

Investigation of Clinical, Physiological, and Polysomnographic Parameters in Patients with Obstructive Sleep Apnea Syndrome

Obstrüktif Uyku Apne Sendromu Olan Hastalarda Klinik, Fizyolojik ve Polisomnografik Parametrelerin İncelenmesi

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ABSTRACT Objective: This study aimed to examine clinical, physiological, and polysomnographic parameters in patients with obstructive sleep apnea syndrome (OSAS), comparing positional and non-positional cases based on variations in the Apnea-Hypopnea Index (AHI) between sleep positions. **Material and Methods:** A retrospective analysis was conducted on the records of 46 patients diagnosed with OSAS via overnight polysomnography from December 2023 to May 2024. Based on AHI differences in the supine and lateral positions, patients were classified as positional or non-positional. Parameters evaluated included demographic data, symptom prevalence, OSAS severity, polysomnographic metrics, and upper airway physical examination findings. **Results:** Non-positional patients reported more severe symptoms, with significantly higher Epworth Sleepiness Scale scores (13 ± 4.6 vs. 8.18 ± 3.21 ; $p=0.032$) and a greater prevalence of witnessed apnea (91% vs. 43.5%; $p=0.023$), insomnia (73.9% vs. 21.7%; $p=0.002$), and morning headaches (78.3% vs. 39%; $p=0.034$). Nasal obstruction was more common in positional patients (65% vs. 21.7%; $p=0.008$), who also demonstrated higher sleep efficiency ($85.69\pm 7.25\%$ vs. $69.79\pm 11.23\%$; $p=0.003$). Severe OSAS was more frequent in non-positional patients (65% vs. 22%; $p=0.003$). AHI values were significantly higher overall in non-positional patients (65.49 ± 20.49 vs. 29.56 ± 15.23 ; $p=0.000^*$) and supine/lateral positions. **Conclusion:** This study underscores distinct clinical and polysomnographic profiles between positional and non-positional OSAS patients, suggesting that positional therapy may benefit positional cases, whereas non-positional patients may require more comprehensive treatment.

ÖZET Amaç: Bu çalışma, obstrüktif uyku apne sendromu (OUAS) olan hastalarda klinik, fizyolojik ve polisomnografik parametreleri incelemeyi ve Apne-Hipopne İndeksi (AHİ) varyasyonlarına göre pozisyonel ve pozisyonel olmayan vakaları karşılaştırmayı amaçlamaktadır. **Gereç ve Yöntemler:** Aralık 2023-Mayıs 2024 tarihleri arasında gece boyunca yapılan polisomnografi ile OUAS tanısı alan 46 hastanın tıbbi kayıtları retrospektif olarak incelendi. Hastalar, sırtüstü ve yan pozisyonlardaki AHİ farklılıklarına göre pozisyonel veya pozisyonel olmayan olarak sınıflandırıldı. Değerlendirilen parametreler demografik veriler, semptom yaygınlığı, OUAS şiddeti, polisomnografik veriler ve üst solunum yolu fizik muayene bulgularını içermektedir. **Bulgular:** Pozisyonel olmayan hastalar daha ciddi semptomlar göstermiş olup, Epworth Uykululuk Ölçeği skorları ($13\pm 4,6$ 'ya karşı $8,18\pm 3,21$; $p=0,032$) ve tanıklı apne (%91'e karşı %43,5; $p=0,023$), uykusuzluk (%73,9'a karşı %21,7; $p=0,002$) ve sabah baş ağrısı (%78,3'e karşı %39; $p=0,034$) gibi semptomlar açısından daha yüksek prevalans göstermiştir. Nazal tıkanıklık, pozisyonel hastalarda daha sık görülmüştür (%65'e karşı %21,7; $p=0,008$) ve bu grup daha yüksek uyku etkinliği göstermiştir (%85,69±7,25'e karşı %69,79±11,23; $p=0,003$). Şiddetli OUAS, pozisyonel olmayan hastalarda daha sık görülmüştür (%65'e karşı %22; $p=0,003$). AHİ değerleri, hem genel olarak ($65,49\pm 20,49$ 'a karşı $29,56\pm 15,23$; $p=0,000$) hem de sırtüstü/yan pozisyonlarda pozisyonel olmayan hastalarda anlamlı derecede daha yüksektir. **Sonuç:** Bu çalışma, pozisyonel ve pozisyonel olmayan OUAS hastaları arasında belirgin klinik ve polisomnografik farklılıkları vurgulamaktadır; pozisyonel tedavinin pozisyonel vakalarda yarar sağlayabileceğini, pozisyonel olmayan hastaların ise daha kapsamlı bir tedaviye ihtiyaç duyabileceğini önermektedir.

Keywords: Obstructive sleep apnea syndrome; obstructive sleep apnea syndrome; Apnea-Hypopnea Index; polysomnography; sleep

Anahtar Kelimeler: Obstrüktif uyku apne sendromu; obstrüktif uyku apne sendromu; Apne-Hipopne İndeksi; polisomnografi; uyku

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Obstructive sleep apnea syndrome (OSAS) is a common sleep disorder characterized by repetitive episodes of partial (hypopnea) or complete (apnea) upper airway collapse during sleep, leading to disrupted sleep and decreased oxygen levels.^{1,2} The severity of OSAS is typically assessed using the Apnea-Hypopnea Index (AHI), with the condition often worsening in the supine sleeping position. Numerous studies have shown that AHI can more than double in the supine position compared to the lateral position, while in some cases, lateral sleeping can normalize AHI (AHI<5), a condition known as positional OSAS (p-OSAS).^{3,4} Positional dependency occurs in approximately 56% of patients with OSAS, indicating its clinical importance.⁵⁻⁷

While the underlying mechanisms of p-OSAS are not entirely clear, anatomical differences in upper airway structures, such as a narrower pharyngeal airway or differences in muscle tone, may play a key role.^{7,8} Positional therapy has been recommended as an initial treatment option for p-OSAS, offering a non-invasive approach to mitigate symptoms.⁹⁻¹¹ However, understanding the physiological and anatomical variations between positional and non-p-OSAS remains crucial for tailoring effective treatment strategies.

This study investigates and compares the clinical, physiological, and polysomnographic (PSG) parameters between positional and non-p-OSAS patients, providing a comprehensive perspective on the variations and clinical implications of positional dependency in OSAS.

MATERIAL AND METHODS

This study adhered to the Declaration of Helsinki's highest ethical standards and principles. Informed consent was obtained from all participants, ensuring anonymity and confidentiality. Ministry of Health of the Republic of Azerbaijan, State Advanced Training Institute for Doctors named after A. The Aliyev Local Ethics Committee approved this study (date: February 09, 2024, no: OSAS/Research No 1/II).

PATIENTS

The medical records of patients diagnosed with OSAS who presented to our clinic between Decem-

ber 2023 and May 2024 were retrospectively reviewed. A total 46 patients were included if they had undergone a full overnight PSG study, were diagnosed with OSAS (AHI>5), and had sufficient sleep time in both the supine and lateral positions for analysis.

The exclusion criteria were as follows:

1. Patients who had previously undergone upper airway surgery (e.g., tonsillectomy, uvulopalatopharyngoplasty) may have altered upper airway anatomy and affected OSAS outcomes.

2. Patients with pulmonary diseases (chronic obstructive pulmonary disease, restrictive lung disease) that could impair oxygen saturation and confound the results.

3. Patients with severe cardiac failure or Cheyne-Stokes respiration, which are known to be associated with central sleep apnea.

4. Patients with central sleep apnea syndrome have a different pathophysiology and management than those with obstructive sleep apnea.

5. Patients with less than 30 minutes of recorded sleep in either the supine or lateral position during the PSG study were excluded because insufficient time in these positions would compromise the accuracy of the positional analysis.

6. Patients met the inclusion criteria and were included in the study for further analysis.

DEMOGRAPHIC AND SYMPTOM DATA COLLECTION

Demographic data, including age, body mass index (BMI), neck circumference, and sex, were collected from the patients' medical records. Symptom data were collected from patient-reported experiences and clinical evaluations documented during the initial assessment. The key symptoms assessed were habitual snoring, witnessed apnea, daytime fatigue, morning headaches, insomnia, nasal obstruction, and dry mouth upon waking. Excessive daytime sleepiness was quantified using the Epworth Sleepiness Scale (ESS), with a score of 10 indicating significant sleepiness.

UPPER AIRWAY PHYSICAL EXAMINATION

Upper airway anatomical features were assessed to determine potential physical contributors to obstruc-

tive sleep apnea severity and positional dependency. Physical examination findings documented included:

1. Septal Deviation: Assessed for nasal airflow obstruction, recorded as present or absent based on clinical observation.

2. Concha Hypertrophy: Evaluated in each patient to determine the extent of nasal cavity narrowing recorded if there was a significant enlargement of nasal turbinates.

3. Uvula and Soft Palate Pathologies: Inspected for abnormalities, including elongation and excessive soft tissue that may contribute to airway collapse.

4. Tonsil Size: Graded on a scale of I–IV based on the Brodsky classification system, with Grades III and IV indicating significant tonsillar hypertrophy.

5. Modified Mallampati Index (MMI): Measured as a clinical predictor of airway obstruction, with grades III and IV indicating higher airway collapsibility risk.

endoscopic laryngeal examination to assess laryngeal structures and epiglottic position was not performed consistently in all patients. Consequently, this component was waived in this manuscript to maintain homogeneity in the presented data.

PSG STUDY

The diagnosis of OSAS was confirmed by polysomnography. All participants underwent an overnight evaluation in the laboratory using a computerized polysomnography device (Philips Respironics ALICE 5 PSG) (Murrysville, Pennsylvania, USA). The recorded physiological signals included electroencephalogram, electrooculogram, submental and leg electromyogram, electrocardiogram, chest and abdominal respiratory movements, arterial oxygen saturation measured by pulse oximetry, snoring, and body position. A sleep technician nurse observed the participants' behavior and verified their sleep positions. The sleep technician manually scored all sleep data according to the guideline criteria from *The AASM Manual for the Scoring of Sleep and Associated Events**.¹² Respiratory monitoring was performed using an oronasal flow sensor cannula to measure airflow at the mouth and nose,

thoracic and abdominal belts to measure respiratory effort, a finger probe to assess oxygen saturation, and a microphone placed on the trachea to record snoring. Additionally, two-channel electrocardiography and leg movements via an electromyography sensor placed on the anterior tibialis muscle were recorded. Sleep stages and respiratory events were scored manually according to standard criteria.^{12,13}

Obstructive apnea was defined as the cessation of airflow at the mouth and nose for at least 10 s with continued respiratory effort. Hypopnea was defined as a 50% reduction in airflow to the mouth and nose and a 3% decrease in oxygen saturation or arousal.¹³ The AHI was calculated by dividing the total number of obstructive apneas and hypopneas by the total sleep time (TST) in hours. Patients with AHI > 5 were diagnosed with OSAS. The severity of OSAS was classified as mild (AHI 5-15), moderate (AHI 16-30), or severe (AHI > 30). Patients whose AHI normalized in the lateral position or whose AHI in the supine position was at least twice that of the lateral position were classified as positional patients (PP). In contrast, patients with no significant difference in AHI between positions were classified as non-positional patients (NPP).

STATISTICAL ANALYSIS

All statistical analyses were performed using SPSS software (version 13.0; SPSS Inc., Chicago, IL, USA). Continuous variables were tested for normality using the Kolmogorov-Smirnov test. Parametric data were expressed as mean±standard deviation (SD) and compared using the independent sample t-test, whereas non-parametric data were analyzed using the Mann–Whitney U test. Categorical variables were presented as percentages and frequencies and were compared using the chi-square (χ^2) test. Pearson's correlation analysis was used to explore the relationships between positional changes in AHI and clinical parameters, such as BMI, neck circumference, and ESS scores.¹⁴ A p-value of less than 0.05 was considered statistically significant, and 95% confidence intervals (CI) were calculated where relevant.

RESULTS

The study cohort consisted of 46 patients, 31 males, and 15 females, with a mean age of 47.21±5.6 years.

Of these, 23 patients (50%) were classified as having PP and 23 (50%) as having NPP. The male-to-female ratio was similar between the groups ($p=0.823$), with the majority of patients in both groups being male ($p=0.0489$), reflecting the typical gender distribution seen in OSAS.

DEMOGRAPHIC DATA

The demographic characteristics of the positional (PP) and non-positional (NPP) OSAS patients showed notable distinctions across age, BMI, neck circumference, and gender distribution.

PP were significantly younger, with a mean age of 43.6 ± 2.21 years compared to 54.23 ± 12.23 years in the non-positional group ($p=0.038$). In terms of BMI, PP also demonstrated significantly lower values (29.21 ± 3.01) than NPP (32.15 ± 4.3) with a p-value of 0.048.

Neck circumference, an indicator of anatomical factors contributing to airway obstruction, was significantly smaller in the positional group (40.18 ± 1.15 cm) than in the non-positional group (45.23 ± 3.32 cm), with a p-value of 0.045. Lastly, gender distribution was relatively similar between the groups, with a male-to-female ratio of 15/8 in the positional group and 16/7 in the non-positional group, showing no statistically significant difference ($p=0.823$). However, in the overall sample, a majority of patients were male (31 males and 15 females), which is consistent with the higher prevalence and severity of obstructive sleep apnea in males due to sex-based anatomical differences in upper airway structure (Table 1-Demographic data).

SYMPTOMS

Compared with PP, NPP exhibited significantly more severe symptoms, as indicated by multiple clinical measures. The ESS scores were notably higher in the non-positional group (13 ± 4.6) compared to the positional group (8.18 ± 3.21), with a p-value of 0.032, indicating greater daytime sleepiness in NPP. Additional symptoms were similarly elevated in the non-positional group, including a higher frequency of witnessed apnea episodes (91% vs. 43.5%, $p=0.023$), insomnia (73.9% vs. 21.7%, $p=0.002$), morning headaches (78.3% vs. 39%, $p=0.034$), and

fatigue (60.9% vs. 13%, $p=0.040$), indicating a more severe symptom burden.

In contrast, nasal obstruction was reported more frequently among patients with PP (65% vs. 21.7%, $p=0.008$), suggesting that this may be a characteristic feature in this group. Habitual snoring was prevalent in both groups, with no significant difference observed (82.7% in PP vs. 91% in NPP, $p=0.907$) (Table 1-Symptoms).

PSG DATA

The PSG parameters demonstrated significant differences between the positional and non-positional groups. The TST was comparable between groups, with PP recording an average of 340.12 ± 50.23 minutes and NPP averaging 333.25 ± 49.2 minutes ($p=0.768$). Supine sleep duration was also similar between the groups, with PP averaging 163.23 ± 70.56 minutes and NPP 161.8 ± 73.82 minutes ($p=0.893$). Similarly, lateral sleep duration showed no significant difference (168.35 ± 80.27 minutes for PP and 165.09 ± 78.96 minutes for NPP, $p=0.852$).

Significant differences were observed in sleep efficiency and oxygen saturation metrics. PP demonstrated higher sleep efficiency ($85.69\pm 7.25\%$) than NPP ($69.79\pm 11.23\%$, $p=0.003$). The mean oxygen saturation (SaO₂) during sleep was also higher in PP ($92.52\pm 5.01\%$) than in NPP ($80.06\pm 4.21\%$, $p=0.041$), with PP spending a greater percentage of time with SaO₂ levels above 90% ($72.09\pm 25.32\%$ vs. $38.54\pm 25.36\%$, $p=0.007$).

AHI values highlight differences in OSAS severity between groups. The overall AHI was significantly lower in PP (29.56 ± 15.23) than in NPP (65.49 ± 20.49 , $p=0.000$). Supine AHI was also lower in PP (62.27 ± 19.15) than in NPP (80.21 ± 16.89 , $p=0.003$). Lateral AHI further distinguished the groups, with PP having a mean lateral AHI of 20.21 ± 10.59 compared to 60.23 ± 25.82 in NPP ($p=0.000$) (Table 1-Polysomnographic Data).

OSAS SEVERITY

The severity of OSAS was markedly different between the two groups. Severe OSAS (AHI>30) was found in 65% of NPP patients, compared with only

TABLE 1: Comparison of clinical and polysomnographic findings of OSAS patients.

| Parameters | PP (n=23) X̄±SD; % | NPP (n=23) X̄±SD; % | p value | Total (n=46) X̄±SD; % |
|---|-----------------------|------------------------|---------|--------------------------|
| Demographic data | | | | |
| Age | 43.6±2.21 | 54.23±12.23 | 0.038* | 47.21±5.6 |
| BMI | 29.21±3.01 | 32.15±4.3 | 0.048* | 30.68±3.71 |
| Neck circumference | 40.18±1.15 | 45.23±3.32 | 0.045* | 42.71±2.48 |
| Gender (M/F) | 15/8 | 16/7 | 0.823 | 31/15* (p=0.0489) |
| Symptoms | | | | |
| Habitual snoring | 19/23 (82.7%) | 21/23 (91%) | 0.907 | 40/46 (86.7%) |
| Witnessed apnea | 10/23 (43.5%) | 21/23 (91%) | 0.023* | 31/46 (67.4%) |
| Fatigue | 3/23 (13%) | 14/23 (60.9%) | 0.040* | 17/46 (37%) |
| Morning headache | 9/23 (39%) | 18/23 (78.3%) | 0.034* | 27/46 (58.7%) |
| Insomnia | 5/23 (21.7%) | 17/23 (73.9%) | 0.002* | 22/46 (47.8%) |
| Nasal obstruction | 15/23 (65%) | 5/23 (21.7%) | 0.008* | 20/46 (43.5%) |
| Dry mouth | 12/23 (52%) | 11/23 (47.8%) | 0.056 | 23/46 (50%) |
| ESS | 8.18±3.21 | 13±4.6 | 0.032* | 11.6±2.1 |
| OSAS severity | | | | |
| Mild OSAS | 10/23 (43%) | 1/23 (4%) | 0.004* | 11/46 (23.9%) |
| Moderate OSAS | 8/23 (35%) | 7/23 (30%) | 0.765 | 15/46 (32.6%) |
| Severe OSAS | 5/23 (22%) | 15/23 (65%) | 0.003* | 20/46 (43.5%) |
| Polysomnographic data | | | | |
| TST (min) | 340.12±50.23 | 333.25±49.2 | 0.768 | 336.69±49.72 |
| Supine sleep (min) | 163.23±70.56 | 161.8±73.82 | 0.893 | 162.52±72.21 |
| Lateral sleep (min) | 168.35±80.27 | 165.09±78.96 | 0.852 | 166.72±79.62 |
| Sleep efficiency (%) | 85.69±7.25 | 69.79±11.23 | 0.003* | 77.74±9.45 |
| Mean SaO ₂ (%) | 92.52±5.01 | 80.06±4.21 | 0.041* | 86.29±4.63 |
| Time with SaO ₂ >90% (%) | 72.09±25.32 | 38.54±25.36 | 0.007* | 55.32±25.34 |
| AHI | 29.56±15.23 | 65.49±20.49 | 0.000* | 47.53±18.05 |
| Supine AHI | 62.27±19.15 | 80.21±16.89 | 0.003* | 71.24±18.06 |
| Lateral AHI | 20.21±10.59 | 60.23±25.82 | 0.000* | 40.22±19.73 |
| Upper airway physical examination findings | | | | |
| Septal deviation | 15/23 (65%) | 2/23 (8.7%) | 0.003* | 17/46 (37%) |
| Concha hypertrophy | 18/23 (78%) | 5/23 (21.7%) | 0.004* | 23/46 (50%) |
| Uvula and soft palate pathologies | 6/23 (26%) | 18/23 (78%) | 0.015* | 24/46 (52%) |
| Tonsil size (III-IV) | 3/23 (13%) | 12/23 (52%) | 0.032* | 15/46 (32.6%) |
| MMI (III-IV) | 2/23 (8.7%) | 15/23 (65%) | 0.016* | 17/46 (37%) |

*p<0.05; OSAS: Obstructive sleep apnea syndrome; PP: Positional patients; NPP: Non positional patients; TST: Total sleep time; BMI: Body mass index; ESS: Epworth Sleepiness Scale; AHI: Average Apnea-Hypopnea Index; MMI: Modified Mallampati Index; SD: Standard deviation.

22% of PP (p=0.003). Additionally, in 43% of PP patients, AHI dropped below 5 when sleeping in the lateral position, whereas only one patient in the non-positional group experienced such a reduction (p=0.004). These findings underscore the efficacy of positional therapy in patients with PP who tend to have milder forms of OSAS (Table 1-OSAS Severity).

UPPER AIRWAY PHYSICAL EXAMINATION FINDINGS

Physical examination revealed distinct anatomical differences between the groups. Septal deviation (65% vs. 8.7%, p=0.003) and concha hypertrophy (78% vs. 21.7%, p=0.004) were significantly more common in PP, possibly contributing to their reliance on lateral sleep positions to alleviate nasal obstruction. In contrast, NPP were more likely to present

with uvula and soft palate pathologies (78% vs. 26%, $p=0.015$), higher MMI grades III-IV (65% vs. 8.7%, $p=0.016$), and larger tonsils (52% vs. 13%, $p=0.032$), indicating more severe oropharyngeal obstruction that likely contributes to the positional independence of their OSAS (Table 1-Upper Airway Physical Examination Findings).

DISCUSSION

OSAS is a widespread disorder with significant effects on various body systems, particularly the cardiovascular, endocrine, and circadian systems. It has been linked to hypertension, cardiovascular disease, and metabolic disorders, such as insulin resistance and diabetes.¹⁵⁻¹⁷ OSAS increases inflammation, oxidative stress, and hormonal imbalances, leading to complications across the body.¹⁸ OSAS can result in severe health issues, decreased quality of life, and increased mortality.¹⁹

Many studies have separately examined the clinical, physiological, and PSG parameters of OSAS. However, few studies have focused on the relationship between sleep position, symptoms, and PSG findings.^{20,21}

The current study examined the correlation between sleep position, clinical symptoms, PSG outcomes, and anterior rhinoscopy findings, offering an integrated perspective on OSAS. The current study emphasized the clinical relevance of p-OSAS and the role of sleep position and nasal obstruction in influencing disease severity. By addressing these factors, we inform future research toward more individualized, noninvasive treatment options, especially for p-OSAS. This study highlights the importance of ongoing investigation into these correlations to enhance management strategies and improve patient outcomes.

The demographic findings underscore that younger age [(43.6±2.21) years vs. (54.23±12.23) years, $p=(0.038)$], lower BMI [(29.21±3.01) vs. (32.15±4.3), $p=(0.048)$], and smaller neck circumference [(40.18±1.15) cm vs. (45.23±3.32) cm, $p=(0.045)$] are associated with positional dependency in OSAS, supporting the potential for more effective use of positional therapy in this patient subgroup,

which is related with the literature.²¹ In our study, males were predominant in both groups, both in total and separately, yet no significant difference in the male-to-female ratio was observed between the positional (PP) and non-positional (NPP) groups ($p=0.823$). Mohsenin is more prevalent in males in the NPP group. His research showed that OSA is more common and severe in men.²² The airways in men are larger but more collapsible, particularly during mandibular movement, making the OSA more positional. Women with more stable upper airways tend to exhibit less positional dependency. This anatomical variability may explain why men experience more severe OSA in certain positions, which could influence treatment strategies like positional therapy.^{10,23-25}

Our findings demonstrated substantial differences in clinical, physical examination, and PSG scores across several parameters between positional and non-p-OSAS patients. Upon evaluating the presenting complaints, nasal obstruction (and other symptoms) was significantly more frequent in the PP group than in the NPP group. In Zonato et al.'s study, nasal obstruction was substantially more frequent in patients with OSAS, similar to our findings.²⁶ They reported that 64% of patients with OSAS experienced persistent nasal obstruction associated with septal deviation and concha hypertrophy. However, their study did not differentiate between positional and non-positional OSA patients, leaving a gap in understanding how sleep position might influence nasal obstruction. Our study expands on this by exploring the correlation between positional dependency, nasal obstruction, and anterior rhinoscopy findings. The integration of these aspects highlights the importance of considering both anatomical abnormalities and positional factors when assessing and treating OSA.

These findings highlight distinct symptom profiles between the positional and non-positional groups. NPP experienced a broader range of severe symptoms, whereas PP predominantly reported nasal obstruction. Teculescu et al. found a significant association between habitual snoring and nasal obstruction, along with soft palate elongation, which is similar to our findings.²⁷ They observed that nasal breathing difficulties at night lead to compensatory

mouth breathing, which increases upper airway resistance and contributes to obstructive sleep apnea. This finding aligns with our study, in which nasal obstruction was more prevalent in positional OSA patients, highlighting the role of airway resistance in OSAS pathogenesis. While Teculescu et al. focused on habitual snorers without distinguishing between positional factors, our study further explored how nasal obstruction affects positional versus non-positional OSA. Understanding these correlations emphasizes the need to consider anatomical and positional factors when managing patients with OSAS.²⁷

Nasal obstruction is a key factor in the pathogenesis of OSAS. Suratt et al. demonstrated that intranasal obstruction primarily leads to obstructive apneas and hypopneas during sleep. This is consistent with our study, in which nasal obstruction contributed to dry mouth in p-OSAS (PP) patients. However, no significant difference in nasal resistance was found between the positional and non-positional (NPP) groups.²⁸ Tagaya et al.'s work on obese patients also highlighted the role of increased nasal resistance, showing correlations with the oxygen desaturation index. This finding supports our findings of more severe symptoms, such as fatigue and morning headaches, in patients with NPP.²⁹

Pevernagie et al. noted that nasal diseases increase airway resistance and can worsen sleep-disordered breathing, which is consistent with our observation of habitual snoring in both groups.³⁰ Although the exact relationship between nasal obstruction and breathing disturbances remains unclear, our study and previous research highlight their significant impact on OSAS severity, particularly concerning positional factors. Future research should further explore these relationships to optimize OSAS management strategies.²⁸⁻³⁰

The ESS is a validated tool for quantifying excessive daytime sleepiness, with a score range of 0-24. Scores of 10 indicate excessive daytime sleepiness. In our study, the mean ESS score was >10 in the NPP group and 10 in the PP group. Excessive daytime sleepiness was significantly more prevalent in the NPP group, likely attributable to their higher

AHI and lower sleep efficiency. A study assessing excessive daytime sleepiness using the Multiple Sleep Latency Test similarly found a higher prevalence of excessive daytime sleepiness in patients with NPP, consistent with our findings.^{14,15,31}

Our study found that p-OSAS (PP) patients had lower mean BMI values than non-positional (NPP) patients, indicating that a lower BMI may be a key factor in positional sleep apnea. This suggests that obesity is less common among patients with PP, which could impact their therapeutic choices. Positional therapy may be a more suitable treatment option for patients with milder anatomical obstruction and reduced adipose tissue around the neck. This finding aligns with previous research, such as that by Mador et al., who observed that positional sleep apnea is more common in mild cases and decreases in moderate and severe cases. While Mador et al. reported no significant differences in BMI between groups, our study suggests that lower BMI is more typical in patients with PP, possibly due to differing populations or methods. We also observed lower oxygen saturation and less time spent with oxygen saturation >90% in the NPP group, reflecting their more severe OSAS.³² Overall, our study and Mador et al.'s findings emphasize that positional therapy may be particularly effective for patients with mild OSAS, where positional dependency is most pronounced. In contrast, more aggressive treatment may be necessary for patients with severe, non-p-OSAS.³²

Lateral sleep may provide some relief for both groups; however, "positional therapy," which prevents supine sleep, may not be effective in patients whose AHI remains high even in the lateral position.³³ Therefore, positional therapy may not be effective in patients with p-OSAS. In one series, 89% of patients in the PP group had AHI values below 20 in the lateral position, and another study reported that 75% of patients had AHI values below 10, suggesting that positional therapy may be a feasible treatment option for PP.³⁴ In our study, no significant intergroup difference was observed in the changes in AHI in the lateral position.

In our study, septal deviation and concha hypertrophy were more frequently detected in the PP

group, with concha hypertrophy being significantly more common in the PP group than in the NPP group. Previous studies comparing OSAS patients with non-OSAS individuals found that septal deviation and concha hypertrophy were more frequently observed in OSAS patients, although these studies did not classify OSAS patients as positional or non-positional. Two studies examining anatomical changes in the upper airway of PP found that the posterior airway region was significantly wider and soft palate elongation was less common in the PP group. Structural nasal anomalies, including nasal diseases, increase nasal resistance and lead to more significant pressure in the upper airway during sleep, contributing to the collapsibility of the pharyngeal walls.^{26,35}

The Mallampati scoring system is commonly used to assess tongue height. Several studies have identified a higher Mallampati grade as a valid predictor of OSAS.^{36,37} In our research, Mallampati scores of grades III-IV were more frequently observed in the NPP group, consistent with the findings of Martinho et al.³⁵

STUDY LIMITATIONS AND STRENGTHS

This study successfully identified distinct clinical, physiological, and PSG differences between patients with and without positional OSAS, providing valuable insights into the role of sleep position in OSAS severity and management.

This study has some limitations, including a relatively small sample size, which may have affected the generalizability of the findings. Additionally, endoscopic laryngeal and epiglottic examinations were not consistently performed, limiting the evaluation of laryngeal structures that may contribute to OSAS severity.

Despite these limitations, this study is the first in Azerbaijan to compare clinical, physiological, and PSG parameters between positional and non-p-OSAS patients. The findings provide a foundation for future

OSAS research and can inform region-specific treatment approaches, thereby marking an important step in understanding OSAS within the Azerbaijani population.

CONCLUSION

This study demonstrated distinct differences between positional and non-p-OSAS patients. PP had milder symptoms, higher sleep efficiency, and better oxygen saturation levels than NPP, who exhibited more severe OSAS. These findings suggest that positional therapy may be particularly beneficial for managing p-OSAS, whereas NPP may require more intensive treatment approaches. Understanding these clinical and PSG differences can guide personalized treatment strategies for patients with OSAS based on their positional dependency.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Aynur Aliyeva, Konul Mammadova, Ramil Hashimli; **Design:** Aynur Aliyeva; **Control/Supervision:** Aynur Aliyeva, Ramil Hashimli; **Data Collection and/or Processing:** Aynur Aliyeva, Konul Mammadova, Ramil Hashimli; **Analysis and/or Interpretation:** Aynur Aliyeva, Konul Mammadova, Ramil Hashimli; **Literature Review:** Aynur Aliyeva, Konul Mammadova, Ramil Hashimli; **Writing the Article:** Aynur Aliyeva; **Critical Review:** Aynur Aliyeva, Konul Mammadova, Ramil Hashimli; **References and Fundings:** Aynur Aliyeva, Konul Mammadova, Ramil Hashimli; **Materials:** Aynur Aliyeva, Konul Mammadova, Ramil Hashimli.

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