulization	1.Nebulization
2.Diaphragmatic breathing exercise, pursed lip breathing	2.4-7-8 Breathing technique
3.Chest physiotherapy	3.Chest physiotherapy

STATISTICAL ANALYSIS

Data of all outcome measures was measured as pre treatment and post treatment values. Mean and standard deviation was calculated for each outcome measure.

Within the groups the data was analyzed by paired t test. Between the groups the data was analyzed by unpaired t test. The p and t values were calculated.

DATA PRESENTATION
1. GENDER DISTRIBUTION IN THE STUDY

Table no.2-Gender distribution

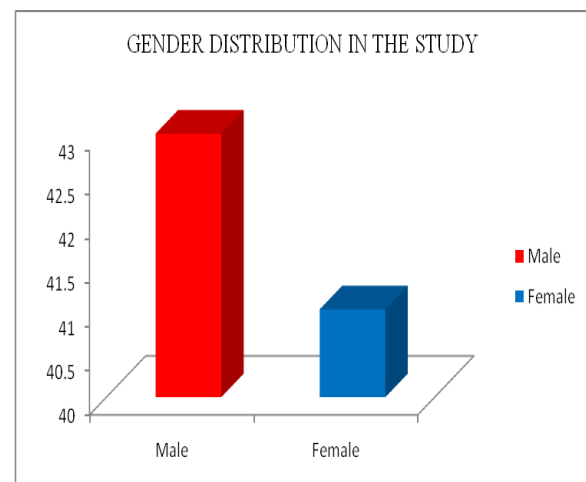| Gender	Total
Male	43
Female	41

Fig.no.1-Gender distribution

Interpretation: The diagram shows 43 males and 41 female patients participated in the study.

2. GENDER DISTRIBUTION IN GROUP A AND GROUP B

Table no.3-Gender distribution in group A and B

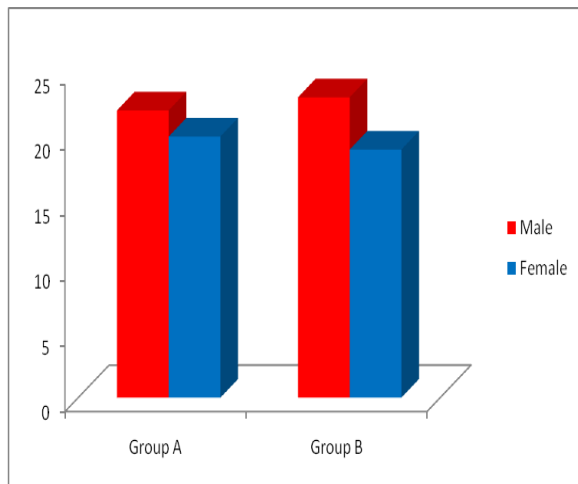| Gender	Group A	Group B
Male	22	23
Female	20	19

Fig.no.2-Gender distribution in group A and B

Interpretation: The diagram shows 22 male and 20 female patients participated in group A and 23 male and 19 female patients participated in group B.

3. MEAN AGE

Table no.4-Mean age

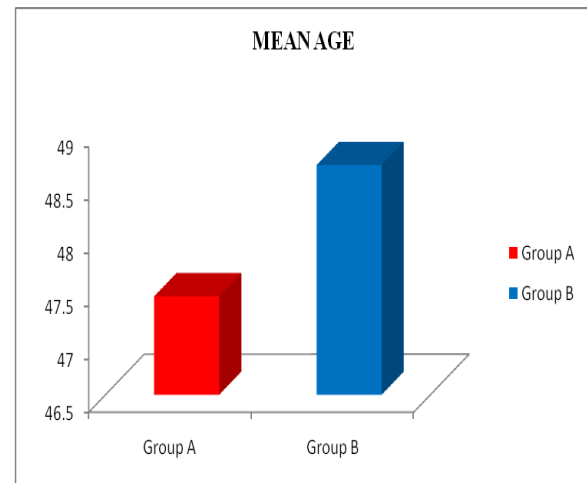| Group	Mean age
Group A	47.4286
Group B	48.6667

Fig. no.3-Mean age

Interpretation: The diagram shows that the mean age of subjects included in group A was 47.4286 and that of group B was 48.6667.

DATA ANALYSIS
WITHIN THE GROUP COMPARISON GROUP A

Table no.5-Comparison between pre and post MMRC and HADS mean values within group A

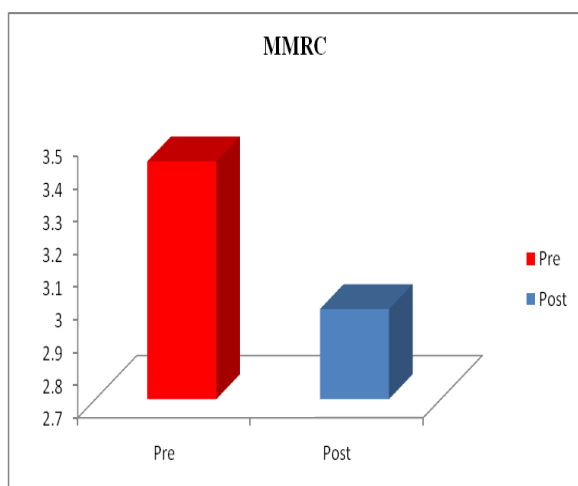| Parameters	Pre	Post	mean diff	t value	p value	Remark
MMRC	3.4285	2.976	0.4525	3.111	0.0034	Significant
HADS	12.452	12	0.4524	1.787	0.0814	Not significant

Fig.no.4-Comparison between pre and post MMRC mean values within group A

Interpretation: The above table and graph shows pre and post comparison within the group A. Post training there was significant

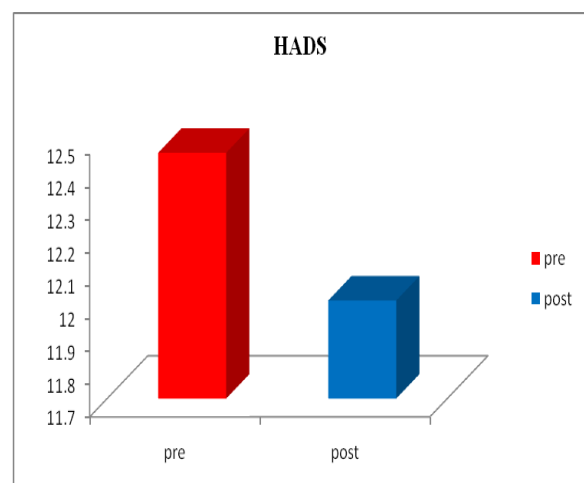improvement noted according to the p value.

Fig.no.5-Comparison between pre and post HADS mean values within group A

Interpretation: The above table and graph shows pre and post comparison within the

group A. Post training there was not significant improvement according to the p value.

GROUP B

Table no.6-Comparison between pre and post MMRC and HADS mean values within group B

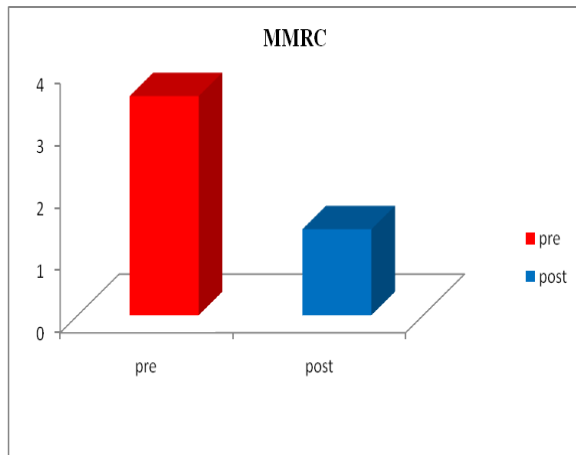| parameters	Pre	Post	mean diff	t value	p value	Remark
MMRC	3.524	1.381	2.143	19.339	<0.0001	Significant
HADS	13.167	7.238	5.929	41.712	<0.0001	Significant

Fig.no.6-Comparison between pre and post MMRC mean values within group B
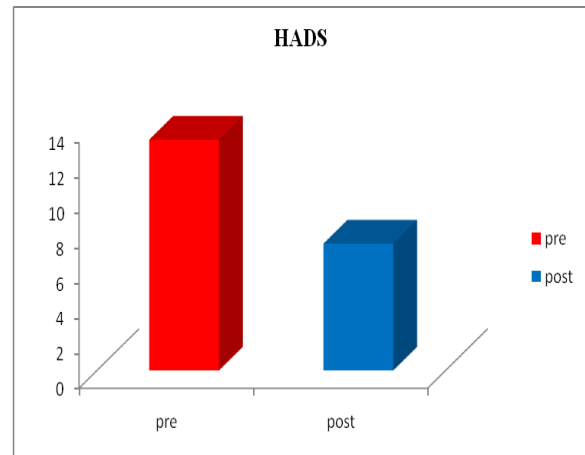

Fig.no.7-Comparison between pre and post HADS mean values within group B

Interpretation: The above table and graph shows pre and post comparison within the group B. Post training there was significant improvement according to the p values.

Interpretation: The above table and graph shows pre and post comparison within the group B. Post training there was significant improvement according to the p values.

BETWEEN THE GROUP COMPARISON

Table no.7-Comparison between post- post MMRC and HADS mean values between group A and group B

parameters	group A	group B	Mean diff	P value	Remark
MMRC	2.976	1.381	-1.595	<0.0001	Significant
HADS	12	7.238	-4.762	<0.0001	Significant

significant improvement noted in group B according to p value.
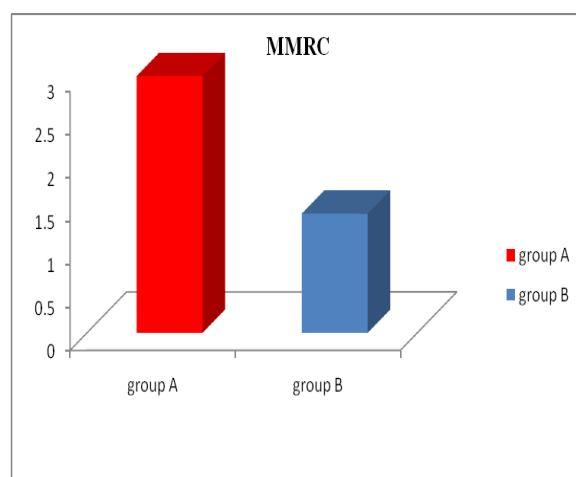
Fig.no.8-Comparison between post- post MMRC mean values between group A and group B
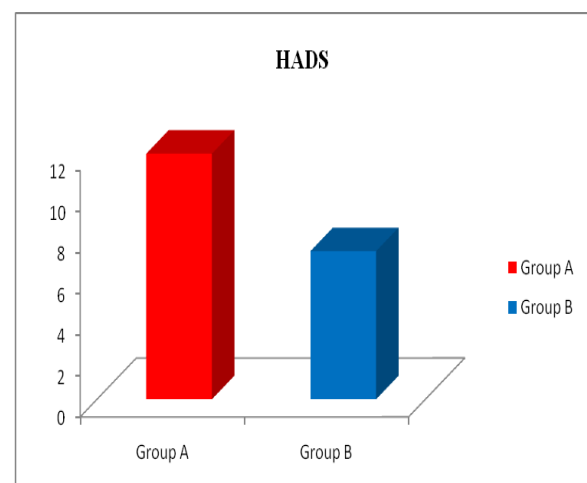

Fig.no.9-Comparison between post- post HADS mean values between group A and group B

Interpretation: The above table and graph shows post comparison between the group A and group B. Post training there was

Interpretation: The above table and graph shows post comparison between the group A and group B. Post training there was significant improvement noted in group B according to the p value.

DISCUSSION

Breathing exercise is a form of yoga which concentrates mainly on breathing and movements. COPD patients have expiratory difficulty and all breathing exercises concentrate on expiration and inspiration not on duration. Mostly both are of same duration performed in COPD patients. Excess carbon dioxide builds up in the tissues which contribute to oxidative stress, inflammation and acidification in the body. The expiratory ratio should be more such that expiration can be facilitated and all the carbon dioxide can be expelled out. When forced expiration is performed there will be collapse of the smaller airways behind so pursed lip breathing during expiration facilitates the airways to remain open.

Due to increased respiratory rate the accessory muscles are used resulting in dyspnea, patient becomes more anxious and due to muscle weakness the activities of daily life are affected which results in depression.

4-7-8 breathing exercise focus on inspiration followed by a hold which allows collateral channels to open up and expand activates parasympathetic nervous system which slows down the heart rate and causes the body to relax and slow down respiration. More the duration more the air can be expelled out.

GABA and glutamate are abundant neurotransmitter of the CNS. GABA has an effect of reducing excessive brain activity and promoting a state of calm .glutamate is an excitatory neurotransmitter and encourages neuron to fire and send nerve impulses .GABA does the opposite by not firing the adjoining cells and no impulse is sent.

Without enough GABA to balance glutamate, GABA hinders the transmission of nerve impulses from one to other. The slow breathing pattern increases collateral circulation and improves oxygenation that signals the brain to release GABA, which in turn inhibit the release of cortisol and adrenaline which reduces anxiety and depression. [21]

Mrudula M Mhaske et al states that anxiety and depression is reduced with breathing exercises where relaxation is incorporated along with. [22] 4-7-8 breathing technique which incorporates both breathing and relaxation along with timing has reduced dyspnea, anxiety and depression in moderate COPD patients.

Within group A for MMRC, p value is 0.0034which is significant and for HADS, p value is equal to 0.0814, which is not statistically significant. Within group B for MMRC and HADS p value is <0.0001 which is statistically significant .When compared between the groups, for MMRC and HADS p value is <0.0001 which is extremely significant, hence proved the effect of 4-7-8 breathing technique on anxiety and depression in moderate COPD is more effective.

Limitations - 1. Subjects were not able to follow the instructions.2.There was lack of follow up.

Suggestions and recommendations -1.This study can be done on other population than Asian population. 2.This study can be done on larger population in all obstructive lung diseases .

CONCLUSION

The results of the study prove that the 4-7-8 breathing technique is effective in reducing anxiety and depression in moderate chronic obstructive pulmonary disease patients.

COPD patients has dyspnea, reduced lung volumes and capacities, abnormal breathing pattern, difficulty during expiration.4-7-8 breathing technique is effective in reducing dyspnea, increasing lung volumes and capacities and improving breathing pattern and expiration.

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