Original Research

Evaluation of Compliance with Continuous Positive Airway Pressure in Patients with Obstructive Sleep Apnea Syndrome

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Abstract

Background and Objective: Obstructive sleep apnea syndrome (OSAS) is a breathing disorder during sleep and defined as unexplained sleepiness during the day, with a minimum of five obstructive respiratory events per hour of sleep. This study aimed to evaluate the compliance to continuous positive airway pressure (CPAP) in patients with OSAS.

Materials and Methods: This cross-sectional study was conducted on OSAS patients whose polysomnography test was performed at least 1 year before, and CPAP was prescribed for them. Apnea–hypopnea index (AHI) and patients' demographic information were recorded.

Results: This study included 105 patients with OSAS. The mean AHI score was 40. Patients were distributed into three groups according to their AHI: Mild ($5 \leq AHI < 15$): 20 patients (19%), moderate ($15 \leq AHI < 30$): 25 patients (23.8%), and severe ($AHI \geq 30$): 60 patients (57.1%). Patients were divided into three groups based on their use of CPAP: 27 (25.7%) patients were regular users of CPAP, their time average use was 5.4 hours a day; 11 (10.4%) patients were in the group who stop using their CPAP, their average of time use was 6.4 hours a day; and 67 (63.8%) patients were in the group who did not use the CPAP.

Conclusion: The long-term adherence to CPAP in patients with OSAS was 25%, which correlated significantly with their financial situation, while there was no significant association between the use of CPAP with age, sex, educational status, and the severity of sleep apnea.

Keywords: Obstructive sleep apnea syndrome; Continuous positive airway pressure; Polysomnography

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Introduction

Obstructive sleep apnea syndrome (OSAS) is a breathing disorder during sleep that has several adverse outcomes including cardiac, neurologic, and perioperative morbidities. This disorder remains undiagnosed in many populations. This syndrome is defined with unexplained sleepiness during the day, with a minimum of five obstructive respiratory events per hour of sleep. OSAS is defined as repeated episodes of obstructive apneas and hypopneas during sleep, frequently followed by transient hemoglobin desaturation (hypoxemia) and unconscious (electroencephalogram) arousals. OSAS is one of the causes of disability and death worldwide and the most common cause of sleepiness. Severe forms of this syndrome are found in 4% of men and 2% of women; however, mild

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forms (i.e., at least five apneas each hour) are found in 27% of men and 9% of women without risk factors of OSAS (1).

OSAS requires lifelong treatment followed by confirmed diagnosis (2). Nowadays, the routine approach to the sleep problems is polysomnography to confirm OSAS (3).

One of the treatments for OSAS is continuous positive airway pressure (CPAP), in which the airway is kept open during sleep by blowing air (usually 5-20 mmHg pressure). CPAP may improve breathing during sleep, sleep quality, sleepiness, blood pressure, alertness, cognitive function, mood, and quality of life in patients with OSAS (4).

In some cases, the use of this device may lead to difficulties in initiating sleep or waking up early in the morning, and this may reduce the likelihood of acceptance by the patient, depriving the patient of the best available treatment (5). Treatment can improve clinical symptoms, drowsiness, strength, cognitive faculties, mood, quality of life, and blood pressure, specifically in the following patients: Epworth Sleepiness Scale (ESS) scores more than 11, subjects who are sleepy at driving or work, and those with over 15 apneas and hypopneas per each hour of sleep.

Treatment in patients with 5-15 obstructive respiratory events in each hour of sleep improved symptoms such as sleepiness, but cognitive functions and quality of life had weak improvement. There is no evidence to improve blood pressure in this group of patients. Adjuvant therapy in patients with sleepiness does not improve cognitive symptoms, mental function, or blood pressure (6).

CPAP device is comprised of three main sections: Mask that is placed on the patient's nose and/or mouth, a tube connected the mask to the engine, and an engine that blows air into the breathing tube (7). Some types of CPAP device include heated humidifiers as well (8). CPAP machines are small, lightweight, and portable and create a rhythmic sound (9).

Most clinicians believe that patients with a respiratory disturbance index (RDI) above 20 require treatment with CPAP. CPAP may also be useful for patients with less RDI, especially those who are sleepy during the day or have other symptoms. If the severity of symptoms during the day and ESS is too high, a CPAP device could help eliminate the symptoms of this disease (10).

The main side effect of CPAP is dry air, which could be solved using an auxiliary humidifier (11). Other disadvantages of using a CPAP device include stuffy nose or nasal dryness, dry mouth, air leakage from the mask, noise in some types of devices, pain or redness, dry eyes, pressure feeling in the chest, and feeling of suffocation with a mask (12).

In a study on 148 patients with OSAS by Hoffstein and Oliver, 105 patients used CPAP during the 17 months of study, of whom 5% were unsure about the effect of CPAP, 14% believed that CPAP is ineffective, and 81% believed that CPAP has a good effect on treatment. Forty-six percent of patients had nocturnal awakenings, and 44% complained of dryness and nasal problems (13).

In a study on 155 OSAS patients by McArdle et al., 4.5% of the patients refused to accept CPAP treatment at the start of the study, mainly women and smokers. From 103 patients who accepted CPAP treatment, 20% interrupted it during the study, and 68% of patients continued treatment with CPAP (14).

Pepin et al. study on 121 patients with OSAS reported 74% CPAP compliance within 3 months (15).

Sin showed that the average use of CPAP was 5.3 hours per day. The use of CPAP had a significant association with three factors: Female gender, advanced age, and reduced ESS. The acceptance of CPAP during the 6-month study was more than 86% (16).

Don indicated that, in AHI > 20, 3 and 6 months' compliance was 83% and 79%, respectively. Furthermore, in this study, a significant association between the use of CPAP with female gender, older age, and greater ESS scores was reported (16). In the study of Rauscher et al., the compliance to CPAP was 50%, and the difficulty in starting or continuing sleep was the main reason for low compliance (17).

Elkhouli et al. found that an improvement in the clinical parameters of sleep is better predictors of long-term adherence, instead of polysomnography data (18). Jean et al. showed that the compliance of CPAP through video training is better compared to the group without video training (19).

In a study by Simon-Tuval et al., only 40% of patients accepted CPAP treatment, and patients with low social status had lower compliance for this therapy (20). In the Wolkove et al. study, 25 of 80 patients never started CPAP usage. Not usage in 10 patients was due to feeling no need for

the device, 3 due to high cost of it, and 12 due to lack of comfort in the use of the CPAP (21).

In Yetkin et al. study, only patients with AHI above 56.6 ± 27.7 used CPAP regularly, and CPAP compliance in patients with mild-to-moderate apnea was reported low (22).

In Campos-Rodriguez et al. study, the compliance to CPAP in women during 5 and 10 years of study was 82.8 and 79.9, respectively (23). Somers et al. showed that 12% of patients accepted CPAP and continued the treatment (24). In the study of Yang et al., compliance to CPAP was lower in older people than younger people. CPAP compliance was related to AHI and the intensity of sleepiness during the day (25).

The study of Nagarajan et al. showed that 41.9% of patients used CPAP. Of these, 84.42% cited improved quality of life and relieved symptoms of OSAS during the use of CPAP; 36.69% of patients did not buy CPAP due to the high cost of the device (26).

Hooti et al. showed that 39% of patients used CPAP regularly, but 20% due to no need to CPAP treatment and 24% due to the high cost of CPAP did not use it (27). CPAP improves symptoms and quality of life, but the problems in the supplying and using this device may deprive patients of the best treatment. Since the compliance to CPAP in different studies has been estimated differently, this study aimed to determine the long-term acceptance of CPAP in a group of patients with OSAS.

Materials and Methods

This was a cross-sectional study, and the subjects with OSAS with at least 1 year passed from their polysomnography test were evaluated. CPAP was prescribed for all of them. The sample size for this study was 100 patients. The random sampling method was used to select 105 patients. Using one questionnaire, the required information was collected.

All procedures performed in studies involving human participants were by the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

This study was performed from September 2013 to May 2014 among the sleep laboratory patients' records in Shahid Rahnamoun Hospital, Yazd, Iran. The demographic characteristics, disease duration, symptoms, and severity of symptoms were recorded.

The inclusion criteria were adult patients (age 18 years or above) with suspected OSAS (based on clinical history), whose polysomnography test, the diagnosis of OSAS, and CPAP treatment were available. Exclusion criteria were patients with OSAS that CPAP was not prescribed for treatment.

For all patients, polysomnography test was done by ALICE®5 DIAGNOSTIC SLEEP SYSTEM (Respironics, USA), and the CPAP device which was prescribed was iCH Auto (Apex, Taiwan).

The usage of CPAP by the patients was divided into three main groups:

1. Prescribed CPAP and continued to use it.
2. Prescribed CPAP but stopped after primary treatment.
3. Prescribed CPAP but never started this treatment.

The improvement of symptoms in patients treated with CPAP was evaluated by scoring from 0 (none) to 3 (severe). OSAS was considered if AHI was 5 or higher and normal if AHI was < 5. The OSAS patients were divided into three groups based on their AHI: Mild OSAS ($5 \leq AHI < 15$), moderate OSAS ($15 \leq AHI < 30$), and severe OSAS ($AHI \geq 30$).

The reasons for discontinuation of CPAP in patients who stopped it after treatment initiation and reasons for discontinuation in the group initially refused CPAP were investigated.

The data were analyzed using SPSS software (version 17, SPSS Inc., Chicago, IL, USA) by ANOVA test, t-test, chi-square, and Fisher exact test.

Results

In this study, we evaluated 105 patients with suspected OSAS based on clinical history; OSAS was diagnosed by polysomnography, and CPAP was indicated for them.

The reasons for discontinuation of CPAP in patients who stopped it after treatment initiation and reasons for discontinuation in the group initially refused CPAP are depicted in table 1.

Patients were divided into three groups:

1. 27 patients (25.7%) in the group of regular users of CPAP
2. 11 patients (10.5%) in those who used CPAP initially and then stopped it
3. 67 patients (63.8%) in the group that did not use CPAP (Table 2).

Table 1. Evaluation of CPAP use in patients who regularly used it, the reasons for stopping the use of CPAP in patients who stopped it, and reasons for not using CPAP in patients who did not use it

Variable	Number (%)
CPAP performance	
Improved sleep	27 (100)
Headache relief	6 (22.2)
Improve overall energy	22 (81.4)
Improve blood pressure	5 (18.5)
Total	27 (100)
The reasons for discontinuation of CPAP	
Destroy	2 (18.1)
Recovery of OSAS	4 (36.3)
Noise of device	2 (18.1)
Problems with the mask	6 (45.5)
Failure to achieve desired results	4 (36.3)
Total	11 (100)
The reasons for not using CPAP	
High cost	41 (61.1)
No need	14 (20.8)
Other reasons	12 (17.9)
Total	67 (100)

CPAP: Continuous positive airway pressure; OSAS: Obstructive sleep apnea syndrome

The average age of patients was 53.02 ± 11.39 years, ranging from 24 to 82 years. The average age of the 67 patients who did not use CPAP was 51.83 ± 10.45 years with the range of 31 to 82 years.

Table 2. Educational and economic status of patients with OSAS (total: 105)

Variable	Number (%)
Educational status	
Illiterate	18 (17.1)
Primary	24 (22.9)
Middle-school	9 (8.6)
High-school	5 (4.8)
Diploma	26 (24.8)
Academic	23 (21.9)
Economic status	
No financial problems	29 (27.6)
Moderate status	55 (52.4)
Financial difficulties	21 (20)

OSAS: Obstructive sleep apnea syndrome

The average age of the 27 patients who used CPAP on a regular basis was 54.31 ± 11.20, ranging from 24 to 80 years (P = 0.144). Hence, there was no significant relationship between the age of patients with OSAS and CPAP usage.

The average age of the 11 patients, who discontinued CPAP, was 49.20 ± 12.87 years, ranging from 32 to 80 years. Seventy-three (69.5%) patients were male.

Average AHI score was 40.22 ± 26.11/hour with the range of 5-113. From these, 20 (19%) patients were in the mild group, 25 (23.8%) in the moderate group, and 60 (57.1%) in the severe group.

The average use of CPAP in 27 patients who regularly used the device in hours/day was 5.4 ± 9.1 hours per night. The average use of CPAP in 11 patients who had discontinued using it after a while was 4.6 ± 1.8 hours per night.

There was a significant association between AHI severity and gender. In other words, the risk of mild OSAS was higher in women, while the risk of severe OSAS was higher in men (Table 3).

AHI score and using of CPAP in patients with OSAS had no significant association (Table 4).

There was no significant association between using CPAP and gender and educational status, but there was a significant relationship between using CPAP and economic status, so the financial problems and the price of CPAP device affect using of it (Table 5).

Discussion

CPAP is one of the accepted treatments for OSAS, which improves symptoms and quality of life in these patients, but the problems in supply and using this device may deprive patients of this treatment. Compliance of using CPAP after 1 year was 25%, which was low in our study sample.

Some other studies have tried to predict the compliance to CPAP based on the demographic data such as age, sex, education, and severity of OSAS by AHI score of patients; however, these were not significant in our study.

Table 3. Sex distribution of patients with different severities of OSAS

Sex	AHI				Statistical test	P-value
	Mild	Moderate	Severe	Total		
Male	9 (12.3)*	17 (23.3)	47 (64.4)	73 (100)	Chi-square	0.019
Female	11(34.4)	8 (25)	13 (40.6)	32 (100)		
Total	20 (19)	25 (23.8)	60 (57.1)	105 (100)		

*Data are presented as number (%) OSAS: Obstructive sleep apnea syndrome; AHI: Apnea–hypopnea index

Table 4. AHI scores in patients

CPAP usage	AHI				P-value
	Number	Mean ± SD	Min	Max	
No	67	32.2 ± 24.4	5	113.1	0.126
Yes	38	45.4 ± 27.5	6	91	
Total	105	40.2 ± 26.1	5	113.1	

AHI: Apnea–hypopnea index; SD: Standard deviation; CPAP: Continuous positive airway pressure

In the study of Sin et al., the mean AHI was 64.00 ± 2.34 and the mean age was 51.0 ± 11.7 years. Compliance of CPAP was reported more than 86%, which had a significant relationship with age and AHI scores (16). This study is antithetic with our study, which would be the result of the large differences in AHI scores of two studies.

Yetkin et al. reported the low compliance of CPAP in patients with mild-to-moderate OSAS (22), which is not in line with our study.

Don in a study on patients with AHI scores of more than 20 reported that compliance of CPAP was 79% and was significantly related to female gender, increased age, and AHI score, which are not in line with the present study (16).

Campos-Rodriguez et al. showed that the compliance of CPAP in women at the end of 5 and 10 years was 82.8% and 79.9%, respectively, which is controversial with the present study (23).

In the study of Yang et al., compliance of CPAP in older people was lower than younger people, and the use of CPAP was significantly related to the severity of AHI and sleepiness during the day, which is antithetic to the present study (25).

In the present study, 27 of 105 patients with OSAS continued CPAP treatment regularly. The most important determinant in the continued use of CPAP was sleep and general energy recovery, and the most important reason for the discontinuing use of CPAP was suffocation sense, the problem with the mask, and not achieving the desired result.

Sixty-seven patients never prepared and used CPAP for general reasons such as high cost and lack of insurance coverage, lack of familiarity with this device, and thus turning to other methods, such as surgery treatment. A significant relationship was between the financial situation of the patients and the preparation and use of CPAP, which significantly affected CPAP compliance.

Elkhouli et al. (18) showed that improvement in clinical parameters of sleep was the main predictor for long-term compliance and satisfaction of CPAP, which is consistent with our study.

In the study of Wolkove et al., the compliance of CPAP was reported 51%. Treatment satisfaction in 43 of 80 patients, who used CPAP continuously, was due to the higher improvement of sleep and energy. The reason for discontinuation of CPAP in 20 of 80 patients was choking sensation during use of masks, which is noted as a consistent study (21).

A study of Simon-Tuval et al. showed that 40% of patients received treatment with CPAP and continued it throughout the study. The study found that people with low social status had the lower compliance, which is in line with the present study (20).

Table 5. The distribution of CPAP according to gender, educational, and economic status in patients with OSAS

Variable	CPAP uses			P-value
	No	Yes	Total	
Gender				
Male	46 (63)*	27 (37)	73 (100)	0.798
Female	21 (65.6)	11 (34.4)	32 (100)	
Total	67 (63.8)	38 (36.2)	105 (100)	
Educational status				
Illiterate	9 (50)	9 (50)	18 (100)	0.781
Primary	16 (66.7)	8 (33.3)	24 (100)	
Middle-school	6 (66.7)	3 (33.3)	9 (100)	
High-school	4 (80)	1 (20)	5 (100)	
Diploma	16 (61.5)	10 (38.5)	26 (100)	
Academic	16 (69.9)	7 (30.4)	23 (100)	
Total	67 (63.8)	38 (36.2)	105 (100)	
Economic status				
No financial problems	12 (41.04)	17 (58.6)	29 (100)	< 0.001
Moderate status	34 (61.8)	21 (38.2)	55 (100)	
Financial difficulties	21 (100)	0 (0)	21 (100	
Total	67 (63.8)	38 (36.2)	105 (100)	

*Data are presented as number (%). OSAS: Obstructive sleep apnea syndrome; CPAP: Continuous positive airway pressure

In the study of Somers et al., the CPAP compliance within 4 and 12 months from baseline was 29% and 12%, respectively (24), which is concurrent with the present study.

Nagarajan et al. showed that the compliance of CPAP was 41.9%. A significant relationship between financial situation and using of CPAP was found, which is consistent with our findings (26).

Hooti et al. showed that 39% of patients used CPAP regularly, but 20% due to not need to CPAP treatment and 24% due to the high cost of the device did not use CPAP, which is in line with our study (27).

In a study of Pepin et al., CPAP compliance reported 74% within 3 months (15), which is inconsistent with the present study. This difference could be due to the short duration of the study.

Hoffstein et al. showed that the compliance of CPAP was 81% (13), which is not consistent with the present study. It is because of 75% supply of the cost of the CPAP by insurance in this study.

In the study of McArdle et al., CPAP compliance after 17 months was 68%, which is not consistent with our study, possibly due to the imposition of the full cost of CPAP to patients (14).

Several limitations may be considered for this study: (1) Uncooperative patients to complete the questionnaire, (2) the difficulty in collecting data on the need to coordinate patient tests, and (3) lack of access to any patient information due to lack of registration records.

Conclusion

Given the significant association between the financial status of the OSAS patients and using of CPAP, one of the reasons for low use of CPAP was CPAP expensive cost along with not being covered by insurance companies, this has made CPAP less affordable to our patients. In those countries where insurance companies pay the costs of CPAP, the usage of CPAP is higher.

Recommendations of authors include: (1) Conducting more extensive studies with larger sample size provides a better assessment of CPAP treatment, (2) the study of CPAP compliance in patients with OSAS and snoring simultaneously and individually, and (3) performing a research by providing CPAP to patients with no cost so that the cost of CPAP for patients could be removed and other factors in the acceptance of patients would be examined.

Conflict of Interests

Authors have no conflict of interests.

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References

1. Sanders MH, Martin RJ, Pennock BE, et al. The detection of sleep apnea in the awake patient. The 'sawtooth' sign. JAMA 1981; 245: 2414-8.
2. Hoffstein V, Oliver Z. Pulmonary function and sleep apnea. Sleep Breath 2003; 7: 159-65.
3. Yaggi HK, Concato J, Kernan WN, et al. Obstructive sleep apnea as a risk factor for stroke and death. N Engl J Med 2005; 353: 2034-41.
4. Marshall NS, Neill AM, Campbell AJ, et al. Randomised controlled crossover trial of humidified continuous positive airway pressure in mild obstructive sleep apnoea. Thorax 2005; 60: 427-32.
5. George CF. Perspectives on the management of insomnia in patients with chronic respiratory disorders. Sleep 2000; 23: S31-S35.
6. Victor LD. Treatment of obstructive sleep apnea in primary care. Am Fam Physician 2004; 69: 561-8.
7. Levy P, Pepin JL. Auto-CPAP: An effective and low-cost procedure in the management of OSAS? Eur Respir J 1998; 12: 753-5.
8. Flemons WW, Tsai W. Quality of life consequences of sleep-disordered breathing. J Allergy Clin Immunol 1997; 99: S750-S756.
9. Morgenthaler TI, Aurora RN, Brown T, et al. Practice parameters for the use of autotitrating continuous positive airway pressure devices for titrating pressures and treating adult patients with obstructive sleep apnea syndrome: An update for 2007. An American Academy of Sleep Medicine report. Sleep 2008; 31: 141-7.
10. Doherty LS, Kiely JL, Lawless G, et al. Impact of nasal continuous positive airway pressure therapy on the quality of life of bed partners of patients with obstructive sleep apnea syndrome. Chest 2003; 124: 2209-14.
11. McEachern RC, Patel RG. Pneumopericardium associated with face-mask continuous positive airway pressure. Chest 1997; 112: 1441-3.
12. Souter MA, Stevenson S, Sparks B, et al. Upper airway surgery benefits patients with obstructive sleep apnoea who cannot tolerate nasal continuous positive airway pressure. J Laryngol Otol 2004; 118: 270-4.
13. Hoffstein V, Viner S, Mateika S, et al. Treatment of obstructive sleep apnea with nasal continuous positive airway pressure. Patient compliance, perception of benefits, and side effects. Am Rev Respir Dis 1992; 145: 841-5.

14. McArdle N, Devereux G, Heidarnejad H, et al. Long-term use of CPAP therapy for sleep apnea/hypopnea syndrome. Am J Respir Crit Care Med 1999; 159: 1108-14.

15. Pepin JL, Krieger J, Rodenstein D, et al. Effective compliance during the first 3 months of continuous positive airway pressure. A European prospective study of 121 patients. Am J Respir Crit Care Med 1999; 160: 1124-9.

16. Sin DD, Mayers I, Man GC, et al. Long-term compliance rates to continuous positive airway pressure in obstructive sleep apnea: A population-based study. Chest 2002; 121: 430-5.

17. Rauscher H, Popp W, Wanke T, et al. Acceptance of CPAP therapy for sleep apnea. Chest 1991; 100: 1019-23.

18. Elkhouli O, Wolkove N, Baltzan M. Predictors of continuous positive airway pressure (CPAP) compliance and satisfaction after split-night protocol. Chest 2005; 128: 222S.

19. Jean WH, Boethel C, Phillips B, et al. CPAP compliance: Video education may help! Sleep Med 2005; 6: 171-4.

20. Simon-Tuval T, Reuveni H, Greenberg-Dotan S, et al. Low socioeconomic status is a risk factor for CPAP acceptance among adult OSAS patients requiring treatment. Sleep 2009; 32: 545-52.

21. Wolkove N, Baltzan M, Kamel H, et al. Long-term compliance with continuous positive airway pressure in patients with obstructive sleep apnea. Can Respir J 2008; 15: 365-9.

22. Yetkin O, Kunter E, Gunen H. CPAP compliance in patients with obstructive sleep apnea syndrome. Sleep Breath 2008; 12: 365-7.

23. Campos-Rodriguez F, Martinez-Garcia MA, Reyes-Nunez N, et al. Long-term continuous positive airway pressure compliance in females with obstructive sleep apnoea. Eur Respir J 2013; 42: 1255-62.

24. Somers ML, Peterson E, Sharma S, et al. Continuous positive airway pressure adherence for obstructive sleep apnea. ISRN Otolaryngol 2011; 2011: 943586.

25. Yang MC, Lin CY, Lan CC, et al. Factors affecting CPAP acceptance in elderly patients with obstructive sleep apnea in Taiwan. Respir Care 2013; 58: 1504-13.

26. Nagarajan R, Ranganathan L, Sundaram AK, et al. CPAP therapy in OSA-A gap analysis between recommendation and usage. Indian J Sleep Med 2012; 7: 150-6.

27. Hooti MA, Jaju D, Abri M. CPAP acceptance and compliance in sleep apnea patients in Oman. Sleep Med 2013; 14: e153.