Original Article

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Effect of Obstructive Sleep Apnea Complication Training on the Follow-up of the Polysomnography Response, the Purchase of the CPAP and Its Use: Randomized Clinical Trial Study

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ABSTRACT

Background & Objective: One of the most common breathing disorders during sleep is Obstructive sleep apnea (OSA).The aim of this study was to evaluate the effect of obstructive sleep apnea (OSA) training complications on the follow-up of the polysomnography test response, the purchase of the CPAP, and its use in patients with OSA.

Materials & Methods: We investigated 60 patients with OSA who were referred to Ibn Sina Hospital in Mashhad (Iran) for a polysomnography test in 2023. Eligible patients were divided into two groups; the intervention group underwent a 2-hour training session individually about OSA, its consequences, and complications by an expert psychologist. One month after intervention and the prescription of the CPAP by the doctor, the patients were compared in terms of the purchase rate of the CPAP machine, using a CPAP, and the follow-up rate of polysomnography response. However, no special training class was held for the control group; only CPAP was prescribed.

Results: The mean (±SD) age was 45.83 (±12.03) vs. 45.50 (±13.52) years in the two groups, respectively. The number (%) of men was 18 (60) vs. 13 (43.3), respectively. After the intervention, the follow-up rate of polysomnography response (66.7 vs. 36.7), purchase of CPAP machine (33.3 vs. 6.7%), and its use (26.7 vs. 6.7) were significantly higher in the intervention group compared to the control group (P<0.05).

Conclusion: Educational intervention can increase the follow-up rate of polysomnography response, purchase of the CPAP, and its use in OSA patients.
Keywords: Sleep apnea, Polysomnography, Psychoeducation, CPAP

Introduction

One of the most common breathing disorders during sleep is Obstructive sleep apnea (OSA). This disorder is defined by frequent obstruction of the upper airways (larynx), which can lead to a decrease of arterial oxygen or engorgement, and then by increasing the range and depth of breathing, the condition of breathing returns to normal **(1, 2)**. In adults, the duration of decreasing the depth of breathing in apnea or hypopnea is considered to be at least 10 seconds **(3)**. The main symptoms of OSA are nighttime daytime sleepiness and snoring. Fatigue without cause during the day, impaired daily functioning, decreased quality of life, impaired concentration, irritability, periodic hypoxemia, mood-cognitive disorders, cardiovascular complications, stroke, and increased risk of accidents during driving and work are its other consequences **(4-6)** . Sleep apnea factors include the shape of the skull and face, old age, obesity, male gender, race, ethnicity, genetic background, diet, smoking, alcohol consumption, and sleeping pills **(7-10).**

About 2-15% of middle-aged people and more than 20% of older adults have OSA. In men, the prevalence increases from 4% in the 3rd decade to 50% in the 7th decade of life, and in women, from 3% to 36% in the

3rd decade of life. Unfortunately, the disease is not diagnosed in most patients. The evidence indicates that 93% and 80% of women and men, respectively, have sleep apnea that has not been diagnosed **(11, 12)**. Compared to the general population, the prevalence of OSA in cardiovascular patients is high. Ischemic hypertension, cardiovascular diseases, heart failure, diabetes, and increased mortality are associated with OSA. Generally, OSA is an independent variable that predicts cardiovascular diseases and the mortality caused by them **(13, 14)**.

Evidence indicates that timely treatment of sleep breathing disorders effectively improves mood and cognitive function, left ventricular ejection fraction, reduces daytime sleepiness, and reduces mortality **(15, 16).** Definitive diagnosis of OSA is done by polysomnography **(17)**. Studies reported that using positive airway pressure (CPAP) can greatly reduce the consequences of OSA. CPAP is a small device used to help people suffering from sleep disorders or other conditions. One of the effective non-surgical treatments for OSA can be CPAP. It is the first treatment choice and is the most commonly used **(18)**. CPAP delivers mild air pressure to the upper airway of a sleeping person using a turbofan, hose tube, and mask. Turbofan CPAP sucks the air in the room, then compresses it a little and transfers it to the upper airway of the patient through the nose or mouth through the hose and mask. Pressurized air prevents the obstruction of the upper airway so that a person can breathe normally while sleeping **(19)**.

However, an important obstacle in the effective treatment of OSA is poor adherence to CPAP use. While more than 4 hours of use is an accepted standard (per night), various physical and psychological factors can influence the less use of this device. Studies reported an association between adherence to CPAP and improvement in quality of life, which shows a significant increase in the improvement of memory function, performance status, and blood pressure, as well as a decrease in sleepiness and cardiovascular diseases **(20, 21)**. Although CPAP treatment is one of the best ways to treat OSA, however, high costs and lack of health insurance coverage have caused many patients not to purchase a CPAP machine. On the other hand, patients' understanding of the benefits and health value of CPAP use is associated with better adherence, and education and supportive strategies can improve patients' long-term adherence to CPAP **(22)**. Considering the limitations of the studies conducted in this field, we evaluated the effect of OSA complications training on the follow-up of the polysomnography test response, the purchase of the CPAP, and its use in patients with OSA.

Materials and Methods

Study Design and Subjects

We investigated 60 patients with OSA who had been referred to Ibn Sina Hospital in Mashhad for a polysomnography test. We used convenience sampling to select participants. The inclusion criteria were age ≥ 18 years, suffering from OSA, and willingness to participate in the research. Exclusion criteria consisted of suffering from COPD or asthma.

How to Do the Intervention

First, informed consent was obtained from the patients. Then, selected patients were divided into 2 groups using a table of random numbers. The intervention group (n= 30) underwent a 2-hour training session individually about OSA, its consequences, and complications. This session was given by an expert psychologist. At the beginning of the session, the patient's knowledge about OSA disorder and its consequences was measured. The polysomnography test and its application were introduced in this session, along with full explanations about sleep disorders and OSA. Then, a continues positive airway pressure **(**CPAP) machine was introduced. How this device works, how to use it, its cost, and how to prepare it were discus sed.

Regarding how CPAP works, it was stated that it is a type of treatment that transfers mild air pressure to the patient's upper airway to keep the airways open and allow patients to breathe naturally while they sleep. However, no special training class was held for the control group (n=30), and only CPAP was prescribed by the doctor. One month after the intervention and the prescription of the CPAP by the doctor, the rate of purchase of CPAP machine, using a CPAP and the follow-up rate of polysomnography response were compared in two groups.

Statistical Analysis

Data were entered into SPSS26. First, the data were described using number (%) and mean (standard deviation). Then, the chi-square test, was used to compare quantitative variables, and the independent-sample T-test was used to compare variables in two groups.

Ethical Considerations

In addition to obtaining informed consent from the participants, this study has been approved by the Ethics Committee of Mashhad University of Medical Sciences (ID-number: IR.MUMS.IRH.REC.1402.142).

Results

Table 1 shows baseline and demographic variables before intervention in two groups; the average (±SD) age was 45.83 (±12.03) vs. 45.50 (±13.52) years two groups, respectively. The number (%) of men in the two groups under study was 18 (60) and 13 (43.3), respectively. The number of patients with academic education in the two groups was 9 (30) and 10 (33.3), respectively. The history of psychiatric treatment and the history of medical treatment in the two intervention and control groups were 9 (30) vs. 11 (36.7) and 14 (46.7) vs. 13 (43.3), respectively. In the intervention group, 16 (53.3) had a monthly income of 200-400 dollars, which was 14 (46.7) for the control group. Generally, no statistically significant differences were observed between the two groups in terms of basic and demographic variables (P-Value>0.05) **(Table 1)**. Table 2 demonstrates the follow-up rate of polysomnography response, purchase of the CPAP machine, and its use in the two investigated groups after the educational intervention. As can be seen, the groups had intervention and control significant differences in terms of purchase of a CPAP machine, using a CPAP machine, and the follow-up rate of polysomnography response **(**P-Value<0.05**)**, so the follow-up rate of polysomnography response (66.7 vs. 36.7), purchase of CPAP machine (33.3 vs. 6.7%) and its use (26.7 vs. 6.7) were significantly higher in the intervention group compared to the control group (P<0.05).

Table 1. Demographic and baseline characteristics of patients in groups

Qualitative Variables		Total	Group		P-Value*
			Control (n=30)	Interventional (n=30)	
		Number (%)	Number (%)	Number (%)	
Sex	Male	31 (51.7)	13 (43.3)	18 (60)	0.196
	Female	29 (48.3)	17 (56.7)	12 (40)	
Education	Nonacademic	41 (68.3)	20 (66.7)	21 (70)	0.781
	Academic	19 (61.7)	10 (33.3)	9 (30)	
Income level ($)	<200	24 (40)	14 (46.7)	10 (33.3)	0.480
	200 - 400	30 (50)	14 (46.7)	16 (53.3)	
	>400	6 (10)	2 (6.7)	4 (13.3)	
Psychiatric treatment history	No	40 (66.7)	19 (63.3)	21 (70)	0.584
	Yes	20 (33.3)	11 (36.7)	9 (30)	
Medical treatment history	No	33 (55)	17 (56.7	16 (53.3)	0.795
	Yes	27 (45)	13 (43.3)	14 (46.7)	
Taking medicine in the last month	No	27 (45)	12 (40)	15 (50)	0.436
	Yes	33 (55)	18 (60)	15 (50)	
Quantitative variables	**Group**	**Number**	**Mean**	**S.D**	**P-Value****
Age (year)	Interventional	30	45.83	12.03	0.920
	Control	30	45.50	13.52	

*: Chi square test
**: Independent sample t-test

Table 2. Follow-up of polysomnography response, purchase of CPAP machine, and its use in the two investigated groups

Qualitative Variables		Total	Group		P-Value*
			Control (n=30)	Interventional (n=30)	
		Number (%)	Number (%)	Number (%)	
Purchase of CPAP machine	No	48 (80)	28 (93.3)	20 (66.7)	0.010
	Yes	12 (60)	2 (6.7)	10 (33.3)	
Using a CPAP machine	No	50 (83.3)	28 (93.3)	22 (73.3)	0.038
	Yes	10 (16.7)	2 (6.7)	8 (26.7)	
Follow-up of polysomnography response	No	29 (48.3)	19 (63.3)	10 (33.3)	0.020
	Yes	31 (51.7)	11 (36.7)	20 (66.7)	

*: Chi-square test

Discussion

One of the most common breathing disorders during sleep is OSA. The airway is blocked and causes cessation of breathing during sleep and consequences such as cardiovascular disorders, obesity, diabetes, daytime sleepiness, decreased concentration, and other physical and mental diseases **(23)**. The main way to diagnose and treat OSA is to perform a polysomnography test and use a CPAP machine. However, the biggest obstacles to effective treatment of OSA are sometimes insufficient awareness of the consequences of OSA as well as poor adherence to CPAP therapy **(24)**. Hence, we evaluated the effect of OSA complications education on the follow-up of the polysomnography response, the purchase of the CPAP, and its use.

In line with our study, the study of Sawunyavisuth et al. showed age, Epworth sleepiness scale (ESS) score, education level, respiratory disturbance index/apnea-hypopnea index (AHI/RDI) , income level, and smoking were the most important predictors of purchasing CPAP in OSA patients, so that the purchase rate of CPAP was higher in people with older age, higher education level, higher income, more smoking and higher ESS and AHI/RDI scores **(24)**. A review study conducted by Askland et al. showed that behavioral interventions compared to usual care can increase the duration of CPAP use in patients with OSA. Also, supportive interventions can increase the use of CPAP to a moderate extent. However, the evidence regarding the effect of educational and mixed interventions on the duration of CPAP use was weak. Finally, more studies were recommended to choose the most appropriate intervention method **(25)**.
In another study by Smith et al. aimed to evaluate the educational, supportive, or behavioral strategies in encouraging patients with OSA to use CPAP, the duration of using the CPAP device in the group receiving supportive and motivational interventions was significantly higher. However, this review could not show that short-term educational intervention can improve CPAP use. Also, this research showed that cognitive behavioral therapy intervention can increase the average duration of CPAP use. Finally, the researchers of this study suggested conducting more clinical trial studies to investigate more closely the factors affecting the continued use of CPAP **(26)**.
Studies conducted on behavioral interventions indicate that the lack of standardization of interventions and strategies used to maintain adherence to CPAP use makes it difficult to identify the most appropriate components **(27).** In general, using a theory-based educational approach to change behavior can provide a more objective evaluation of the effect of the intervention, the continuation of its use, and compliance in patients **(28)**. Another issue regarding adherence to CPAP use is the balance of educational information and encouraging the continuation of desired behavior. In the study on 29 educational interventions regarding the continuation of CPAP use by Stepnowsky et al., the main components of these interventions were placed in the four categories of providing general information, instructions, information about consequences, and general encouragement. However, only 9 of these 29 studies provided feedback to patients. However, out of these 29 studies, only 9 studies provided feedback to patients, while providing feedback to patients, sharing information, and continuously encouraging them to adhere to CPAP use in OSA patients is important **(28)**.
Intervention time is another important factor on patients' adherence to CPAP treatment. Most of the educational interventions carried out in this field are limited to the early diagnosis of OSA by

polysomnography in these patients; while this disease is often lifelong, educational sessions and interventions should be continuous to encourage continued use and adherence to treatment **(27)**.

Recently, studies have emphasized the use of smartphones and web-based programs in providing educational interventions for patients. For example, Espie and colleagues have shown that these programs can be effective in providing educational interventions for compliance with CPAP treatment, behavioral feedback to patients, and its effectiveness **(29)**. Likewise, Isetta et al. also concluded that a smartphone health technology program can improve treatment self-monitoring and increase adherence to CAPA treatment in patients with severe OSA **(30)**. Interventions designed based on patients' needs and characteristics are likely to be more effective and cost-effective. Future research should focus on a more detailed investigation of the factors determining non-adherence of OSA patients to CPAP treatment, and the effect of different demographic, psychological, and behavioral factors, disease severity, and other diseases along with different educational theories should be considered **(31)**.

Conclusion

Our study showed educational intervention can increase the follow-up rate of polysomnography response, purchase of the CPAP, and its use in OSA patients, so it is recommended to hold educational classes about the complications of OSA in these patients. However, conducting intervention studies with a higher sample size and based on different educational theories seems necessary to choose the most appropriate educational approach.

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Authors' Contribution

Conflict of Interest

The authors declare that they have no conflict of interest.

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Ethics Approval and consent to participate

The study was approved by the Deputy of Research and Ethics Committee of Mashhad University of Medical Sciences (ID-number: IR.MUMS.IRH.REC.1402.142).

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