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# Effect of Peak Expiratory Flow Rate When Using Mask and Mouthpiece Nebulization in Adult Asthmatics

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**Abstract:** ***Asthma is a clinical condition characterized by airway obstruction, partially or fully reversible either by itself or with therapy; airway inflammation; and airway hyperresponsiveness (AHR) to various stimuli. Peak expiratory flow (PEF) is a useful method of monitoring changes or trends in the patient's lung function. Aerosol administration by a mouthpiece rather than a facemask is generally preferred due to improved drug delivery to the lungs by as much as twofold. Methodology: This prospective Interventional study was carried out at Calicut, Kerala, in a Tertiary care Hospital. Adult male and female asthmatic patients between the ages of 18 and 60 participated in the study. A total number of 74 subjects was taken from the medical wards. Nebulization using a mouthpiece, or a nebulization mask was used to administer the participants' prescribed bronchodilators (salbutamol) thus to assess the effect of nebulization, PEFR was carried out using both methods of nebulization. Results: Comparison of the PEF mask and Mouthpiece was estimated separately with pre- and post-values. that difference was found to be statistically very highly significant (p<0.001). Similarly, the Mean PEF mouthpiece was 144.662 at pre and 173.311 at post having a difference of 28.649 and was found to be statistically very highly significant. (p<0.001). Similarly, at post-session, the difference between the PEF mask and PEF Mouth piece technique was 16.149 and that also was found to be statistically significant (p<0.001)***

**Keywords:** Asthma, Nebulization, PEFR, Mouthpiece, Mask

## 1. Introduction

Asthma is a clinical condition characterized by airway obstruction, partially or fully reversible either by itself or with therapy; airway inflammation; and airway hyper responsiveness (AHR) to various stimuli [1,2,].Asthma can be delineated by respiratory symptoms histories such as wheezing, breathlessness, chest tightness and cough that vary from time to time with severity, together with variable expiratory airflow limitation [3].

Sympathetic control in the airway is carried out through β2-adrenoreceptors situated on airway smooth muscle, which are responsible for bronchodilatation in response to albuterol which is used in diagnosis and symptom relief and for longer-term bronchodilation facilitated by long-acting $\beta_2$-agonist controller agents(Short- and long-acting $\beta_2$-agonists are used for distinct purposes in asthma therapy) [4]. Peak Expiratory Flow (PEF) is a useful method of monitoring changes or trends in the patient's lung function. PEF measurement can be a useful component for self-assessment at home and can help the patient identify changes in lung function during exacerbations or trigger exposure. Ongoing twice-daily PEF assessment is typically reserved for patients with severe asthma or those with impaired perception of airflow limitation [5,6]. It is diagnosed clinically, but no unique gold standard test is available; Asthma's pathophysiology and clinical presentation are heterogeneous which is substantial, and clinical over diagnosis can occur, especially in those without spirometric confirmation [7]. A PEFR is repeated after 15 minutes of administering a short-acting bronchodilator. An increase of 60ml or 20% in the PEFR represents reversible airflow obstruction [8]. In the absence of spirometry, PEFR provides additional objective evidence of airflow limitation. Patient education decreases hospitalizations due to asthma, improves daily function, and improves patient satisfaction [9], [10].

Managing asthma involves the administration of bronchodilators via nebulization. The interface between the aerosol-generating device and the patient is an important, and often ignored, component of effective therapy. Aerosol administration by a mouthpiece rather than a facemask is generally preferred due to improved drug delivery to the lungs by as much as twofold Since aerosol drug delivery is improved as twofold by a mouthpiece than a face mask, it is generally a preferred route [11]. The nose can filter aerosol particles efficiently. Thus, while using a facemask, any nose breathing can result in increased deposition of aerosol in the upper airway [12][13]. There are currently few studies that directly compare these two delivery strategies because they tend to concentrate on general results or particular populations. So, this study aims to find out the nebulization efficiency of mouthpiece and mask utilizing pre- and post-PEFR because there is a lack of information and literature

addressing the effectiveness of employing mouthpieces to give these drugs to adult populations.

## 2. Methodology

This prospective Interventional study was carried out in Calicut, Kerala, at a Tertiary care Hospital. Adult male and female asthmatic patients between the ages of 18 and 60 participated in the study. A total number of 74 subjects was taken as per the sample size calculation. The medical wards served as the study area. Three senior consultants in the Department of Pulmonary Medicine referred the study subjects after the Institutional Review Board (IRB) gave its permission. The patients were those who had been moved from the emergency room after receiving a diagnosis of asthma either recently or in the past, and whose tachycardia and severe dyspnea had improved. The inclusion and exclusion criteria will determine who is and is not eligible to participate in the study. Random nebulization (using a mouthpiece connected to a chamber or a nebulization mask, because the nebulization kit includes both a mask and a mouthpiece) was used to administer the participants' prescribed bronchodilators (salbutamol). To assess the effect of nebulization, PEFR was carried out using both methods of nebulization. The data (pre-and post-PEFR) will be imported into Excel format and analyzed using SPSS-24.Studentspaired t-tests and students' unpaired t-tests were administered to find out the pre and post-difference. P<0.05 was considered as significant.

**Inclusion criteria**

- Adult Male & Female patients between age18 and 60 years old.
- Patients admitted in the wards via the emergency department or from the Pulmonology
- outpatient departments.
- Patients who can understand how to use a mouthpiece after demonstration.
- Stabilized patients with acute exacerbation of Asthma on admission.

**Exclusion Criteria**

- Pediatric population or those with an age less than 18 years.
- Patients who are disoriented and/ or non-obeying.
- Patients whose vital signs are not stable.
- Patients who have ongoing chest pain or have had a recent heart attack.

## 3. Results and Discussion

**Table 1:** Age Distribution

| Age group | Number of subjects | Percentage |
|---|---|---|
| <30 | 8 | 10.8 |
| 30 -40 | 5 | 6.8 |
| 40 - 50 | 14 | 18.9 |
| 50 - 60 | 23 | 31.1 |
| >=60 | 24 | 32.4 |
| Total | 74 | 100.0 |

Mean age: 50.648 SD= 12.068

Out of the total of 74 patients most of them were above 60 years of age (32.4%) and then having 31.1% of the people were in the age group of 50 -60 years. Only 6.8% of the subjects were in the age group of 30 -40 years. Most of the subjects were females (67.6%) and the remaining 32.4% were Males.

**Table 3:** Comparison between Pre and Post values of PEF mask & PEF Mouthpiece technique

| | Pre | | Post | | Difference | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Standard Deviation | Mean | Standard Deviation | Mean | Standard Deviation | t | p |
| PEF mask | 163.243 | 51.234 | 189.459 | 52.202 | 28.216 | 25.425 | 8.87 | <0.001 *** |
| PEF Mouth piece | 144.662 | 49.006 | 173.311 | 58.616 | 28.649 | 26.603 | 9.264 | <0.001 *** |
| Mask- Mouth piece difference | 18.581 | 44.825 | 16.149 | 46.32 | | | | |
| Significance | t=3.566 , p<0.001*** | | t=2.999, p<0.001*** | | | | | |

Comparison of the PEF mask and Mouthpiece was estimated separately with pre and post-values. The mean PEF Mask at pre-session was 163.243 and that of post-session it was 189.459 with a difference of 28.216 and that difference was found to be statistically very highly significant (p<0.001). Similarly, the Mean PEF mouthpiece was 144.662 at pre and 173.311 at post having a difference of 28.649 and was found to be statistically very highly significant.(p<0.001). In all these cases comparison between pre- and post we have used students paired t test.

We have also compared the mean PEF of the Mask and Mouthpiece technique separately for pre- and post-session. At pre-session, the difference between the PEF Mask and PEF mouthpiece technique was 18.581 and found to be a statistically significant difference (p<0.001). Similarly, at post-session, the difference between the PEF mask and PEF Mouth piece technique was 16.149 and that also was found to be statistically significant (p<0.001)

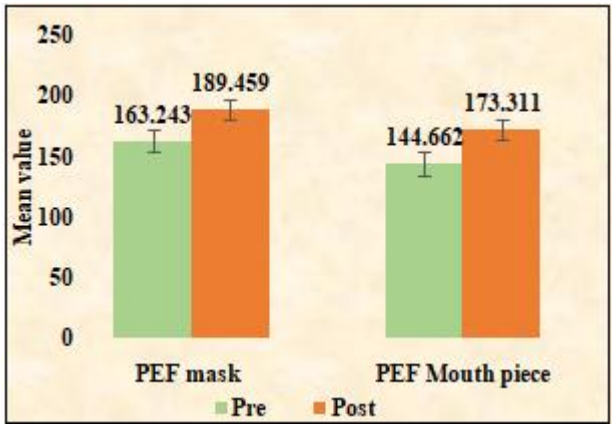


**Figure 2:** Comparison between pre and post values of PEF Mask & PEF Mouth piece technique

**Table 4:** Percentage difference from pre to post of PEF mask & PEF Mouthpiece technique

| | Mask | | Mouth piece | | t | p |
|---|---|---|---|---|---|---|
| | Mean | Standard Deviation | Mean | Standard Deviation | | |
| Percentage difference | 18.65 | 18.75 | 21.57 | 22.43 | 0.858 | 0.392 |

While comparing the percentage difference from pre to post of Mask and Mouthpiece technique the difference was found to be statistically insignificant(p=0.392). The percentage difference in Mouth piece was 21.57% whereas in the Mask it was 18.65% only. But statistically insignificant. PEFR increased gradually in both groups, and the increase was found to be statistically significant but the percentage difference between these two methods was statistically not significant. But still, we could prove that the percentage difference in Mouthpiece technique was more (21.57%) compared to Mask (18.75%)

## 4. Discussion

In a study, the majority of the 74 patients (32.4%) were over 60, which is consistent with the study that reports that between 4% and 13% of adults over 65 have asthma. However, this number is probably underestimated because asthma is often under diagnosed in this age range [14] [15] [16]. Aerosols can be delivered using a face mask or a mouthpiece. According to Nikander et al. there is a difference in the inhaled mass percentage between 5.0%–6.9% when using a normal non-sealed face mask and 8.9%–12.2% when using a jet nebulizer coupled to a mouthpiece [17]. The findings support Nikander's research, as they observed that the aerosol deposition from an open-face mask was less than that from a mouthpiece (6.84% against 7.66%, respectively). As opposed to face masks, Kishida et al. found that aerosol distribution through a mouthpiece significantly improves forced expiratory volume in the first second (FEV1) [18]. However, nasal inhalation—an alternative to using a mouthpiece when wearing a mask—reported a roughly 50% reduction in aerosol deposition in the lungs, according to Everard et al. [19].In comparison to the mouthpiece and closed mask interfaces used with the Breath Actuated Nebulizer (BAN), several interfaces used in this study with both small volume and continuous Jet nebulizers, such as open aerosol masks and blow-by, are less effective interfaces for aerosol delivery [20]. Mouthpiece and face mask users did not respond differently to therapy in two short trials of β2-agonists in asthmatic patients [21]. Comparable outcomes were noted in a more extensive, randomized study comprising 64 children with acute asthma between the ages of 6 and 19; both administration modalities were judged to be equally efficacious overall [22]. Therefore, the therapeutic judgment about the use of a mouthpiece or a face mask for nebulizer-driven budesonide inhalation suspension therapy should be based on the patient's capacity to operate the corresponding devices.

Limitations of this study include a small sample size. Hence further study will be conducted with a larger sample size to compare the pre and post-effectiveness of nebulization with mask and mouthpiece technique using PEFR.

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