The Use of Modified Mandibular Advancement Appliance in the Treatment of a Partially Edentulous Patient with Obstructive Sleep Apnea

Obstrüktif Uyku Apnesi Olan Kısmi Dişsiz Bir Hastanın Modifiye Mandibuler İlerletme Apareyi ile Tedavisi

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ABSTRACT

Introduction: Obstructive sleep apnea (OSA) is a chronic disorder of sleep and breathing characterized by recurrent obstruction of the upper airway. Oral appliances can be recommended to treat moderate-to-severe OSA when nasal continuous positive airway pressure (nCPAP) treatment is not tolerated. Insufficient number of teeth in maxillary and mandibular arches is considered a contraindication to oral appliance therapy. Case presentation: This case report describes the treatment of a 48-year old, partially edentulous patient with moderate obstructive sleep apnea. A modified oral appliance with artificial teeth was designed. The patient reported an improvement in his daytime symptoms and he was satisfied with the esthetic look of the appliance. Polysomnographic evaluation showed that there was a significant decrease in his apnea-hypopnea index (AHI) with the appliance. Conclusion: This case report shows that an oral appliance fabricated like a denture may be successful in treating sleep apnea patients.

ÖZET

INTRODUCTION

Obstructive sleep apnea (OSA) is a chronic disorder of sleep and breathing characterized by recurrent obstruction of the upper airway. OSA is a widely prevalent problem which increases the risk and development of comorbid diseases such as systemic hypertension, depression, stroke, angina and cardiac dysrhythmias. Treatment options include various non-invasive, surgical and pharmacological modalities.

Since its introduction in the 1980’s, nasal continuous positive airway pressure (nCPAP) is considered as the primary treatment for moderate-to-severe OSA. However, side effects associated with nCPAP use are frequently reported. These problems lead to noncompliance, especially in younger and less severe patients.

Oral appliances are alternative therapies for patients with OSA. They increase the oropharyngeal space by advancing the mandible and/or the tongue. The degree of mandibular advancement commonly used in clinical studies varies between 50% and 75% of the patient’s maximum mandibular protrusive capacity. Oral appliances can be recommended to treat moderate-to-severe OSA when nCPAP treatment is not tolerated, or when the patient rejects it as a therapeutic option. Although oral appliances can be used in a wide range of patients with sleep disordered breathing, they have several contraindications, one of which is insufficient number of teeth in maxillary and mandibular arches. Posterior teeth are considered particularly important in obtaining a solid intraoral fixation of the mandibular advancement device. However, a search of literature reveals only a few reports describing the treatment of edentulous patients with obstructive sleep apnea using mandibular advancement splints.

The purpose of this case presentation is to report the use of a modified mandibular advancement appliance in a partially edentulous patient with OSA who refused nCPAP therapy.

CASE REPORT

A 48-year-old male patient was referred to the Chest Diseases Department with a history of snoring and excessive daytime sleepiness. An overnight polysomnography revealed an apnea/hypopnea index (AHI) of 31 events per hour of sleep with a minimum pulse oximetric saturation (SaO2) of 63%. A nasal CPAP (nCPAP) titration in the second half of the night showed suppression of apneas with a nCPAP level of 10 cm H2O. However, the patient refused to use the nCPAP device and he was referred to the Department of Orthodontics for oral appliance therapy.

Radiographic examination revealed a maxillary edentulous and mandibular partially edentulous patient with a Class I skeletal base relationship (Figure 1) (Table I). Soft palate, nasopharynx, oropharynx, and hypopharynx cross-sectional areas were determined according to Liu et al. (Figure 2). Since the patient had minor maxillary and mandibular residual ridge resorptions, fabrication of a one piece oral appliance in the form of a denture was planned and the patient was referred to the Department of Prosthodontics.

Fabrication of the appliance

Maxillary and mandibular preliminary impressions were made using alginate impression
material (Cavex CA37, Haarlem, Holland). Study casts were made using these preliminary impressions and custom trays were fabricated from autopolymerizing acrylic resin (Vertex Trayplast; Vertex-Dental B.V., Zeist, The Netherlands). After border molding of the custom trays, final impressions were made using zinc oxide and eugenol impression material (SS White Impression Material, Gloucester, England) in the maxilla and Coltex Medium impression material (Coltex® Medium, Coltene/Whaledent AG, Altstatten, Switzerland) in the mandible. Particular care was made to fully record the labial and buccal vestibular reflection as well as lingual borders. Wax occlusal rims (Modelling wax; Kemdent, Purton, Swindon, UK) with shellac base plates (Cavex Baseplates; Cavex Holland BV, Haarlem, Holland) were fabricated on master casts made from the final impressions.

Maxillomandibular relation was recorded increasing the patient’s existing vertical dimension of occlusion by 5 mm. Vertical marks were made bilaterally on both of the wax occlusion rims in the premolar region on the right side and in the canine region on the left side at the centric relation position. The patient was then instructed to protrude his mandible maximally, and the amount of maximum protrusion was ascertained to be 8 mm. The appliance was decided to be fabricated with a protrusion of 4 mm, which was 50% of the patient’s maximum protrusion. The maxillomandibular relation with the determined amount of protrusion was recorded on occlusal rims and the casts were mounted on an articulator in this position.

The patient especially requested the appliance to look like a denture so teeth were set up. After checking the amount of protrusion with the teeth in place, the dentures were processed with heat-polymerized acrylic resin (Meliodent, Heraeus Kulzer Ltd, Berkshire, Germany). After the maxillary and mandibular dentures were trimmed and polished, they were placed in the mouth and attached to each other in the determined protruded position using an autopolymerizing clear acrylic resin (Panacryl; Arma Dental, Istanbul, Turkey) (Figure 3).

After the insertion, the patient was instructed on how to use and care for the appliance (Figures 4 a,b). He was advised to wear the splint during the night and was called for after one week for any necessary adjustments.

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<th>Measurement</th>
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**TABLE I**

*Lateral cephalometric evaluation of the patient with and without the oral appliance.*

**FIGURE 2**

*Pharyngeal airway measurements of the patient without the appliance; 1, 2 and 3 show the nasopharyngeal, oropharyngeal and hypopharyngeal airways respectively.*
RESULTS

The patient reported an improvement in his daytime symptoms and snoring in his one-week control appointment. The cephalometric evaluation with the appliance in situ showed that nasopharyngeal area increased from 329 mm$^2$ to 397 mm$^2$, oropharyngeal area increased from 869 mm$^2$ to 1450 mm$^2$, and hypopharyngeal area increased from 162 mm$^2$ to 306 mm$^2$ (Figure 5) (Table I). SNA stayed the same as would be expected, SNB decreased 1° although the mandible was moved forward and ANB increased 1°. The reason for the decrease in SNB was thought to be the relative posterior movement of point B due to the 5 mm increase in the vertical dimension of the face. Lower facial height increased from 44° to 51° and Saddle angle decreased from 122° to 120°. The patient was scheduled to undergo a polysomnography with the appliance to enable objective evaluation of the improvements.

Results of the follow-up polysomnography that was performed 2 months after the insertion of the appliance revealed that his AHI decreased to 4 events per hour of sleep with a minimum SaO2 of 96%. The patient was scheduled for control appointments every 2 months for two years and he reported no problems owing to the effectiveness of the appliance during the two years.
DISCUSSION

This case report describes clinical and laboratory procedures to use in the fabrication of a modified oral appliance to prevent sleep apnea in a maxillary edentulous and mandibular partially edentulous patient.

Although insufficient number of teeth in maxillary and mandibular arches is considered a contraindication for oral appliance therapy, our patient reported no problems with the stability of the appliance. One of the reasons for this stability might be the less amount of alveolar bone resorption, and the retention provided by the teeth in the mandible. Another contributing factor was considered to be the increase in the vertical dimension. Robertson suggested that an increase in interocclusal distance from the physiological rest position was necessary to make sure that dislodgement did not occur at night\(^9\). However, others noted that such an increase would cause posterior movement of both tongue and soft palate, resulting in a decrease in the pharyngeal space\(^10-12\). Cephalometric analysis of the patient showed that despite the increase in the vertical dimension and the fact that the appliance was fabricated with an advancement of only 50% of the maximum protrusion; cross-sectional areas of all the pharyngeal spaces increased.

Although lateral cephalograms have been used to analyze the skeletal and soft tissue characteristics of OSA patients using mandibular protruding devices\(^13\), they are 2-dimensional images, which do not necessarily correlate with objective measurements of respiration during sleep. Subjective findings reported by patients are also used to determine the success of an appliance but ideally the efficacy of an appliance should be evaluated using polysomnography\(^14\). Nayar and Knox\(^15\) reported the use of a similar appliance in edentulous patients but they used diminishing of daytime somnolence and sleep improvement to evaluate the effectiveness of their appliance. In this case, we used polysomnographic records to verify the subjective clinical success of the appliance reported by the patient. The polysomnographic evaluation confirms the results reported by the patient and his wife.

CONCLUSION

The significant decrease in the AHI and the increase in minimum pulse oximetric saturation show that the oral appliance described in this case report can be a useful treatment modality in OSA patients with insufficient number of teeth in their dental arches.

REFERENCES


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