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# *The Effect of the COVID-19 Pandemic on the Follow-up of the PAP Treatment in Patients with Obstructive Sleep Apnea Syndrome*

## *COVID-19 Pandemisinin Obstrüktif Uyku Apne Sendromlu Hastalarda PAP Tedavisinin Takibine Etkisi*

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### Abstract

**Objective:** Coronavirus disease-2019 (COVID-19) pandemic mentioned some disease-specific problems related to obstructive sleep apnea syndrome (OSAS). This study determined problems faced by patients using positive airway pressure (PAP) devices due to OSAS during the COVID-19 pandemic.

**Materials and Methods:** Patients with OSAS using PAP were retrospectively identified. The cases that were contacted by phone were invited to complete the survey. Patients who agreed to participate in the study were asked whether the pandemic process affected their daily lives, OSAS treatment and PAP device use, and their responses were recorded.

**Results:** Fifty patients (37 men/13 women) included in this study. Eleven cases had a history of COVID-19 infection; however, the disease symptoms were not severe in any case. Half of the patients reported that daily living was moderately or severely affected during the pandemic. Eight patients experienced problems with their PAP devices, five patients started to use the PAP devices irregularly during the pandemic, and 10 cases completely stopped using them.

**Conclusion:** A significant portion of the patients experienced serious problems with PAP devices and the daily living activities were affected in half of the them during the pandemic. However, the follow-up and treatment services for many chronic diseases, as for OSAS, have been interrupted in this period that obligate the patients to handle their condition on their own. To provide continuous and adequate health care for OSAS patients under similar conditions in the future, it may be beneficial to establish widespread remote telecommunication systems in advance.

**Keywords:** COVID-19, obstructive sleep apnea syndrome, pandemic, positive airway pressure

### Öz

**Amaç:** Koronavirüs hastalığı-2019 (COVID-19) pandemisi, obstrüktif uyku apne sendromu (OUAS) açısından hastalığa özgü bazı problemlerin tekrar düşünülmesini gerektirmiştir. Bu çalışmada, OUAS nedeniyle pozitif hava yolu basıncı uygulayan (PAP) cihazları kullanmakta olan hastaların pandemi sürecinde karşılaştıkları sorunların tespit edilmesi amaçlanmıştır.

**Gereç ve Yöntem:** Retrospektif dosya taramasıyla PAP kullanmakta olan OUAS hastalarından dahil edilme kriterlerini karşılayanlar telefonla aranarak bu anket çalışmasına davet edilmiştir. Katılmayı kabul edenlere pandemi sürecinin günlük yaşamlarını, OUAS tedavilerini ve cihaz kullanımlarını etkileyip etkilemediği sorularak cevaplar kaydedilmiştir.

**Bulgular:** Çalışmaya alınan 50 hastanın (37 erkek/13 kadın) 11'inin COVID-19 enfeksiyonunu geçirdiği tespit edilmiştir, ancak hiç birinde hastalık belirtileri şiddetli izlenmemiştir. Hasta grubunun yarısında pandemi günlük yaşam aktivitelerini orta ve ileri derecede olumsuz etkilemiştir. Sekiz hasta pandemi döneminde cihazla ilgili sorun yaşadığını (üç hasta cihaza uyum sağlayamadığını, üç hasta maske ile ilgili sorun yaşadığını, iki hasta ise cihaz ayarlarının yetersiz geldiğini) bildirmiştir. Pandemi sırasında beş hastanın cihazı düzensiz kullanmaya başladığı, 10 hastanın ise cihaz kullanmayı bıraktığı anlaşılmıştır.

**Sonuç:** COVID-19 pandemisi hasta grubunun yarısında günlük yaşam aktivitelerini orta ve ileri derecede olumsuz etkilemiş, hastaların kayda değer bir bölümünde PAP cihazları ile ilgili ciddi sorunlar yaşanmıştır. Bu dönemde COVID-19 hastalığı dışındaki hastalıkların takip ve tedavi süreci sekteye uğramış, bu durum OUAS hastalarının pandemi döneminde yalnız kalmasına neden olmuştur. Hastalarla bağlantıda kalmayı sağlayacak telekonsültasyon, telefon destek hatları gibi uzaktan izlem araçlarının hızla yaygınlaştırılabileceği sistemleri kurmak hastaya tıbbi destek sağlanabilmesi için yararlı olabilir. Böyle bir süreçte hastanın takibinde destek alınabilecek diğer branşlardaki paydaşların belirlenmesi bundan sonra karşılaşılabilecek benzer süreçlerde hastaların sürekli ve iyi bir sağlık hizmeti almasına imkan sağlayabilir.

**Anahtar Kelimeler:** COVID-19, obstrüktif uyku apne sendromu, pandemi, pozitif hava yolu basıncı

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## Introduction

It has been reported that in the severe acute respiratory syndrome-coronavirus-2 Coronavirus disease-2019 (COVID-19) pandemic, which started in December 2019 and still constitutes a global health problem, the transmission route is spread airborne droplets, aerosols, and close contact (1). The COVID-19 pandemic has created serious problems in terms of public health and disrupted health services in many areas. The follow-up and treatment process of diseases other than COVID-19 has been interrupted in Turkey, similar to the situation in many parts of the world.

The COVID-19 pandemic has also led to the need for the reconsideration of some disease-specific problems for patients with obstructive sleep apnea syndrome (OSAS), which has a prevalence of 2-4% in the general population (2). The frequent co-existence of chronic diseases in these patients has also placed them at a high risk for contracting COVID-19. In a multicenter study evaluating the impact of the COVID-19 pandemic in European countries, while laboratory-based polysomnography was performed in 92.5% of the centers in the pre-pandemic period, it continued to be performed in only 20% of the centers during the pandemic, and even the rate of telemedicine-based sleep apnea diagnoses in these centers was reported to decrease from that 30% in the pre-pandemic period to 27.5% during the pandemic (3).

An important issue that needs to be addressed during the pandemic conditions for patients with OSAS concerns devices they use for positive airway pressure (PAP) in the treatment of this condition. No matter what type of PAP device is used for OSAS, it is necessary to adjust the device settings according to the needs of the patient, readjust them when necessary, and perform device maintenance to ensure that the treatment continues without any problems, that might be distracted during the COVID-19 pandemic.

This study was conducted to investigate whether OSAS cases with PAP treatment experienced any problems with their PAP devices during the COVID-19 pandemic.

## Materials and Methods

The study included patients diagnosed with OSAS according to the International Classification of Sleep Disorders-3 diagnostic criteria and followed up in the Sleep Laboratory of Dr. Ersin Arslan Training and Research Hospital Neurology Department and the Neurology Outpatient Clinics of SANKO University Faculty of Medicine. Approval was obtained from the Ethics Committee of Sanko University Faculty of Medicine (date: 17/09/2020, session number: 2020/16, decision number: 01).

In order to form the study group, the files of the patients followed up with the diagnosis of OSAS were screened, and those that continued to be followed up with PAP devices were identified. A total of 98 patients' information was obtained. These patients were called by phone and, verbal consent was obtained from the cases that accepted to participate in the study. Fourteen of these patients rejected to attend in the study, a questionnaire couldn't be applied with 6 of them, 28 patients couldn't be contacted by phone until the completion of the study.

During the interview, socio-demographic data, time of OSAS diagnosis, type of device used in the treatment of OSAS, presence any known chronic diseases or continuous medication use, presence of a newly diagnosed disease during the pandemic, and COVID-19 infection history in cases and their household were recorded. The patients were also asked whether they encountered any problems with the PAP devices during the COVID-19 pandemic, and if so, what kind of problems they experienced, whether it was resolved and the environment in which they used the device. Then, opinion for the effect of pandemic on OSAS treatment, PAP device use and daily life in general (1: Not at all, 5: Very much) was obtained from all cases. As this study was purposed to examine PAP treatment, another assessment wasn't made for sleep.

### Statistical Analysis

Descriptive statistics were given as numbers and percentages for qualitative data, and mean and standard deviation values for quantitative data.

## Results

The study included a total of 50 patients with OSAS (37 males and 13 females, who met the inclusion criteria. The demographic data of the patients are given in Table 1, and the details of their PAP device use are summarized in Table 2.

**Table 1. Demographic data of the patients**

| | | OSAS (n=50) |
|---|---|---|
| Gender | Male | 37 |
| | Female | 13 |
| Age (mean ± SD) | | 52.72±9.6 |
| Marital status | Single | 4 |
| | Married | 46 |
| Educational level | None/literate | 4 |
| | Primary school | 22 |
| | Middle school | 7 |
| | High school | 11 |
| | University | 6 |
| Body weight (mean ± SD) | | 94.9±15.9 |
| Weight (cm) (mean ± SD) | | 167.4±9.5 |
| Body mass index (mean ± SD) | | 34.2±7.3 |

SD: Standard deviation, OSAS: Obstructive sleep apnea syndrome

**Table 2. Details of the patients' device use**

| Device type | Number (%) |
|---|---|
| BPAP | 13 (26) |
| BPAP-ST | 19 (38) |
| CPAP | 10 (20) |
| Auto CPAP (APAP) | 8 (16) |

BPAP: Bilevel positive airway pressure, BPAP-ST: Bilevel positive airway pressure-spontaneous timed, CPAP: Continuous positive airway pressure, auto CPAP (APAP): Automatic continuous positive airway pressure

Thirty-four (68%) of the patients had a history of at least one chronic disease, with the most common being hypertension (32%), diabetes mellitus (28%), and coronary artery disease (16%). In addition, during the pandemic, one patient was diagnosed with adult-onset Still's disease and another patient with Parkinson's disease. It was determined that for 23 (46%) of the patients, the COVID-19 infection occurred in either the patients themselves (n=11) or in at least one of their household. None of the patients with OSAS who had contracted the COVID-19 infection required intensive care follow-up, and all recovered without any problems.

While 36 patients stated that the pandemic did not cause a serious problem in the treatment of OSAS (72%), four reported that it affected their treatment moderately (8%) and 10 severely (20%). During the pandemic, 30 (60%) patients continued to use their PAP device regularly and five (10%) started to use it irregularly, while the remaining 10 (20%) completely abandoned it (Table 3).

Eight patients (16%) stated they had problems with the PAP device during the pandemic. Three of these patients reported that they could not adapt to the device, three experienced problems with the mask use, and two stated that the settings were inadequate. Three of these patients reported that their problem was resolved. Of the patients that continued to have problems with the PAP device, five explained that they were not able to visit a sleep laboratory during the pandemic, one stated that the device could not be repaired, and the remaining two did not know why their problem could not be resolved.

Twenty-five patients (50%) stated that COVID-19 pandemic didn't affected their daily lives, 5 cases (10%) reported a partial affect, and 20 cases (40%) reported that the pandemic severely affected their daily lives.

## Discussion

We determined that in half of our patient group, the COVID-19 pandemic negatively affected the activities of daily living moderately or severely compared to the pre-pandemic period. It can be expected that as a chronic disease that disrupts daily life activities, OSAS may have had further adverse effects on daily life during the long-term lockdown experienced by individuals due to the pandemic conditions.

Clinical studies have shown that the risk of developing severe diseases, such as hypertension, left ventricular dysfunction, coronary artery disease, arrhythmia, ischemic cerebrovascular events, pulmonary hypertension, increased insulin resistance, and metabolic syndrome are increased in patients with OSAS who do not receive adequate treatment, and these observations have also been supported by laboratory studies (4). It has been known for a long time that these risks can be reduced through the long-term follow-up of patients under treatment (5). An important problem indicated by our study results is the disruption in the use of PAP devices, which is considered to be the gold standard in OSAS treatment, during the pandemic. It is an important issue to know if the PAP device management has been affected in the ongoing pandemic conditions. However, there is not sufficient data on this topic. A survey study in 112 OSAS cases recently revealed that 21% used more their devices than before since they believed that it was more secure clinically to use the PAP device longer in outbreak period, whereas 11% cases with PAP treatment stopped using their devices during the pandemic (6).

Considering our findings, 72% of our patients stated that the pandemic process did not cause serious difficulties in their OSAS treatment. However, 28% of the patient group reported that the pandemic had a partial or severe negative impact on their OSAS treatment. More importantly, 10% of the patients began to use their PAP devices irregularly, while 20% completely stopped using this device during the pandemic. In OSAS, which is very commonly seen in the general population, maintenance of treatment under the most appropriate conditions is very important not only for the patient but also for public health and in reducing the socio-economic burden.

During the periods of complete lockdown, the access of patients to hospitals except for emergencies has been severely restricted across the world. During the implementation of lockdown measures, as in other countries of the world, many hospitals in Turkey also closed their sleep laboratories and the healthcare team in those places were assigned to COVID-19 clinics. During the pandemic, not only sleep laboratories but also sleep outpatient clinics were closed and access to health care was limited for a long time which leaded OSAS patients, one of the most vulnerable groups due to the high risks of comorbidities, to be alone to manage their health problems in this period.

It was determined that during the pandemic, 11 of our patients had contracted the COVID-19 infection, but none developed a severe disease, and during the phone survey, they generally reported feeling well. However, this cannot be a realistic expectation for all patients with OSAS. It has been reported that the presence of OSAS increases susceptibility to the COVID-19 infection, more severe respiratory problems can be seen in patients with OSAS that contract COVID-19, the treatment of these patients has specific problems, and the co-existence of OSAS and COVID-19 can even increase mortality (7-9). In a systematic review, it was reported that OSAS was detected at a high rate of 8-28% among COVID-19 cases that required follow-up in the intensive care unit (10).

Another issue that should be carefully considered is the increased viral load spreading to the environment during the use of PAP devices by patients infected with COVID-19, as well as the possibility of a higher risk of transmission for other people in the same environment (11). However, there is not sufficient research in this area. Identifying problems in pandemic conditions can assist in the development of solution proposals and provide guidance for future. It has been reported that the use of PAP devices increases the risk of COVID-19 transmission by exposing people around these patients to a higher viral load, and it has been recommended that patients using these device continue their treatment at home (10). However, this recommendation has resulted in patients with OSAS fearing that they will spread the virus among their household. In a multicenter study conducted in France, it was

| Table 3. Comparison of the survey responses of the individuals with and without a COVID-19 history | | |
|---|---|---|
| | **Individuals with a COVID-19 history (n=11)** | **Individuals without a COVID-19 history (n=39)** |
| | **n (%)** | **n (%)** |
| **Question 1: Did the COVID-19 pandemic affected your OSAS treatment in general?** | | |
| Not at all | 4 (36.3%) | 23 (59%) |
| Slightly | 2 (18.2%) | 7 (18%) |
| Moderately | 2 (18.2%) | 2 (5.1%) |
| Very | 3 (27.3%) | 6 (15.4%) |
| Extremely | 0 (0%) | 1 (2.5%) |
| **Question 2: How did the COVID-19 pandemic affected your PAP device use?** | | |
| Not at all | 3 (27.3%) | 20 (51.3%) |
| Slightly | 3 (27.3%) | 5 (12.8%) |
| Moderately | 2 (18.2%) | 4 (10.2%) |
| Very | 2 (18.2%) | 8 (20.6%) |
| Extremely | 1 (9%) | 2 (5.1%) |
| **Question 3: How did the COVID-19 pandemic affected your daily life?** | | |
| Not at all | 2 (18.2%) | 9 (23.1%) |
| Slightly | 3 (27.3%) | 11 (28.2%) |
| Moderately | 2 (18.2%) | 3 (7.7%) |
| Very | 3 (27.3%) | 15 (38.5%) |
| Extremely | 1 (9%) | 1 (2.5%) |
| **Question 4: Did you had any problems with your PAP device during the COVID-19 pandemic?** | | |
| Yes | 2 (18.2%) | 9 (23.1%) |
| No | 9 (81.8%) | 30 (76.9%) |
| **Question 5: Did you change the settings of your PAP device or the environment that you used it during the COVID-19 pandemic?** | | |
| Yes | 3 (27.3%) | 13 (33.3%) |
| No | 8 (72.7%) | 26 (66.7%) |
| **Question 6: Is this phrase is convenient for you? I used to use it regularly before the pandemic, and I am still using it regularly.** | | |
| Yes | 5 (45.5%) | 25 (64.1%) |
| No | 6 (54.5%) | 14 (35.9%) |
| **Question 7: Is this phrase is convenient for you? I used to use it irregularly before the pandemic, and I am still using it irregularly.** | | |
| Yes | 3 (27.3%) | 1 (2.5%) |
| No | 8 (72.7%) | 38 (97.5%) |
| **Question 8: Is this phrase is convenient for you? I used to use it regularly before the pandemic, but I am using it irregularly during pandemic.** | | |
| Yes | 0 (0%) | 5 (12.8%) |
| No | 11 (100%) | 34 (87.2%) |
| **Question 9: Is this phrase is convenient for you? I stopped to use it during the pandemic.** | | |
| Yes | 3 (27.3%) | 7 (18%) |
| No | 8 (72.7%) | 32 (82%) |
| **Question 10: Is this phrase is convenient for you? I am sleeping in the same room as I was used to before the pandemic.** | | |
| Yes | 11 (100%) | 39 (100%) |
| No | 0 (0%) | 0 (0%) |
| **Question 11: Is this phrase is convenient for you? I am sleeping in an isolated room from other household, just in case of being infected.** | | |
| Yes | 0 (0%) | 0 (0%) |
| No | 11 (100%) | 39 (100%) |
| n: Number, OSAS: Obstructive sleep apnea syndrome, PAP: Positive airway pressure, COVID-19: Coronavirus disease-2019 | | |

found that 33% of patients with OSAS stopped using their treatment device on their own initiative during active COVID-19 infection, fearing that they would infect other household members (11). In the same study, it was reported that 4.5% of patients started to sleep in a separate room from the rest of the family since the beginning of the pandemic (11). In the current study, we determined that our patients slept in the same conditions as was in the pre-pandemic period, and none of them made any arrangements for sleep spaces in their house. These data suggest that patients using PAP devices need medical advice on how to isolate themselves in case of an active infection to protect both themselves and others at home while continuing to use their device. It is clear that their own solutions were not sufficient. However, most of the patients were not able to seek consultation about this situation due to the pandemic conditions. During this period, patients can be provided with necessary information through other medical branches, such as infectious disease specialists and family physicians, who actively monitor infections and isolation. However, such an initiative cannot be expected to start spontaneously, and it can only be achieved if people are aware of the importance of the issue and physicians and patients cooperate with each other.

A similar cooperation is also important for the follow-up and treatment of comorbidities in patients with OSAS. Good management of the treatment of cardiovascular, cerebrovascular and metabolic diseases during this long pandemic period will also play a positive role in reducing the risk of morbidity in the event that a patient with OSAS contracts COVID-19.

### Study Limitations

The main limitation of our study is the small number of patients. In addition, although phone survey is a method that has been used in many different follow-up studies to ensure safety during the pandemic, it is necessary to consider the possibility that responses obtained by this method are not adequately descriptive and reliable.

## Conclusion

We need to take lessons from the ongoing COVID-19 pandemic and determine what solutions should be implemented for similar problems that are not unlikely to occur in future. Adopting the use of remote monitoring systems, such as telemonitoring, teleconsultation, and sleep disorders support lines that can be quickly put in the service, when necessary, will allow physicians to stay in touch with their patients, detect problems at an early period, and produce timely solutions, although these tools cannot completely replace face-to-face approaches. Determining all participants that can provide support during the solution of problems and preparing an action plan in advance will ensure that patients receive continuous and good health care in similar conditions that may occur in future.

### Ethics

**Ethics Committee Approval:** The study included patients diagnosed with OSAS according to the International Classification of Sleep Disorders-3 diagnostic criteria and followed up in the Sleep Laboratory of Dr. Ersin Arslan Training and Research Hospital Neurology Department and the Neurology Outpatient Clinics of SANKO University Faculty of Medicine. Approval was obtained from the Ethics Committee of Sanko University Faculty of Medicine (date: 17/09/2020, session number: 2020/16, decision number: 01).

**Informed Consent:** These patients were called by phone and. verbal consent was obtained from the cases that accepted to participate in the study.

**Peer-review:** Internally and externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: A.N., Concept: E.K.C., Y.E.F., A.N., A.M.N., Design: A.M.N., Data Collection or Processing: E.K.C., Y.E.F., Analysis or Interpretation: E.K.C., Y.E.F., A.N., A.M.N., Literature Search: E.K.C., Y.E.F., A.N., A.M.N., Writing: E.K.C., Y.E.F., A.N., A.M.N.

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