

## Case Report

# Management of severe obstructive sleep apnea using mandibular advancement devices with auto continuous positive airway pressures

*Rashmi Upadhyay, Abhishek Dubey, Surya Kant, Balendra Pratap Singh<sup>1</sup>*

*Departments of Pulmonary Medicine and <sup>1</sup>Prosthodontics, King George's Medical University, Lucknow, Uttar Pradesh, India*

## ABSTRACT

The use of continuous positive airway pressures (CPAP) is considered standard treatment of moderate to severe obstructive sleep apnea (OSA). Treatment of the disease poses a great challenge not only for its diagnostic purpose but also for its treatment part. In about 29-83% of the patients, treatment is difficult because of non-compliance resulting due to high pressures, air leaks and other related issues. In such situations, alternative methods of treatment need to be looked for so as to ascertain better management. Mandibular advancement devices along with CPAP may show better treatment outcome in specific situations.

**KEY WORDS:** Continuous positive airway pressures, mandibular advancement devices, obstructive sleep apnea

**Address for correspondence:** Dr. Rasmi Upadhyay, Department of Pulmonary Medicine, King George's Medical University, Lucknow - 226 003, Uttar Pradesh, India. E-mail: rash.georgian@gmail.com

## INTRODUCTION

Mandibular advancement devices (MAD) are recommended for treatment of mild to moderate obstructive sleep apnea (OSA).<sup>[1]</sup> These devices have been known and used for treatment of airway obstruction since 1902.<sup>[2]</sup> Several oral devices are now known, which can be used to modify position of mandible and other structures obstructing the airway and thus improving the sleep-related grievances. Mandibular advancement device (MAD) is one such modality in row and has shown excellent results with respect to remedy and compliance.

We report the case of a 55-year-old male, BMI 33, suffering from OSA managed by MAD as he could not tolerate the autoPAP alone due to severe occlusion in the oral cavity.

## CASE REPORT

A 55-yr-old obese, BMI of 33 kg/m<sup>2</sup>, male, attended our OPD for complaints of breathlessness, interrupted sleep pattern and choking episodes during sleep at night. He complains of dryness of mouth and lethargy throughout the day. He also complained of decreased alertness and difficulty in memory retention in past 1 year. On probing, we could elicit history of snoring from his family members. He gave evidences of excessive daytime sleepiness (EDS) with ESS = 20 [Table 1]. He was suffering for past 5 years, but his symptoms had increased in past 4 months after the lower respiratory tract infection. His younger brother, nearly of the same built, had similar symptoms, but more severe and had expired 8 months back during sleep; the cause of death was cardiac arrest. This prompted him to visit a physician and seek remedy. He was a hypertensive controlled on medications for past 4 years. There was no family history of hypertension or diabetes in family. He was a non-diabetic and his thyroid profile was within normal limits. His fasting lipid profile was deranged with total cholesterol 195, HDL-C 38, LDL-C 115 and triglycerides 209. His liver and kidney functions were found to be within normal limits. He had been an ex-smoker, hence a pulmonary function test was performed to deduce the cause of his breathlessness, but the results were within normal limits. He did not give any history of orthopnea, pedal

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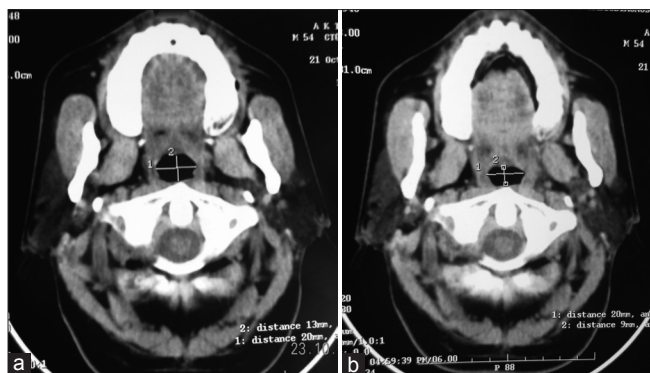
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edema or palpitations. Echocardiography was done and was found to be inconclusive. An otolaryngological examination was done to look for anatomical cause for obstruction. On examination, he was found to have a Mallampati Grade 4 with bulky tongue and enlarged uvula >2.5 cm. Full night polysomnography [Table 2] was done to diagnose and evaluate the severity of OSA. His apnea hypopnea index (AHI) was found to be 66.8/h with average saturation of 87% during sleep. His titration study to decide the CPAP to be applied could not be done as he could not tolerate the applied pressure of 12.7 cm of water. In order to reduce the obstruction, uvulopalatopharyngoplasty (UPPP) was planned. On pre-anesthetic evaluation he was found to be unfit for surgery. He was then advised for the mandibular advancement device application techniques along with autoPAP [Table 3], which showed a reduction in required airway pressure by 33% on day 1 and 51% on day 90. This time when used along with mandibular advancement device he was able to tolerate the CPAP due to the widening of the airways as shown by change in the sagittal dimensions at various levels [Figures 1 and 2, Table 4]. He showed a tremendous response with the use of this device and with regular judicious use of MAD [Figure 3] with an autoPAP, he could also reduce his weight by 9 kg in the same duration which further added to the excellent outcome. Simultaneous use of MAD and autoPAP has been shown to be very effective in overcoming the obstruction and increasing tolerability and compliance in severe OSA, where the oral anatomy is the cause of occlusion in airway passages.

**DISCUSSION**

Snoring as of yet is not considered manifestation of ailment. People often hesitate to reveal their own or snoring habits to their dear ones regarding it as a part of carelessness or ill manners. Snoring may be present in persons of all ages, especially men and women of middle age who are overweight or have some obstructive airway anatomical anomaly. Snoring has now been established as a risk factor for hypertension, ischemic heart diseases and stroke.<sup>[3-5]</sup> Though all snorers may not develop OSA, it still remains a cardinal symptom and helps in identification



**Figure 1:** (a) Computed tomography cross-section the retropalatal high level without appliance; (b) Computed tomography cross-section at the retropalatal high level with appliance

of disease. OSA results in pathological sleepiness and respiratory and cardiovascular complications secondary to airway obstruction. Upper airway resistance syndrome is characterized by repeated arousals related to increase upper airway resistance without recognizable hypopnea or apneic episodes and the condition is improved once the obstruction is properly managed.

MAD are designed so that it can be attached to one or both dental arches, so that the airways can be widened by changing the position of mandible or maxilla thus changing the positions of soft palate and the tongue.<sup>[6,7]</sup> There are certain devices designed to retain the tongue in anterior position during sleep, thus keeping airway patent. Oral appliances have been found to be more useful in patients with upper airway resistance syndrome with low AHI.<sup>[6,8-14]</sup> The changes in the airway, resulting in relief in obstruction are, downward and outward rotation of the mandible leading to increase in superior airway space and the posterior airway space.

In our patient, the areas of concern were patient compliance, effects on snoring, sleep apnea and patient satisfaction with respect to quality of life and overall health status. He could not tolerate the autoPAP initially during titration procedure and hence was planned for

**Table 1: Excessive day time sleepiness and anthropometric variables**

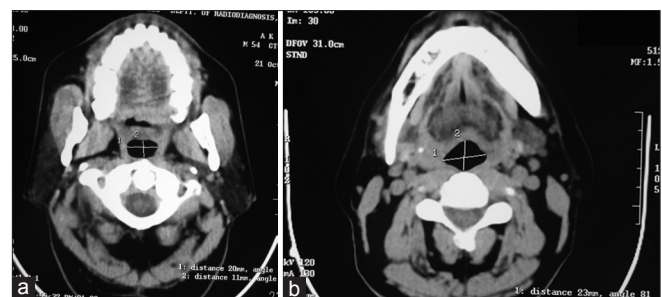
| Variables                            | Baseline | After MAD (day 90) | Changes (%) |
|--------------------------------------|----------|--------------------|-------------|
| ESS (0-24)                           | 20       | 06                 | -14 (-70)   |
| Weight (kg)                          | 90       | 81                 | -9 (-10)    |
| Body mass index (kg/m <sup>2</sup> ) | 33       | 29.7               | -3.3 (-10)  |
| Neck circumference (cm)              | 42.6     | 40.1               | -2.5 (-5.8) |

ESS: Epworth sleepiness score, MAD: Mandibular advancement device

**Table 2: PSG parameters at the time of diagnosis**

| Variable                              | Value |
|---------------------------------------|-------|
| AHI (per hour)                        | 66.8  |
| Apnea index (per hour)                | 50.2  |
| Hypopnea (per hour)                   | 16.5  |
| Average saturation (%)                | 87    |
| Maximum desaturation (%)              | 38    |
| Average heart rate during sleep (bpm) | 82.2  |
| Highest heart rate during sleep (bpm) | 158   |

PSG: Polysomnography, AHI: Apnea hypopnea index



**Figure 2:** (a) Computed tomography cross-section at the retropalatal low level without appliance; (b) Computed tomography cross-section at the retroglottal level with appliance

**Table 3: Comparison of autoPAP pressure and AHI\***

|   | Before MAD | After MAD (day 1) | Change from baseline (%) | After MAD (day 90) | Change from baseline (%) |
|---|------------|-------------------|--------------------------|--------------------|--------------------------|
| Average pressure (cm of H <sub>2</sub> O)               | 12.7       | 8.5               | -2.2 (-33)               | 6.5                | -6.2 (-51.6)             |
| Average 90 percentile pressure (cm of H <sub>2</sub> O) | 13.8       | 10                | -3.8 (-27.5)             | 6.9                | -6.9 (-50)               |
| Average AHI (per hour)                                  | 17.3       | 10.5              | -6.8 (-39.3)             | 1.5                | -15.8 (-92.9)            |

\*After application of apex autoPAP (data extracted from inbuilt data management software). MAD: Mandibular advancement device, AHI: Apnea hypopnea index

**Table 4: Change in dimensions of the oropharyngeal tract at various levels**

|                   | Without appliance (mm) | With appliance (mm) | Changes (%) |
|-------------------|------------------------|---------------------|-------------|
| Retropalatal high | 13                     | 9                   | -(-30.7)    |
| Retropalatal low  | 11                     | 7                   | -(-36.6)    |
| Retroglossal      | 7                      | 12                  | +(+71.4)    |
| Epiglottic        | 11                     | 16                  | +(+45.4)    |
| Hypopharynx       | 11                     | 19                  | +(+72.7)    |

**Figure 3:** Mandibular advancement device

UPPP. He could not be taken up for surgery as he was found to be unfit for anesthesia. MAD was then tried along with autoPAP which showed very promising results. The patient could tolerate the positive pressure and also the oral appliance and the results were overwhelming.

Patient's complain of excessive salivation and transient discomfort for some time after awakening, which may pose problems in the early phase of use of device.<sup>[6,14]</sup> Long-term use of the device may sometimes cause pain in the temporomandibular joint which may be a cause for discontinuation of device. Till now no data is available regarding preferential modality of treatment of sleep apnea. For patients presenting with snoring as the principle complaint, oral appliances and soft palate surgeries are preferred. An evaluation of the upper airway tract for anatomical corrections should always be done. UPPP has been shown to reduce snoring in 90% of the patients.<sup>[15,16]</sup>

## CONCLUSION

CPAP is an established treatment modality of treatment

for OSA.<sup>[17,18]</sup> Still there are issues of cost and compliance. CPAP treatment outcome is fairly good but its compliance is a very important still undervalued aspect of treatment. 29-83% of patients were found non-adherent to CPAP therapy defined by minimum 4 hours usage.<sup>[19]</sup> Treatment offered to the patient may be tailor made so that in situations where high pressures are not tolerated due to severe anatomical obstruction, CPAP fails to overcome the obstruction. When compared with CPAP or UPPP, oral appliances have been seen to be less effective in improving AHI and oxygenation.<sup>[20]</sup> Hence, it is not applied as a first-line treatment modality in cases of severe OSA. Oral appliance may be used to reduce pressures in apprehensive patients and in those presenting with overcrowding of oral cavity and difficulty in tolerating high pressures using CPAP in first instance. It may also be helpful in increasing alertness, attentiveness and quality of life along with reduction in weight. Judicious choice of treatment options available, taking into consideration compliance of the patient, can definitely improve the sleep disordered breathing and to a great extent, the related co-morbidities. Further studies are being done to specify the use of MAD along with CPAP as a protocol of treatment under difficult to treat or in cases of difficulty in tolerating high pressures in patients suffering with sleep apnea syndromes.

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