# Effects of edentulism in obstructive sleep apnea syndrome

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## Abstract

**Objectives:** The purpose of this study was to investigate the effects of edentulism in obstructive sleep apnea syndrome (OSAS) patients.

**Materials and Methods:** The study patients' were selected from the Gaziantep University Sleep Clinic and Orthodontic Department archives between the years of 2009 and 2011. Study groups were determined according to age and edentulism, and the overall study population consisted of 42 (21 male, 21 female) OSAS patients. Data from 14 edentulous (Group I), 14 older dentate (Group II), and 14 middle-aged dentate OSAS patients (Group III) were compared in this study. Polysomnographic parameters, which were measured and analyzed included: Sleep time, sleep efficiency, sleep stage 1, sleep stage 2, sleep stage 3, percentage of rapid eye movement sleep, apnea-hypopnea index, oxygen saturation and arousal index. The Kruskal–Wallis and Mann–Whitney U statistical tests were used for comparing the differences between the three groups and subgroups.

**Results:** Sleep time parameters showed significant differences between the groups ($P < 0.05$). Differences occurred between Group I and Group III in the sleep time parameter ($P < 0.05$), while the edentulous subjects showed lower mean sleep time values when compared to the older and middle-aged dentate groups.

**Conclusion:** According to our results, edentulism may not impact polysomnography parameters, with the exception of the sleep time parameter. Important attention should be given to edentulous individuals during sleep with their dentures to prevent OSAS complications. The use of dentures may prevent or protect patients from the predisposing factors of OSAS.

**Key words:** Dentures, edentulous, obstructive sleep apnea syndrome, polysomnography

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## Introduction

Obstructive sleep apnea syndrome (OSAS), characterized by obstruction episodes of the upper airway during sleep, results in a reduction in oxygen saturation and is the cause of many systemic disorders.[1] OSAS affect 3.9% of men and 1.2% of women, and this prevalence increases with age, to approximately 20–54% for elderly women and 28–67% for elderly men.[2,3]

It has been shown that OSAS is a complex problem that may entail oro-nasal and maxilla-mandibular disorders.[4,5] According to the soft tissue stretching hypothesis, restriction of the upper airway causes a postural change, resulting in the extension of the cranio-cervical angle. Increased forces inhibit the forward growth of the maxilla and mandible, steering the mandible caudally.[6] However, edentulous patients have many morphological changes caused by their age and dental condition.[7,8] These changes include, mandibular rotation, lessening of the lower facial height and a decrease in vertical dimensions that may affect the

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airway area and respiration.[9] Although, tooth loss produces morphological changes that may affect the upper airway, the effect of edentulism on OSAS has not been clearly stated. Polysomnography (PSG) plays an important role in acceptable OSAS studies, and PSG is recommended as the gold standard for the diagnosis of OSAS.[10]

The purpose of the present study was to evaluate the effects of edentulism on PSG parameters with respect to age in OSAS patients.

## Materials and Methods

Experimental procedures were approved by the Gaziantep University Human Ethical Committee, with an 11.08.2014/266 code. The PSGs and digital panoramic radiographic records of 42 patients (21 male, 21 female), with a mean age of 55.40 ± 15.41 years and were selected from the Gaziantep University Pulmonary Disease Department and Orthodontic Department records from 2009 to 2011. These 42 patients were separated into 3 groups according to their age, sex, and dental conditions. The edentulous OSAS group (Group I) included 14 subjects (7 male, 7 female) with a mean age of 65.36 ± 11.40 years; the older dentate OSAS group (Group II) included 14 subjects (7 male, 7 female) with a mean age of 62.29 ± 6.59 years; and the middle‑aged dentate OSAS group (Group III) included 14 subjects (7 male, 7 female) with a mean age of 38.43 ± 10.38 years [Table 1].

The radiographs were taken with the same digital machine (Sirona XG 3, Munchen, Germany), and the criteria for the selection of the patients radiographs included high quality and sharpness. In addition, all radiographs were taken by the same apparatus and the same technician. In the completely edentulous group, all subjects were denture wearers. All teeth existed in both dentate groups, with the exception of wisdom teeth, and patients with histories of any surgical operations related to the maxilla or mandibular region and those under 18‑year‑old were excluded from the study groups.

Polysomnography is considered to be the gold standard for diagnosis of OSAS.[2] All of the subjects in this study underwent overnight PSGs. PSG data were taken while the patients were sleeping with dentures at the sleep laboratory under the supervision of a sleep laboratory technician. The PSG variables included the measurements of sleep time, sleep efficiency, sleep stage 1, sleep stage 2, sleep stage 3, percentage of rapid eye movement (REM) sleep, apnea‑hypopnea index (AHI), oxygen saturation and arousal index.

Sleep time: Was equal to the total sleep time during the entire night.

Sleep efficiency: Was considered to be the ratio between the total sleep time and the total recording time.

Sleep stages were as follows: Stages 1–3 together are called nonREM sleep; stage 1, the very lightest sleep, approximately 5% of the total sleep time; stage 2 sleep is equal to about 55–60% of the total sleep time; stage 3 is deep sleep or "slow wave" sleep; and REM refers to REM sleep.

Apnea‑Hypopnea Index: The frequency of apnea and hypopnea per hour of sleep is measured with the AHI. The severity of OSAS was determined using the AHI, which consisted of the sum of the mixed obstructive apneas and hypopneas per hour of sleep, when the patient was in the PSG period. OSAS is divided into mild (AHI = 5–15), moderate (AHI = 16–30), and severe (AHI ≥ 30) as defined by the American Academy of Sleep Medicine Task Force.[11] OSAS was determined when the AHI was over 5, according to the PSG results.

Oxygen saturation is the amount of oxygen in the blood.

Arousal index refers to the arousal division of sleep, lasting 3–10 s, while the arousal index is the number of arousals per hour of sleep.[11,12]

Descriptive statistical analyses including the means and standard deviations were used to describe the average orientation and variability [Table 1]. The Kruskal–Wallis nonparametric statistical test was used to determine significant differences between the three groups [Table 2], whereas the Mann–Whitney U test was used to compare the subgroups [Table 3]. Significance level was set at $P < 0.05$.

## Results

The study population consisted of 42 OSAS subjects; age and gender distribution are presented in Table 1. The gender distribution was similar between the groups and the age distributions of Groups I and II were also similar. Significant differences were found only in the sleep time parameter among the three groups ($P < 0.05$) [Table 2]. In the comparison of subgroups according to the Mann–Whitney U test, a significant difference was found between Groups I and III in the sleep time parameter ($P < 0.05$) [Table 3]. Edentulous subjects showed a lower mean sleep time value than the older and middle‑aged dentate groups. According to the Kruskal–Wallis statistical test, no significant differences were found between the other parameters (sleep efficiency,

**Table 1: Descriptive statistics of study groups**

| | Number of subjects (*n*) | Sex (male/female) | Mean age |
|---|---|---|---|
| I | 14 | 7/7 | 65.36±11.40 |
| II | 14 | 7/7 | 62.29±6.59 |
| III | 14 | 7/7 | 38.43±10.38 |

**Table 2: Comparison of parameters between groups**

| | Mean±SD | | | $P$ |
|---|---|---|---|---|
| | Group I | Group II | Group III | |
| Sleep time | 4.62±1.33 | 5.16±0.78 | 5.58±0.86 | 0.040* |
| Sleep efficiency | 62.64±19.66 | 73.14±15.10 | 78.79±14.90 | 0.065 |
| Sleep stage 1 | 7.86±5.08 | 7.64±7.29 | 5.79±3.53 | 0.557 |
| Sleep stage 2 | 57.00±16.62 | 55.29±16.92 | 55.30±13.19 | 0.974 |
| Sleep stage 3 | 16.14±10.32 | 18.36±11.08 | 22.21±12.42 | 0.504 |
| REM | 19.21±11.15 | 18.71±13.02 | 16.79±7.23 | 0.871 |
| AHI | 28.43±20.43 | 31.86±29.04 | 26.07±25.13 | 0.694 |
| Oxygen saturat | 76.00±9.22 | 66.71±21.19 | 76.71±12.99 | 0.198 |
| Arousal index | 12.93±6.26 | 14.29±10.75 | 10.29±5.28 | 0.618 |

**P*□0.05 is significantly different. AHI=Apnea-hypopnea index; SD=Standard deviation; REM=Rapid eye movement

**Table 3: Mean sleep time values, SD and Mann–whitney U-test grouping**

| Variable | Number of subjects (*n*) | Groups | Mean (SD) values | Mann–whitney U grouping |
|---|---|---|---|---|
| Sleep time | 14 | I | 4.62±1.33 | A |
| | 14 | II | 5.16±0.78 | AB |
| | 14 | III | 5.58±0.86 | B |

Different capital letter indicate that sleep time values are significantly different at $P<0.05$. SD=Standard deviation

sleep stage 1, sleep stage 2, sleep stage 3, percentage of REM sleep, AHI, oxygen saturation and arousal index) (*P* □ 0.05).

## Discussion

Obstructive sleep apnea syndrome is a common disease; however, it is more common in the elderly, where 61% of patients older than 50 years of age are estimated to meet the minimum criteria for OSAS (AHI > 5).[13] OSAS causes systemic problems, such as cardiovascular disease, hypertension, and morning headaches.[14] Therefore, predisposing factors become very important and play a great role in OSAS.

This study evaluated the effects of edentulism on the PSG parameters with respect to age in OSAS patients. We also compared groups with similar OSAS values, ages and gender. Our study showed that while using PSG for diagnosing OSAS, significant differences were found between Groups I and III in the sleep time parameter. Edentulous subjects had lower sleep times than dentate groups. However, according to our results, edentulism (while using dentures) had no great impact on the sleep parameters, with the exception of the sleep time parameter.

Many studies have suggested that edentulism induces reduced dimension and tone of the pharyngeal musculature, and it may cause apnea in edentulous individuals.[15] Morphological changes caused by tooth loss consist of a decrease in the vertical dimension of occlusion, reduction of the lower face height and anterior rotation of the mandible.[16] Additionally, edentulism causes an unnatural tongue position.[17] All these conditions cause occlusion disturbances and airway obstruction.[18] Usually, the goal of oral appliances is to increase the upper airway dimension during sleep by repositioning the mandible in a forward and downward position.[19]

Bucca *et al.*, compared the PSG results of edentulous individuals sleeping with and without dentures, and showed that the AHI and mean oxygen saturation were significantly worse in the nights edentulous people slept without dentures than when they slept with dentures.[18] These results support our study because our edentulous study group underwent PSG while wearing dentures.

Another method for detecting air flow rates in OSAS patients is spirometry. Bucca *et al*. reported that edentulous patients with dentures revealed improvements in some airflow rates while performing spirometry.[15] The quality of sleep parameters, such as sleep efficiency, sleep period 1, sleep period 2, sleep period 3, percentage of REM sleep, AHI, oxygen saturation and arousal index, may be protected in OSAS groups using dentures.

Traditionally, dentists advise their patients to sleep without dentures during the night, in order to prevent the risk of oral irritation.[20] According to Bucca *et al*., careful attention should be paid to edentulous individuals who sleep with their dentures in order to prevent OSAS problems.[18] Erovigni *et al*., studied cephalometric evaluations in patients with complete dentures, as a result of this study, determined that wearing dentures stimulates changes in the jaw and tongue positions and pharyngeal airway space, which can favor the diminution of apnea in denture wearers.[21]

Our study has some limitations, including a low number of OSAS patients and the lack of body mass indexes. Our study group consisted of 21 male and 21 female patients, which is not common for OSAS because it is reportedly seen more frequently in males.

## Conclusions

In conclusion, according to our study results, edentulism (while using dentures) did not cause PSG parameter changes, except in the sleep time parameter, in three OSAS groups. The use of dentures may prevent or protect patients from the predisposing factors of OSAS. However, additional studies are suggested to evaluate the effects of edentulism and dentures in a larger sample of patients.

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