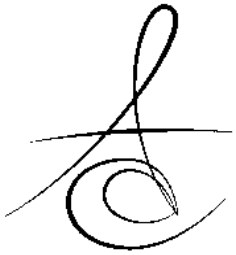

CEPHALOGRAPHIC AND POLYSOMNOGRAPHIC EVALUATION OF EXCELLENT EFFICIACY OF THE MANDIBULAR ADVANCEMENT SPLINT IN A PATIENT WITH MODERATE OBSTRUCTIVE SLEEP APNEA SYNDROME

ORTA OBSTRÜKTİF UYKU APNE SENDROMLU BİR OLGUDA MANDİBULAR İLERLETİCİ SPLİNTİN ÜSTÜN ETKİSİNİN SEFALOMETRİK VE POLİSOMNOGRAFİK OLARAK GÖSTERİLMESİ

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ABSTRACT

Obstructive sleep apnea syndrome (OSAS) is a chronic disorder of sleep and breathing characterized by recurrent obstruction of the upper airway. Oral appliances are used to treat mild-to-severe OSAS when nasal continuous positive airway pressure (nCPAP) treatment is not tolerated or refused by the patient. A 52-year-old male referred to the Department of Chest Diseases with snoring and excessive daytime sleepiness. He was diagnosed as moderate OSAS and refused to be treated with nCPAP. He was given mandibular advancement splint (MAS) therapy and his compliance to the device was expressive. After 6 months treatment, all his symptoms related to OSAS were improved. Polysomnographic (PSG) evaluation showed decrease in his apnea-hypopnea index (AHI) from 27 events per hour to 0.5 events per hour. Besides, the cephalometric evaluation revealed increase in naso-oro-hypopharynx spaces and posterior airway space. The distance between mandibular plane and hyoid decreased, since hyoid bone had been elevated to the front and up with the appliance.

In conclusion, nCPAP is the first choice of treatment in moderate and severe OSAS. However, if the patients refuse or show no adherence to CPAP therapy, oral appliances can be used successfully.

Keywords: Obstructive Sleep Apnea Syndrome (OSAS), oral appliance (OA), cephalography, polysomnography (PSG), mandibular advancement splint (MAS), continuous positive airway pressure (CPAP).

ÖZET

Obstrüktif Uyku Apne Sendromu (OUAS) üst hava yolunun tekrarlanan tıkanmalarınca karakterize uyku ve solunumun kronik bir düzensizliğidir. ***Oral Apareyler (OA)*** hafif ve hastalar tarafından ***nasal Devamlı Pozitif Havayolu Basıncı(nDPHB)***nı tolere edilemeyen veya ret edilen ağır OUAS'nu tedavi etmek için kullanılmaktadırlar. 52 yaşında erkek bir hasta horlama, aşırı güniçi uykululuk semptomları ile Göğüs Hastalıkları A. D.'na başvurdu. Orta OUAS teşhis edildi, ve NDPHB ile tedavi edilmeyi ret etti. Hastaya ***Mandibuler İlerletici Splint (MİS)*** terapisi verildi, ve ağız içi aygıta uyumu yüksekti. Tedaviden 6 ay sonra, OUAS ile ilişkili tüm semptomlar düzeldi. ***Polisomnografik (PSG)*** değerlendirme hastanın ***Apne-Hipopne İndeksi (AHİ)***'nin saatte 27'den 0.5'e düştüğünü gösterdi. Ayrıca, sefalometrik inceleme oro-farinks alanı ve ***Posterior Havayolu Alanı (PHA)***'da artışı gösterdi. Hyoid kemiği aparey ile öne ve yukarı kaldırılmış olduğu için, ***Mandibuler Düzlem ve Hyoid arasındaki mesafe (MD-H)*** azaldı.

MİS terapisi OUAS'lı uygun endikasyonlu hastalarda başarılı olarak kullanılabilmektedir.

Anahtar kelimeler: Obstrüktif Uyku Apne Sendromu (OUAS), oral apareyler (OA), polisomnografi (PSG), sefalometri, mandibuler ilerletici splint (MİS), nasal devamlı pozitif havayolu Basıncı(nDPHB)

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INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is a chronic disorder of sleep and breathing characterized by recurrent obstruction of the upper airway. It is a widely prevalent problem which increases the risk and development of co-morbid diseases such as systemic hypertension, depression, stroke, angina and cardiac dysrhythmias.[1] Treatment options include various non-invasive and surgical modalities.

Since its introduction in the 1980's, nCPAP is considered as the primary treatment for moderate-to-severe OSAS.[2] However, side effects associated with nCPAP use are frequently reported.[3] These problems lead to noncompliance, especially in younger and less severe patients.[4]

Oral appliances (OA) are effective therapies for patients with OSAS. They increase the oropharyngeal space by advancing the mandible and/or the tongue.[5] The degree of mandibular advancement commonly used in clinical studies varies between 50% and 80% of patient's maximum mandibular protrusive capacity. Oral appliances are used to treat simple snoring and mild OSAS as primary, moderate-to severe OSAS when nCPAP treatment is not tolerated, or when the patient rejects it as a secondary therapeutic option.[6,7]

We report here the use of a mandibular advancement splint (MAS) in a patient with moderate OSAS who refused nCPAP therapy. Therapeutic effects are investigated onto both cephalography measures and polysomnographic (PSG) variables.

CASE REPORT

A 52-year-old male patient was referred to the Department of Chest Diseases, Faculty of Medicine, Ege University with a history of OSAS. A baseline overnight PSG revealed an apnea/hypopnea index (AHI) of 27 events per hour of sleep with minimum oxygen saturation (SaO2) of 87%. Baseline score of daytime sleepiness was measured as 11, according to Epworth sleepiness scale (ESS). The patient refused to use nCPAP device and he was referred to the Department of Prosthodontics, Ege University, Faculty of Dentistry for OA therapy.

Extraoral and intraoral examination showed micrognathia, retrognathia with a small opening, and relatively large size, scalloping tongue (Fig. 1), enlarged soft palate and uvula, and battered uvula as length of soft palate and size of uvula, obstructed airway as crowding of oropharyngeal area.

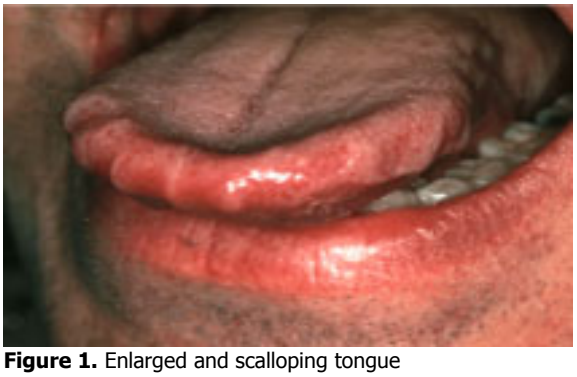

Figure 1. Enlarged and scalloping tongue

Cephalographic examination revealed Class II skeletal base relationship (Table I). Soft palate, nasopharynx, oropharynx, and hypopharynx crossectional areas were determined according to Liu et al.[8] The SNA angle, (the angle among points sella, nasion and subspinal), the SNB angle (the angle among points sella, nasion, supramental), posterior airway space (PAS) and the distance between mandibular plane and hyoid bone (MP-H) were examined according to Prinsell.[9] These data were used for cephalometric diagnosis. The fabrication of a one piece (monoblock) MAS was planned.

Tablo I. Lateral cephalometric evaluation of the patient pre-fitting and post-fitting the MAS

	Measurements	**Variables**	
		Pre-fitting	*Post-fitting*
1.	Nasopharynx area	329 mm^2	397 mm^2
2.	Oropharynx area	869 mm^2	1450 mm^2
3.	Hypopharynx area	162 mm^2	306 mm^2
4.	SNA	86 º	86 º
5.	SNB	78 º	85 º
6.	PAS	3 mm	20 mm
7.	MP-H	25 mm	≤ 1 mm

Fabrication of the Appliance

Maxillary and mandibular preliminary impressions were taken by using irreversible hydrocolloide impression material (CA37, Cavex, Haarlem, Holland). Study cast were made using these preliminary impressions. Particular care was made to fully record on autopolymerizing acrylic resin (Imicryl, London, England) bases.

Maxillomandibular relation was recorded with wax rims, increasing the patient's existing vertical dimension of occlusal from 5 mm to 7 mm. Vertical marks were made bilaterally on both of the wax 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 then decided to be fabricated with a protrusion of 6 mm, which was 75% of the patient's maximum protrusion. This maxillomandibular relation with the determined amount of protrusion was recorded on wax, and the casts were mounted on a hinge type articulator in this position (Figs. 2a,b).

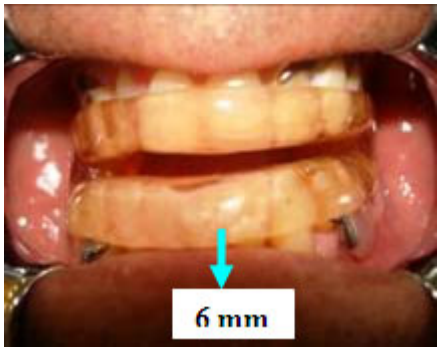

Figure 2a. Frontal view, MAS in situ (Note 6 mm interincisal distance as vertical openning)

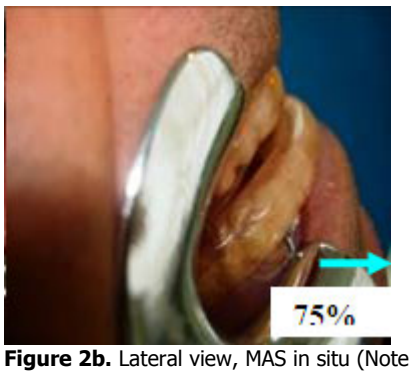

Figure 2b. Lateral view, MAS in situ (Note 75% of maximum protrisive position)

After the maxillary and mandibular bases of the device were trimmed and polished, they attached to each other in the determined protruded position using an autopolymerizing clear acrylic resin (Panacryl, Arma Dental, Istanbul, Turkey) (Fig. 3).

Figure 3. The mandibular advancemen splint (MAS)

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

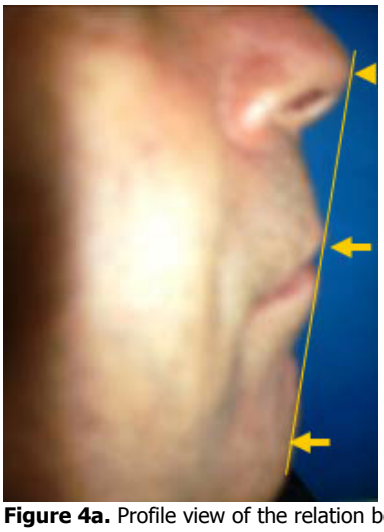

Figure 4a. Profile view of the relation between maxilla and mandible as extra-oral. (Note retrognathia and micrognathia)

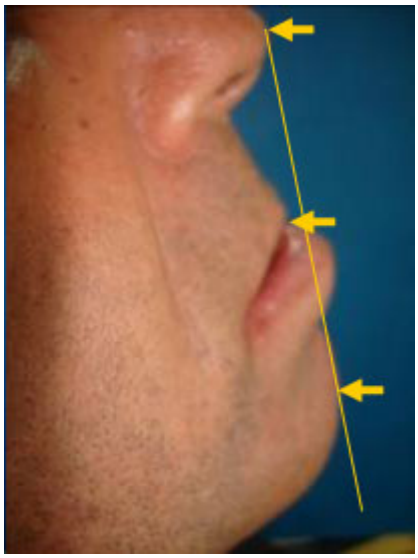

Figure 4b. Profile view with the MAS as extra-oral

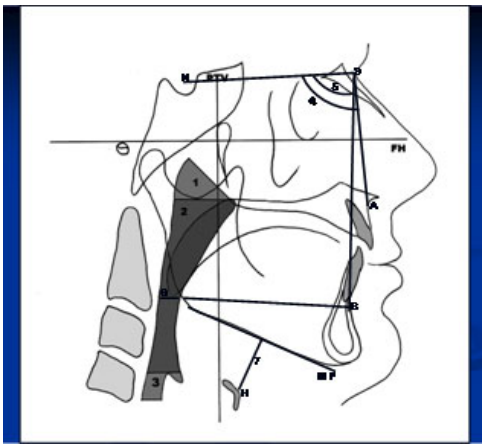

Figure 5b. Cephalographic measurements without MAS; 1, nasopharyngeal airway space; 2, oropharyngeal airway space; 3, hypopharyngeal airway space; 4, SNA; 5, SNB; 6, PAS; 7, MP-H

Follow-up

The patient reported an improvement in his daytime symptoms and snoring after one week treatment. Besides, the patient's wife was also very pleased with the recovery in her husband, especially cessation of snoring.

The cephalometric data were repeated 2nd time to control the findings during follow-up of action of the treatment at 6th month (Figs. 5a,b).

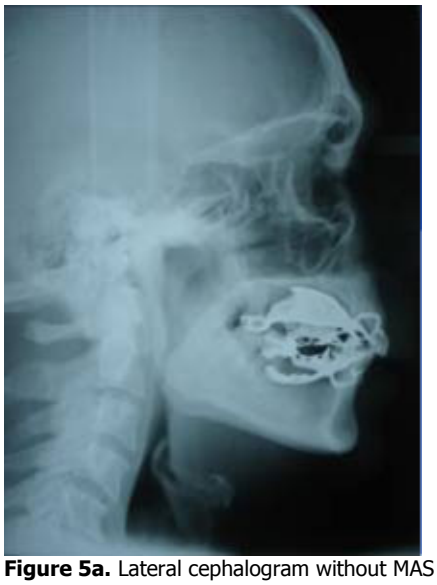

Figure 5a. Lateral cephalogram without MAS

After 6 months treatment, the 2nd cepholometric evaluation with the appliance in situ performed and 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 (Table I). SNA stayed the same as would be expected, SNB increased 7º (Figs. 6a,b). The patient was scheduled to undergo a PSG with the appliance to enable objective evaluation of the improvements.

The follow-up PSG was performed 6 months after the insertion, and revealed that AHI decreased from 27 to 0.5 events per hour of sleep with minimum SaO2 of 97%. Sleepiness assessed by ESS decreased from 11 to 6. The patient was scheduled for control appointments every 3 months owing to the effectiveness of the appliance. The patient's treatment has been still continuing. He has not reported any problems recently.

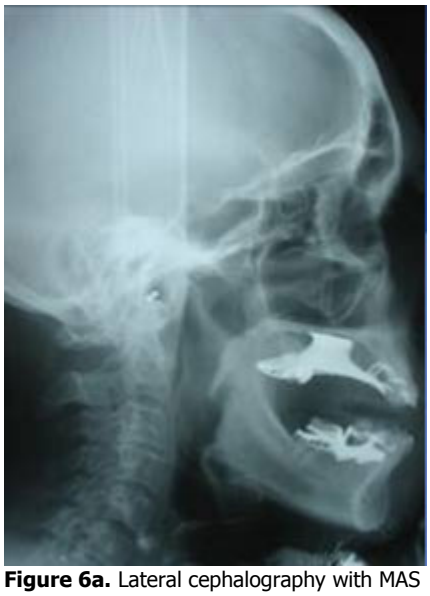

Figure 6a. Lateral cephalography with MAS

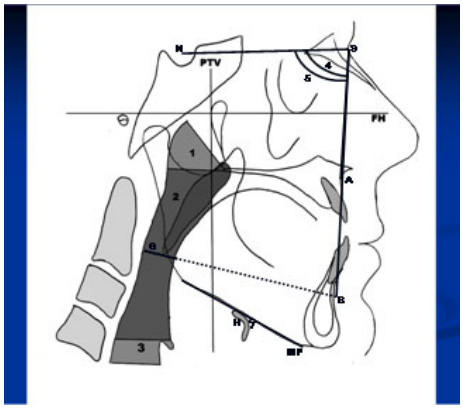

Figure 6b. Cephalometric variables with MAS; 1, nasopharyngeal airway space; 2, oropharyngeal airway space; 3, hypopharyngeal airway space; 4, SNA; 5, SNB; 6, PAS; 7, MP-H

DISCUSSION AND CONCLUSION

Oral appliances can be used to treat from mild OSAS as primary to moderate/severe OSAS as secondary, when nCPAP treatment is not tolerated or refused by the patient.

We presented here a case report described clinical and laboratory procedures to use in the fabrication of a MAS to treat moderate OSAS in a patient refused nCPAP, and explained concurrently cephalography and polysomnography methods to reveal effective management of the MAS. In the 6 month-follow-up, we ensured prominent revisions in his clinical, PSG and cephalometry.

The authors have suggested that an increase in interocclusal distance and protruded position was necessary to make sure that obstruction did not occur at night.[5-7] However, others have noted that, such an increase in interocclusal distance would cause posterior movement of both tongue and soft palate, resulting in a decrease in the pharyngeal space, while mandible developed frontad.[8,10,11] Cephalometric analysis of the present case showed that despite the increase in the vertical dimension and the fact that the appliance was fabricated with an advancement of only 75% of the maximum protrusion; cross-sectional areas of all the pharyngeal spaces increased as reviewed literatures. [5-7]

Lateral cephalograms have been used often to analyze the skeletal and soft tissue characteristics of OSAS patients using MAS[12]. However, as they are 2-dimensional images and performed when the patient is awake and in the upright position; they do not necessarily correlate with objective measurements of respiration during sleep.

Subjective findings reported by patients and/or their wife can be also used to determine the success of an appliance but ideally the efficacy of an appliance should be evaluated using PSG.[13] In this case report, PSG records were employed to monitor the clinical success of the appliance reported by the patient and his wife. The cephalometric and PSG evaluations were compatible very well. According to these results, there was an excellent improvement with the MAS. Especially, the PSG evaluation confirmed the measurements of cepholometric evaluation and the satisfaction reported by the patient and his wife.

The improvements with MAS therapy in a patient with moderate OSAS refused nCPAP can be indicated with polysomnography and cephalographic analysis. The significant decrease in the AHI and the increase in minimum SaO2 show that MAS is a useful treatment modality in selected OSAS patients[14-18].

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