ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation Journal Home Page: www.ijrps.com

Efficacy of breathing retraining program on bedside assessment of pulmonary function

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Article History:

Received on: 25.09.2019
Revised on: 02.12.2019
Accepted on: 09.12.2019

Keywords:

Breathing Retraining,
Snider Match Test,
Single Breath Count,
COPD,
Pursed Lip Breathing

ABSTRACT

Breathing retraining alters respiratory muscle recruitment and improves respiratory muscle performance. However, the effectiveness of Pursed Lip Breathing in reducing dyspnoea is controversial. The aims of this study are to determine if breathing retraining is influencing the Single Breath Count performed by dyspneic subjects and to assess the correlation between Single breath Count Test and Snider match test as the standard measures of bedside pulmonary function test in patients with dyspnoea. 100 Patients with dyspnoea were assessed in the baseline with snider match test and they were asked to perform a single breath count. 5 times weekly and for 4 weeks, the participants have been practicing Breathing Retraining. Pursed lip breathing (PLB) and diaphragmatic breathing (DB) are breathing retraining strategies to subjects with dyspnoea; Single Breath Count was measured by asking patients to take a deep breath and count as far as possible in their normal speaking voice without taking another breath. Counting was timed to a metronome set at 2 counts per second. Snider match test was conducted by blowing the matches at increasing the test distance from 3, 6, 9 inches. The result of this study will determine whether breathing retraining is safe and beneficial for people with dyspnoea.

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ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v11i2.2019

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INTRODUCTION

In clinical practice, assessment of dyspnea is always a burden and a challenge, because of the subjective experience of quantifying it. The American Thoracic Society defines dyspnea as "a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity [it] derives from interactions among multiple physiological, psychological, social, and environmental factors, and may induce secondary physiological and behavioral responses (Bianchi *et al.*, 2004). The subjectivity of dyspnea is one of the main difficulties confronting the clinician whose task it is to determine the diagnosis and judge the severity of the underlying condition. The pathology behind dyspnea is still not fully clear and is now under investigation. Various instruments are used to analyze dyspnea, VAS (visual analog scale), Borg scale are simple measures of intensity of dyspnea and multidimensional questionnaires- dyspnoea profile also used

commonly (Dechman and Wilson, 2004). These instruments have been validated and are useful for communication. Other disease-specific dyspnoea classifications include the New York Heart Association (NYHA) classification. Dyspnoea is the predominant symptom limiting exercise capacity and activity of daily living in patients (Sankar and Monisha, 2019). It is usually described as a range of different descriptors that varies in intensity and influences by a patient's experiences. Clinical disorders that affect the heart, lungs and neuromuscular apparatus produce symptoms of dyspnea (Sankar *et al.*, 2019). Breathing Retraining Program benefit chronic mouth breathers and patients with sleep apnea and dyspnoea (Garrodl *et al.*, 2005). Routine investigations of respiratory functions like volumes, flows, and indices of gas exchange, are non need, and they are not specific to diagnosis but give some information about respiratory muscle performance (Jones *et al.*, 2003). But the respiratory muscle dysfunction can be identified by conventional respiratory function tests. On occasion, the presence of breathing pattern dysfunction is first suspected from the pattern of breathing, which is spontaneously adopted by the patients (Manshawi *et al.*, 1986). PFT- pulmonary function testing is more frequently used in assessing the severity of underlying lung disease and the progress of a patient with goof lung function (Garrodl *et al.*, 2005). The efficacy of pursed-lip breathing (PLB) and diaphragmatic breathing (DB) in the rehabilitation of people with dyspnoea remains unclear and there is no proper teaching of these breathing retraining exercises was done in routine practice (Nield *et al.*, 2007). This study examines the usefulness of these techniques in normalizing the breathing pattern of people with dyspnoea (Jones *et al.*, 2003). The studies included the use of PLB and DB and used outcomes that were measured at the bedside. Pursed-lip breathing is the well-known respiratory rate lowering technique, and evidence suggests that this decreases the resistive pressure drop across the airways and, therefore, decreases airway narrowing during expiration. This decrease in airway narrowing may account for the decreased dyspnea (Manshawi *et al.*, 1986). Diaphragmatic breathing has negative and positive effects, but the latter appears to be caused by simply slowing the respiratory rate (Spahija *et al.*, 2005). Evidence supports the use of PLB, but not DB, for improving the breathing of people with obstructive lung disease. Despite many studies on the topic, there is no specific research has highlighted the effects of breathing retraining program individually without including that under combination technique, the role of breathing retraining techniques such as pursed-lip breathing (PLB)1 and diaphragmatic breathing (DB)2 in the rehabilitation of people with dyspnoea remains unclear (Stel *et al.*, 2001).

METHODOLOGY

Totally 100 Patients with dyspnoea are included in the study and randomly assigned to Group A and Group B, in that 20 patients were dropped out of the study in 3 days after the commencement of the study, because of the exacerbation of the underlying lung disease and because of other factors.

Selection criteria

Inclusion Criteria

1. Patients with an age group of 30 to 50 years, having a Borg scale grading of 0-6
2. Patients with a clinical disorder of the lung

Exclusion Criteria

1. Patients with cardiac disease and neuromuscular complications.
2. Patient with long-term use of supplemental oxygen.
3. Patients who underwent surgery within the preceding 3 months.
4. Exacerbation of cardio-respiratory disease within preceding 4 weeks.
5. Musculoskeletal disorders.
6. Patients with cognitive deficits.

Assessment parameters

1. Single Breath Count
2. Snider Match Test
3. Six-minute walk test

The parameters are measured at baseline and at 5th week.

Study Protocol

Group A

After getting informed consent signed, patients were allocated into Pursed lip breathing group

Training protocol

50 Dyspnoeic subjects were evaluated with Borg's scale, The modified Borg scale was used to estimate the magnitude of dyspnea and it helps compare subjects. The scale has a range between 0 and

10. The study subjects have to point at the numbers or word that describes his/her shortness of breath range. Reliability and Reproducibility of the modified Borg scale have been well documented. The 6MWD was used as a stimulant of dyspnea and the Borg scale is answered at the beginning and end of the 6MWD. Baseline pulmonary function is evaluated using Snider match test and single breath count. Patients were allocated to group 1 (n=50) was submitted to pursed-lip breathing exercise sessions and dyspnoea score was evaluated at the end of the exercise training. Patients were instructed to practice Pursed-lips breathing by demonstration. The arterial oxygen saturation measured from a pulse oximeter is used to provide feedback Subjects were asked to breathe out through pursed lips and they were instructed to practice PLB for 5 min/d the first week, 10 min/d the second week, 15 min/d by the third week, and 20 min/d by the fourth week.

Group B

After getting informed consent signed, patients were allocated into Diaphragmatic breathing group.

Method

(n=50) were evaluated with modified Borgs scale and there baseline lung function is evaluated with single breath count test and snider match test, the study subjects were instructed to practice Diaphragmatic breathing exercise 5 min/d the first week, 10 min/d the second week, 15 min/d by the third week, and 20 min/d by the fourth week immediately after breathing retraining program, subjects were asked to perform Single breath count (SBC) by serial counting of numbers after maximal inhalation. SBC is the bedside pulmonary function test that has a good correlation with the gold standard measures of pulmonary function test (PFT), peak expiratory flow rate (PEFR), and forced expiratory volume in the first second (FEV1). SBC is a simple and effective replacement for the laboratory measurement of PFT. Patients were also asked to perform a snider match test. This shows theability of a patient to blow out a match at a distance of 6 or 9 inches was found to be a useful clinical test. This ability was tested in 100 patients. It is used at the bedside of the patient during regular ward rounds.

Data Analysis

Pre and Post-test values of Single Breath Count (SBC) among Group A subjects treated with pursed-lip breathing exercise Group B subjects treated with a diaphragmatic breathing exercise.

Table 1 shows that there exists a significant difference between Pre and post-test of single breath count among Group A subjects treated with pursed-lip breathing ($P< 0.005$, C.I.95%) but there no exist statistically significant difference between Pre and post-test of single breath count among Group B subjects treated with diaphragmatic breathing exercise ($p>0.054$).

Pre and Post-test values of Snider match Test among Group A subjects treated with pursed-lip breathing Group B subjects treated with Diaphragmatic breathing exercise.

Table 2 shows that there exists a significant difference between Pre and post-test of Snider match test among Group A subjects treated with pursed-lip breathing and also there exists a significant difference between Pre and post-test of snider match test among Group B subjects treated with a diaphragmatic breathing exercise.

Pre and Post-test values of six-minute walk test among Group A subjects treated with pursed-lip breathing Group B subjects treated with Diaphragmatic breathing exercise.

Table 3 shows that there exists a significant difference between Pre and post-test of SIX Minute walk test among Group A subjects treated with pursed-lip breathing and also there exist a significant difference between Pre and post-test of six-minute walk test among Group B subjects treated with a diaphragmatic breathing exercise.

DISCUSSION

This study is restricted in examining a single breathing retraining technique so that the effect of the specific technique could be clearly assessed. The study focus was on patients with dyspnoea, reports that included subjects diagnosed with cardiovascular events were not included in the study. Subjects in the PLB and DB groups were instructed to begin daily practice sessions and were given logbooks to record their practice times and any adverse reactions. Weekly visits were made to reinforce their breathing pattern retraining program and to analyze their dedication to the assigned protocol. We excluded participants when the diagnosis was not clearly defined. PLB is the easiest breathing technique to learn, and Patients were instructed to inhale through the nose over several seconds with the mouth closed and then exhale slowly over 5 to 6 seconds through pursed lips held in a whistling or kissing position. This is done with or without contraction of the abdominal muscles. Patients reported that relief of dyspnea is immediate after practicing to use the PLB technique. Subjects were equally divided into two groups, where group A was instructed to perform pursed-lip breathing, where

Table 1: Between group analysis of SBC- single breath count

		Mean	St.deviation	SE	P value
Group A	Pre test	9.23	2.547	0.00	0.000
	Post-test	19.35	4.228		
Group B	Pretest	8.58	2.206	.291	0.054
	Post-test	11.20	1.843		

P < 0.005

Table 2: Between group analysis of SMT- snider match test

		Mean	St.deviation	Std. Error Mean	P value
Group A	Pre test	1.50	2.148	.340	0.000
	Post-test	6.38	2.976	.471	
Group B	Pre test	1.70	1.181	.187	0.000
	Post-test	3.75	.981	.155	

P< 0.005 (C.I.95%)

Table 3: Between group analysis of 6MWT- six minute walk test distance

		Mean	St.deviation	Std. Error Mean	P value
Group A	Pre test	11.45	1.999	.316	0.000
	Post-test	19.40	1.985	.314	
Group B	Pre test	10.65	1.460	.231	0.000
	Post-test	19.40	1.985	.314	

P< 0.005 (C.I.95%)

PLB is easy to practice and immediately relived dyspnoea. As the equipment required for measuring pulmonary function testing is not generally available in all outpatient and inpatient wards, so this simple bedside screening test, such as the match test described by Snider and single breath count is used as an outcome measure. In the snide match test, subjects were asked to blow out a match held at six to 9 inches from his widely opened mouth. To determination of the maximum breathing capacity and timed vital capacity equipment not available at the bedside. In this study, a simple bedside pulmonary function test is evaluated. Standard matches are used. After illumination matches were burning steadily, it is held at 9, 6, 3inches from the patient's opened mouth. The subjects were instructed to inspire maximally and expire rapidly to extinguish the illuminated match at an appropriate distance. Instructions were given that the subjects not to do purse lip during expiration he must expire with his mouth completely open to measure true air-flow velocity, there must be three trials to assess maximal effort on the part of the patient.

In this study, Single breath count has been statistically increased with a pursed-lip breathing exercise. However, diaphragmatic breathing retraining has also shown improvement in single breath count (Table 1). This finding was confirmed, Professor. Arul Kumaran, in his research, even a single breath count (2017), proved that single breath count is a simple, non-invasive, safe and cost-effective bedside assessment tool and it correlated well with FEV1 and FVC. SBC is a good alternative to pulmonary function testing in resource-poor settings and also in outpatient wards. On the other hand Joel M bartfield (2016), in his research work on single breath counting in the assessment of pulmonary function, concludes that SBC is a reasonable alternative to peak expiratory flow rate and he quoted that further investigation in the emergency ward is needed. When comparing snider match test group A and group B showed statistically significant value (Table 2). Pursed lip breathing and diaphragmatic breathing, these two breathing retraining strategies show equal improvement in 2 training groups. When the SBC increases, it has a direct influence on Snider match test distance. After 4 weeks of breathing retraining, both group A trained with pursed-lip breathing and group B trained with Diaphragmatic breathing exercise shows a minimum improvement in six-minute walk test distance. A study was done by Majid Meriem and Jouda Cherif on six-minute walk test correlates in COPD population concluded

that six-minute walk test is the reliable assessor of exercise capacity and perceived breathlessness is correlated with walking distance in patients with COPD and The 6MWT was negatively correlated with dyspnea severity (Table 3).

CONCLUSION

Pursed-lips breathing provided sustained improvement in dyspnea and physical function on comparison with diaphragmatic breathing exercise as this technique is manually adapted by the patients, proper re-education is needed in the practice of these breathing retraining techniques and also the bedside assessment tools are a good correlates of PEFR AND FEV1, FVC and it can be safely concluded that both SBC and snider match test is bedside assessment tools for the assessment of pulmonary function in the emergency and resource-limited settings.

Ethics

Ethical clearance obtained from the department of occupational therapy- SRM medical college hospital and research institute, Kattankulathur, Chennai, India.

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