



## **Critical Overview on Oral Appliances for the Management of OSA**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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**Review Article**

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## **ABSTRACT**

Obstructive sleep apnea is caused by obstruction of the upper airway during the sleep. This illness is characterised by a wide range of symptoms and associated comorbidities. OSA is a complex illness that necessitates a comprehensive approach to diagnosis and treatment. The craniofacial structure, as well as the soft tissues and muscles that surround it, all contribute to OSA. Obstructive sleep apnea affects 936 million individuals around the world. After China, India comes second with 81 million OSA patients. Continuous positive airflow (CPAP) as an interventional option and Oral Appliances as a non-interventional alternative have both been mentioned in the literature as therapy options for OSA. The clinical findings associated with OSA should be noted by the dentist during the initial session so that an early diagnosis, proper treatment planning, and the avoidance of long-term consequences can be accomplished. Dentists are crucial in diagnosis, treatment, and screening of OSA patients.

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Oral appliances for mandibular advancement and tongue stabilisation have been shown to be successful in treating OSA. The clinical studies, and current clinical practice suggest utilising oral appliances to treat OSA when patients cannot tolerate CPAP. Dental appliance therapy is a non-invasive treatment for obstructive sleep apnea syndrome that involves the use of a variety of dental appliances. This review provides an update on the most recent trends in Oral Appliances as a therapeutic option for managing OSA.

**Keywords:** *Mandibular advancement device; obstructive sleep apnea; oral appliance; continuous positive airway pressure.*

## 1. INTRODUCTION

Obstructive sleep apnea (OSA) is a disorder of sleep in which upper airway becomes partially or fully closed. Constriction or collapsing of the pharyngeal walls is the reason for the upper airway to collapse. OSA can result in cardiovascular and mental problems. [1]. They have also been observed to have daytime tiredness and a low quality of life. A skilled sleep medicine professional uses nocturnal polysomnography to diagnose OSA. OSA patients have a soft palate that is posteriorly positioned and near to the pharyngeal wall during phonation. Uvula is bulky and prominent in OSA [2].

To classify the severity of OSA, the apnea-hypopnea index (AHI), or the number of apneas and hypopneas episodes recorded in an hour of sleep, is utilised. OAS is characterised as mild (AHI5–15), moderate (AHI15–30), or severe (AHI>30) based on the AHI. [3].

Some of the therapeutic options for OSA include positional therapy, surgical therapies (pharyngeal and maxillomandibular operations), continuous positive airway pressure (CPAP), and oral appliances (OA) such as the mandibular advancement device (MAD). [4,5,6].

Dental appliance therapy is a non-invasive treatment for obstructive sleep apnea that employs a range of dental appliances (OSA). OA causes jaw and/or tongue to shift forward in the mouth, thus expanding pharyngeal space. There are around 60 different types of OA in use today, each with substantial architectural changes. None, on other hand, has been designated as a "gold standard." [7,8].

For patients with mild to severe OAS, MAD has been shown to be a feasible alternative. Some studies have revealed that MAD has a good contribution in lowering AHI and enhancing quality of life in these patients when compared to

CPAP [9,10]. MAD is based on the idea of clasp the jaw forward and downward to broaden the upper airway and lower AHI [11].

Long-term model analysis studies have described tooth pain, temporomandibular joint difficulties, xerostomia (excessive salivation), and gum irritation [12,13,14]. TMD symptoms in patients wearing an occlusal splint have been observed to last up to 3-4 months in other investigations. The majority of patients' symptoms had disappeared after 5 years [15].

Oral appliances come in a variety of shapes and sizes, and the number continues to expand. They are divided into three categories: soft palate lifters, tongue holding devices, and mandibular advancement devices. [16,17,18].

The aim of this review article is to provide a critical overview on oral appliances present in the market for the management of OSA.

## 2. MATERIALS AND METHODS

A review was conducted as per the most opted reporting protocol (PRISMA) for a systematic review. Two electronic databases (PubMed and Cochrane Library) were explored for manuscripts published from 1991 till September 30, 2020. Two reviewers were appointed to screen the titles and abstract independently. Full texts of articles that fulfilled the inclusion criteria were obtained. The final search was done manually from the selected articles for the cross-references and citations, to include all relevant articles and to improve the electronic search.

### 2.1 Inclusion Criteria

1. Language of publication English
2. All article types (case reports, techniques, RCTs)
3. Articles related only to Oral appliances in OSA

### 3. RESULTS

After the electronic and manual search the total number of articles that were displayed for the search were analysed and tabulated in

Table-1. The Full text of the articles were obtained and after a thorough assessment by both the reviewers for these articles independently checked for duplications.

**Table 1. Literatures were analysed**

<b>Authors (Year)</b>	<b>Aim</b>	<b>Findings</b>
Fernando R Carvalho et al. in 2016	Effect of oral and functional orthopedics appliances	Found that it is considered in specific cases who have craniofacial anomalies.
Jing Hao Ng, Mimi Yow in 2018	Effectiveness of oral appliances	Oral appliances are less predictable in managing OSA compared with CPAP therapy.
Bartolucci ML et al in 2019	Effectiveness of different MAD design in AHI reduction and oxygen desaturation.	Result found that AHI improvement to be not proportional to mandibular advancement.
Vikram Belkhode et al. in 2021	To develop new design of OA	Proved potential impact of OSA on general and mental health.

### 4. DISCUSSION

#### 4.1 OA in OSA

##### 4.1.1 Mandibular advancement device

It is a custom-made device that moves mandible forward to expand the airway. Tongue is linked to lower jaw behind chin, and forward movement of the tongue and other airway muscles keeps collapsible part of airway open while jaw moves forward.

##### Indication

1. 1)Mild to moderate sleep apnea
2. 2)Patient who do not tolerate CPAP.
3. 3)Young people with retrognathic mandible

##### Contraindication

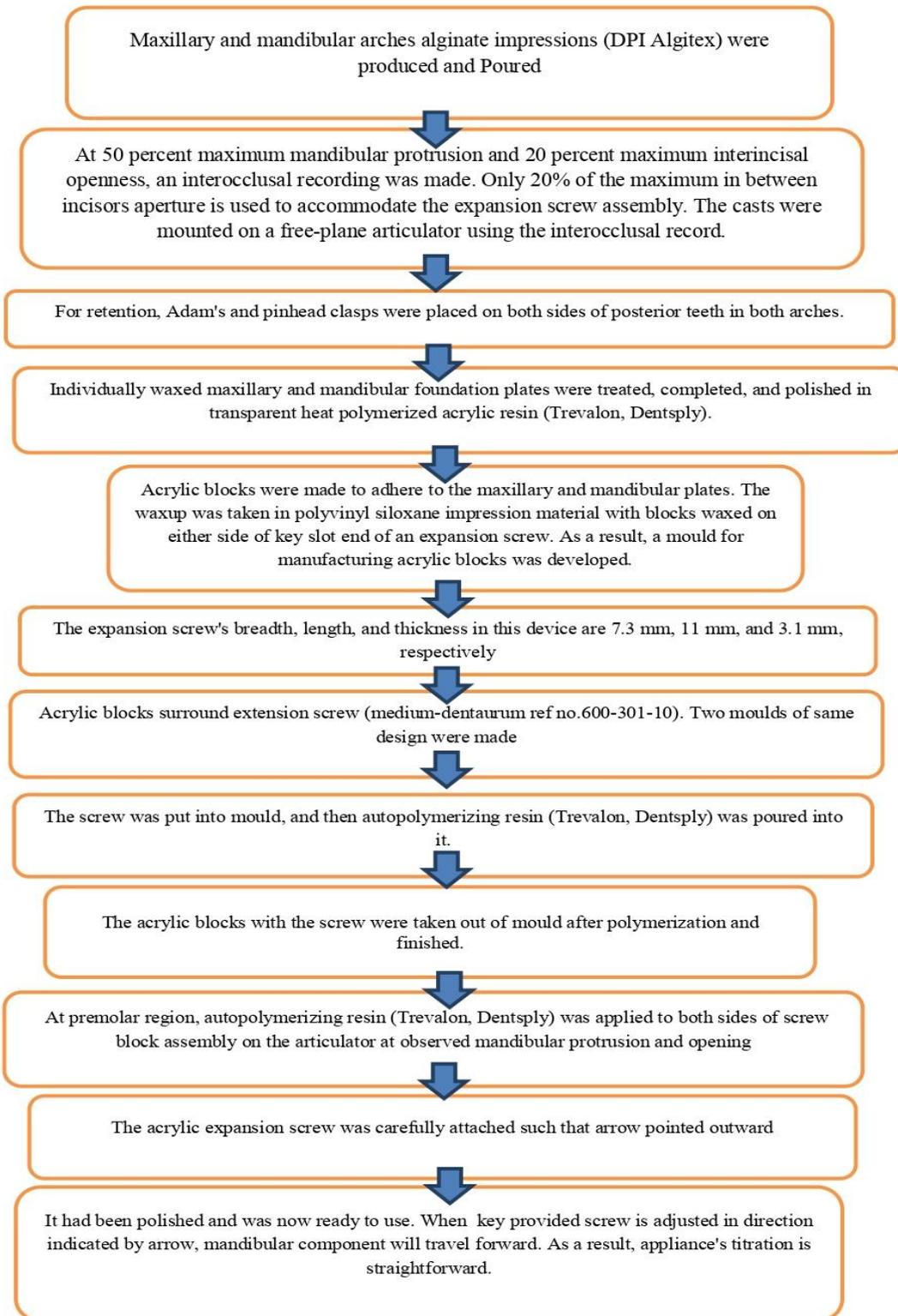
1. There are no enough teeth to sustain device.
2. Tooth mobility is caused by periodontal problems.
3. TMJ disorder that is active

##### Advantages

1. Can help with OSA symptoms such as daytime tiredness, mood swings, and concentration issues, as well as lessen or eliminate snoring.
2. Is more convenient to travel with.
3. Works without electricity

##### Disadvantages

1. Discomfort around the jaw and mouth area
2. Toothache and Gum irritation
3. Temporomandibular disorders
4. Supraeruption
5. A need for dental work replacement



**Fig.1. Procedures For Fabrication: The following are steps in making appliance**

#### 4.1.2 Tongue stabilizing device

It's a small piece of plastic that sits on the lips and looks like a larger pacifier with a hole for your tongue to go through. When utilised, it can help to keep the tongue forward, which can help with sleep apnea.

##### Indication

1. Mild snoring in non-apneic snorers due to a lack of tooth support or edentulous snorers.
2. Down syndrome.
3. In case of macroglossia.

##### Contraindication

1. Patient with excessive salivary flow
2. Patient who has difficulty in swallowing.

##### Advantages

1. Simpler
2. More economical than other therapies.

##### Disadvantages

1. Causes tonsil enlargement
2. Allergies
3. Might cause abnormal facial anatomy.

For mild to moderate OSA, oral appliances have gained popularity as the most recommended and preferred treatment option over CPAP. A meta-analysis was conducted by Zhang M et al [19] and Schwartz M et al [20] to compare the effectiveness of OA versus CPAP in treating OSA. They discovered that CPAP was more effective than OA at reducing AHI, but that CPAP had significantly lower compliance, with no differences in quality of life, cognitive, or functional outcomes when compared to OAs. Nasal dryness, facial ulcerations at the mask interface, and claustrophobia has all been reported as side effects of CPAP use. In a crossover trial, Phillips CL et al [21] and Young T et al [22] discovered that OA had a higher adherence rate than CPAP by about 1.5 hours per night.

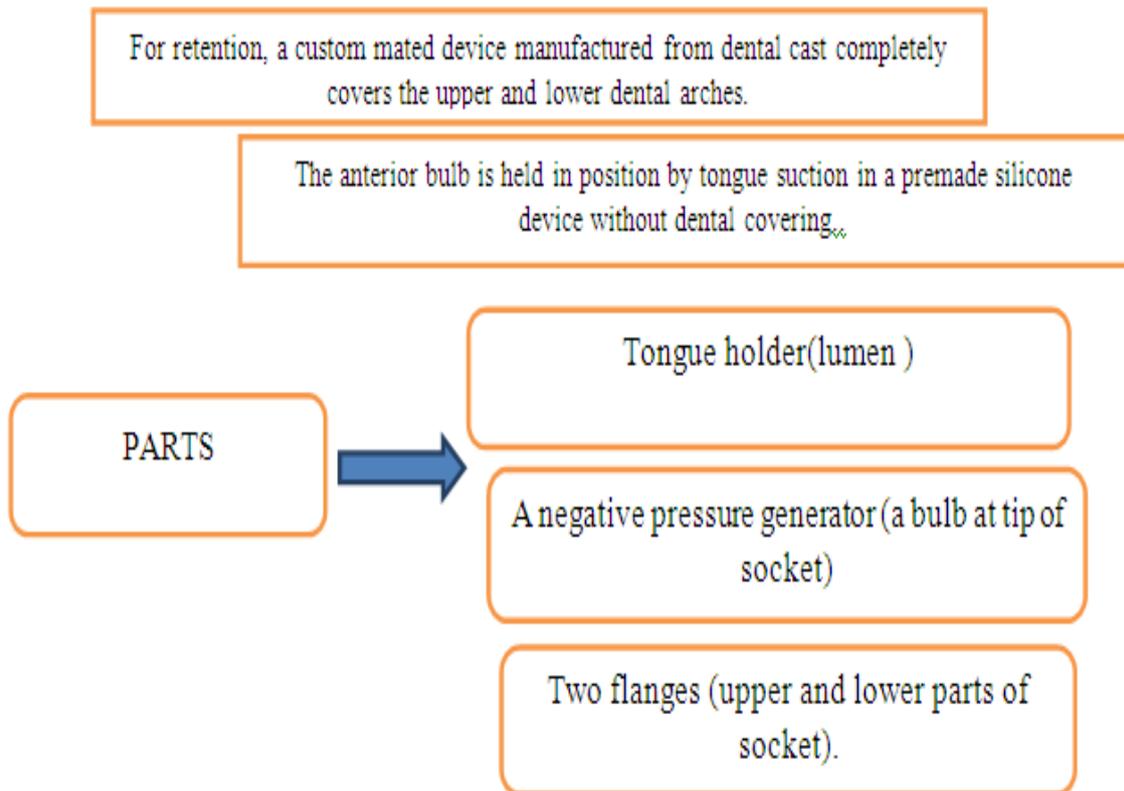


Fig. 2. Procedures for Fabrication

**Chart 1. Treatment for OSA in oral appliances**

	<b>Mandibular advancement device</b>	<b>Tongue stabilizing device</b>
Patient compliance	Non complacent	Not complacent, poor aesthetics
Fabrication	Difficult	Difficult
Developing time	5 to 10 days	10 to 15 days
Speciality inputs	Always required	Always required
Functional issues	Creates occlusal derangement	Strains tongue musculature

Soft palate lifters (SPL), mandibular advancement splints (MAS), and tongue retaining devices (TRD) are three types of OA used in the treatment of OSA [23]. OAs (Boil and Bite) in a variety of commercial designs are also available on market. Customized OAs, on the other hand, has produced best results [24]. Among these, MAD has emerged as the most promising treatment option. MAD prevents upper airway collapse by moving the mandible downward and forward [25]. Many dental problems have been reported as a result of this opening of the bite, including abnormal occlusion, muscle tenderness, jaw stiffness, Temporomandibular dysfunctions, retroclined upper incisors, proclination of lower incisors, decreased overjet and overbite, tipping of teeth, loss of aesthetics, and others [26-27]. It is necessary to introduce a new OA design to address these flaws.

Unmet Clinical needs of present OA in managing OSA are:

1. Complacent and easy to use for patients.
2. Ease of fabrication
3. Digital workflow for designing and manufacturing
4. Less development time i.e. 1 to 2 day
5. Choice of material used Plastics/Silicone/ABS/PMMA etc.
6. Speciality inputs may or may not be required.
7. Functional issues should be addressed.

Future trials should include patients with more severe drowsiness symptoms to evaluate if treatment response differs between subgroups in terms of quality of life, symptoms, and usage persistence. Long-term data on cardiovascular health is required.

As a result, there is no gold standard treatment for OSA in oral appliances that meets unmet clinical needs. In addition, significant advancements in oral appliances are being made to address unmet clinical needs.

## 5. CONCLUSION

When compared to a control group, there is growing evidence that OA reduces subjective drowsiness and sleep disturbed breathing. CPAP appears to be more helpful than OA in treatment of sleep disordered breathing. Although there may be some prejudice in favour of one therapy over the other, there is no substantial difference in clinical response between two. Patients with minor symptoms of OSA and those who are unwilling or unable to tolerate CPAP therapy should be administered OA therapy until more solid data on the effectiveness of OA versus CPAP in terms of symptoms and long-term implications becomes documented. OA will not correct hypoxemia and oxyhemoglobin desaturation seen in patients with OSA.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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