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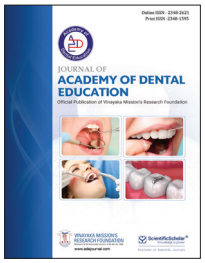

Review Article

Oral appliances: An odds-on in obstructive sleep apnoea management

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ABSTRACT

Breathing affiliated with sleep disorders usually lies between simple snoring without sleepiness, upper airway resistance syndrome, obstructive sleep apnoea (OSA) syndrome, and hypercapnic respiratory failure. Of all these, OSA is very often accompanied with morning symptoms and extension of comorbidities and mortalities with a high prevalence rate. General health implications and an altered quality of living are the major setbacks. Mostly patients with neurologic disorders are affected. There are many surgical and non-surgical approaches concerned with its management. This review article provides a description of oral appliances along with recent treatment modalities, clinical efficacy of alternative treatment modalities of OSA patients.

Keywords: Obstructive sleep apnoea, CPAP, Oral appliances, Surgical, Non-surgical, Behavioral approaches

INTRODUCTION

Obstructive sleep apnea (OSA) is a sleep-disordered breathing disease that involves repeated obstruction of the upper airway during sleep or reduction/elimination of airflow completely for at least 10 s and in a number of 5 episodes or more every hour of sleep. The common sites affected are the area between the nasopharynx and the larynx, base of the tongue (retroglossal), behind the soft palate (retropalatal).[1,2] The upper airway is occluded due to the sleep-induced physiologic changes, including structural defects and abnormal muscular activity, sleeping posture in the supine position, edema in upper airway whose etiology may be smoking, hypothyroidism, acromegaly, and nasal obstruction.[3-7] It is a serious systemic disorder with an incidence of 17% in adult women and 34% in men, which when left untreated may accelerate the development of new comorbidities, fatigue, sleepiness during day time which in turn cause an impaired cognitive performance, a reduced quality of life, an increased risk of occupational and traffic accidents[8] metabolic disturbances,[9] hypertension,[10] cardio and cerebrovascular morbidities, and OSA-related mortality.[11] Its long-term management is based on:

a. Patient with treatable physiological or structural abnormalities
b. Comprehensive lifestyle interventions such as weight-loss intervention.

Apart from the conventional continuous positive airway pressure (CPAP) therapy to treat the cases of moderate to severe OSA, the automatic positive airway pressure and bilevel

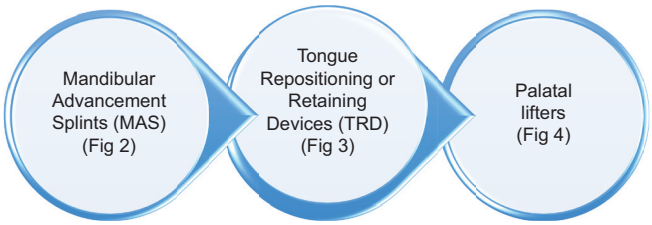
therapy have also become a standard option regardless of the underlying mechanisms of apnoea and site of the pharyngeal collapse, or patient phenotype.[12-17] Non-invasive treatment options like oral appliances (OA) like mandibular advancement devices (MAD) are indicated for use in patients with mild to moderate OSA whose compliance solely depends on the balance between the perception of benefit and the side effects and monitoring throughout the follow up is mandatory.[18-22]

TREATMENT MODALITIES

Figure 1 shows the various treatment modalities of OSA.

THERAPY USING OA

The three broad categories of the OA for the treatment of OSA:



Mandibular advancement splints (MAS) or MAD

MAS aim at advancing the mandible forwards and downwards slightly so that the upper airway is enlarged thus, preventing it from collapsing, thereby reducing snoring and OSA.[13]

These devices are configured in such a way that they are attached to the maxillary and mandibular teeth in a protruded position. The designs of the device is customized according to the dentition, materials used for fabrication, occlusal coverage, single plate (monobloc) or two separate plates device, acceptable vertical mouth opening, the advancement technique and its adjustability to the advancement level (titration). Boil-and-bite MADs are also available over the counter featuring soft materials which are pliable on exposure to hot water. Biting down over a flexible mold helps to fit the device. However, MADs are not suitable in people wearing dentures or with severe dental issues. There are not many studies that directly compare different OA designs however, to achieve a better prognosis, a customized and titratable device is recommended.[23]

Oral devices involving craniofacial structure have a better efficacy. Most studies reported that the treatment response might be due to altered mandibular plane angle, hyoid position, size of upper airway soft tissue, and cranial base angle. According to Banabilh *et al.*, "96% increase in the area associated with the downward displacement of the hyoid bone was detected in patients with OSA."[24] However, craniofacial characteristics alone does not indicate good treatment outcome.

Tongue repositioning or retaining devices (TRD)

TRD suction the tongue forward into an anterior bulb and opens up or widens the upper airway dimensions so that it is prevented from falling back and thereby reduces obstructive sleep apneas.[13]

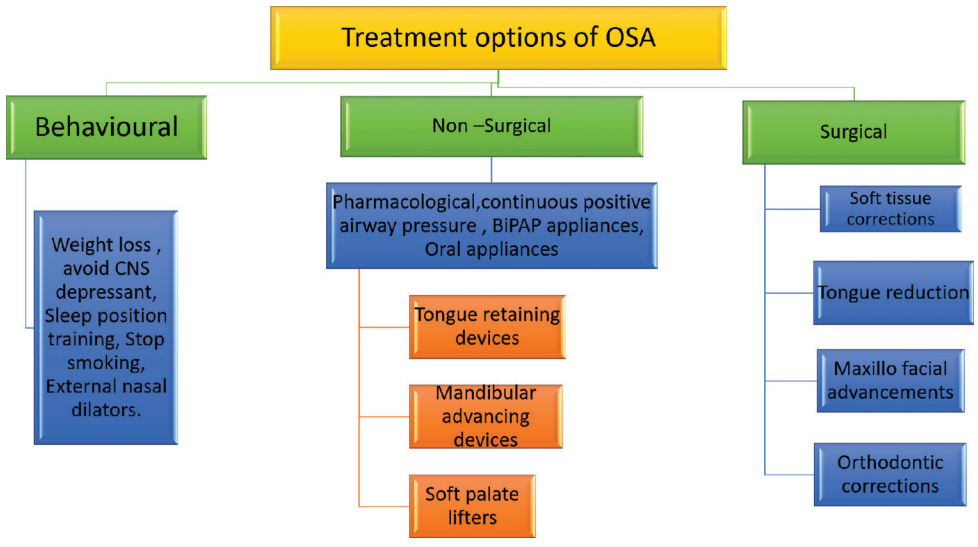


Figure 1: Various treatment modalities of OSA.

The TRD has a mouthpiece that covers the maxillary and mandibular arches entirely, with a definitive mandibular protrusion. The displacement of air from the lingual compartment of device creates a negative pressure, thus, brings the tongue slightly forward. TRDs, customized from casts of the tongue and teeth using a soft copolymer can bring about 50–75% of the maximum mandibular protrusion. However, if the patient experiences pain which exaggerates or if snoring persists even after a 3-week trial, the protrusion distance is reduced. Mouth breathing is facilitated by the lateral holes in the device.[13]

Figure 2: Mandibular advancement splints (Courtesy of http://www.dentalartslab.com).

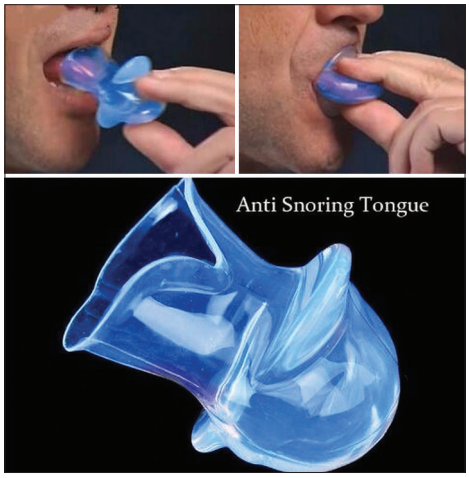


Figure 3: Tongue repositioning or retaining devices (Courtesy of https://www.ebay.ca).

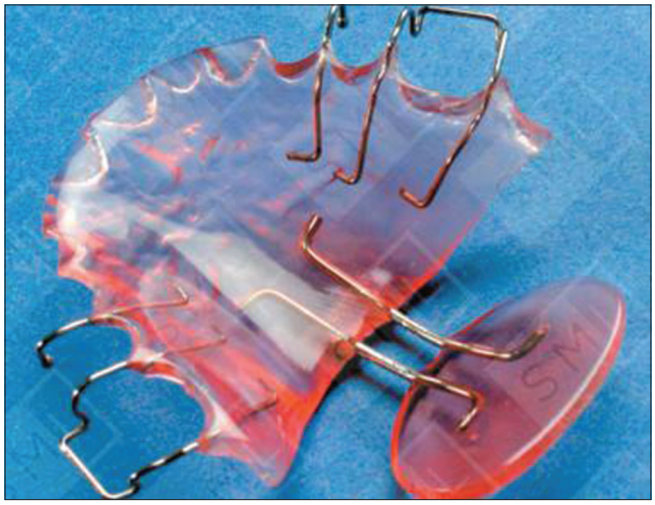


Figure 4: Palatal lifters (Courtesy of https://stlouis.smlglobal.com).

Studies show that when a tongue stabilizing device was compared with an MAD, the latter is more preferable, though, the apnea reduction from these two devices was found to be similar. Sleep apnoea reduced to some extent in patients using TRD in the supine position.[25-27]

Palatal lifters

Majority of patients experience snoring because they have excessive or pendulous tissue in the oral pharyngeal region that obstructs the airway. These Lifter appliances have an adjustable acrylic button that extends distally to the midpoint of the soft palate and gently lifts the tissue, preventing it from vibrating as air passes during sleep. Most patients find it hard to tolerate this appliance for a long time, but when you suspect that the airway obstruction is due to an excessive palatal drape, it might prove helpful as a diagnostic tool. Thus, the Palatal lifter significantly improves the upper airway passage dimensions, helping to terminate snoring and airway obstruction.[28]

ORTHODONTIC MANAGEMENT

Some of the other oral appliances for the treatment of OSA are shown in Table 1 [Figure 5].

EFFICACY OF CPAP VERSUS OA

CPAP is no doubt the gold standard Non-surgical treatment as it is highly potential in preventing OSA. However, its compliance rates have declined despite its effectiveness[12] due to the fact that the systems involved are noisy. Discomfort on wearing the mask, sometimes, causing claustrophobia in some users is a major drawback. As non-invasive devices, OA which are as efficient as CPAP, stand as its better alternative and are prescribed in patients who refuse conservative treatment, who prefer them to or those who do not respond to or those who have failed to CPAP therapy.[12]

Table 1: Orthodontic appliance for treatment of OSA.

In adults	In edentulous persons	In children
Twin bloc appliances	Implant retained OA	Rapid maxillary expanders
Herbst activator appliance	Placebos	Modified mono bloc appliances

Figure 5: Orthodontic oral appliances for sleep apnea (Courtesy of https://pacificdentalcare.org/sleep-apnea).

CONCLUSION

Despite the developing approaches to OSA, many unresolved problems linked to their treatment modalities still remain a question mark. Diagnosis and treatment of OSA aim at improving the quality of life for patients whose compliance depends on the stability between the idea of benefit and the side effects of the therapies performed. Constant communication and follow-up is essential for an effective OSA management. Currently, the primary motive of OSA should be on terminating apnoeas with personalized therapy for each subject with an ultimate goal of maintaining the quality of life and managing the onset of comorbidities. The patients are motivated to participate in healthier lifestyle modification programs associated with increasing physical activities and exercises to reduce weight so that the overweight or obesity is reduced among the individuals.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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