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Correlation of Peak Expiratory Flow Rate to Pulmonary Function Test in Chronic Obstructive Pulmonary Disease Subjects

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory disorder (CRD) that progresses slowly and is characterized by an obstructive ventilatory pattern which is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases. COPD can be examined by using Pulmonary Function Test (PFT) which include Spirometry. In PFT, Forced Expiratory Volume in 1 second decreases due to fibrotic remodeling of the airways but however, PFT is not always available in the Primary care settings or Clinical setups. Hence, a simple and affordable method is required in COPD subjects for the assessment of pulmonary functions. This study used an alternative method to check pulmonary functions by using Peak Expiratory Flow Rate (PEFR) to measure FEV1. Thus, the need of the study is to correlate PEFR as a screening tool to PFT in the COPD subjects in clinical setups or primary care settings with the same efficacy and potentiality.
Aim & Objective: The Objective of the study was to correlate the Peak Expiratory Flow Rate to Pulmonary Function Test in Chronic Obstructive Pulmonary Diseases subjects.
Study design: Cross-Sectional Study
Method: Subjects diagnosed with COPD of age 40 years and above were referred to Cardiorespiratory Physiotherapy OPD by Medical Practitioner or Pulmonologist. The sample size was calculated based on the Convenient Method of Sampling, by which a total of 30 patients were recruited for the study. After obtaining scores of PFT, three readings were recorded of PEFR by using a Peak Flow Meter and the best of the three was considered for final analysis. The Statistical analysis was done using SPSS version 23.0. The descriptive analysis was done for the baseline characteristic that was presented as percentages, means and standard deviation (SD). Karl Pearson's correlation coefficient applied for correlation of PEFR with PFT respectively. P- value less than equal to 0.05 was statistically significant.
Result: In this study, 30 subjects were taken of age 40 to72 years, out of which 22(73.33%) were males while 8(26.67%) were females. This study resulted that the correlation of PEFR scores with PFT that comprises of FEV1, FVC, FEV1/FVC is statistically significant as the p-value is less than 0.05i.e FEV1 (0.0005*), FVC (0.0005*), FEV1/FVC (0.0185*).

Conclusion: We concluded that PEFR can be used as an effective and potential screening tool to the Physiotherapists and Clinicians for the assessment of the individuals with different stages of COPD in any sector of health care, including consultations/OPD or primary health care as an alternative to the PFT.

Keywords: Chronic Obstructive Pulmonary Diseases, Pulmonary Function Test, Peak Expiratory Flow Rate, Forced Expiratory Volume 1 second, Peak Expiratory Flow.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory disorder (CRD) that progresses slowly and is characterized by an obstructive ventilatory pattern[1] which is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases.[2]

Pulmonary Function Test (PFT) is a standard diagnostic tool according to the GOLD guidelines to assess COPD. As, GOLD (Global Initiative for Chronic Obstructive Lung Disease) classification of staging the COPD groups is performed by Spirometry.[3]

Around 50–90% of the disease burden remains undiagnosed, because of the under-recognized significance of respiratory symptoms by clinicians to diagnose COPD at primary care consultations setups due to unavailability of tools, Early detection may offer opportunities to reduce disease progression.[4]

Therefore, a simple and affordable method is required for the COPD screening in the primary care settings where spirometry is unavailable.[5]

PEFR (Peak Expiratory Flow Rate) is a marker for Expiratory Flow Rate and FEV1 which helps to predict the prognosis for subjects with COPD. As, FEV1 is the most reproducible airway function parameter and is also the superior test for estimating small airway obstruction.[6]

PEFR is easily adaptable and less tiring, it could be used in different stages of COPD as a

clinical assessment format. Assuming that the tool may be useful in treating individuals with COPD in the Cardio-Respiratory Physiotherapy department, Thus, the need of the study is to correlate PEFR as a screening tool to PFT in the COPD subjects in clinical setups or primary care settings with the same efficacy and potentiality.

OBJECTIVES: The Objective of the study was to correlate the Peak Expiratory Flow Rate to Pulmonary Function Test in Chronic Obstructive Pulmonary Diseases subjects.

MATERIALS AND METHODS:

This study was approved and ethical clearance was given by SDMCMSH, Shri Dharmasthala Manjunatheswara University SDMCMSH Institutional Ethics Committee on 26-05-2022.

In this cross-sectional study, subjects diagnosed with COPD of age 40 years[7] and above were referred to Cardio-Respiratory Physiotherapy OPD in SDMCMSH by Medical Practitioner or Pulmonologist. The sample size was calculated based on the Convenient Method of Sampling, by which a total of 30 individuals were recruited for the study.

Inclusion Criteria:

1. Subjects who have undergone PFT on the same day of assessment.
2. Subjects who can read/write/understand English or Kannada.
3. Stable COPD subjects who are non-oxygen dependent.

Exclusion Criteria:

1. Subjects who refuse to participate in the study.
2. Subjects who are unable to follow the commands.
3. Subjects who are dependent on oxygen therapy or artificial ventilation (NIV).

4. Any recent trauma or surgery (in and around the thoracic cage)/spinal/ abdominal surgeries (Hernia, appendectomy, splenectomy, etc.)
5. Subjects who are suffering from any restrictive lung pathology/ any acute lung traumatic injury/ any neurological injury or any primary cardiac involvement will be excluded.
6. Subjects with inflammation/infection and injury to the upper respiratory tract will be excluded.

Subjects were explained about the study, study instruments, and study procedure, and then written consent was obtained from the volunteers. The demographic data of each subject were noted.

PEFR was measured using Mini Wright PFM. PFM was set at zero. The subjects were instructed to sit straight on a chair with shoulders and arms relaxed, were told to take a deep breath, hold the mouthpiece in his/her mouth, and seal the lips around it ensuring that the tongue is away from the mouthpiece and no air leak should be present and blow as hard as he/she can into the mouthpiece. The PFM was removed, the readings were recorded and the participants were asked to breathe normally and discard the disposable mouthpiece just after the recording, for zero percent of contamination. Three readings were recorded and the best of the three was considered for final analysis.

For PFT, values were obtained from the PFT reports and further analysis was done.

STUDY ANALYSIS:

The Statistical analysis was done using SPSS version 23.0. The descriptive analysis was done for the baseline characteristics including ordinal, continuous and nominal data that was presented as percentages, means and standard deviation (SD). P-value less than equal to 0.05 was statistically significant. Karl Pearson's correlation coefficient applied for correlation of PEFR with PFT respectively.

RESULTS

Table 1: Demographic profile of patients

Demographic profile	No of patients	% of patients
Age groups		
40-49yrs	11	36.67
50-59yrs	8	26.67
>=60yrs	11	36.67
Mean	55.40	
SD	10.42	
Gender		
Male	22	73.33
Female	8	26.67
BMI		
Under weight	5	16.67
Normal	15	50.00
Over weight	10	33.33
Mean	22.91	
SD	4.95	
Total	30	100.0

Table no. 1 summarizes the details regarding the demographic profile of 30 subjects with respect to the age group 40-49years, 50-59years, >=60years with the mean age of (55.40). In this study, subjects aged from was 40 and 72 years, out of which 22(73.33%) were males and 8(26.67%) were females. The table shows normal BMI of all three categories with respect to their age. Hence, the mean BMI is (22.91).

Table 1 is presented in the Figure 1 represents age wise distribution of normal BMI. Males are more with the percentage of 73.33 and around 50% of the subjects falls under normal BMI.

FIGURE 1: Demographic profile of patients

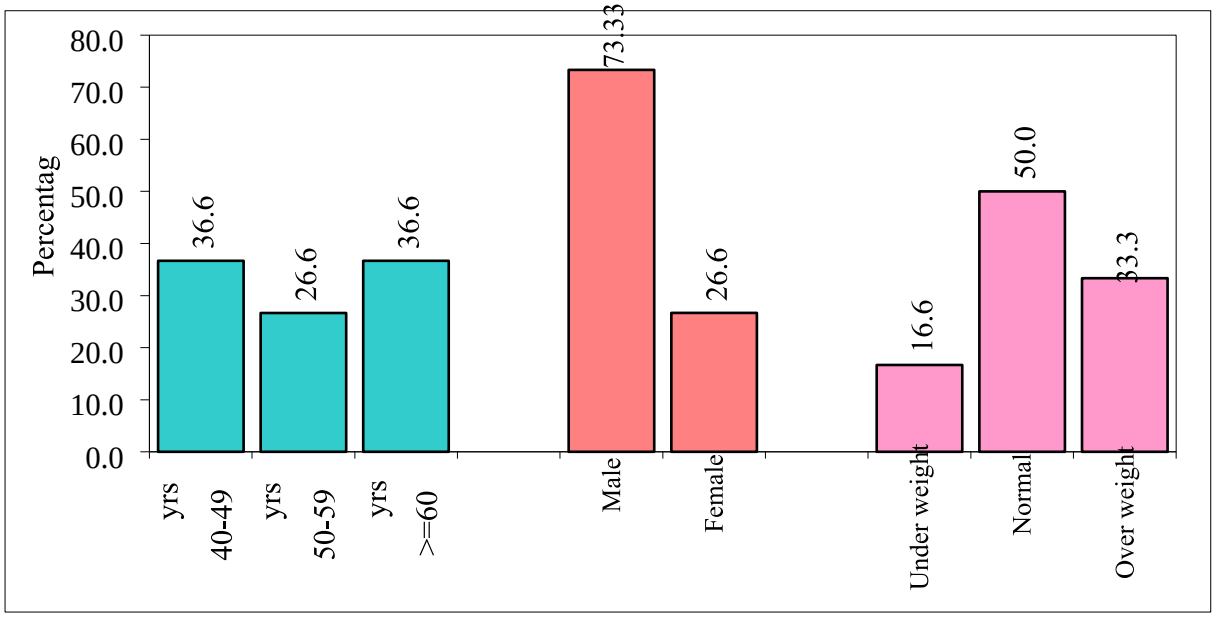


Table 2: Correlation between PEFR scores with PFT parameter scores

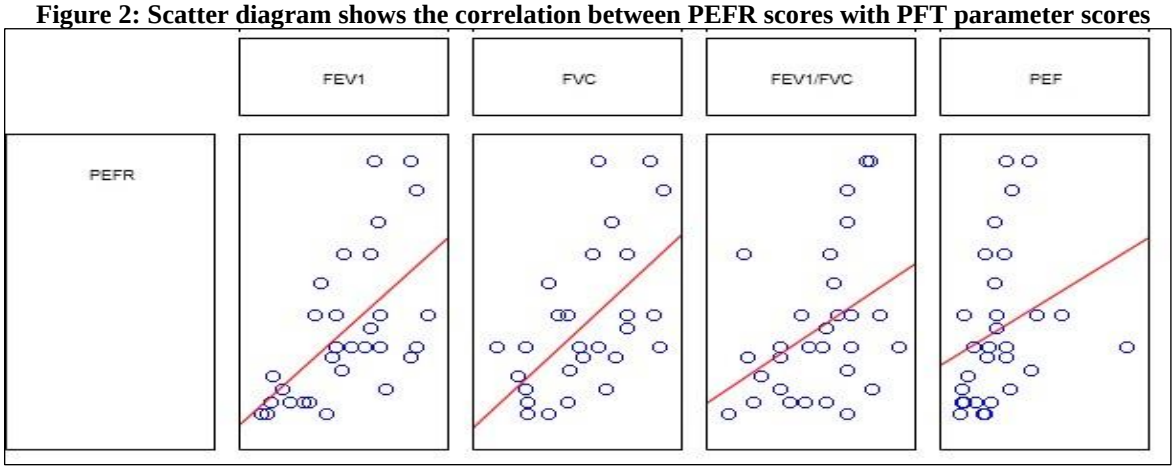
Parameters	Correlation between PEFR scores with		
	r-value	t-value	p-value
FEV1	0.5978	3.9459	0.0005*
FVC	0.5975	3.9432	0.0005*
FEV1/FVC	0.4275	2.5020	0.0185*
PEF	0.2854	1.5756	0.1264

***p<0.05 indicates significant relationship**

Correlation of PEFR scores with PFT parameters was done by using Karl Pearson's correlation coefficient. It showed a statistical significant correlation as the P-value is less than 0.05 i.e FEV1(0.0005*), FVC (0.0005*), FEV1/FVC (0.0185*) but PEF value is not statistically significant as the P-value is more than 0.05. It stated that if PEFR increases, PFT scores increases and vice versa Same thing is presented in the scatter plot Graph 2 that represents the above table 2.

As, the lines are going in upwards direction in scatter plot hence it shows a good correlation of PEFR and PFT.

Figure 2: Scatter diagram shows the correlation between PEFR scores with PFT parameter scores



DISCUSSION

This study had shown a satisfactory correlation between Peak Expiratory Flow Rate scores with Pulmonary Function Test (PFT) that comprises of FEV1, FVC, FEV1/FVC. Hence, Peak Expiratory Flow Rate can be used in place of Spirometry to measure FEV1.

But the ratio of FEV1/FVC still needs PFT as a tool to be evaluated, though using Mini Wright PFM we can still measure FEV1 during Pulmonary rehabilitation as and when need arises.

Previous studies have shown PFT as valid tool to measure FEV1, FVC, FEV1/FVC. In this study we tried to inculcated the use of Mini Wright PFM tool which is cost-effective and can be used at clinical level by the therapists. The study was carried out only at one tertiary health care sector, further more health care sectors can join in to make it as more reliable and valid tool in further studies.

More studies are required to validate the PEFR as an alternative tool to PFT, then these instruments will offer Cardio-Respiratory Physiotherapist an alternative way to assess airway function in COPD subjects.

CONCLUSION

Thus, we suggest through our study and result that Peak Expiratory Flow Rate can be used as an effective and potential screening tool to the Physiotherapists and Clinicians for the assessment of the individuals with different stages of COPD in any sector of health care, including consultations/OPD or primary health care as an alternative to the Pulmonary Function Test.

LIMITATIONS OF THE STUDY

- Sample size was limited.
- Other parameters can be included for more specific results.
- Unequal gender distribution.

FUTURE RECOMMENDATION OF STUDY

- Gender should be equally represented across various types of COPD.
- A large sample can be taken for better results.
- Further studies can be done with comparison of other instruments for better results.
- Instruments can be used to compare Pre and Post PFT to see bronchodilators effects.

Funding & Conflict of Interest: It is self-funded study and has no conflicts of interest.

Declaration by Authors

Ethical Approval: Ethical clearance has been undertaken by the Institutional Ethics Committee, SDM College of Medical Sciences and Hospital, Dharwad.

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Conflict of Interest: The authors declare no conflict of interest.

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