OVERVIEW

Sleep Disorders and Oral Appliances: What Every Orthodontist Should Know

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(Editor's Note: In this quarterly column, JCO provides an overview of a clinical topic of interest to orthodontists. Contributions and suggestions for future subjects are welcome.)

The American Academy of Sleep Medicine recognizes many sleep disorders, including insomnia, somnambulism, narcolepsy, and periodic leg movements. The two main sleep disorders that can be treated with oral appliances prescribed by orthodontists, however, are simple snoring and obstructive sleep apnea (OSA).

Simple snoring is caused by the vibration of tissues in the posterior oropharynx during sleep. This can be exacerbated by alcohol consumption, obesity, or sleeping on one's back. In simple snoring, there is no drop in oxygen saturation or change in cardiac rhythm.[1] Because a sleeping partner is often awakened by the snorer, simple snoring is considered more of a social problem than a medical problem.

Sleep apnea can be a life-threatening medical condition. It is a known predictor of mortality in patients with coronary artery disease[2]; in fact, long-term studies have demonstrated benefits from treatment of OSA in patients with coronary artery disease.[3] Eskafi and colleagues reported successful use of an oral device in a case of congestive heart failure.[4] Silverberg and colleagues noted that even with essential hypertension, treatment of OSA can help improve the quality of life.[5]

Sleep apnea is defined as the cessation of breathing for 10 seconds or more during sleep.[1] It can be central (neurologically based), obstructive (caused by collapse and closure of a portion of the airway by mechanical means), or a mixture of both. This discussion will be confined to obstructive sleep apnea, which is the form susceptible to treatment with an oral appliance.

In OSA, the negative pressure created during inhalation causes a portion of the airway to close. The patient experiences a decrease in oxygen saturation as normal breathing ceases. Once the saturation reaches a critical level, the brain triggers the body to attempt to breathe, which usually creates a negative abdominal pressure. Eventually, the body overcomes the obstruction with increased respiratory attempts, typically generating a loud "snorting" sound that can be mistaken for simple snoring.[1]

Unfortunately, only a sleep test or polysomnogram (PSG) can distinguish between simple snoring and OSA. These tests are done overnight in special sleeping environments, with channels to monitor EEG, ECG, electromyography (EMG), electro-oculography (EOG), and levels of sleep, breathing, airflow, and oxygen saturation. A physician trained in sleep medicine makes a diagnosis of OSA using several parameters, the most com-

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mon being the Apnea-Hypopnea Index (AHI). Hypopnea is a reduction in airflow by 50% for 10 seconds or more, usually associated with a decrease in blood oxygen saturation.[1] The AHI classifies the number of apneic or hypopneic events over a night of sleep as mild (5-15 per hour), moderate (15-30 per hour), or severe (more than 30 per hour).

The standard treatment for OSA is a Continuous Positive Airway Pressure device (CPAP), which pushes air into the oropharynx during exhalation, thus preventing an airway collapse from negative pressure.[1] Although these devices have become quite portable, some patients cannot tolerate them due to claustrophobia or other physical problems. Oral appliances may be an alternative in such cases, but according to the American Sleep Disorders Association, they should be prescribed only in cases of mild-to-moderate OSA or simple snoring.[6]

Oral Sleep Appliances

Oral sleep appliances of various designs and materials have been used for more than two decades. There are two major categories—Tongue-Retaining Devices (TRDs) and Mandibular Advancement Appliances (MAAs)[6,7]—but each type operates by moving the tongue out of the posterior pharynx to open the airway.

With a TRD, the patient forces the tongue into a small anterior suction cup that holds the tongue forward and out of the airway during sleep. These appliances have a limited following, because patients tend to report paresthesias ("pins and needles") from the long-term suction, and will often break the suction voluntarily before getting an entire night's sleep.[7] Nevertheless, a TRD would be the appliance of choice in an edentulous patient.[7]

The MAA uses the dentition to anchor a mandibular protrusion that keeps the airway patent, much like the CPR maneuver of jutting the jaw forward to open the airway.[7] Two-piece MAAs usually have screws for fine-tuning the amount of protrusion, or tube-and-piston assemblies that can be adjusted with spacers. These tend to break more easily than the one-piece devices, but a one-piece MAA cannot be readjusted during treatment without constructing a new appliance.

For proper device retention, the patient needs a minimum of eight healthy teeth in each arch, with no active periodontal disease or dental mobility. Any active dental diseases—especially those requiring endodontic or prosthetic procedures[1,7]—should be resolved before taking impressions for an oral appliance. Patients with a history of TMJ disorders (particularly chronic pain) should not be fitted with an MAA, because the protrusive positioning may lead to a recurrence of or increase in TMJ pain.

Clinical Procedures

Before treating a patient with an oral sleep appliance, the orthodontist should ensure that a PSG is on file to show that the diagnosis of OSA was made by a physician, not by a dentist. The diagnosis should indicate an inability or disinclination to wear a CPAP for treatment. In my experience, sending a copy of the PSG along with the usual forms can be helpful with some insurance carriers. Many insurance companies will not cover these devices, however, even for medical treatment, and the patient should be advised that it may be an out-of-pocket expense.

At the initial examination, I record the patient's symptoms (daytime somnolence, headaches, etc.) and perform an oral examination that includes the number and stability of teeth, the periodontal condition and mobility of teeth, any active dental diseases requiring restorations, and an evaluation of the TMJ. A lateral cephalogram is taken to establish the airway position at rest.

If no contraindications are found, alginate impressions with deep borders are taken and poured in dental stone. A wax or polyvinyl siloxane bite registration is then made with the mandible positioned forward to about 80% of maximum protrusion. This advancement will open the airway without placing undue strain on the TMJs. The impressions and bite registration are sent to a laboratory for construction of the appliance; I prefer a simple one-piece MAA (Fig. 1).

At the initial placement visit, the device is fitted and checked for comfort, and adjustments are made as needed. A lateral cephalogram taken with

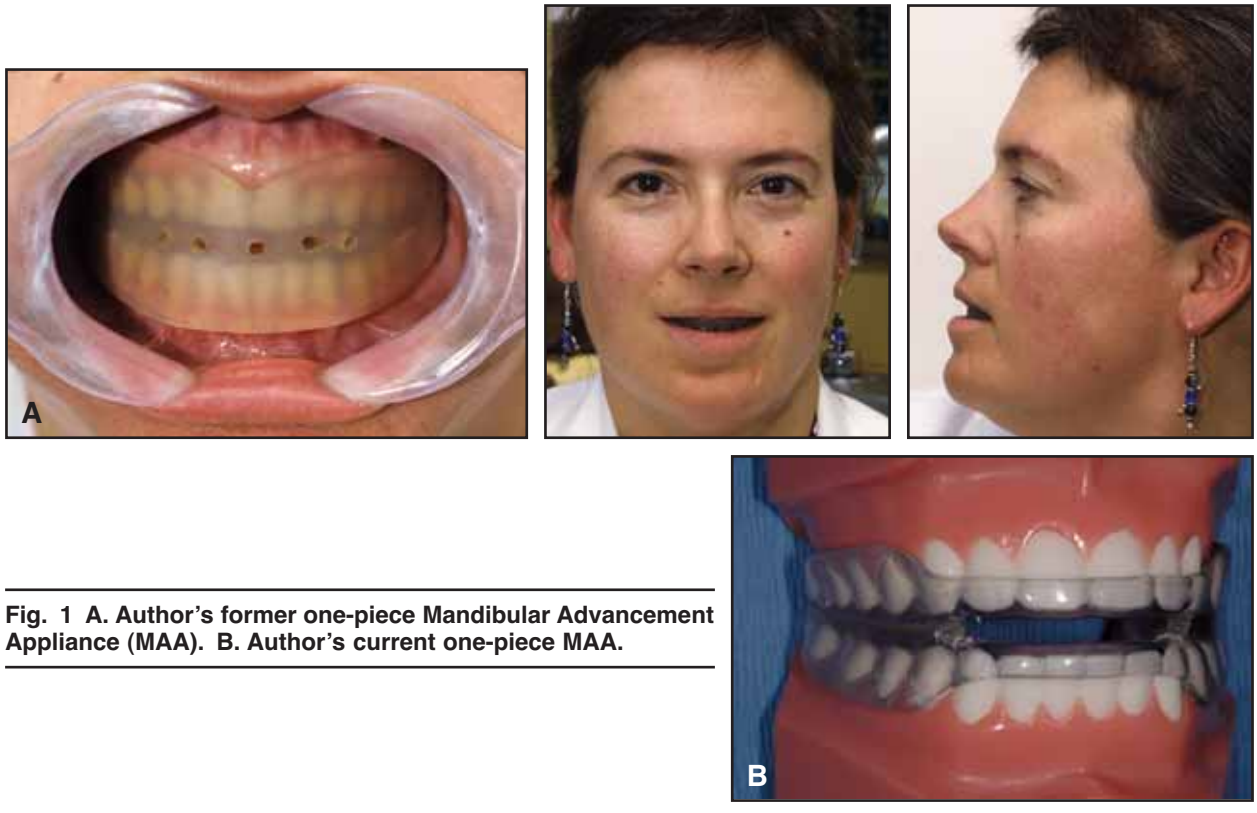

Fig. 1 A. Author's former one-piece Mandibular Advancement Appliance (MAA). B. Author's current one-piece MAA.

the appliance in place is compared to the baseline headfilm. The patient is informed of possible side effects and common problems while getting used to the appliance, and appointed to return in four to six weeks for re-evaluation. I find that most patients take about two weeks to adjust to wearing the appliance throughout the night.

The follow-up exam should review the patient's initial symptoms and their resolution. We often ask the sleeping partner whether the patient has stopped snoring, or no longer stops breathing, while wearing the device. Adjustments can be made to improve comfort.

If little or no improvement is noted despite proper wear of the device, and no TMJ discomfort precludes it, a new set of impressions and a bite registration in a more protrusive position can be made to improve the efficacy of the appliance. Once the patient is satisfied, he or she should be sent back to the referring physician for a repeat PSG with the appliance in place. Further adjustments can then be made according to the recommendations of the report and the tolerance of the patient.

Side Effects

According to Ferguson and colleagues, the most commonly noted side effects from use of oral sleep appliances are TMJ pain, myofascial pain, dental pain, salivation, TMJ sounds, dry mouth, gingival irritation, and morning-after occlusal changes.[7] Any side effects are generally mild, and typically resolve within a few weeks with continued appliance use. TMJ pain can be a long-term effect, however, and is the most common reason for discontinuing use of an oral appliance.[7]

Long-term occlusal changes, usually involving proclination of the mandibular incisors and retrocli-

nation of the maxillary incisors, have also been noted.[7-10] After reviewing many long-term studies, Ferguson and colleagues concluded that all patients wearing oral sleep appliances should be followed for extended periods to monitor such changes.[7]

Conclusion

Every dental practitioner should be familiar with sleep disorders and have an established medical referral system. Oral appliances have been proven effective in the treatment of simple snoring and mild-to-moderate obstructive sleep apnea. With little change in routine, orthodontists can prescribe these appliances to current patients and offer additional services for other medical patients in need.

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