

Effectiveness of Transcutaneous Electrical Nerve Stimulation (TENS) on Acupressure Point with Muscle Stretching in Chronic Obstructive Pulmonary Disease Patients

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ABSTRACT

Background - Chronic obstructive pulmonary disease is a progressive condition characterized by airflow limitation which is not fully reversible (WHO). Acu-TENS is a low rate category of TENS which gives acupuncture like strong low frequency stimulus. Acu-TENS aids in improving energy flow to the lungs through neural stimulation and also facilitating release of endogenous opiates which are respiratory depressants. Hyperinflation of the chest places the pectoralis major in a shortened position, increasing resistance of the chest wall to expansion, further increasing the work of breathing and demand placed on respiratory muscles. Stretching aids in the elongation of this muscle and thereby decreases the work load on respiratory muscles.

Specific Objective - To compare the effect of Transcutaneous Electrical Nerve Stimulation (TENS) on acupressure point with muscle stretching technique and muscle stretching technique alone in increasing Forced Expiratory Volume in one second (FEV₁) and decreasing Dyspnea in patients with Chronic Obstructive Pulmonary Disease.

Design - Pre test – Post test with comparative Treatment (Quasi experimental)

Study Setting - Department of Pulmonology, P.S.G Hospitals, Coimbatore.

Participants - A total of 30 COPD patients who have not received bronchodilator for the past 6 hours prior to data collection. Age more than 30 years.

Intervention -Group A-15 participants received Acu-TENS and muscle stretching technique with duration of 45 minutes (single session) and Group B-15 Participants received muscle stretching technique with duration of 20 minutes (three repetitions).

Outcome Measures - FEV₁ using Digital peak flow meter and Modified Borg dyspnea scale.

Results - The patients in Acu-TENS with muscle stretching group showed the mean difference in FEV₁ and dyspnea were 0.62 and 4.46 respectively. The patients in muscle stretching group alone showed the mean difference of FEV₁ and dyspnea were 0.54 and 2.54 respectively using paired 't' test. The FEV₁ of patients in Acu-TENS with stretching and stretching group showed a mean difference of 0.08 and dyspnea in Acu-TENS with stretching and stretching showed a mean difference of 1.93 using independent 't' test.

Conclusion - This study reveals that there was more positive improvement in the group who received acu-TENS along with muscle stretching than the group who received muscle stretching alone.

Key words: Acu-TENS, acupressure point, muscle stretching, COPD

INTRODUCTION

Currently, Chronic Obstructive Pulmonary Disease (COPD) is in the fourth place in the list of major top 10 diseases causing mortality and morbidity throughout the world. Chronic cough, excessive sputum

and dyspnea are the classical symptoms of COPD and wide spectrum of diseases may lead COPD such as chronic bronchitis, Emphysema, Bronchial Asthma, and Bronchiectasis. Therefore, COPD can be defined as "A disease characterized by

airflow limitation that is not fully reversible, is usually progressive, and is associated with an abnormal inflammatory response of the lungs to inhaled noxious particles or gases” – The Global Initiative for Chronic Obstructive Lung Disease (GOLD).^[1]

COPD is mainly caused by smoking as well as other diseases, but however smoking is not only the major cause of COPD and not necessarily affects only smokers. A risk of death is 10times higher in smokers than non smokers. Other than smoking, the following can cause COPD indoor air pollution caused by cooking – especially in women, passive exposure to cigarette smoke or environmental pollution, dusts and chemicals (vapors, irritants and fumes) released by factories.

FEV₁ is the important measure to assess the status of COPD and to obtain a FEV₁ value the continuous exhalation effort should last 6 seconds at least, when there's no more flow from the lungs to the spirometer. Dyspnea is a subjective sensation defined as an uncomfortable sensation of breathing. Though there is a broad spectrum of management for COPD includes, pharmacological and non pharmacological, still there is a pressing need for new therapeutic intervention

Stimulation of the A alpha and A Beta nerve fibers by TENS especially on acu points induce vagal afferents via hypothalamic stimulation similar to acupuncture. This result the reduction of dyspnea due to hypothalamic activity associated with endorphin release.^[2] Muscle stretching releases the shortness of the muscle around the chest wall and it eases the breath, thus increases the lung expansion and vital capacity.^[3]

This study is sought to compare the effect of Transcutaneous Electrical Nerve Stimulation (TENS) on acupressure point with muscle stretching technique and muscle stretching technique alone in increasing Forced Expiratory Volume in one second (FEV₁) and decreasing Dyspnea level in patients with Chronic Obstructive Pulmonary Disease (COPD).The massive

clinical and economical burden of COPD in India is vast. It is a necessity to study and understand an economic, practical and effective method to tackle COPD.

Objectives

- To determine the effectiveness of TENS on acupressure point with muscle stretching technique in increasing FEV₁ and decreasing Dyspnea level in patients with COPD.
- To determine the effectiveness of muscle stretching technique in increasing FEV₁ and decreasing Dyspnea level in patients with COPD.
- To compare the effect of TENS on acupressure point with muscle stretching technique and muscle stretching technique alone in increasing FEV₁ and decreasing Dyspnea level in patients with COPD.

MATERIALS & METHODOLOGY

STUDY DESIGN: A quasi experimental study design - Pre test and post test design with comparison treatment

STUDY SETTING: Department of Pulmonology, PSG Hospitals, Coimbatore. PSG Hospitals is a multi specialty 1000 bedded hospital with fully equipped Physiotherapy department.

ETHICAL CLEARANCE: This study obtained ethical clearance from Institutional Human Ethics Committee, PSG IMSR, Coimbatore, India.[ref no. 11/038]

PARTICIPANTS: A total 30 patients were selected by convenience sampling method. They were included if age more than 30 years, using bronchodilator need to avoid its use for the past 6 hours prior to data collection. They were excluded if Ischemic heart disease patients, cardiac pacemaker patients, acute exacerbation of obstructive airways disease, COPD patients with ventilator support.

Group A-15 participants received Acu-TENS and muscle stretching technique with duration of 45 minutes (single session)

Group B-15 Participants received muscle stretching technique with duration of 20 minutes (3 repetitions/session).

INTERVENTION:

Acu-TENS APPLICATION

- The patient in sitting or lying position the electrodes is placed.
- The 2 electrodes are placed bilaterally 3cm lateral to the spinous process of the seventh cervical vertebrae.
- The electrodes are then attached to the Acu-TENS machine.
- Frequency of the machine is set at 4Hz
- Pulse width of 200microseconds is set.
- Intensity is based mainly upon the tolerance levels of the patient.
- Here the intensity is set at the highest tolerance level of the patient.
- Only a single session is required per patient
- Treatment is given for duration of 30-45min.

Muscle Stretching Technique

- First the subject is asked to raise shoulder in 90⁰ abduction and then external rotate with the elbow flexed.
- Upon maintaining this position the subject is asked to contract the pectoral muscles.
- This is achieved by asking the subject to move the limb in horizontal flexion.
- This movement is resisted for duration of 6 seconds.
- This facilitates the required isometric contraction.
- Further upon relaxation, passive stretch is applied in the opposite direction.
- The cycle is repeated thrice for each patient.

OUTCOMES

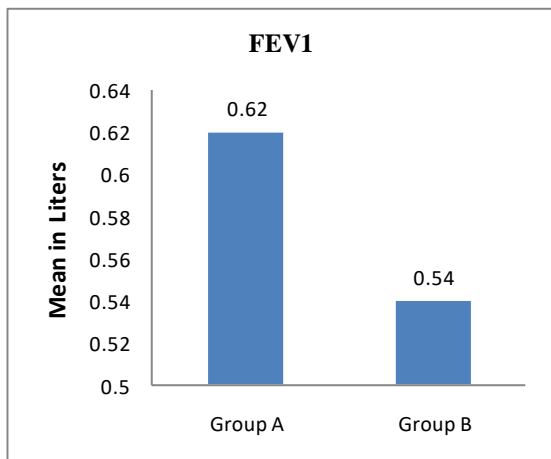
- Vitalograph asma-1 Digital Peak Flow Meter- used for measuring FEV₁
- 10-point Modified Borg Dyspnea Scale- used for measuring Dyspnea level.
- In group A, who received TENS on acupressure point with muscle stretching

FEV₁ and Dyspnea level were measured before and after the treatment session. In group B who received muscle stretching technique alone FEV₁ and Dyspnea level were measured before and after the treatment session. FEV₁ was measured using Vitalograph asma-1 (digital peak flow meter). Manufacturer: Vitalograph (Ireland) Ltd, Ennis, Ireland. Dyspnea level was measured using 10-point Modified Borg Dyspnea Scale.

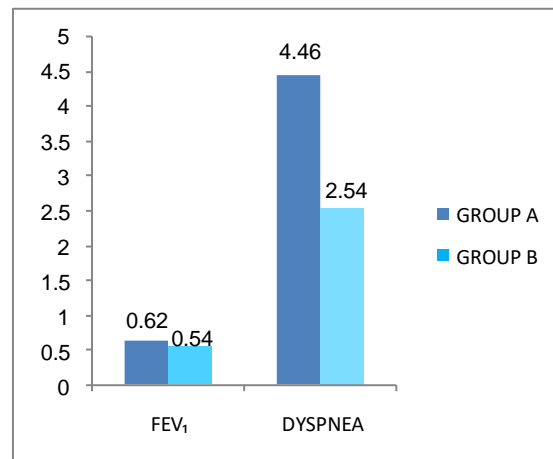
Technique of measuring FEV₁ using Vitalograph asma-1 (Digital peak flow meter)

- Allow the patient to sit down while blowing into the device. Turn on the device, with the mouthpiece inserted into the device. (Use a disposable mouthpiece). When the device is ready for the proceeding, ask the patient to hold his head high and to breathe in as deeply as possible, hold the Vitalograph asma-1 ready in front of the mouth. Instruct the patient to holding the breath, place the mouthpiece into the mouth, biting the mouthpiece lightly, and with the lips firmly sealed around it. Ask the patient to blow out as HARD and as FAST as possible for a second or more, with the caution of not blocking the mouthpiece with the tongue or teeth. As 'spitting' action will give false readings. The PEFr result for this blow will be displayed, followed by the FEV₁ result after approximately 3 seconds. Usually 3 blows are required, and best among (PEFR & FEV₁) them is chosen.

DATA ANALYSIS: The data analysis was done using IBM SPSS. The mean, standard deviation and Paired "t" test values were used to find out whether there is any significant difference between pre test and post test values within the groups. Independent 't' test, mean difference values for FEV₁ and Dyspnea level of Group A and Group B were used to find out whether there is any significant difference in between the groups.



Graph 1: Pre test and post test mean values for forced expiratory volume in one second (FEV_1), (n=30)



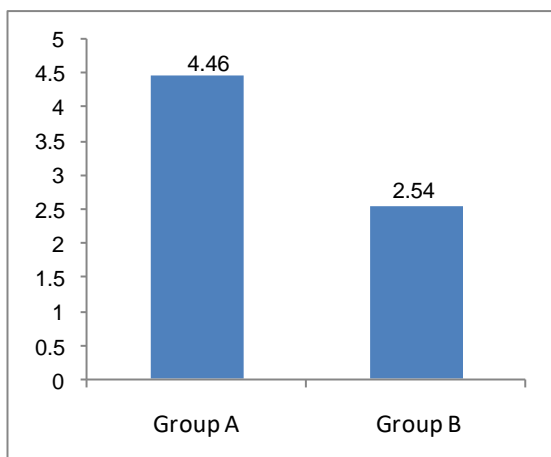
Graph 3: Mean Difference Values for FEV_1 & Dyspnea Level Of Group A & Group B

Table 1: Forced Expiratory Volume in one second (FEV_1)

GROUPS	n	Mean Difference	SD	t-value	p-value
Group A (Pre Test –Post Test)	15	0.62	0.094	25.27	<0.05
Group B (Pre Test –Post Test)	15	0.54	0.102	20.37	<0.05

Table 3: Mean difference values for FEV_1 & Dyspnea Scale of Group A & Group B

GROUPS	n	Mean difference	SD	t-value	p-value
FEV_1	15	0.08	0.007	2.202	<0.05
DYPSPNEA	15	1.93	0.36	8.274	<0.05



Graph 2: Pre test and Post test mean values for 10-point modified Dyspnea scale

TABLE 2: 10-POINT MODIFIED DYSPNEA SCALE

GROUPS	n	Mean difference	SD	t-value	p-value
Group A (Pre Test –Post Test)	15	4.46	0.639	27.03	<0.05
Group B (Pre Test –Post Test)	15	2.54	0.639	15.33	<0.05

RESULTS

The FEV_1 value of post intervention (mean =2.81) is increased in Group A who received TENS on acupressure points along with muscle stretching compared to pre intervention (mean = 2.19). The FEV_1 value of post intervention (mean =2.89) is increased in Group B who received TENS on acupressure points along with muscle stretching compared to pre intervention (mean = 2.35). The Dyspnea level is significantly decreased with post intervention (mean =2.60) in Group A who received TENS on acupressure points along with muscle stretching compared to pre intervention (mean = 7.06). The Dyspnea level is significantly decreased with post intervention (mean =3.66) in Group B who received TENS on acupressure points along with muscle stretching compared to pre intervention (mean = 6.20). The improvement rate of FEV_1 in Group A (0.61) is higher than Group B (0.54). The improvement rate of Dyspnea in Group A (4.46) is higher than Group B (2.54).

DISCUSSION

From the above data it is clearly understood that a combination of both Acu-

TENS along with the muscle stretching technique is much more efficient than muscle stretch technique alone in patients with COPD. Takeshige et al, 1993, [4] hypothesised that signals from stimulation of peripheral nerve fibers (possibly through acupuncture points) can influence hypothalamic functions via the dorsal periaqueductal grey fibers, and there by influence the respiratory centre in the medulla, modifying respiration. The effect of Acu-TENS on endorphin levels, its combined effect with medication on dyspnea, its effect on frequency or intensity of disease exacerbation, and its long-term effect on the quality of life in patients with COPD. Xu and Tan (1988) [5] states that “According to traditional Chinese medicine, dyspnea results from a deficiency in the flow of ‘Qi’ (energy) in the lungs and application of an appropriate acupuncture technique is thought to restore the energy balance”. The results of this study are similar to the study conducted by Lau et al, 2008, [3] were they have achieved an increase in the FEV₁ value and also a reduction in dyspnea level but at a lower range. In their study they demonstrated that compared to placebo-TENS with no electrical stimulation, bilateral application of Acu-TENS at acupressure point EX- B1 for 45 minutes in ambulatory patients with COPD lead to an improvement in dyspnea and FEV₁. They suggest other conventional techniques will give better comparisons. In the current study we had followed the same method of application of Acu-TENS along with muscle stretching for the experimental group. The result shows that the increase in the FEV₁ value and reduction in dyspnea level is better than the previous study. [1] Maa and associates in 1997 have reported on the favorable results of acupuncture and acupressure in Dyspnea through self administration of acupressure over 7 acupoints during a 6 week treatment programme. [6] Similar study was done by Wu et al, in 2004 has compared the effects of acupressure to sham acupressure over 5 acupoints for 3 minutes, 5 sessions per week

for a period of 4weeks led to a significant reduction in dyspnea. [7] Michael T. Putt and Michelle Watson et al, 2008, demonstrated that stretching technique based on proprioceptive neuromuscular techniques is able to increase ROM in the chest and shoulder girdle and increase vital capacity in patients with COPD in the short term. [3] In our study we had followed the muscle stretching based on PNF stretching for both groups. The result shows that increase in the FEV₁ value and reduction in dyspnea level when compared to pre test values.

Limitations

- Only mild and moderate severity COPD patients are participated in this study.
- This study checks only the immediate effect of TENS on acupressure point with muscle stretching or with only muscle stretching in FEV₁ and Dyspnea level in patients with COPD.
- In this study, the measurement of FEV₁ and Dyspnea level were not blinded to the evaluator.

Recommendations

- It is further recommended to have long term follow up following multiple treatment sessions with large number of samples.
- It is suggested that the effect of TENS on acupressure point with muscle stretching technique also be taken for further study.
- The effect of the technique used to be explored in conditions other than COPD that presents with Dyspnea among various age groups and in occupational lung disorders.

CONCLUSION

This study was conducted to compare the effect of TENS on acupressure point with muscle stretching technique and muscle stretching technique alone in increasing FEV₁ and decreasing Dyspnea level in patients with COPD. Therefore from the literature available and the statistical analysis of the data obtained, the study concluded that, “There is more positive improvement in Forced Expiratory

Volume in one second (FEV₁) and Dyspnea level following Transcutaneous Electrical Nerve Stimulation (TENS) on acupressure point with muscle stretching technique than muscle stretch technique alone in patients with Chronic Obstructive Pulmonary Disease”

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