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Positive Airway Pressure and Mask Factors Affecting Adherence in Patients with Obstructive Sleep Apnea

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Abstract

Purpose: Sleep apnea is a major risk factor for cardiovascular disorders. CPAP (Continuous Positive Airway Pressure) therapy is the main treatment for sleep apnea. However, adherence with CPAP remains a concern. Although there are various factors attributed to failure of CPAP therapy, mask related factors are not well studied.

Methods: The study recruited patients with obstructive sleep apnea using CPAP from neurology outpatient clinic at Progressive Neurology and Sleep Center. An IRB (Institutional Review Board) approved questionnaire was administered to evaluate factors affecting CPAP compliance.

Results: The study recruited 24 patients. It showed that almost 50% of the patients did not like using CPAP, 70.8% patients felt that the mask bothered them in sleep. Almost 67% of the patients felt sleepy at least on some days and 71% of the patients took naps, though occasionally. 87.5% of the patients had experienced dry mouth with CPAP. 91.8% of patients wanted to consider custom fit CPAP masks.

Conclusion: The study showed that mask related factors play a major role in non-compliance with CPAP therapy. Designing a custom fit CPAP mask might help reduce the mask related factors further increasing CPAP adherence.

Keywords: Obstructive Sleep Apnea, CPAP (Continuous Positive Airway Pressure), CPAP mask

Introduction

Various studies have associated loud snoring and obstructive sleep apnea to be independent risk factors for stroke [1]. Untreated obstructive sleep apnea has been significantly associated with fatal and non-fatal cardiovascular events [2]. Prevalence of 40-72% of obstructive sleep apnea has been reported in patients with acute ischemic stroke [3].

CPAP (Continuous Positive Airway Pressure) therapy has been shown to reduce the metabolic effects of obstructive sleep apnea and improve blood pressure and glycemic control [4]. Also, studies have shown that CPAP therapy among stroke patients with obstructive sleep apnea improved depression and subjective well-being [5]. Self-reported fatigue, verbal memory, and executive function outcomes and scores on sleepiness scales have been positively related to CPAP compliance and possibly have dose effects [6,7].

CPAP compliance remains a major concern [8]. Commercial CPAP masks are mostly available as small, medium, and large, and do not fit well-given variations in the physical characteristics of an individual's face. The study aims at exploring the patient's satisfaction with CPAP mask.

Methods

The study is a cross-sectional survey, a pilot study used to evaluate satisfaction with current CPAP mask and interest in custom fit 3D printed CPAP mask. The study was performed after IRB (Institutional Review Board) approval. A random sample of patients from the sleep clinic at Progressive Neurology and Sleep Center were recruited. All the patients that were scheduled for outpatient visit to the Progressive Neurology and Sleep Center between the months of June to August 2023 were evaluated for participation in the study. Inclusion criteria included the patients with known obstructive sleep apnea (defined as AHI>5 on polysomnogram (PSG) or home sleep study (HST)) and are using CPAP. Patients older than 18 years of age were recruited. Exclusion criteria included patients who did not meet inclusion criteria, patients who were pregnant, patients who were mentally incapacitated or lacked capacity to give informed consent.

Questionnaire was developed for the study which was IRB approved. The questionnaire was administered by the study coordinator to the recruited patients in face-to-face visit at the Progressive Neurology and Sleep Center. The same coordinator administered the questionnaire to all the patients for uniformity. Data was extracted from the questionnaire and some of the sleep apnea details were also confirmed from medical records for accuracy. The data was analyzed using statistical software STATA.

Results

The study recruited 24 patients, all of whom had been diagnosed with obstructive sleep apnea and using CPAP. Gender distribution was equal with half of the participants male, and half female. 7 patients were on fixed CPAP settings and 17 patients were on an auto mode. Mean weight was 216.7 lbs. and mean height was 73.1 inches. All the patients were using ResMed devices. 79.1% patients were using heated hose, 95.8% were using humidifier but only 20.8% patients were using chin strap. About 8.3% patients had exposure to using CPAP liners (Table I).

Analysis of the data showed that 50% of the patients did not like using CPAP. Although 70% of the patients felt that their mask fit well, 70% of the patients also felt that their mask bothers them in sleep. Almost 67% of the patients felt sleepy at least on some days and 71% of the patients took naps, though occasionally. 87.5% of the patients had experienced dry mouth with CPAP. Interestingly, 91.7% of the patients were interested in a custom-fit CPAP mask (Table I).

Table I. CPAP Satisfaction Survey

Questions	YES	NO
Like using CPAP	12 (50%)	12 (50%)
Does mask fit well	17 (70.8%)	07 (29.2%)
Mask bother in sleep	17 (70.8%)	07 (29.2%)
Mask bother your partner	07 (29.2%)	17 (70.8%)
Wake up to adjust mask	13 (54.2%)	11 (45.8%)
Wake up refreshed	16 (66.7%)	08 (33.3%)
Feel sleepy during day	16 (66.7%)	08 (33.3%)
Take naps during day	17 (70.8%)	07 (29.2%)
Wake up with dry mouth	21 (87.5%)	03 (12.5%)
Feel Claustrophobic	02 (8.3%)	22 (91.7%)
Like your head gear	16 (66.7%)	08 (33.3%)
Get skin rash from mask	07 (29.2%)	17 (70.8%)
Have tender spots on face	10 (41.7%)	15 (58.3%)
Interested in custom fit mask	22 (91.7%)	02 (8.3%)

There was no statistical significant difference in height, weight, or bridge of nose to chin measurements between patients who liked or did not like using CPAP, and between patient who felt their mask bothered or did not bother in sleep. There was no statistical difference in distribution of patients with dry mouth, felling sleep during day, taking naps during day, or feeling that mask bothers them in sleep within groups of patients who liked or did not like using CPAP.

Discussion

CPAP remains the main treatment for obstructive sleep apnea. There have been various studies looking at the variables affecting CPAP adherence. Increased nasal resistance from decrease in nasal volume [9], mood problems like depression, personality types of negative affectivity and social inhibition have been associated with lower compliance [10]. However, there is limited data available about the effect of mask related factors on CPAP adherence.

Although the majority of the patients were using humidifier and heated hose, half of the patients did not like using CPAP. Among the patients who did not like using CPAP, the majority of them felt that mask bothered them in sleep. Among patients who felt sleepy through the day, again more than 80% of the patients felt that mask was bothering them in sleep.

There was no significant differences for distribution of various factors that were analyzed among the groups of patients who liked or did not like CPAP or groups of patients that felt mask was bothering them in sleep or not bothering them. However, the study has low sample size and may not have enough power to detect those changes.

Despite all the advances in the mask, it still remains an important factor affecting the CPAP compliance and control of sleep apnea. The commercially available masks only come in fixed sizes which affects appropriate fitting of the masks. Appropriate fitting of the mask remains a major concern which can lead to patients having leaks and waking up multiple times to adjust their mask.

Conclusion

The study shows that the majority of the patients were not satisfied with their CPAP and their masks. More than 90% of the patients wanted a custom fit mask. We plan to design a custom fit CPAP mask prototype as our next project based on the results of this study, and plan to recruit patients from this pilot study to see if their satisfaction improved with custom fit mask.

Declarations

Funding

No funding was received for this research.

Conflict of Interest

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (BRANY IRB) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study. IRB approved consent form was used.

Data Available in a Repository

The datasets generated by the survey research during and/or analyzed during the current study are available in the Dataverse repository, <https://doi.org/10.7910/DVN/6T6MLB>. The access will be available upon request.

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