

Is it Possible to Use Portable Monitors which are Cheaper and Simpler Method in Obstructive Sleep Apnea Diagnosis?

Sema Sarac* and Gulgun Cetintas Afsar

University of Health Science, Süreyyapaşa Training and Research Hospital, Istanbul, Turkey

***Corresponding Author:** Sema Sarac, Süreyyapaşa Chest Diseases and Thoracic Surgery Training and Research Hospital, Department of Pulmonology, Basıbüyükmah, Maltepe, Istanbul, Turkey.

Received: March 14, 2019; **Published:** March 20, 2019

Abstract

Introduction and Objective: Obstructive sleep apnea (OSA) affects mortality and morbidity due to persistent hypoxemia attacks during the night. The use of “portable sleep monitors-PM” has been investigated in recent years because polysomnography (PSG) for OSA diagnosis is a rare and expensive tool. In our study, we aimed to investigate the compliance of PM and PSG among Turkish population.

Methods: The demographic records of 62 patients who were referred with OSA symptoms were collected from the database. The ENT (ear, nose and throat) examination was performed. After that, sleep records were taken with PM, followed by PSG.

Results: There was no difference between PM and PSG parameters in terms of AHI (Apnea-hypopnea Index) and ODI (Oxygen desaturation Index). The sensitiveness of the portable monitors was 89% and the specificity was 100%.

Conclusion: This study showed that the parameters of portable monitor and polysomnography were compatible with each other. Considering the limited resources of our country, we think that portable monitors could be used more widely.

Keywords: Obstructive Sleep Apnea; Portable Monitor; Polysomnography

Introduction

Obstructive sleep apnea (OSA) is a condition in which airflow due to partial collapse of the upper airway occurs with recurrent episodes of sleep, when the airflow is interrupted. Intermittent hypoxia during sleep decreases the sleep quality and reduces the quality of life [1,2]. In addition, OSA is a risk factor for, arterial disease, hypertension, stroke, cognitive disorders affecting all the systems [3-7].

The method for diagnosing OSA is polysomnography (PSG) that is used in sleep laboratories in hospitals.

Polysomnography is an expensive and inadequate toll to diagnose all patients with low number of devices. Portable sleep monitors (PM), which can also be used in the home environment, are being used more simply because they are cheap and effective [8,9].

In this study, we aimed to investigate the diagnostic efficacy of portable sleep monitors (PM) in Turkish population by comparing them with parameters of polysomnography, Apnea-hypopnea index (AHI), oxygen desaturation index (ODI) in laboratory.

Methods

This study was designed retrospective cross-sectional. Local ethics committee approval was obtained for the study. In accordance with Helsinki Declaration Principles.

Patient population

Between January 2015 and June 2015, 70 patients who were admitted to a university hospital sleep outpatient clinic with snoring, sleeping during daytime, complaints of tiredness, sleeping with portable monitor in the home environment, $AHI \geq 15$ and referred to our center for polysomnography were included in the study. Clinical and medical unstable cases were excluded. These patients had a myocardial infarction or cerebrovascular events in the last two months. In addition, those with an active infection, cancer and psychosis were excluded from the study. 3 patients had cerebrovascular event, 1 patient had myocardial infarction, 1 patient had malignancy, 2 patients had active infections and one patient had psychosis. The study was completed 62 patients.

The patients who were diagnosed with OSA who were sleeping with a portable monitor in their homes and were referred to our center for PSG recording and PSG-guided titration studies in order to receive CPAP device in accordance with the health practice notification (SUT) as PSG registration could not be performed in a medical center hospital. Patients were hospitalized in our sleep clinic in 15 days and PSG was performed. A total of 62 patients were compared retrospectively on AHI and ODI criteria determined by portable monitor and polysomnography. Height and weight of all patients were measured and Body-Mass Index (BMI) was calculated [10]. Epworth sleepiness questionnaire was performed. Polysomnography was evaluated by 2 physicians who did not know the results of portable monitor.

Epworth sleepiness scale (ESS)

The subjective responses of the patients about daytime sleep conditions were evaluated as 0 - 24 points. A score of 10 and above was considered positive [11].

Portable sleep monitors

Sleep records of patients were performed using ResMed brand Nox T3 device (USA) and Apnea Link Ox device (Sweden).

NOXT3 portable monitor

Thorax, abdomen, RIP respiratory effort and RIP flow, current (from the nasal cannula), snoring sound recording channel, position records were obtained.

Apnea link Ox device

Firmware version 04.08, software version 8.00. They record the inverse square root of the current as a flow index using a nasal flow signal (a nasal cannula/pressure transducer system [sample rate] 100 Hz) and pulse oximeter (Nonin XPod 3012 with nonin 7000A finger probe [sample rate 1 Hz]; Hudiksvall, Sweden).

Patients were seen at the hospital at noon and recorded which time they usually sleep in the evening. The device was set to start recording at the appropriate time. The patients were told how to use the device by the sleep technician. The patients were sent home with the device the next day.

Both devices with less than four hours were re-enrolled for sleep, respiratory events were scored manually. When the air flow decreased ≥ 90 and lasted for at least 10 seconds, the apnea was recorded as a hypopnea when the air flow decreased ≥ 30 at least 10 seconds.

Apnea hypopnea index (AHI) was calculated as the average of apnea hypopnea values recorded for each hour.

Polysomnography

All participants underwent a standard diagnostic overnight PSG (Neurosoft, Neuron spectrum5, Ivanovia-Russia). Two-channel electrooculogram and three-channel electroencephalogram were used to determine sleep stages during polysomnography records; nasal air-flow catheter and thermistor for intranasal pressure monitoring; used a submental electrode for sleep stages. Two tibia electromyography for leg movement records; oxygen saturation measurement probe, and chest and abdomen belts were used for the status of ventilatory effort during respiration. Scoring was based on 2013 criteria of AASM [12]. Apnea was defined as 90% or more decrease in airflow for at

least 10 seconds. Hypopnea was defined as 3% or more decrease in oxygen saturation and/or 30% or more decrease in airflow for at least 10 second with arousal. AHI was considered as number of apnea-hypopnea observed in every hour of sleep. If AHI score was 5 or higher, the patient was deemed to have OSA, and the severity of OSA was categorized as mild (AHI: 5.0 - 14.9 events/hour), moderate (AHI: 15.0 - 29.9 events/hour), or severe (AHI > 30.0 events/hour) according to 2014 classification of AASM [13].

Statistical analysis

Statistical analysis was made using IBM SPSS Statistics for Windows 2012 (version 22.0, IBM Corp., Armonk, NY, USA). Chi-square (χ^2) test was used for the comparison of categorical data, while numerical data were analyzed using Students’ t-test for variables with normal distribution and with Mann-Whitney U for non-normally distributed variables. Data were expressed as “mean (SD)”, median (25 - 75 percentile), and percentage (%) where appropriate. $p < 0.05$ was considered statistically significant.

Results

General demographic characteristics of patients are shown in table 1.

	Patients numbers (n:62)
Gender	
Male gender, n (%)	44 (71%)
Female gender, n (%)	18 (29%)
Age, mean (SD)	51 (10)
BMI (kg/m ²) (SD)	33 (7)

Table 1: Patients demographics
BMI: Body-mass Index; SD: Standard Derivation.

AHI and ODI values in portable monitor and polysomnography were shown in table 2. The sensitivity of the portable monitor was 89% and the specificity was 100% (Table 2).

		N	Mean (SD)	P value
AHI	PM	62	36 (26)	0.60
	PSG	62	39 (27)	
ODI	PM	62	35 (27)	0.32
	PSG	62	39 (27)	

Table 2: The comparison of portable monitor and polysomnography parameters.

PM: Portable Monitor; PSG: Polysomnography; AHI: Apnea-Hypopnea Index; ODI: Oxygen Desaturation Index; SD: Standard Derivation.

50 of the patients were evaluated with the portable monitor named NOXT3. AHI: 37 ± 3 , ODI at this device was 35 ± 26 . 12 patients were evaluated with apnea-Link OX device. At this device AHI was 35 ± 27 ; ODI was 30 ± 26 . There was no statistical difference between the two devices in comparison with each other and with PSG.

Discussion

In our study, AHI and ODI values in Portable Monitor (PM) records were consistent with AHI and ODI values in polysomnography records.

In some previous studies, it was emphasized that PM will be inadequate with current status in diagnosing OSA. However, there is a need to standardize technology [14,15].

In a different study, the device was used in the hospital instead of the home [16]. In our study, the device was used at home in accordance with its purpose. The devices have already been set to start the appropriate time. The patients took the shot without the supervision of a medical professional.

In addition, the first night effect was eliminated, and the required PM recording repetition was minimized due to insufficient sleep time.

In some previous studies, it was observed that PM data were not reviewed manually and only the automatic scoring of the device was achieved [17,18]. In our study, all data were evaluated manually and the error rate of the device in detecting respiratory events was minimized.

As in our study, a randomized study was performed with 2-channel PM, with a sufficient number of patients, which was scored manually the sensitivity (83%), the specificity was 100% [19]. Another study performed with NOX 3 device showed sensitivity of 95% and specificity of 69% [20]. The devices used in the two studies mentioned above were the same as the device used in this study. The portable monitor is a less extensive device than PSG. EEG, EOG and chin activities can't be recorded. The absence of these signals hinders the patient's sleep awakening period and complete detection of sleep stages. In this case, the PM can record respiratory events per hour during the recording time. However, the PSG shows respiratory events per hour during sleep. Therefore, the portable monitors have a lower detection status than the AHI.

Although there was no statistical difference in our study, similar to previous studies, AHI and ODI were found to be higher in patients with PSG [19,20].

It is a known fact that Portable monitors can skip mild OSA cases despite all the conditions required by the device [16]. In our study, while our cases' s AHI values ranged from (12 - 64/h), 30 cases (51.6%) were in the severe OSA group and 20 cases (32.2%) were in the moderate OSA group. We think that the high AHI values of our patients are contributing to the high specificity and sensitivity results.

In the population, the presence of OSA without daytime sleepiness (AHI > 5) is 24% in men and 9% in women [21]. Recently increased sleep apnea due to the increase in obesity. As in all over the world, obesity is increasing in our country. According to data in Turkey TUR-DEP obesity prevalence of 35%, 27% men, 44% women. In the last 12 years, obesity has increased in women (34%) and men (10.7%) in Turkey [22]. According to the Regulation on the health conditions and examinations to be sought for drivers published in the Official Gazette dated 29 December 2015; Persons with a BMI > 33 have been reported to be evaluated by polysomnography before obtaining a driver's license, whether they have complaints or not [23].

Since the PSG is expensive and few, almost 90% of the current potential patient group is under investigation and deprived of access to treatment. Considering the comorbid diseases caused by OSA [24], it would decrease mortality and morbidity as soon as possible to diagnose and start treatment. Portable monitors provide the opportunity for patients to shoot in the home environment.

Due to the comfort of the home environment, the patients experience problems such as lack of sleep activity due to the first-night effect they are exposed to in the laboratory.

The strength of our study is that a large number of patients can receive portable monitor records and polysomnography recordings at very close intervals in a standard manner, and that a portable monitor record can be obtained in a home environment in accordance with its purpose.

The weak side is that we cannot include any other PM parameters besides AHI and ODI because of its retrospective nature. The use of two different devices as a portable monitor is among the limitations of the study.

Conclusion

This study showed that the parameters of portable monitor and polysomnography were compatible with each other. Portable monitors are cheaper, simpler, and can be used in home.

Considering the limited resources of our country, we think that portable monitors could be used more widely.

Funding

This research received no specific grant for many funding agencies in the public, commercial or not - for- profit sectors.

Conflict of Interest

The author declare that they have conflict of interests.

Bibliography

1. Young T, *et al.* "Risk Factors for obstructive sleep apnea in adults". *Journal of the American Medical Association* 291.16 (2004): 2013-2016.
2. Epstein LJ, *et al.* "Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. Adult obstructive sleep apnea Task Force of the American Academy of Sleep Medicine". *Journal of Clinical Sleep Medicine* 5.3 (2009): 263-276.
3. Young T, *et al.* "Epidemiology of obstructive sleep apnea: a population health perspective". *American Journal of Respiratory and Critical Care Medicine* 165.9 (2002): 1217-1239.
4. Peppard PE, *et al.* "Increased prevalence of sleep-disordered breathing in adults". *American Journal of Epidemiology* 177.9 (2013): 1006-1014.
5. Gastaut H, *et al.* "Polygraphic study of the episodic diurnal and nocturnal (hypnic and respiratory) manifestations of the Pickwick syndrome". *Brain Research* 1.2 (1966): 167-186.
6. Ryan CM and Bradley TD. "Pathogenesis of obstructive sleep apnea". *Journal of Applied Physiology* 99.6 (2005): 2440-2450.
7. Yaggi HK, *et al.* "Obstructive sleep apnea as a risk factor for stroke and death". *New England Journal of Medicine* 353.19 (2005): 2034-2041.
8. Masa JF, *et al.* "Effectiveness of home single-channel nasal pressure for sleep apnea diagnosis". *Sleep* 37.12 (2014): 1953-1961.
9. Corlățeanu A, *et al.* "To sleep, or not to sleep-that is the question, for polysomnography". *Breathe* 13.2 (2017): 137-140.
10. Khosla T and Lowe FR. "Indices of obesity derived from body weight and height". *British Journal of Preventive and Social Medicine* 21.3 (1967): 122-128.
11. Howard ME, *et al.* "Sleepiness, sleep-disordered breathing, and accident risk factors in commercial vehicle drivers". *American Journal of Respiratory and Critical Care Medicine* 170.9 (2004): 1014-1021.
12. Berry RB, *et al.* "Rules for scoring respiratory events in sleep: update of the 2007 AASM Manual for the Scoring of Sleep and Associated Events. Deliberations of the Sleep Apnea Definitions Task Force of the American Academy of Sleep Medicine". *Journal of Clinical Sleep Medicine* 8.5 (2012): 597-619.
13. Sateia MJ. "American Academy of Sleep Medicine. International Classification of Sleep Disorders- third edition: highlights and modifications. 2014 third ed". *Chest* 146.5 (2014): 1387-1397.

14. Collop NA, *et al.* "Clinical guidelines for the use of unattended portable monitors in the diagnosis of obstructive sleep apnea in adult patients. Portable Monitoring Task Force of the American Academy of Sleep Medicine". *Journal of Clinical Sleep Medicine* 3.7 (2007): 737-747.
15. Kuna ST, *et al.* "An official ATS/AASM/ACCP/ERS workshop report: research priorities in ambulatory management of adults with obstructive sleep apnea". *Proceedings of the American Thoracic Society* 8.1 (2011): 1-16.
16. Wang Y, *et al.* "Validation of microMESAM as screening device for sleep disordered breathing". *Pneumology* 57.12 (2003): 734-740.
17. Oktay B, *et al.* "Evaluation of a single-channel portable monitor for the diagnosis of obstructive sleep apnea". *Journal of Clinical Sleep Medicine* 7.4 (2011): 384-389.
18. Erman M, *et al.* "Validation of the Apnea link for the screening of sleep apnea: a novel and simple single-channel recording device". *Journal of Clinical Sleep Medicine* 3.4 (2007): 387-392.
19. Ward KL, *et al.* "A Comprehensive Evaluation of a Two-Channel Portable Monitor to "Rule in" Obstructive Sleep Apnea". *Journal of Clinical Sleep Medicine* 11.4 (2015): 433-444.
20. Xu L, *et al.* "Validation of the Nox-T3 Portable Monitor for Diagnosis of Obstructive Sleep Apnea in Chinese Adults". *Journal of Clinical Sleep Medicine* 13.5 (2017): 675-683.
21. Young T, *et al.* "The occurrence of sleep disordered breathing among middle-aged adults". *New England Journal of Medicine* 328.17 (1993): 1230-1235.
22. Satman I, *et al.* "Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults". *European Journal of Epidemiology* 28.2 (2013): 169-180.
23. Official Register in Turkey with 29.12.2015 date 1229 item no.
24. McNicholas WT, *et al.* "Sleep apnoea as an independent risk factor for cardiovascular disease: current evidence, basic mechanisms and research priorities". *European Respiratory Journal* 29.1 (2007): 156-178.

Volume 8 Issue 4 April 2019

©All rights reserved by Sema Sarac and Gulgun Cetintas Afsar.