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Treatment of Moderate Obstructive Sleep Apnea Using Mandibular Advancement Device: A Case Report

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ABSTRACT

Obstructive Sleep Apnea (OSA) is one of the most prevalent sleep disorders, characterized by repeated upper airway collapse during sleep, leading to intermittent hypoxia and sleep fragmentation. Mandibular advancement devices (MADs) are commonly used to treat primary snoring and OSA, particularly in mild to moderate cases.

This case report presents the clinical management of a 47-year-old male diagnosed with moderate OSA, confirmed by polysomnography. Due to the patient's refusal to undergo Continuous Positive Airway Pressure (CPAP) therapy, a MAD was proposed as an alternative treatment. The device was custom-fabricated and progressively adjusted to optimize mandibular protrusion while ensuring patient comfort. Follow-up assessments, including repeat polysomnography, demonstrated a significant reduction in the apnea-hypopnea index (AHI), which decreased by more than 50% from the initial value but remained above five events per hour—considered a partial therapeutic success. Clinically, the patient reported substantial improvement in daytime symptoms and overall sleep quality.

This case underscores the importance of individualized treatment planning and supports the efficacy of MADs as a non-invasive, patient-compliant solution for managing moderate OSA when CPAP therapy is declined or poorly tolerated.

Keywords

Mandibular advancement device, Obstructive sleep apnea, Polysomnography, Sleep-disordered breathing.

Introduction

There are more than 70 sleep disorders listed in the International Classification of Sleep Disorders (ICSD) [1]. The most common sleep disorder is insomnia followed by obstructive sleep apnea (OSA) [2]. OSA is a prevalent sleep disorder that affects nearly one billion individuals worldwide [3]. This disorder is characterized by episodes of a complete (apnea) or partial collapse (hypopnea) of the upper airway, accompanied by a decrease in oxygen saturation or arousal from sleep [4].

The most common cause of OSA in adults is obesity [5]. There are other factors that contribute to OSA such as retrognathia of the lower jaw and poor muscular tone [5].

Polysomnography (PSG) is the gold-standard diagnostic tool for sleep apnea [6]. It provides a comprehensive evaluation of sleep quality by monitoring various physiological parameters, including oxygen saturation and airway flow. This diagnostic method provides detailed data, allowing for an overall evaluation of sleep patterns and related physiological measures.

The Apnea-Hypopnea Index (AHI), calculated from PSG data, quantifies the number of apneas and hypopneas per hour of sleep.

Based on this index, OSA can be categorized into three levels [7,8]. For adults, if the AHI is more than 5 events per hour and less than 15, it is considered mild. Moderate OSA is 15-30 events per hour, while severe OSA is when the AHI is more than 30 per hour. It should be noted that a normal AHI in adults is defined as fewer than 5 events per hour [7,8].

The main treatment option for OSA is continuous positive airway pressure (CPAP) [5], which keeps the airway open by providing a constant airflow [9]. This treatment modality has demonstrated high efficacy; however, the compliance rate for CPAP therapy is often low due to reported discomfort associated with its use. An alternative treatment is the mandibular advancement device (MAD) [10]. This device works by positioning the lower jaw forward during sleep, helping to keep the airway open and reduce both snoring and apnea events [10]. However, this option is primarily offered to patients with primary snoring, mild to moderate OSA, or those with severe OSA who are intolerant of CPAP [10].

This case report presents a patient with moderate OSA managed with a mandibular advancement device (MAD), resulting in complete resolution of OSA symptoms and near-normal PSG parameters, including AHI.

Case Presentation

A 47-year-old male presented to the Occlusion and Fixed Prosthodontics department at CHU Ibn Rochd in Casablanca. He was referred by his pulmonologist. The patient was 180 cm tall, weighed 90 kg, and had a BMI (**Body Mass Index)** of 27 kg/m². His main symptoms included loud snoring, witnessed gasping, morning headaches, and excessive daytime sleepiness. A complete overnight PSG was conducted, revealing an AHI of 20 events per hour. All apnea events were obstructive, with no central apneas detected.

The pulmonologist prescribed the MAD as a second-line treatment for moderate OSA after the patient refused CPAP, making the MAD the indicated alternative.

A clinical interview was conducted, followed by a complete clinical examination, including examinations of the dental, periodontal, prosthetic, and temporomandibular joint areas to rule out any general or dental contraindications and to confirm the patient's eligibility for the MAD.

The extra-oral assessment revealed a concave profile with a short chin-to-throat length, an increased neck circumference (Figure 1).

Intraorally, the patient had a Class I canine relationship on the right side and a Class II canine relationship on the left side (Figure 1). The overbite was relatively deep, and teeth 16, 35, and 47 were missing. The range of mandibular protrusion was 12 mm.

The panoramic radiograph revealed the absence of teeth 16, 35, and 47, along with endodontic treatment on teeth 26 and 27 (Figure 2).

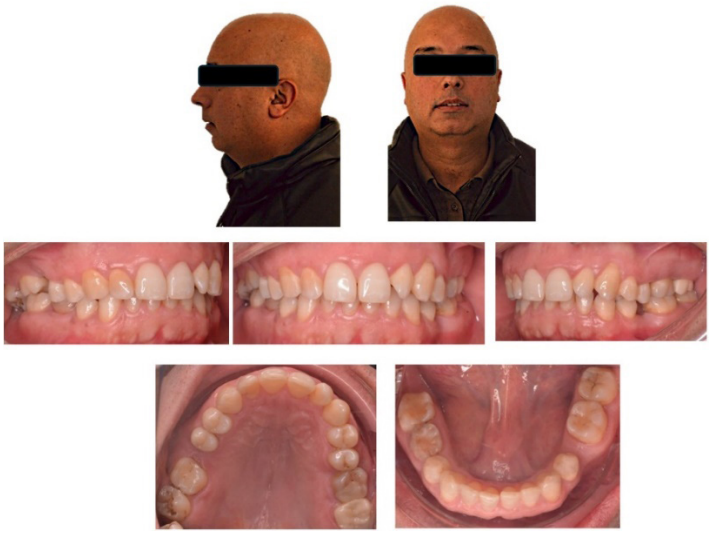

Figure 1: Extra-oral and Intra-oral photographs.

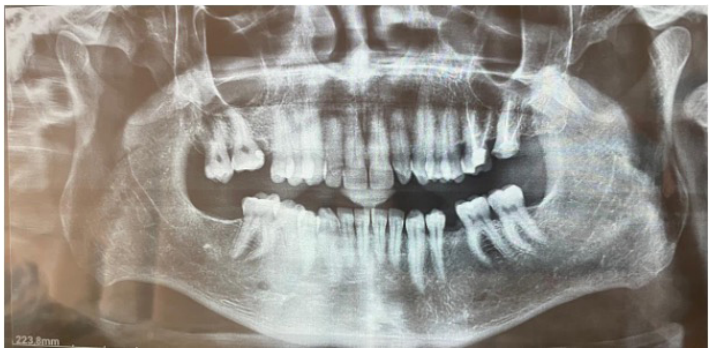

Figure 2: Panoramic radiograph.

After discussing and explaining the treatment protocol, a second appointment was scheduled for impression taking. The chosen design was a Herbst, a custom-made, titratable dual-block oral appliance (OA). This design is characterized by attached bilateral compression (bilateral push).

This MAD can be fabricated using either physical or digital impressions, combined with an occlusal registration taken in mandibular protrusion. This registration can be provided as a bite record in the desired forward position, typically between 50% and 75% of the maximum propulsion position (MPP), or directly in the MPP. It is essential to ensure a proper alignment of the MPP with the centric relation to avoid any pathological deviation, that could lead to temporomandibular joint (TMJ) disorders.

For our case, we opted for an optical impression. Upper and lower intraoral scans were taken (Figure 3). The absolute range of maximal mandibular propulsion (MMP) was measured, and the construction bite was registered at 60% of the MMP (Figure 4). The digital data were then transmitted to a specialized laboratory for processing.

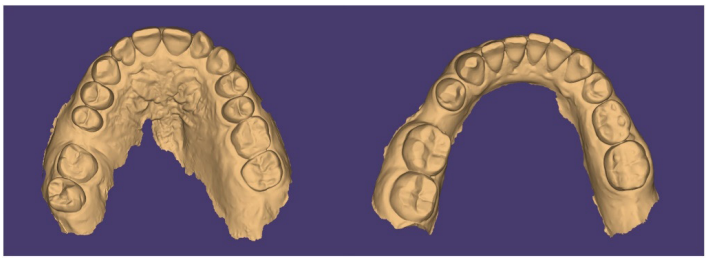

Figure 3: Digital impression.

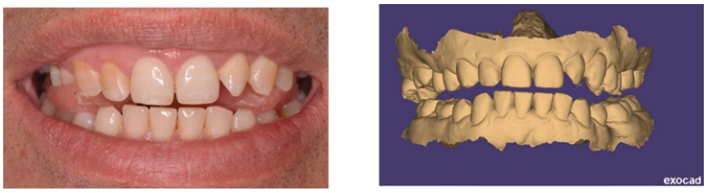

Figure 4: Bite registration at 60% of the maximal mandibular propulsion (MMP).

After one week, we received our MAD. The fit was first assessed on the printed models first (Figure 5) then intraorally to evaluate retention and comfort (Figure 6). The patient reported discomfort caused by pressure from the MAD on teeth 21 and 22. To address this issue, we slightly relieved the inner surface of the MAD in the affected areas, thereby reducing the pressure (Figure 7).

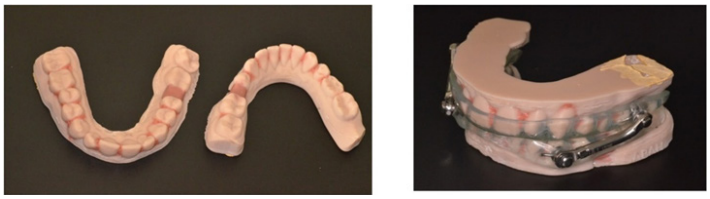

Figure 5: Printed models and the MAD seated on them.

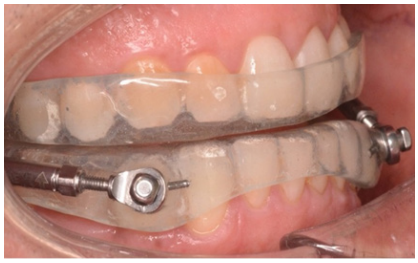

Figure 6: The mandibular advancement device fitted in the mouth.

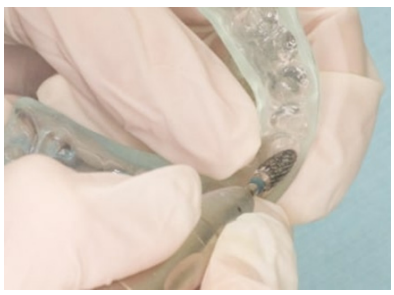

Figure 7: Modification of the intrados of the MAD was made to relieve pressure.

The initial mandibular protrusion was set at 60% of the total protrusion range, and the device was delivered to the patient for a one-week trial. After this period, the patient reported significant improvement with the oral device at 60% advancement; however, his bed partner still observed some snoring events. Subsequent progressive advancements were performed three times, reaching up to 70% of the MMP, with two-week intervals between each adjustment (Figure 8). At this position, the MAD was optimally titrated, resulting in symptom resolution, and the patient reported no complaints related to the temporomandibular joints.

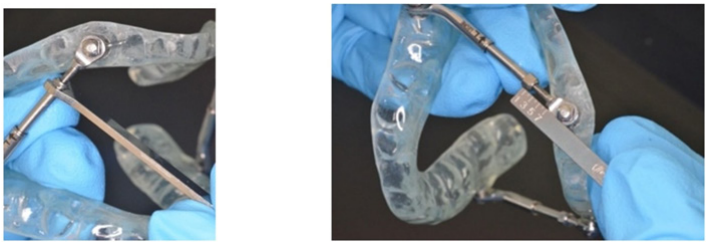

Figure 8: Procedure of titration.

After one month of using the device in the initial position, the patient reported a disappearance of OSA symptoms. Remission was evaluated through a ventilatory polysomnography (PSG) examination, which showed a reduction of AHI index from 20/h (moderate OSA) to 13/h (mild OSA), and a decrease in the desaturation index from 17/h to 16.8/h. However, given these suboptimal results, new titration appointments were scheduled. After adjusting the mandibular advancement, a subsequent ventilatory PSG revealed an AHI of 8/h and a desaturation index of 4.8/h (Table 1).

Table 1: Polysomnography data.

Variables	Baseline PSG	On MAD
AHI	20/h	8/h
BMI (Kg/m²)	27 kg/m²	28 kg/m²

PSG: Polysomnography; MAD: Mandibular Advancement Device; AHI: Apnea/Hypopnea Index; BMI: Body Mass Index

Once optimal titration has been achieved and confirmed by ventilatory PSG, regular long-term follow-up is carried out every six months to prevent the onset of side effects and ensure the long-term efficacy of the MAD. After eight months of use, during the first follow-up appointment, the patient reported no complaints related to temporomandibular disorders or masticatory muscles.

Discussion

The Mandibular Advancement Device (MAD) is a first-line treatment option for patients with mild to moderate obstructive sleep apnea (OSA), and it is also used for patients with severe OSA who are unable to tolerate continuous positive airway pressure (CPAP) therapy [10,11].

All devices use the same concept by advancing the position of the lower jaw during sleep and keeping the mandible in a forward position to open the airway [12]. However, they come in

different designs and can be either custom-made or prefabricated [13]. Custom-made appliances are made in a dental laboratory and require dental impressions or scans of the upper and lower dentition.

Another design aspect is whether MADs are titrable or non-titratable. Non-titratable appliances are typically one-piece, or "monoblock" devices, meaning that the upper and lower jaws are rigidly connected, holding the mandible in a fixed position. In contrast, titratable appliances consist of separate upper and lower part. For example, "biblock" or "duoblock" appliances are composed of two separate pieces that fit together in different ways, allowing for lateral and/or vertical movements [14,15].

Furthermore, to ensure optimal therapeutic outcomes, a balance must be struck between effective mandibular protrusion and patient tolerance. This is the purpose of the titration manoeuvre, during which the mandible is gradually advanced to a more anterior position to determine the optimal degree of MAD protrusion.

To date, no standardized protocol exists for identifying this optimal position. Most studies evaluating MAD effectiveness rely on subjective titration, where mandibular advancement is progressively increased over a period of 5 to 40 weeks, either until symptoms improve or resolve, or until the patient can no longer tolerate further advancement [16-18].

The effectiveness of oral appliances (OAs) varies across studies. Treatment success is typically defined as a reduction in the apnea-hypopnea index (AHI) to normal levels, i.e., fewer than five events per hour [1]. Partial success is achieved when the AHI decreases by more than 50% but remains above five [1]. Treatment failure is classified as a reduction in AHI of less than 50% with OA therapy [1]. Most studies agree that the success rate of OAs decreases as the severity of obstructive sleep apnea (OSA) increases [1,19].

In this case, we present a 47-year-old male patient with moderate OSA, treated with a custom-made and titratable MAD. The patient's AHI was initially 20 events per hour and decreased to 8 events per hour during sleep, which is considered a partial success.

The titration procedure was carried out gradually over a two-month period to achieve optimal mandibular advancement. Therapeutic success was confirmed by the resolution of symptoms and validated through ventilatory polysomnography (PSG).

For further improvement, it will be important to address dietary and lifestyle factors, with the goal of reducing body weight and minimizing fat infiltration around the upper airway (aeropharyngeal corridor).

Although this case report demonstrates successful management of moderate OSA, the findings should be interpreted with caution, as case reports are considered the lowest level of scientific evidence and cannot be used to draw definitive conclusions. An additional limitation is the lack of follow-up, due to the recent nature of the case. As a result, long-term effectiveness and potential side effects of the device have not yet been assessed.

Conclusion

Continuous positive airway pressure (CPAP) remains the gold standard for the treatment of obstructive sleep apnea (OSA). However, mandibular advancement devices (MADs) offer a valuable alternative or adjunctive therapy for patients who are intolerant of CPAP, prefer an oral appliance, or have limited access to CPAP treatment.

Periodic follow-up is essential, as MADs may deteriorate over time, resulting in diminished retention, comfort, and therapeutic effectiveness. Regular re-evaluation is recommended to assess the device's condition, make necessary adjustments or replacements, and ensure continued treatment success. Follow-up also plays a critical role in monitoring for potential side effects and maintaining long-term efficacy.

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