Journal for Re Attach Therapy and Developmental Diversities
eISSN: 2589-7799
2023 August; 6 (10s2): 67-73

A Psychological Study to Compare the Difference in Expiratory Parameters of Breathing among Normal and Different Respiratory Conditions

Dr. Vidhi Talati Joshi [1*], Prof. Dr. Priyanshu Rathod [2]
[1] PhD scholar, School of Physiotherapy, R.K. University, Rajkot, Gujarat, India
vtalati254@rku.ac.in
[2] PhD, Director of School of Physiotherapy. R.K. University, Tramba, Gujarat, India.

Received: 20- June -2023
Revised: 18- July -2023
Accepted: 15- August -2023

Abstract

Background: Pulmonary function serves as one of the important measurement tool while studying respiratory disorders and forced spirometry being one of the most effective techniques for assessment of pulmonary disorders. This test provides information on etCO2, peak expiratory flow rate, and forced expiratory volume in the first second (FEV1).

Method: Patients according to selection criteria were divided into 3 groups – Normal, Obstructive and Restrictive with 30 subjects in each group. Each subject was asked to perform spirometer for FEV_1, mini wrights peak flow meter for PEFR and capnogram for $etCO_2$.

Results: ANOVA test was done for intergroup comparison between 3 groups and null hypothesis was rejected.

Conclusion: Significant difference was found in expiratory parameters among obstructive and restrictive conditions.

Keywords: Expiratory parameters, Obstructive disease, Restrictive disease.

1. Introduction

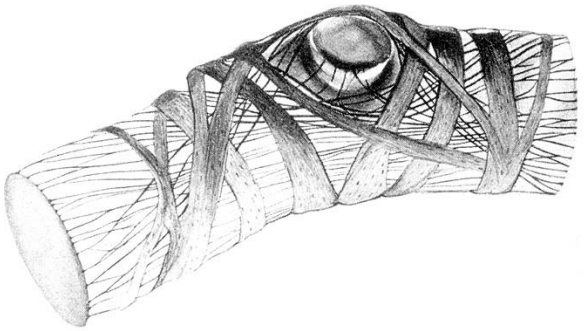
As a result of smoking, environmental pollution, the use of biomass as a fuel in rural areas, and a number of other causes, the prevalence of pulmonary illnesses is rising in India. According to the estimates there are approximately 150 million smokers in our country which accounts for 12% of the world's smokers According to the World Health Organization (WHO).

About 70% of people in India live in villages, and the majority of them cook using wood and other biomass. A lot of smoke is produced by burning of such fuels which results in respiratory diseases of both restrictive and obstructive type. Also, industrial progress and development has led to increase in environmental pollution.

Pulmonary disorders have two types of patterns, obstructive and restrictive. Acute inflammation of vascularized tissue occurs in obstructive patterns in response to injury; the main goals of this inflammatory response are to protect the host and to restore the tissue's normal structure and function. One widely accepted model or theory states that the progression of inflammation from acute, episodic to chronic stages, and the ensuing parenchymal and airway wall remodeling, is what causes the faster fall in forced expiratory flow over time.

The restoration of the columnar/cuboidal epithelium with normal ratios of goblet and ciliated cells follows the loss of epithelium, however in the case of repeated injury, squamous cell metaplasia and/or goblet cell hyperplasia take place.

Increase in smooth muscle mass can be attributed to increasing myocyte number due to Smooth muscle cell (myocyte) proliferation and some Other novel mechanisms may also be responsible for it.



Anatomic Arrangement of Bronchial Smooth Muscles

The bronchial smooth muscle is arranged in a geodesic manner so that it forms two opposing spirals around the airway. As the muscle contracts, the airway constricts and also becomes shorter. Any factor, such as increased collagen deposition, vascular congestion, or oedema, that stiffens the airway will eventually cause resistance to airway shortening.

Due to reduced ability to shorten an elastic airway due to stiffening, the stress created by the geodesic/oblique anatomic configuration of airway smooth muscle is consequently directed in a way that causes airway constriction rather than airway shortening. These changes in an obstructive pattern would ultimately result in Loss of normal elasticity, and airway trapping during exhalation. This at the end leads to a hyperinflated chest.

According to restrictive patterns on spirometry, restrictive lung illnesses are a diverse group of pulmonary conditions. Due to these abnormalities, the lungs are less able to expand fully, resulting in smaller lung capacities. Pathology either at the alveolar or interstitial tissue level changes the architecture of the lungs, impairing their ability to function. The etiology of restrictive lung disease may be internal causes, such as the extra parenchymal disorders, or extrinsic factors, such as the deterioration of the distal lung parenchyma caused by infiltrates from inflammation, toxins, and mechanisms that are still unknown.

Regardless of the intrinsic or extrinsic processes, these disorders are characterized by the impairment of ventilatory function and the subsequent development of respiratory failure by preventing the patient from fully expanding their lungs.

The functioning condition of the respiratory system can be evaluated with accuracy and consistency using pulmonary function tests. The various pulmonary function tests aid in determining the disease's severity and in evaluating the course of the condition as well as the effectiveness of treatment.

This test acts as an effective tool to differentiate between obstructive and restrictive lung disorders since it offers a written record of the subjects' forced expiratory volume in the first second (FEV1%), peak expiratory flow rate (PEFR), and etCO2.

Need of the Study

When evaluating the pattern of ventilatory dysfunction in a restrictive and obstructive group of lung illnesses, simple breath pulmonary function tests are frequently utilized. The majority of these tests' standard values are based on Western observations.

Spirometry has been utilized in this study because it facilitates a simple assessment of the degree of functional impairment and provides a broad understanding of the patient with such impairment and their susceptibility for recovery.

We aimed to find out differences in the values of Expiratory parameters like FEV_1 %, $etCO_2$, and PEFR both in healthy individuals and those with obstructive and restrictive lung disorders.

2. Objectives

To determine values of Expiratory parameters like FEV_1 %, $etCO_2$ in the expiration, and PEFR amongst normal individuals.

To determine values of Expiratory parameters like FEV_1 %, $etCO_2$ in expiration, and PEFR amongst patients with Obstructive disease.

To determine values of Expiratory parameters like FEV_1 %, $etCO_2$ in expiration, and PEFR amongst patients with Restrictive disease.

To compare all the expiratory parameters in Normal individuals and patients with obstructive and restrictive pulmonary disease.

Hypothesis

Null hypothesis:

There is no significant difference between the expiratory parameters of respiration among Normal, Obstructive, and Restrictive conditions.

Alternate hypothesis:

There is a significant difference between the expiratory parameters of respiration among Normal, Obstructive, and Restrictive conditions.

Criteria for Selection

Inclusion criteria:	**Exclusion criteria:**
• Age group – 20 to 60 years. • Gender – Both males and females were included. • Patients with Obstructive and Restrictive conditions were taken • Normal individuals	• Recent thoracic surgery • Recent upper abdominal surgery • Any neurological conditions

Any neurological conditions

3. Methodology

STUDY SETTING - In and around different hospitals of Rajkot district.

STUDY TYPE - An Exploratory Study

STUDY POPULATION - Normal individual, patients with Obstructive and Restrictive conditions were taken.

SOURCE OF DATA - In and around Rajkot.

SAMPLING TECHNIQUE - Purposive sampling

SAMPLE SIZE - 30 in each group

STUDY DURATION - One-time study

4. Materials and Method

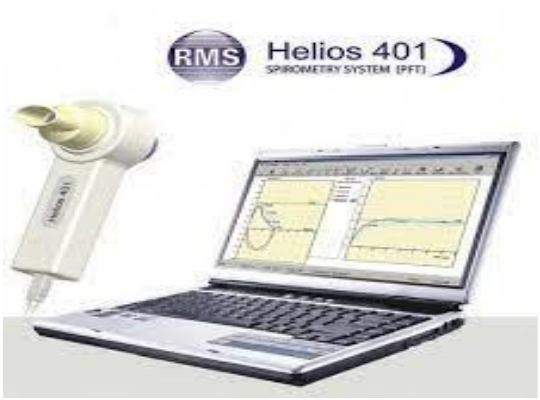
This research study is a cross-sectional, and comparative study. In this study, we have taken a total of 90 patients with 30 subjects were normal healthy individuals, 30 patients were with restrictive lung disease, and 30 patients were with obstructive lung disease.

(The sample size was chosen based on the tactician's knowledgeable recommendations.) A computerized spirometer (RMS-Med spirometer) was used to conduct pulmonary function tests. Prior to conducting pulmonary function testing, each subject's verbal and written agreement was obtained. The age group of all the subjects ranged from 20-60 yrs. Demographic details including the height and weight of each subject were taken.

For the purpose of avoiding diurnal variation, all tests were performed at the same time of day. The individual was required to stand in front of the electronic spirometer that was placed on a table with his lips directly over the mouthpiece. The subject was given an explanation and demonstration of the entire process. The patient was instructed to let out his or her clothes and waist belt. A nasal clip was used to seal the nostrils. The individual was

then instructed to inhale fully and slowly, to seal their lips around the mouthpiece, and to forcibly exhale into it. The FEV1% and PEFR pulmonary function tests have been considered out of all the tests. These three metrics were chosen because they are thought of as typical indices for determining and measuring airflow limitation. These aid in both the diagnosis of obstructive and restrictive disorders as well as the evaluation of the disease's severity. Analytical statistics All subjects' means and standard deviations were computed. One-way ANOVA test was used for the statistical analysis in Graphpad Instat.

- Spirometer – PFT machine (RMS HELIOS 401)
- Peak flow meter (Mini Wrights peak flow Meter)
- Capnogram
- Chair
- Required stationary
- Consent form
- Data collection sheet



Spirometer

Capnogram

Wright's Peak Flow Meter

5. Methodology

- Patients were assessed and consent was taken. After that according to inclusion and exclusion criteria, they were included in the study.
- Patients were explained about the procedure and purpose of the study.

Group A: Normal individuals

Group B: Patients with obstructive conditions.

Group C: Patients with restrictive conditions.

- Selection of patients was done as per the inclusion and exclusion criteria followed by assessment of patients with obstructive and restrictive lung disease
- Allocation of Subjects was done into 3 groups
- Normal individuals and Patients with respiratory disorders were made to do spirometry test to measure FEV1
- Normal individuals and Patients with respiratory disorders were analysed for PEFR with mini wright's peak flow meter.
- Normal individuals and Patients with respiratory disorders were analysed for $etCO_2$ with capnogram

Statistical Analysis

- Statistical analysis was done through software called statistical package for social science (SPSS) version 21.

ANOVA TEST was done

6. Results

Table 1: Comparison of physical characteristic in normal and patients with obstructive and restrictive pulmonary disorders.

Physical parameters	Normal	Obstructive pulmonary disease	Restrictive pulmonary disease
	Mean ± SD	Mean ± SD	Mean ± SD
Age (Yrs.)	39.1 ±13.71	42.37 ± 0.58	38.3 ± 0.55
Height (Cms.)	159.2 ± 11.27	161.36 ± 0.32	162.57 ± 0.34
Weight (Kgs.)	60.24 ± 2.32	58.31 ± 4.34	57.36 ± 6.24

From above table it is apparent that the difference in age, height and weight in all the three group is insignificant ($p > 0.05$). Thus, all three groups match closely for these three physical characteristics.

Following observations were made from the study of pulmonary function tests

Test	Normal	Obstructive	Restrictive
	Mean ± SD	Mean ± SD	Mean ± SD
FEV_1	87.34±2.79.	50.17% ±4.69	93.17% ±0.9
PEFR	5.82±2.2	2.15±2.4	4.96±0.8
$EtCO_2$	36 mmHg ±3	49 mm Hg ±2	40 mmHg ±5

7. Discussion

Table 2 demonstrates the substantial ($P>0.05$) differences in the individuals' ages, heights, and weights in the three groups, indicating that the three groups share these three physical characteristics in common.

This study's primary goal was to compare the results of pulmonary function tests like the FEV1%, PEFR, and etCO2 in the normal (control) group, people with obstructive lung disease, and subjects with restrictive lung pathology, as well as between the groups.

According to the study, the mean PEFR value in the group of people with obstructive pulmonary problems is 2.152.4 and p0.002, which is significantly different from normal subjects. According to this study, the mean PEFR for healthy people is 5.82 2.2, whereas the mean PEFR for people with restrictive illnesses is 4.96 0.8.

Obstructive pulmonary disease is characterized by reduced PEFR, which is a highly sensitive measure. The main cause of the peak flow is airway blockage, which causes the bronchi and bigger bronchioles to tighten, increasing airway resistance and decreasing PEFR. Reduced PEFR in restricted patients is therefore not important. Expiratory flow rates are typically preserved in pulmonary conditions with a restrictive pattern because there is minimal airway resistance.

According to the study's findings, the average FEV1 in healthy participants is 87.342.79. FEV1% in healthy persons is greater than 80% of what is expected. FEV1% is 50.17% 4.69 in patients with obstructive pulmonary disease, which is very significant (p0.002 compared to normal participants), and 93.17% 0.9 in restrictive conditions. When the airway resistance is strong, as it is in the obstructive group of pulmonary disease, the FEV1% is lower. This finding is in line with the findings of Deborah Leader, Joshi, and Sushma, who came to the conclusion that obstructive lung illnesses result in a slight decline in forced vital capacity but a significant statistical decline in FEV1%. According to the findings, a restrictive pattern of respiratory illness has a mean FEV1% of 93.17% 0.9, p>0.005 which is not statistically significant.

Hence, in restrictive disorders, FEV_1% is normal or increased.

According to our results, the mean $etCO_2$ in an obstructive pattern of respiratory disorder is 49 mm Hg ±2, p<0.002 which is statistically significant. In a restrictive pattern of respiratory disorder mean $etCO_2$ is 40 mmHg ±5, p>0.005 which is not statistically significant. In normal individuals, the mean value of $etCO_2$is 36 mmHg ±3, of the predicted value. $etCO_2$ gives a non-invasive screening tool for blood gas analysis. Because there is a very minor difference between $etCO_2$ and $PaCO_2$. The patient does not have to go frequently for invasive procedures like ABG analysis.

Hence in an obstructive pattern of respiratory disorders $etCO_2$ is increased.

8. Conclusion

By this research, data results indicate that as compared to a normal healthy individual, individuals with an obstructive group of pulmonary disease, it was observed that $etCO_2$ was increased whereas FEV_1 and PEFR were decreased.

In individuals with a restrictive group of pulmonary disease, it was observed that $etCO_2$ was normal whereas FEV_1 was increased and PEFR was normal.

Hence, it can be concluded that FEV_1%, PEFR, and $etCO_2$ in expiration can be used to distinguish obstructive and restrictive groups of diseases.

Source Of Financial Support- Self.

Conflict Of Interest- None.

References

1. Prabhat Jha,, Binu Jacob,, VendhanGajalakshmi, Prakash C. Gupta,, NeerajDhingra, Rajesh Kumar, et al , A Nationally Representative Case–Control Study of Smoking and Death in India. N Engl J Med 2008;358:1137-47.
2. Jones and Barlet learning. Forced spirometry and related tests. N Engl J Med 2008; 358:1137-1147, 2008DOI: 10.1056/NEJMsa0707719
3. Harrisons principle of internal medicine. Disturbances of respiratory system 234. 1498-1501.
4. R. Pellegrino, G. Viegi, V. Brusasco, R.O. Crapo, F. Burgos, R. Casaburi, A. Coates,C.P.M. van der Grinten, P. Gustafsson, J. Hankinson, R. Jensen, D.C. Johnson, N. MacIntyre, R. McKay, M.R. Miller, D. Navajas, O.F. Pedersen and J. Wanger. Interpretative strategies for lungfunction tests. EurRespir J 2005; 26: 948–968

5. Ashok Fulambarker, MD, FCCP; AhmetSinanCopur, MD; AsavariJaveri, SujataJere ; and Mark E. Cohen, Reference Values for Pulmonary Function in Asian Indians living in United States. Chest / 126/4/ Ocotober, 2004, 1225-30
6. Deborah Leader, RN.Obstructive and Restrictive Lung Diseases: Comparing Differences Between Obstructive and Restrictive Lung Diseases. About. com guide 2012
7. Vaidya P, Kashyap S, Sharma A, Gupta D, Mohapatra P R. Respiratory symptoms and pulmonary function tests in school teachers of Shimla. Lung India 2007;24:6 10.
8. Joshil Kumar Behera, SushmaSood, Naresh Kumar, Kirti Sharma, Reshmi Mishra, and PrasantaSaha Roy. Heart Rate Variability and its Correlation with Pulmonary Function Test of Smokers. Heart Views 2013 Jan-Mar; 14(1): 22–25.
9. Rubeenabano, Nadeemahmad, Mahagaonkar.Study of lung functions in smokers and non-smokers.Indian j physiolpharmacol 2011; 55 (1) : 84–88 10. R Prajapati,B Shrestha, S Dhungel,KC Devkota, T Pramanik1 and P Roychowdhury. Spirometric evaluation of pulmonary function tests in clinically diagnosed patients of bronchial asthma. Nepal Med Coll J 2010; 12(1): 45-47
10. HarpreetRanu, Michael Wilde, and Brendan Madden. Pulmonary Function Tests. Ulster Med J. 2011 May; 80(2): 84–90.