

Oral Appliance Therapy for Sleep Disordered Breathing: An Introduction for Healthcare Professionals

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DOI No:10.5958/0974-0155.2016.00018.8

Indian J Sleep Med 2016; 11.4, 129-131

The American Academies of Sleep Medicine (AASM) and Dental Sleep Medicine (AADSM) recently updated their clinical guidelines on the use of oral appliances for the treatment of obstructive sleep apnea and snoring. A summary of these guidelines¹ approved by the boards of the AASM and AADSM is as follows:

- Sleep physicians should prescribe oral appliances, rather than no therapy, for adult patients who request treatment of primary snoring (without obstructive sleep apnea).
- When oral appliance therapy is prescribed by a sleep physician for an adult patient with obstructive sleep apnea, it is suggested that a qualified dentist use a custom titratable appliance.
- Sleep physicians should consider prescription of oral appliances, rather than no treatment, for adult patients with obstructive sleep apnea who are intolerant of CPAP therapy.
- Qualified dentists should provide oversight of oral appliance therapy to reduce dental-related side effects or occlusal changes.
- Sleep physicians should conduct follow-up sleep testing to improve or confirm treatment efficacy for patients fitted with oral appliances.
- Sleep physicians and qualified dentists should instruct adult patients treated with oral appliances for obstructive sleep apnea to return for periodic office visits.

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What are Dental Appliances?

A dental appliance is a device that the patient wears in their mouth as they sleep that is intended to prevent vibration and reduce collapsibility of the upper airway. There are two basic kinds of dental appliances that are used in the treatment of Snoring and OSA:

Devices that pull the tongue forward (useful in properly selected patients)

Devices that reposition the mandible (most effective)

How Does advancing the Mandible Improve the Sleeping Airway?

The concept of being able to open the airway by simply pulling the mandible forward, to move the base of the tongue out of the back of the throat, is an oversimplification. The tongue is part of a complex muscular apparatus that participates in speech, swallowing, breathing and, cannot be considered in isolation of its anatomic relationships to surrounding structures in the upper airway.

Studies have shown that changes occur in the upper airway at several levels when the mandible is pulled forward. A study by Isono et al² used video endoscopy to examine the effects of advancing the mandible on the pharyngeal airway of 13 patients with OSA who were under general anesthesia with total muscle paralysis. They found that advancing the mandible widened the retropalatal airway as well as that at the base of the tongue. They applied negative pressures to the airway and showed that a more negative pressure was required to cause collapse of the airway when the mandible had been advanced. In their discussion, they postulated that one of the mechanisms by which mandibular advancement stabilizes the soft palate and retropalatal

airway is through tension transmitted along the palatoglossus muscles to the soft palate.

A study by Schwab et al³ using MRI on snorers while they were awake showed that advancing the mandible resulted in a greater increase in the lateral than the A-P dimension of the airway. CPAP produces a similar change³.

Wearing an appliance will also prevent the mouth from falling open during sleep. A study by Meurice et al⁴ showed that upper airway collapsibility was increased in normal subjects while awake when their mouths were opened. They postulated that opening the mouth causes narrowing of the upper airway due to posterior displacement of the hyoid bone and, reduces the efficiency of upper airway dilator muscles.

Therefore, wearing a mandibular repositioning appliance may stabilize the upper airway by:

1. Pulling the base of the tongue forward

2. Pulling the soft palate forward and putting the walls of the upper airway under tension

3. Keeping the mouth from falling open during sleep

The critical anatomic relationships in terms of improving the sleeping airway with mandibular advancement are as follows:

1. Insertion of the tongue into the mandible anteriorly
2. Linkage of the soft palate to the tongue by insertion of the palatoglossus muscles into the sides of the tongue
3. Linkage of the palatopharyngeus muscles to the palatoglossus muscles through the palatine aponeurosis
4. Linkage of the superior and middle pharyngeal constrictors to the mandible via their insertion on the pterygomandibular raphe, a fibrous band that extends from the inferior hamulus of the pterygoid to the medial angle of the mandible

Clinical Practice Guideline - Ramar et al.

Figure 45—Summary of Findings: OAs vs. CPAP for OSA (All Physiologic Sleep Outcome Measures).

OAs compared to CPAP for OSA						
Patient or population: patients with OSA						
Intervention: OAs						
Comparison: CPAP						
Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	CPAP	OAs				
AHI/RDI/REI		The mean AHI/RDI in the intervention groups was 6.24 higher (8.14 to 4.34 higher)		481 (15 studies)	⊕⊕⊕⊕ moderate ¹	
Oxygen Saturation		The mean oxygen saturation in the intervention groups was 3.11 lower (1.74 to 4.48 lower)		354 (9 studies)	⊕⊕⊕⊕ moderate ¹	
Arousal Index		The mean arousal index in the intervention groups was 3.57 higher (5.51 to 1.64 higher)		274 (6 studies)	⊕⊕⊕⊕ moderate ¹	
Sleep Efficiency		The mean sleep efficiency in the intervention groups was 0.37 lower (0.47 higher to 1.21 lower)		191 (5 studies)	⊕⊕⊕⊕ moderate ²	
%REM		The mean %REM in the intervention groups was 0.72 lower (1.09 higher to 2.52 lower)		244 (8 studies)	⊕⊕⊕⊕ low ^{1,2}	
ODI		The mean ODI in the intervention groups was 4.76 higher (7.15 to 2.37 higher)		234 (3 studies)	⊕⊕⊕⊕ low ^{1,2}	

*The basis for the assumed risk (e.g., the median control group risk across studies) is provided in footnotes. The corresponding risk (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval.

GRADE Working Group quality of evidence:

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

¹ Squared is high

² CI of absolute effect crosses clinical decision threshold

It is important to keep the mouth closed. If the mouth is opened, tensile forces that are produced by advancing the mandible are directed partly towards the feet. This increases the longitudinal tension in the pharynx and promotes collapse. However, there are situations in which combining advancement of the mandible with a slight increase in the opening of the jaw (vertical) will help to further stabilize the soft palate without promoting collapse of other portions of the upper airway.

Effect of Increasing the Vertical Opening with the Mandible Advanced

When the mandible is advanced, the arch formed by the palatopharyngeus and palatoglossus muscles is splayed and tension is developed in the palatoglossus muscle. The tension in the palatoglossus muscle is transmitted into the arch of the soft palate and reduces vibration. This is analogous to tightening the strings on a guitar.

However, only the component of the force vector that is parallel to the axis of the palatoglossus muscle produces tension in this muscle. For a given amount of mandibular advancement, you can increase the force vector along the palatoglossus muscle by increasing the vertical dimension. This explains why some patients who continue to snore with their mandible advanced by an appliance will stop snoring when you increase the vertical dimension.

There is a limit to this relationship. If you open the mouth too much, you will start to compress the tissues around the pharynx and promote collapse of the lateral walls. In some patients, you will also decrease the amount

of contact between the back of the tongue and the palate and this will make it easier for the tongue to obstruct the airway. This is likely to occur in a patient who has had a UPPP or a LAUP. Lastly, a study by Pitsis et al⁵, suggested that the amount of vertical opening induced by an oral appliance does not have a significant impact on treatment efficacy but does have an impact on patient acceptance.

CPAP vs. Mandibular Advancement

A systematic review of the literature and meta-analysis by Ramar¹ et al compared major physiologic sleep outcomes of oral appliances versus CPAP in the treatment of obstructive sleep apnea.

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