Oral Appliances for the Treatment of Snoring & Sleep Apnea

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Urban newspapers regularly carry display advertising from dentists with some version of the all-too-familiar query, “Do you despise, detest, deplore or generally just dislike your CPAP?” There are a substantial number of dentists carving a significant niche in the marketplace soliciting and treating patients clinically diagnosed with sleep apnea who are unable to tolerate their CPAP. Treatment of sleep apnea and snoring with oral appliances is a burgeoning field of dentistry. There are even dentists who limit their practices to “sleep.” What is this all about?

Everyone seems to know a snore when they hear one and snoring can be a warning sign of the more serious condition — sleep apnea. Apnea literally means “want of breath.” In episodes of obstructive sleep apnea the tongue collapses on the palate and/or back of the throat during sleep, resulting in an airflow reduction of 80-100% for a period of at least 10 seconds. Hypopnea is a 30-80% reduction in airflow for at least 10 seconds accompanied by a drop in blood oxygen level of 3-4%. Apneas and hypopneas terminate with an arousal. Patients often awaken gasping and choking. These conditions are very disruptive of one’s sleep, causing excessive daytime sleepiness, increased incidence of workplace and motor vehicle accidents and injury. The morbid health consequences of obstructive sleep apnea have been related to increased risk of diabetes, depression, hypertension, increased risk of both heart attack and stroke, atrial fibrillation, gastroesophageal reflux, neurocognitive impairment, mood disturbances, cognitive memory loss, obesity and hormonal imbalances.

Mild sleep apnea is defined as 5-15 apnea or hypopnea events per hour. Moderate sleep apnea is defined as 15-30 events per hour and severe sleep apnea is defined as over 30 events per hour. Continuous Positive Airway Pressure (CPAP) is the recommended treatment for severe sleep apnea, but mild and moderate obstructive apnea may be treated with oral appliances designed to open the airway.1
Design of an oral appliance to treat snoring and sleep apnea involves finding a position of maximal airway patency during sleep. The basic postulate is the more room created in the mouth for the tongue, the less likely it is to collapse on the airway during sleep. Additional principles of oral appliance designs are mandibular advancement, oral airway dilation, facilitation of protrusive and non-retrusive tongue reflexes and optimal nasal breathing.

There are several categories of oral appliances for the treatment of sleep apnea and snoring. Actually, the history of oral appliance therapy (OAT) for sleep apnea reflects an evolutionary process. The original oral appliance was the tongue retaining device or TRD, an example of which is the Snore-X (Fig. 1).

The second generation of oral appliance designs were mandibular advancement devices (MADS), but these tended to restrict maximal forward tongue protrusion. The adjustment mechanism located in the anterior area restricts the tongue from advancing to the lips. Examples are the Klearway and TAP (Figs. 2 & 3).

The third generation of oral appliances featured mandibular advancement plus oral airway dilation. The singular feature of these appliances is a non-restrictive anterior. The open anterior design allows the tongue to protrude to the lips and affects mandibular advancement. This category includes oral airway dilation in addition to the mandibular advancement characteristic. This latest generation of oral appliances are designed to advance the mandible, dilate the oral airway and stimulate protrusive and non-retrusive tongue reflex activity (Fig. 4).

The insidious nature of the sequelae associated with obstructive sleep apnea (OSA) have brought a new imperative to successful treatment modalities. According to recently published guidelines of the American Academy of Sleep Medicine, oral appliances are appropriate for primary treatment of mild to moderate obstructive sleep apnea, and for those patients who fail other treatments such as CPAP and/or surgery. Research has reported that mandibular advancement devices have up to 80% compliance compared to a reported 46% patient compliance for CPAP. One definition for CPAP compliance commonly used is four hours of nightly use at least five nights per week resulting in at least 20 hours per week. The basis for the criteria for CPAP compliance is hours of usage and not related to successful physiological results. Furthermore, it is a rather low standard for compliance despite seven hours of sleep per night recommended by the American Academy of Sleep Medicine. Therefore, to be a “compliant user” of CPAP one must use it roughly 40% of the time. However, a study by Kribbs et al. demonstrated that sleeping without CPAP for one night reversed virtually all of the sleep and daytime alertness gains derived from sleeping with CPAP. As an alternative to CPAP, oral appliances offer a number of advantages.

According to Chan and Cistulli, patients report better acceptance, tolerance, adherence, convenience, and bedpartner acceptance with oral appliances than with CPAP. Moreover, they state that oral appliances are as good as CPAP with respect to affordability, health benefits, and symptom control. Oral appliances are preferred by patients over CPAP primarily because they are more comfortable, more portable, more socially acceptable, make no noise and have fewer undesirable side effects. Common side effects associated with CPAP are bloated feeling, nasal congestion, rhinorhea, mask discomfort, machine or mask noise, headaches or ear pressure, tubing interfering with sleep, sneezing, and dryness of the eyes and mucosal membranes of the upper airway. For these reasons, CPAP is never used for the treatment of primary non-apneic snoring.

Approximately 91 percent of all apnea patients snore, but not all snorers have apnea. Snoring occurs in about 40 to 50 percent of the general population. It is an alarm indicating something is wrong with the airway and breathing during sleep. Snoring is caused by the diffuse vibrations or fluttering of pharyngeal tissues during
sleep. The pathogenesis of snoring is vibrating tissues, the occurrence of which implies increased airway resistance during sleep. Any membranous part of the upper airway from the nose to the vocal cords that lacks cartilaginous or bony support may vibrate such as tongue, soft palate, uvula, faucial pillars, pharyngeal walls, tonsils, adenoids, or swollen nasal membranes.

Snoring may be generated at multiple sites in the flexible and compliant human airway and it may occur during either inhalation or exhalation, though inhalation snoring is most common. Successful oral appliance treatment of snoring is needed to prevent, and more successfully direct treatment at, upper airway resistance syndrome (UARS), hypopnea, apnea and their comorbid consequences, and also to prevent the disruption of the bedpartner’s sleep. To determine the efficacy of oral appliance therapy, monitoring devices, such as the BRAEBON MediByte®, simplify objective documentation of baseline condition and evaluation of treatment outcome for snoring and sleep disordered breathing. The BRAEBON MediByte® software objectively records all snores, measures them in decibels and offers the healthcare provider the ability to listen to any or all snoring events. In addition to snoring, it records oronasal airflow, ventilatory effort, blood oxygenation, and body position to permit the evaluation of obstructive, central, and mixed apnea, hypopnea, positional apnea, flow limitation and UARS (Fig. 5). Indeed, published guidelines concerning unattended home snoring and sleep apnea recorders state that such devices are appropriate to use when monitoring the effectiveness of oral appliance therapy. The technology used in such home recorders is identical to that used in the sleep laboratory and the results are easy to understand. The combination of baseline and follow-up tests empower the dentist to monitor oral appliance success and determine if appliance titration is needed (Fig. 6).

In conclusion, years of published peer-reviewed articles have validated the use of oral appliance therapy as a viable alternative to CPAP for the treatment of obstructive sleep apnea. Oral appliances remain the preferred method for the treatment of benign non-apneic primary snoring. Newer oral appliances have evolved to combine both mandibular advancement and tongue repositioning to offer the best of both designs. Inexpensive and easy-to-use home snoring and apnea recorders are available to measure baseline and oral appliance success. After all, any good clinician wants to objectively measure and understand therapeutic effectiveness.

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Richard A. Bonato, PhD, MA, RPSGT has been involved in the study of sleep and its disorders since 1986 and has been an author, co-author, reviewer, sessional lecturer at Carleton University, and examiner in various educational organizations within the sleep field, including the AAST, and BRPT. He is the CEO and Co-Founder of BRAEBON® Medical Corporation based in Ottawa, Canada.

Oral Health welcomes this original article.

REFERENCES:


Photos

![Larger photo & full caption](File size: 678.9 KB (900px X 675px)
Caption: Figure 1. Snore-X tongue retaining device (TRD).

![Larger photo & full caption](File size: 599.1 KB (900px X 673px)
Caption: Figure 2. Tongue advancement to the lips not possible w...)

![Larger photo & full caption](File size: 273.5 KB (900px X 676px)
Caption: Figure 3(a). Anterior adjustment mechanisms preclude th...
Figure 3(b).

Figure 4(a). Third generation oral appliance designs co...

Figure 4(b). Center, three-dimensional upper airway ima...

Figure 4(c). Image on right while wearing Moses™ ...

Figure 5. Unattended home snoring and apnea raw data re...