

# Compliance with continuous positive airway pressure in Persian patients with obstructive sleep apnea

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**Background:** Obstructive sleep apnea (OSA) is defined by recurrent apnea and hypopnea during sleep. The main treatment of OSA is continuous positive airway pressure (CPAP). Adherence to CPAP is challenging and depends on multiple factors. This study was designed to evaluate the compliance with CPAP in patients with OSA. **Materials and Methods:** This was a prospective observational study including 106 patients with confirmed OSA by a standard polysomnography. We recorded CPAP usage hours after 7 and 90 days by a smart card. We compared the adherence of the patients with respect to body mass index (BMI), gender, smoking status, living area, and education level. **Results:** Patients in the 18–45 years' age group had higher compliance in mean (standard deviation) daily use of CPAP (0.93 [0.40] h) compared to the other age groups ( $P < 0.001$ ). Patients with BMI  $>35$  had better compliance (1.13 [0.44]) than the other patients ( $P < 0.001$ ). Furthermore, nonsmokers and highly educated patients had better compliance compared to the others ( $P < 0.001$ ). **Conclusion:** Age, BMI, education, and smoking are important factors in adherence to CPAP in patients with OSA.

**Key words:** Age, body mass index, compliance, continuous positive airway pressure, obstructive sleep apnea

**How to cite this article:** Soltaninejad F, Sadeghi A, Amra B. Compliance with continuous positive airway pressure in persian patients with obstructive sleep apnea. *J Res Med Sci* 2017;22:114.

## INTRODUCTION

Obstructive sleep apnea (OSA) syndrome is characterized by repeated cessations of breathing during sleep, which lead to the fragmentation of sleep and repeated hypoxia.<sup>[1]</sup> The prevalence of OSA among adult male and female is 4% and 2%, respectively, and 20% among the elderly population.<sup>[1-3]</sup> Different studies have shown that people with OSA have an increased risk for traffic accidents,<sup>[4-8]</sup> hypertension, cardiovascular morbidity, and impaired health-related quality of life.<sup>[9-12]</sup>

Continuous positive airway pressure (CPAP) is the choice of treatment for OSA. This treatment improves the quality of life and decreases cardiovascular morbidity and mortality.<sup>[13]</sup> However, a significant proportion

of patients do not use their CPAP properly.<sup>[14]</sup> Poor compliance is associated with a decrease of treatment efficacy.<sup>[14]</sup>

Although some studies are available about factors that influence CPAP compliance,<sup>[15-17]</sup> in this study, we evaluated the compliance with CPAP in patients with OSA with respect to different variables including body mass index (BMI), gender, smoking status, living area, and education level.

## MATERIALS AND METHODS

This study was a prospective, observational study conducted at Bamdad Respiratory Research Center, Isfahan. Between March 2015 and November 2016, 106 patients with confirmed OSA were enrolled in our study. The inclusion criteria were as follows: (i) Patients

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DOI:

10.4103/jrms.JRMS\_108\_17

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**Received:** 30-01-2017; **Revised:** 11-06-2017; **Accepted:** 10-07-2017

with apnea-hypopnea index (AHI) >15 in polysomnography and (ii) age  $\geq 18$  years. Patients with central sleep apnea syndrome ( $\geq 50\%$  of apneas were central) and with a history of sedative or narcotic drugs use were not included.

Patients had been referred to Bamdad Respiratory Research Center due to clinical suspicion of OSA. We performed a standard attended overnight polysomnography by a polysomnography device (SOMNO medics GmbH, Randersacker, Germany). In standard polysomnography, electroencephalogram, electrocardiogram, electrooculogram, chin electromyogram, oronasal airflow, oxygen saturation by pulse oximetry, and thoracic, abdominal, and leg movements were recorded. Scoring was done according to the American Association of Sleep Medicine 2015 guideline.<sup>[18]</sup>

In patients with moderate and severe OSA (AHI >15), CPAP titration test was performed another night. CPAP treatment with defined pressure was started in patients.

All patients used the device with nasal mask and masks were comfortable. Patients' demographics as well as information about the living area (urban or rural), BMI, education level, and smoking were recorded. Then, after 7 and 90 days, we recorded CPAP usage daily according to the memory card. CPAP compliance was compared between patients according to their BMI, gender, smoking status, living area, and education level.

Statistical analyses were carried out using Statistical Package for the Social Sciences software (version 19.0.0, SPSS Inc., Chicago, IL, USA). The repeated analysis of variance test and the independent-*t* test were used to determine significant differences. All tests were two-tailed, and  $P < 0.05$  was considered statistically significant.

The study protocol was approved by Ethical Committee of Isfahan University of Medical Sciences (Research Project Number 394822), and informed written consent was obtained from all patients included in this study. The results are presented as mean (standard deviation [SD]) or number (percent) where applicable.

## RESULTS

We evaluated 106 patients including 59 men and 47 women, with a mean age of 53.7 (12.7) years. The demographic characteristics of patients are shown in Table 1. The mean daily use of CPAP after 7 and 90 days was recorded and compared in all patients.

Patients in the 18–45 years' age group had higher compliance in mean (SD) daily use compared to other

age groups ( $P < 0.001$ ). In addition, patients with BMI >35 had better compliance ( $P < 0.001$ ). CPAP compliance in all patients was higher after 90 days compared with 7 days ( $P < 0.001$ ).

Nonsmokers and highly educated patients had better compliance compared to others ( $P < 0.001$ ). The CPAP compliance for age group, BMI, gender, education, and smoking is shown in Tables 2 and 3. Patients with at least 4 h usage of the device are considered to have good compliance.<sup>[19]</sup> After 7 days, none of the patients had good compliance; however, after 90 days, 32.1% of patients had good compliance.

## DISCUSSION

In our observational study, nonsmoker, educated, and younger patients had better compliance. Also, BMI >35 was associated with higher adherence to treatment. However, there was no significant difference in compliance among patients with respect to gender and living area. Furthermore, 90-day mean daily CPAP usage was more than 7-day mean daily CPAP usage in all patients.

Better adherence to treatment in educated patients may be due to greater insight into the disease and improved quality of life. In addition, the awareness about the complication of untreated OSA is another important factor. The effect of motivation on treatment adherence was mentioned in the

**Table 1: Demographic characteristics of the study patients (n=106)**

Parameters	Value
Age (years)	53.70 (12.70)
BMI (kg/m <sup>2</sup> )	28.25 (5.30)
Gender (male/female)	59 (55.66)/47 (44.34)

Data expressed as mean (SD), or n (%). SD = Standard deviation; BMI = Body mass index

**Table 2: The association of quantitative parameters with continuous positive airway pressure compliance**

Parameters	Number of patients	Daily use of CPAP after		P
		7 days (h)	90 days (h)	
Age (years)				
18–45	35	0.93* (0.37)	3.99* <sup>a</sup> (1.78)	<0.001
46–65	43	0.67 (0.29)	3.27 <sup>a</sup> (1.42)	
46–65	28	0.46 (0.34)	2.47 <sup>a</sup> (1.61)	
P		<0.001	<0.001	
BMI (kg/m <sup>2</sup> )				
<25	20	0.48 (0.35)	2.74 <sup>a</sup> (1.68)	<0.001
25–29.9	41	0.69 (0.35)	3.44 <sup>a</sup> (1.54)	
30–34.9	35	0.72 (0.33)	3.07 <sup>a</sup> (1.72)	
>35	10	1.13* (0.29)	4.61* <sup>a</sup> (1.50)	
P		<0.001	<0.001	

<sup>a</sup>Comparison between groups, \*Compared to other age groups (within-group analysis). Data expressed as mean (SD). SD = Standard deviation; CPAP = Continuous positive airway pressure; BMI = Body mass index

**Table 3: The association of qualitative parameters with continuous positive airway pressure compliance**

Parameters	Number of patients	Daily use of CPAP after		P
		7 days (h)	90 days (h)	
Gender				
Male	59	0.69 (0.36)	3.21 <sup>a</sup> (1.73)	<0.001
Female	47	0.72 (0.37)	3.41 <sup>a</sup> (1.82)	
P		0.57	0.69	
Living area				
Urban	74	0.73 (0.43)	3.47 (1.92) <sup>α</sup>	<0.001
Rural	32	0.65 (0.20)	3.01 (1.02) <sup>α</sup>	
P		0.35	0.22	
Smoking				
Yes	35	0.37 (0.24)	1.96 (1.18) <sup>a</sup>	<0.001
No	71	0.86* (0.32)	3.98* (1.53) <sup>a</sup>	
P		<0.001	<0.001	
Education				
Under diploma	35	0.52 (0.34)	2.38 <sup>a</sup> (1.39)	<0.001
Diploma	32	0.70 (0.31)	3.32 <sup>a</sup> (1.42)	
Higher than diploma	39	0.86* (0.55)	4.12* <sup>a</sup> (1.66)	
P		<0.001	<0.001	

\*Compared to other age groups (within-group analysis), <sup>α</sup>Comparison between groups. Data expressed as mean (SD). SD = Standard deviation; CPAP = Continuous positive airway pressure

study of Bakker *et al.*<sup>[20]</sup> In another study, the patients who were requested to be treated by their partners had lower compliance that emphasizes the role of motivation.<sup>[21]</sup> Also, an association of education with better CPAP compliance was reported previously.<sup>[14]</sup>

The greater CPAP usage in patients with high BMI is probably related to more subjective benefit and symptom control. Better compliance in higher BMI was reported in previous studies.<sup>[22]</sup>

We also found that older patients had lower compliance, unlike the results of other studies.<sup>[23,24]</sup> These differences might be due to a lack of training and support of older patients in their families. In addition, education may have a role in this difference.

The association of smoking with poor adherence may be due to their lower attention toward health risk factors.

In our study, gender had no significant association with compliance, while in another study female gender was associated with more compliance.<sup>[23]</sup> The difference may be related to the different levels of education of patients in studies.

In addition, we found better compliance at 90 days in patients compared to 7 days, which is due to the patients' perception of subjective benefit of treatment during this time.

Limitations of this study are lack of data about patients' symptoms, effect of treatment on symptoms and association

with CPAP compliance, and limited number of patients. However, the study should be done using a larger number of population and including detailed data about patients' symptoms at the initiation of the treatment and follow-up.

## CONCLUSION

The present study showed that education and understanding the benefits of treatment are important factors in increasing CPAP compliance.

## Financial support and sponsorship

Nil.

## Conflicts of interest

The authors have no conflicts of interest.

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