COMPARISON OF PEF MEASUREMENTS USING PEAK FLOW METER AND DIGITAL SPIROMETER AMONG PEOPLE OF UDUPI DISTRICT; A CROSS SECTIONAL STUDY

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ABSTRACT

Peak expiratory flow (PEF) monitoring is an effective method to be used to measure airflow obstruction in patients. Most of the peak flow meter which are available in the market follow ATS guidelines for measurement. This study was done to assess the limits of agreement of PEF values measured with Peak-Flow Meter (JSB Healthcare, India) with digital spirometer (Vitalograph alpha). PEF measured with peak flow meter shows high levels of correlation with digital spirometer ($r=0.699$). The measurement of PEFR with Spirometry does not seem to provide any significant advantage over other PEFR meter.

KEYWORDS: Spirometry, PEFR, Peak Flow Meter

Peak expiratory flow rate (PEFR) can be explained as the maximal expiratory flow rate by a subject for at least 10 milliseconds expressed in Litre per minute (L/min). PEFR is a simple, reliable, reproducible and easily measurable ventilatory lung function test.6 This simple test can be performed by different types and shapes of instruments for long since and there is large availability of these instruments which are also inexpensive, portable devices and which has made PEF monitoring easier & feasible.¹

PEFR are the dimensions of the large intra and extra thoracic airways², the force generated by the expiratory muscles, the speed with which maximal alveolar pressure is ³ and how prior to PEFR manoeuvres, the lung was stretched. PEFR has also been well correlated with maximum expiratory pressure which is a representation of respiratory muscle.

Most of the digital spirometers measures PEF along with FEV1 (Force expiratory volume in one second) and FVC (Forced vital Capacity). It has been recorded in previous studies that different spirometers and different Peak Flow Meters can record PEF differently with some error rates which can be up to 26% in laboratory calibration tests.⁴

PEFR is highly sensitive and accurate index of airway obstruction. It can be used as a guideline of admission and discharge of asthma when PEF value >60% of expected admission is probably unnecessary, 40-60% of expected consider admission and <40% of expected- admission is probably necessary⁵. Peak flow measurement is sensitive indicator to measure the strength of muscles of respiration.⁵

Most of the peak flow meter uses a traditional Wright scale to record PEF whilst after 2004 Peak flow meters. It has not formally been assessed whether the PEF values measured with digital spirometer are in close agreement with the PEF values measured with other peak flow meters.

MATERIALS AND METHODS

Subjects: The participants were recruited from the camp organized in udupi taluk and karkala taluk of udupi district. Total of 55 participants who volunteered were taken in the study. Nature of the study was explained and informed consent was obtained from each subject prior to participation in study. A thorough history was taken and Subjects were asked about any medical history, respiratory problems or any other health problem. Participant with any serious medical problem were excluded from the study.

Devices: Vitalograph alpha device records spirometry parameters including FVC, FEV1, percentage, PEF, forced expiratory flow of predicted FEV1, Mid expiratory phase, forced expiratory time along with flow/volume curve. Vitalograph alpha device have been laboratory tested, and met the latest ATS accuracy standards. The standard range version of the Peak-Flow Meter (JSB Healthcare, India) was used. It has 10-L increments from 100 to 850 L/min, and its performance has been studied. The monitoring devices used in the study were new and were acquired directly from the manufacturers.

Protocol: Subjects were individually instructed for measuring their PEF with peak flow meters. Minimum three efforts at a time were recorded and best one measures. Also the value of PEF was recorded. Simultaneously Spirometry of each subject was performed as per the ATS guidelines. PEF obtained in L/s was converted to L/min. All measurements were performed in sitting position. Collected data were checked and those with incomplete test record or inadequate testing were rejected. Finally 40 subjects were selected for inclusion into analysis.

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Statistical analysis: The mean values of PEF were calculated normality of the data was tested. All the results of PEF were expressed as means and are compared by paired sample ‘t’-test. The primary end point of the study was to determine if the PEF was different when recorded with different instruments. For this purpose correlation analysis was then performed on Digital spirometer measured PEF and Peak-Flow Meter measured PEF’s. P value less than 0.05 was taken as significant.

RESULTS

A total of 40 subject’s data was analyzed. All the participants included were non smokers with normal lung functions. None of them had any personal and family history of pulmonary and cardiovascular diseases. Participant’s characteristics are given in Table-1.

Table 1: Participant’s Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean (std deviation)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>age of the participant</td>
<td>41.82 (12.512)</td>
<td>17-76</td>
</tr>
<tr>
<td>Weight of the participant</td>
<td>63.0053 (10.12827)</td>
<td>41.10- 86.95</td>
</tr>
<tr>
<td>height of the participant</td>
<td>160.60 (9.84764)</td>
<td>130.00 -179.00</td>
</tr>
<tr>
<td>FEV1</td>
<td>2.6462 (.56166)</td>
<td>1.61 - 3.77</td>
</tr>
<tr>
<td>FVC</td>
<td>2.8949 (.60788)</td>
<td>1.67 - 4.42</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>89.7143 (9.79547)</td>
<td>52.00 -100.00</td>
</tr>
</tbody>
</table>

The comparison of mean between Peak Expiratory Flow measured by Spirometer and Peak Expiratory Flow Meter with traditional Wright Scale is given in table 2. The mean difference between PEF measured by Spirometer and peak flow meter which was 17.04 l/mins and was statistically significant, (p < 0.05).

Table 2: Comparison of PEFR values

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak flow meter</td>
<td>446.35</td>
<td>69.184</td>
</tr>
<tr>
<td>spirometer</td>
<td>429.31</td>
<td>58.027</td>
</tr>
</tbody>
</table>

FEV1 with PEF measured by spirometer and Peak Flow Meter were also compared. The pearson correlation coefficient and their significance levels are given in Table-3.

Table 3: Comparison of PEFs with FEV1

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Pearson correlation</th>
<th>significance levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1 with PEF (spirometer)</td>
<td>0.699</td>
<td>.000</td>
</tr>
<tr>
<td>FEV1 with PEF (peak flow meter)</td>
<td>0.517</td>
<td>.000</td>
</tr>
</tbody>
</table>

DISCUSSION

This study was aimed at comparing the PEF measured by spirometer Peak Flow Meter. The PEF values with spirometer and Mini Wright peak flow meter correlates with each other as well as with FEV1 as expected and the correlation levels are almost similar to that reported in previous studies. The observed difference between two parameters can be explained by the fact that FEV1 values represents airway caliber of proximal and peripheral airways, while PEFR values represents primarily proximal airway caliber.

Originally the Peak Flow Meter was developed for the purpose of measuring Peak Expiratory Flow. This process requires the participant to exhale as quickly as possible into the device following maximum inspiration. This maximal expiratory flow occurs very early in expiration and lasts for only a fraction of a second. For most participants, a short but forceful blow will be sufficient to record the maximal expiratory flow (“PEF technique”). For the measurement of FVC, participant is required to blow that starts from maximal inspiration to residual volume. Although in case of both PEF and FEV1/FVC measurements, rapid exhalation is required but the instructions which are given to the participants are different and that the two techniques are not interchangeable.

CONCLUSION

The two instruments compared in this study did produced comparable peak flow readings.

The peak flow meter tended to give higher values, but the correlation results were significant.

So it can be concluded from this study that there is no significant difference in mean values of PEF from peak flow meter and spirometer.

REFERENCES


