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MANDIBULAR ADVANCEMENT DEVICE USE IN A PATIENT WITH OBSTRUCTIVE SLEEP APNEA: A CASE REPORT

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Abstract: Obstructive sleep apnea (OSA) is a sleep-related respiratory condition that causes episodes of reduced breathing or complete stops, in addition to triggering other major health complications such as cardiovascular problems, stroke, fatigue and drowsiness. Usual treatments are performed with continuous positive airway pressure (CPAP) devices and mandibular advancement devices (MADs). The study presents a case report of a male patient, 57 years old, 84kg diagnosed with OSA, in which treatment with MADs made and adjusted in the patient is presented, so that beneficial results could be collected and confirmed. Observing that after 1 month of treatment with MADs there was an improvement in the percentage of sleep, as well as a reduction in AHI, in addition to greater oxygenation, absence of nucturia and reduction of snoring for some sporadic moments.
Keywords: Obstructive sleep apnea; occlusal splints; Dentistry.

INTRODUCTION

Obstructive Sleep Apnea (OSA) is characterized as a sleep-related breathing disorder, which has as main consequence hypopnea and apnea, that is, partial reductions in breathing and complete pauses, respectively. These changes trigger several health problems, such as intermittent hypoxemia, fragmented sleep and variation in intrathoracic pressure, which directly reflects on the health and quality of life of these individuals. (LEE; SUNDAR, 2021)

OSA is directly related to the risk of death, given that it doubles the chances of car accidents triggered by daytime sleepiness, as well as increases the likelihood of acute myocardial infarction, stroke and congestive heart failure, given that that blood pressure is high. (SPENCER et al., 2019)

The pathophysiology of OSA is more complex than just a narrow and collapsible pharynx, as there is a wide range of anatomical and non-anatomical factors that can cause changes in the caliber of the upper airways during sleep periods, which increases the propensity for disorders. and, consequently, triggers the collapse of these airways causing cyclic hypoxemia, as well as fluctuations in intrathoracic pressure and sleep fragmentation, which lead to an inflammatory process as a result of these changes. In addition, it is worth noting that obesity, advanced age, craniofacial differences and male gender are risk factors for developing OSA. (LEE; SUNDAR, 2021).

The American Sleep Medicine Association was responsible for organizing sleep criteria and tests for Obstructive Sleep Apnea, which are contained in the third edition of the International Classification of Sleep Disorders. From this perspective, it is observed that the use of a standardized assessment instrument makes it possible to classify the severity of OSA, through the Apnea and Hypopnea Index (AHI), observing and evaluating the respiratory events present every hour, which allows classifying such as: Mild (5 to 14.9 events/hour), Moderate (15 to 29.9 events/hour), and Severe (>30 events/hour) cases of AOS. (AAMS, 2021).

From this perspective, the use of Mandibular Advancement Devices (MADs) has been introduced as one of the possible treatments for OSA, given that they are well tolerated by patients, reduce the collapsibility of the upper airways by increasing the dimensions of the pharynx after movement. protrusion of the mandible, which consequently reduces the patient's AHI, but it is noteworthy that the degree of reduction varies depending on the patient and the severity of OSA, as well as having no effect on other pathophysiological characteristics linked to OSA. (MARKLUND; BRAEM; VERBRAECKEN, 2019).

Addition, MADs have shown positive evidence regarding the reduction of AHI and better scores on the Epworth Sleepiness Scale (ESS) compared to continuous positive airway pressure (CPAP) devices commonly used in treatment, in addition to presenting results comparable in terms of health and quality of life. (SPENCER et al., 2019)

CASE REPORT

Patient PFF, male, 57 years old, weighing 84 kg and 1.73 meters tall (BMI = 28), attended the dental clinic of CESUPA, diagnosed and referred by the sleep doctor as having OSA, for the manufacture of the device. orally (FIGURE 1, 2, 3 and 4).

In the anamnesis, the patient reported breathing with difficulty during the day, with a history of nasal obstruction, in addition to feeling sleepy and tired during this period. He had already undergone clinical and surgical treatment of the upper airways. Patient is controlled hypertensive, has never undergone any cardiac intervention. Clinical and cephalometric examination showed a mesiofacial pattern and Angle class I (Marques; Maniglia, 2005).

Initial polysomnography showed a sleep efficiency of 80%, an apnea-hypopnea index of 31 events/hour of sleep, and an oxygen saturation of 93%.

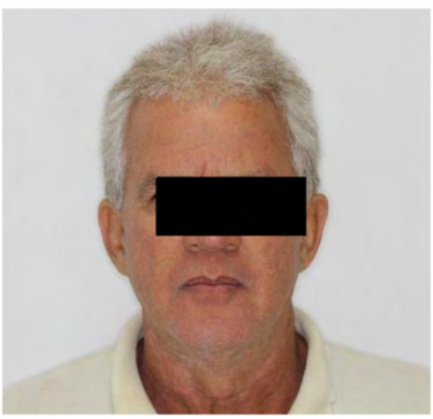

Figure 1 - PFF patient, facial appearance.

Source: Authors, 2022.

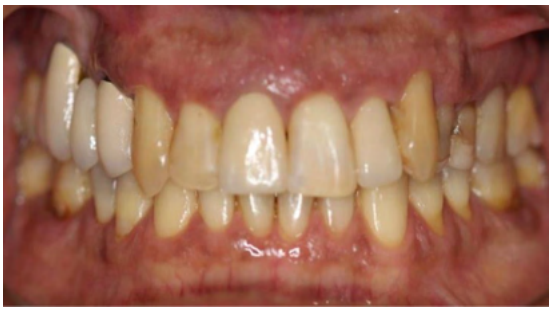

Figure 2 - Patient in MIH.

Source: Authors, 2022.

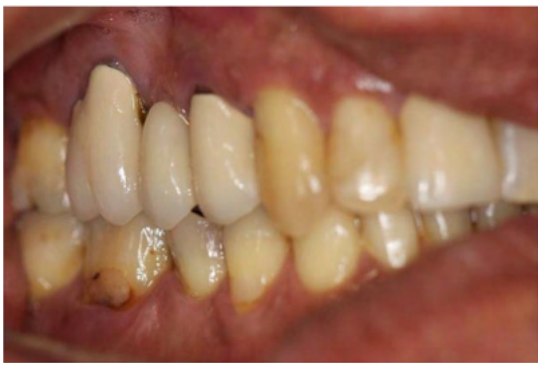

Figure 3 - Right intraoral profile.

Source: Authors, 2022.

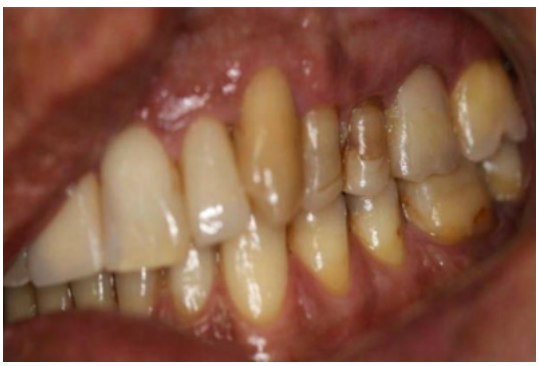

Figure 4 - Left intraoral profile.

Source: Authors, 2022.

Clinical Data	Cephalometric Data
Male, 57 years old	Increased soft palate length
Nocturia	Reduced upper pharyngeal space
BMI = 28	middle posteropalatal space
daytime sleepiness	Reduced middle pharyngeal space
Angle Class I	Reduced posterior pharyngeal space
Maximum protrusion 12 mm	meso facial pattern

Table 1- Relevant clinical and cephalometric examination data.

Initially, for the manufacture of the device, a total impression was carried out, upper and lower, with alginate (Avagel, Dentsplay, Santiago, Chile), the cast models were obtained with special type IV plaster (Vel -mix, Kerr, USA). To record the change in mandibular posture, the George gauge®, Great lakes Orthodontics (GG) (FIGURE 5), which allows, in a precise way, to measure the total distance of the protrusion, from the position relative to the maximum habitual intercuspation (MIH) to the maximum protrusion.

This instrument is composed of a body with inserts for the bite forks, a millimeter scale, two fixation screws, a sliding piece to adjust the thickness of the lower incisors and two bite fork options with different intercisal heights, to be used in different ways. according to the case, since the thickness of the fork will determine the interincisal distance.

In order to obtain the appropriate change in mandibular posture for the case, we must first select the bite fork that is most appropriate for the patient's characteristics. For patients with a long face, characteristic of vertical development (height greater than depth), a greater interincisal distance (light-colored fork, 5 mm) should be used, as in the clinical case in question; however, in other patients, we should use the shortest possible interincisal distance (dark fork, 2 mm), (Godolfim, 2010). (FIGURE 6).

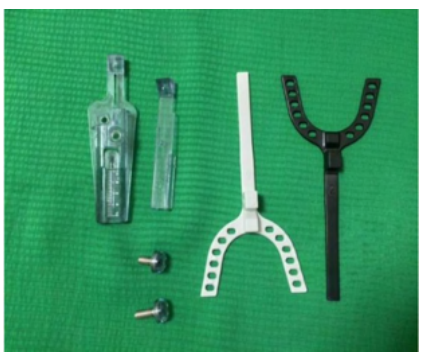

Figure 5 - George Gauge ® and his parts.

Source: Authors, 2022.

Figure 6 - GG® Bite Forks.

Source: Authors, 2022.

To determine mandibular advancement, the thickness of the lower incisor was first adjusted by locking the sliding part (clear slider) with the lower screw (FIGURE 7), placing the chosen fork, leaving the upper screw loose. Next, the George's Fork® (GG) was positioned in the upper arch and the patient was instructed to close the MIH position, verifying the value on the scale, which in this case was 5mm (FIGURE 8). Subsequently, the patient was instructed to advance the mandible, without opening the mouth, until the maximum possible protrusion and, at that moment, lock the upper screw, verifying the value on the scale (7mm) (FIGURE 9).

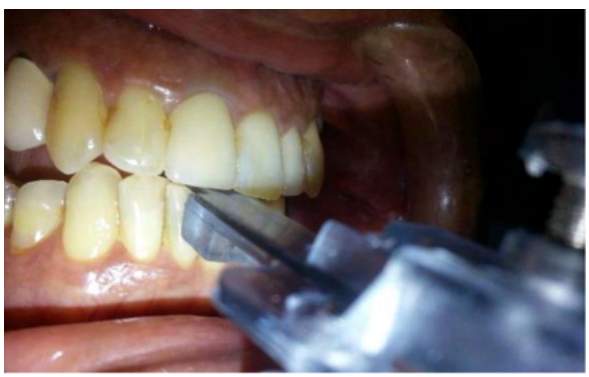

Figure 7 - Lower incisor Thickness Adjustment in position.

Source: Authors, 2022.

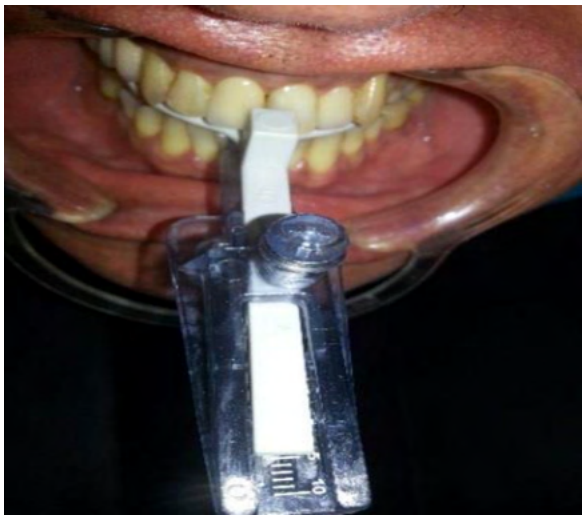

Figure 8 - Patient in MIH, with fork.

Source: Authors, 2022.

The total extension of the patient's protrusion was the sum of the values obtained in the two measurements (MIH and maximum protrusive) and from this value 80% was calculated, which will be the limit of advancement of the device. In the present case it was 9.6 mm. If this value is greater than 7 mm, 7 mm should be adopted as the initial value, reaching the calculated limit of 80%, with successive advancement of approximately 1 mm every 15 days.

This percentage corresponded to the difference between the maximum protrusion obtained with the GG and the safety margin that should be left to avoid major problems with the patient's TMJs. After determining the initial advance, the GG was adjusted to the desired value, releasing the upper screw and moving the fork back to the distance corresponding to the maximum protrusion and the determined value (percentage or 7mm). After the GG was adjusted, heavy condensation silicone (Speedex)was manipulated and placed on the ends of the bite fork and taken to the patient's mouth to record the change in mandibular posture (FIGURE 10).

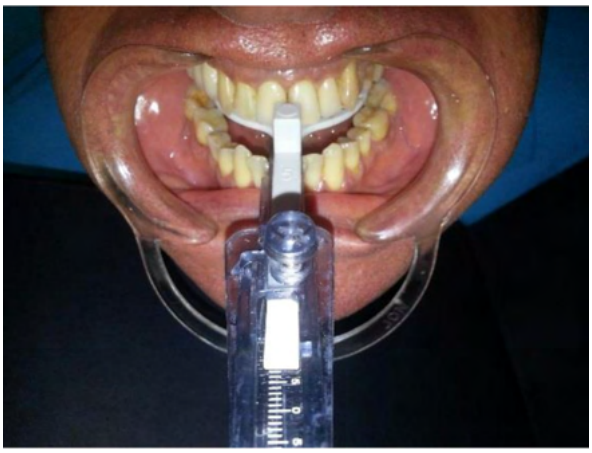

Figure 9 - Patient in maximal protrusive position with fork in position.

Source: Authors, 2022.

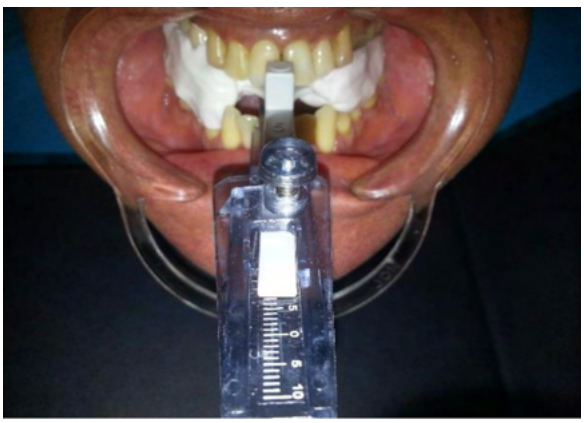

Figure 10 - Record of Mandibular Posture Change.

Source: Authors, 2022.

The plaster casts of the arches and the fork with GG registration, taken from the patient, were sent to the laboratory for the manufacture of the device (FIGURE 11). In the installation consultation, the plates were adjusted, first individually, upper and lower, so that they remain retentive. However, without great difficulty to remove, as this in some cases is also uncomfortable for the patient (FIGURE 12 and 13).

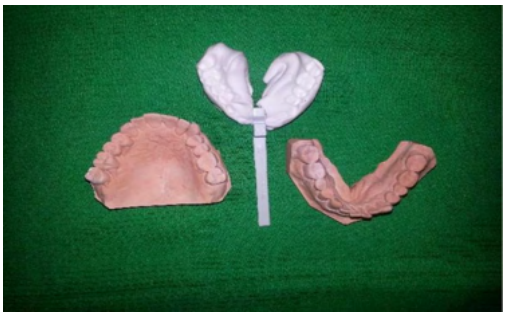

Figure 11 - Models of the patient's arches and the fork with registration.

Source: Authors, 2022.

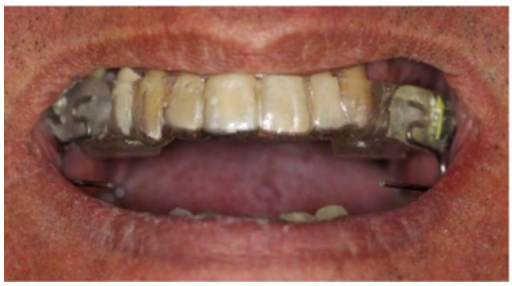

Figure 12 - Upper plate adjustment.

Source: Authors, 2022.

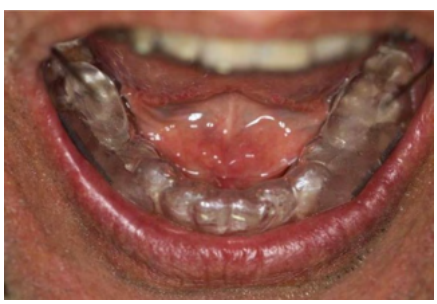

Figure 13 - Lower plate adjustment.

Source: Authors, 2022.

Figure 14 - Relief of plaques with a maxcut drill.

Source: Authors, 2022.

The plates must not have pressure located in a sector or in a specific tooth, and must be relieved so that they present a homogeneous pressure (FIGURE 14). After individual adjustment, the device was assembled by fitting the dorsal arches into the tubes and again positioning itself in the patient's mouth to remove possible retentions, due to the angle of closure of the mandible in relation to the device and in relation to proclination of the incisors. In the appointment for placement of the device, no advance was made beyond what was determined in the assembly, however, eventually, some retreat can be made, if there is a complaint of discomfort by the patient. The device allows, through the activation of the dorsal arches, a gradual advancement of the mandible (titration), in cases where this is necessary. (FIGURE 15)

One month after installing the device, with a titration of 1mm every 15 days, the second polysomnography was performed (DUARTE, 2006), this time the patient using the device. There was an increase in sleep efficiency to 93%, a considerable reduction in AHI to 4 events per hour and an increase in O2 saturation to 95%. Clinically, we observed the presence of sporadic snoring and the disappearance of nocturia, leading the patient to a situation of significant improvement in the condition (Figure 16).

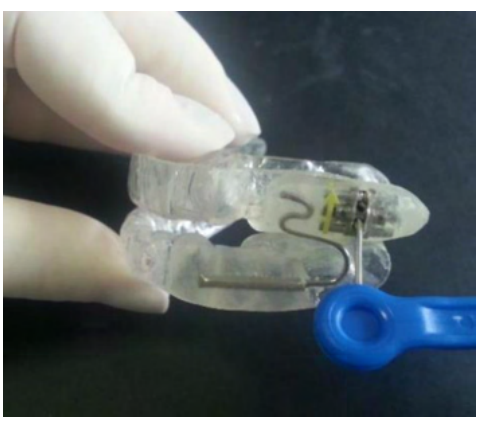

Figure 15 - Activation of the dorsal arches (titration).

Source: Authors, 2022.

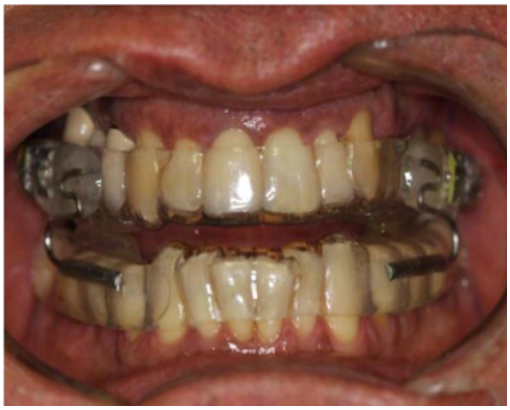

Figure 16 - PLG device installed

Source: Authors, 2022.

Polysomnography without device	Polysomnography with device
AHI = 31	AHI = 04
SO_2 = 93%	SO_2 = 95%
Sleep efficiency = 80%	Sleep efficiency = 93%
constant snoring	sporadic snoring

Table 2 - Polysomnography before and after treatment, showing that in addition to a significant reduction in the apnea and hypopnea index, there was a significant improvement in sleep quality.

DISCUSSION

According to Martins et al. (2018) there are two types of oral appliances (OA) used for the treatment of OSA in mild and moderate cases, they are the Tongue Stabilizing Devices (TSDs) and the mandibular advancement appliances. In the current context, TSDs are practically in disuse, as they cause considerable discomfort for the patient, which explains the use of MADs as one of the main treatment options.

The MADs work by anchoring the teeth in the appliance so that the mandible remains vertically open and forward, at a distance that varies from 50% to 75% in mild to moderate cases of OSA and above 75% of the distance from the protrusion movement in severe cases of OSA. This movement causes the forward displacement of the tongue base, as well as stretching the soft tissues of the pharynx, which promotes a better prognosis in the evaluation of AHI. (MARTINS et al., 2018).

In the study by Dontsos et al. (2020) it is found that the use of MADs promoted a significant increase of 1.95cm ^{3} (14.4%) in the upper airways in cases of OSA, as well as decreased the number of apneic events to less than 10 events/hour of sleep. sleep, or reduced by more than 50% of the AHI values. There was even an increase in volume linked to the velopharynx, oropharynx and hypopharynx, with the velopharynx showing the largest volume.

In addition, the patients' protrusion values ranged from 65% to 76% of maximum protrusion, however the improvement in AHI levels is not proportional to the greater mandibular advancement, given the variability of the responses of each individual to treatment with MADs. It is worth noting that in the cases of edentulous patients, there were also improvements in the volume metrics of the upper airways with the installation of prostheses. (DONTSOS et al., 2020)

Even if there is a more accurate knowledge about the effects of using CPAP, patients do not have a good adherence to treatment, which made the use of MADs the first treatment option for Mild and Moderate cases of OSA, and in severe cases. that the patient refuses to use CPAP. Highlighting some effects such as improvement in physical health, emotional and mental health, greater vitality, as well as an increase in total sleep time (LI et al., 2020).

In the meantime, the research by Li et al. (2020) presents a comparison between conventional treatment with Continuous Positive Airway Pressure (CPAP) and MADs, which showed a significant result in terms of reducing the AHI, in addition to being able to expand and improve the upper airways, as well as eliminate simple, light to moderate snoring and acts to reduce apnea events, so that it

keeps the mouth open, releasing the tongue and removing the posterior constriction of the soft palate.

Furthermore, the study by Bartolucci et al. (2020) presented positive results related to an improvement in the minimum oxygen saturation rate of +10.8% in the monoblock (MB) devices and +3.3% in the duoblock (DB) devices used in patients with OSA, reduction of oxygen AHI, as in some cases with a frame of 28.5 ± 5.7 which reduced to 8.5 ± 3.2 in MB and 14.2 ± 4.5 in DB, another case with 32.5 ± 5.6 which reduced to 5.9 (1.6 – 20.4) in MB and to 15.2 (4.0 – 38.1) in DB, also seen in this case from 26.38 ± 4.13 which reduced to 7.58 ± 2.28 in MB and 8.87 ± 2.88 in DB and, finally, a case of 26.7 ± 3.3 that reduced to 7.9 ± 1.6 in MB and 8.7 ± 1.5 on DB, giving an overall success rate of 82.1% (72.2%-88.7%) for MB and 54.7% (44.3%-63.7%)to DB.

However, the longer the time of use of MADs, there is a risk of developing an overload in the dental structures, in the masticatory muscles and linked to excursive movements, in addition to the greater susceptibility to develop signs and symptoms of temporomandibular disorders, but they are mild and temporary. in the process of adapting to the use of MADs. Dental changes can cause a decrease in maxillary incisor inclination and an increase in mandibular incisor inclination, which triggers a reduction in posterior contact points, as well as downward and backward rotation of the mandible triggers an increase in facial height. (MARTINS et al., 2018; PATEL et al., 2019).

However, it is worth mentioning that the use of an appliance with proclination of the upper incisors can reduce the effect caused by MADs, in addition to the authors indicating the use of a daytime corrective splint, as well as the use of chewing gum, in order to reduce the possible negative effects of use of MADs. (PATEL et al., 2019).

CONCLUSION

Based on the knowledge previously exposed, it is possible to affirm that the use of mandibular advancement devices has a fundamental role in the treatment of patients with obstructive sleep apnea through a non-invasive procedure, unlike the orthognathic surgery also used, as well as having a higher adherence rate by patients when compared to treatment with the continuous positive airway pressure device.

It is unquestionable that MADs have positive effects on reducing the apnea and hypopnea index, as well as promoting an increase in the volume of the upper airways, which directly reflects on greater oxygenation, in addition to causing a reduction in snoring and apneic events during sleep., which leads to longer sleep time, greater vitality, fewer episodes of daytime sleepiness and, ultimately, improved physical and mental health, promoting a better quality of life for patients with OSA.

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