

ROLE OF ORAL APPLIANCES TO TREAT OBSTRUCTIVE SLEEP APNEA

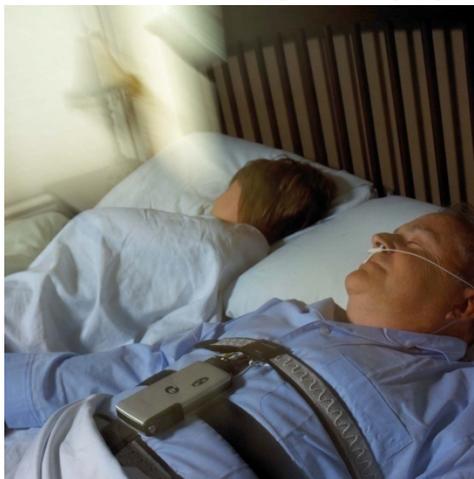
There are three documented ways to treat obstructive sleep apnea:

1. CPAP device
2. Oral Appliances
3. Surgical correction of nasal and oral obstructions

In 2006 in the medical journal ***Sleep*** (January issue) the sleep specialists represented by the American Academy of Sleep Medicine stated for the first time that oral appliances are the best treatment option for patients with mild to moderate obstructive sleep apnea. They are also indicated for patients who cannot wear the CPAP (Continuous Positive Air Pressure) device or are unable to lose weight.

The majority of the oral appliances that are fabricated for patients with an adequate number of teeth are mandibular repositioning appliances that reposition the lower jaw and tongue forward to open the pharyngeal airway. The ideal design for oral appliances are two piece appliances that can be adjusted either laterally, anterior-posteriorly or vertically.

PRE TREATMENT SLEEP STUDY



EMBLETTA HOME SLEEP STUDY

Prior to the fabrication of an oral appliance the patient must have either a home sleep study (Embletta X100) or a polysomnogram done in a hospital or private sleep clinic. The home sleep study or hospital sleep study must be diagnosed by a certified sleep specialist. Patients with severe obstructive sleep apnea will be encouraged to wear the CPAP device. The CPAP has proven to be most effective in the treatment of patients with severe obstructive sleep apnea (OSA). If the patient is diagnosed with mild or moderate sleep apnea and there are no co-morbid medical disorders or sleep disorders then the sleep specialist should recommend the oral appliance.

Unfortunately, many sleep specialists do not have an appreciation of the effectiveness of oral appliances in the treatment of OSA. They will often dismiss the patient who has mild OSA and who snores and not even recommend oral appliances. Most sleep specialists also recommend CPAP for moderate OSA patients despite what their guidelines have

recommended. Dentists must educate themselves in the area of OSA and learn to work with the sleep and ENT specialists in an effort to treat their patients.

Diagnosis of Obstructive Sleep Apnea

Obstructive sleep apnea is a common sleep disorder breathing problem that affects approximately 20% of adults. It occurs when there is an obstruction in the nasal, oral or pharyngeal airway and the patient's ability to breathe is partially or fully inhibited

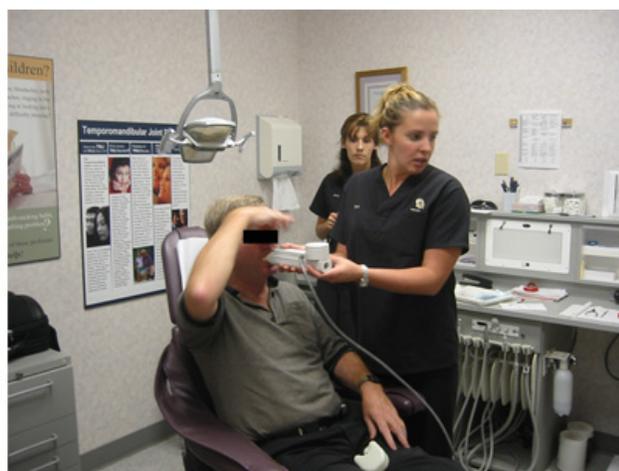
Apnea is defined as the cessation of breath for more than 10 seconds. A hypopnea is a reduction in airflow accompanied by a drop in oxygen saturation.

AHI Apnea Hyponea Index

Mild OSA	5-15 events per hour
Moderate OSA	16-30 event per hour
Severe OSA	Over 30 events per hour

Appliance Fitting

The most critical element to appliance success is the bite registration and the position of the mandible. A vertical or protrusive change of 1mm or less can make or break the success of oral appliance therapy. Patients are tested in their natural position using the Acoustic Pharyngometer to identify site and severity of upper airway collapse. Recent research has shown a strong connection between the minimum cross-sectional area (MCA) of the airway and both the presence and severity of OSA in the patient. Bite repositioning jigs are used to open the bite and protrude the mandible while several additional Pharyngometer tests are taken in order to dial in optimal vertical and protrusive position. A bite registration is taken when the optimal position is found.



Design of Oral Appliance

The ideal oral appliance is two separate parts, an upper and lower joined at the side with either a screw or a strap to slowly advance the mandible forward in 1 mm increments or less (U.S. Medicare guidelines). There are over 90 different oral appliances to move the lower jaw forward and open the bite. In the U.S. in order to receive compensation from insurance companies it is important only to use appliances that are FDA (Federal Drug Administration) approved. The lab fees for oral appliances range from \$200-\$600.

Three oral appliances that advance the mandible with side screws include:

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| 1. | Respire | \$199 |
| 2. | Dorsal | \$350 |
| 3. | Somnodent | \$600 |

These appliances depend on an adequate number of teeth for proper retention. Ideally you require 10 teeth on each arch and preferable posterior teeth for adequate retention. The ideal oral appliances have hard acrylic on the outside and a thermoplastic material inside (dual laminate) to improve patient comfort and acceptance. To increase retention ball clasps are sometimes used but this is not as comfortable and if they become distorted can cause spaces to open up between the teeth.

The advantages of oral appliances is that they are inexpensive, non-intrusive, easy to fabricate, reversible, easy for travelling and comfortable with a high rate of compliance.

Test Efficacy of Oral Appliances

The two main signs that a patient may have OSA are snoring and excessive daytime sleepiness. We recommend that all patients who snore should be screened for daytime sleepiness (Epworth Sleepiness Scale). It has been estimated that most patients who snore also have some degree of OSA.

1. Insert oral appliance, check for sore teeth or gums
Adaptation period 2 weeks
Patients snore or smoke have the tissue at the back of their throat including the uvula swell up as much as 30% due to the irritation. Usually this takes a few weeks to subside.
2. Titration period 2-3 months
Instruct the patient to start adjusting the oral appliance after a few weeks if the snoring persists. Advance the mandible slowly in order not to cause a problem for the temporomandibular joint.
3. Cessation of snoring – Home Sleep Study
When the patient reports that the snoring has decreased (including the level of snoring) then I recommend a home sleep study to check the efficacy of the oral appliance.
4. Evaluate home sleep study.

If the patient still has OSA instruct the patient to keep adjusting the appliance until sound of snoring is reduced. Some of our patients have 2-3 home studies until we eliminate the snoring, daytime sleepiness and number of apenic events.

5. Keep adjusting (titrating) oral appliance anteriorly and vertically until Embletta home sleep study shows a reduction in AHI index and an increase in oxygen saturation in the blood.
6. Recall patient in 6 months to check fit and comfort of the oral appliance
7. Recall the patient on a yearly basis to check oral appliance

The objective of oral appliance therapy is to resolve the snoring and obstructive sleep apnea with minimum discomfort and side effects.

Most patients agree that accepting minor side effects from oral appliance therapy is preferable to the serious health consequences that can result from severe sleep apnea.

Once the home sleep study (Embletta 100) shows that the oral appliance treatment has increased the oxygen saturation levels (ideally above 90%) and reduced the AHI by either 50% or below 5, the results are sent to the sleep specialist for their evaluation. When the sleep study indicates that the treatment with the oral appliance has successfully reduced or eliminated the sleep apnea then no further sleep studies are necessary. In cases where the patient has co-morbid medical problems or severe OSA the patient is instructed to go back to the hospital sleep clinic for a more comprehensive sleep study in order to prove the efficacy of the oral appliance.

To verify the efficacy of the oral appliance therapy follow-up sleep studies must be obtained to confirm the success or failure of the treatment. The objective is not only stop the snoring, which is a social nuisance, but also to correct the obstructive sleep apnea, which is a significant health risk. ¹

CPAP is still the most commonly prescribed treatment for patients diagnosed with moderate or severe obstructive sleep apnea. However, in a study published in *Chest* in 1996, Clark, Blumerfeld, "A crossover study comparing the efficacy and compliance rates of patients wearing CPAP devices with oral appliances demonstrated that patients prefer the oral appliances 20:1 (twenty to one)."

Another major problem with the CPAP device is the actual time it is worn by most patients. In a study published in *AM Rev Res. Dis.* in 1993, Kribs and Park reported "Objective measurement of nasal CPAP patterns of use by patients with obstructive sleep apnea," "most patients wear their CPAP machines an average of 4.5 hours per day, five days a week. This means the patients airway is unprotected approximately 50% of the time."

Adverse Effects of Oral Appliances

By holding the mandible forward and vertically open in the anterior, the oral appliance generates an anterior force on the lower incisors and a posterior force on the upper incisors. This could, over time, change the inclination of the incisors. However, when the oral appliance is made of hard acrylic the changes should be minimal²⁻⁸ When the appliances are first inserted, excess salivation and slight tooth and gum soreness sometimes occur. These slight irritations are corrected before dismissing the patient. There should be no discomfort when the patient wears the oral appliance. One common

problem is that patients will wake up in the morning and because the jaw was held forward all night, they cannot bite properly first thing when they awaken. If the patient had a healthy temporomandibular joint prior to treatment then this is only a short term problem that resolves itself within 10-30 minutes. Approximately 90% of the patients who continue treatment with oral appliances consider that the benefits of treatment outweigh the adverse effects as described above.⁹

Advantages of Oral Appliances

Effective in treating snoring and obstructive sleep apnea

- Reduction in the frequency and loudness of snoring
- Improved quality of sleep
- Reduced daytime sleepiness
- Improved airflow
- Smaller and more portable than CPAP devices makes them more comfortable for travelling
- Oral appliances fit comfortably inside the mouth and are worn all night and the compliance rate is high compared to CPAP

Minor Problems with Oral Appliances

- Discomfort and soreness from the oral appliance
- Excess salivation when appliance first inserted
- Changes in the position of the teeth
- Sore teeth and gums initially
- Temporomandibular joint discomfort
- Posterior open bite when patient wakes up in the AM

Oral appliances generally result in a reduction of snoring in a high proportion of patients^{10, 11} and other reported benefits include substantial improvement in daytime sleepiness, work performance and quality of sleep for both the patient as well as the bed partner. Oral appliances also reduce the AHI (Apnea Hyponea Index) oxygen desaturation frequency and intensity and the number of arousals during sleep^{11, 12} Oral appliance therapy has shown increased Slow Wave (Stage 3 Non REM restorative sleep) and rapid eye movement (REM Dreaming Sleep)^{13, 14} Studies that follow the long-term effects of oral appliances in the treatment of OSA suggest a high rate of success after follow-up periods ranging from two to five years^{15, 16}

Sometimes oral appliances can be worn with CPAP devices to increase the success rate of reducing OSA. Research has shown that when oral appliances are worn this allows for the reduction of the pressure for the CPAP device. One of the main objections to CPAP is that the pressure is too high and causes irritation to the throat and the nose. The reduction in pressure due to the oral appliance allows a higher compliance rate for CPAP which is particularly important in patient with severe OSA. Unlike CPAP which has a 60% failure rate after 1 year the compliance rate for oral appliances is high (75% - 100%)⁸ My clinical experience has been that the compliance rate with CPAP is much higher with severe OSA patients rather than mild to moderate

OSA. If the compliance rate is low with CPAP for patients with mild to moderate OSA then it seems logical that those patients should be referred for oral appliance therapy.

Good Candidates for Oral Appliances

- Healthy teeth
- Lack of periodontal (gum) disease
- No significant temporomandibular (TMJ) jaw joint problems
- Normal weight or only moderately overweight
- Underdeveloped lower jaw (buck teeth appearance)
- Airway obstruction is behind the tongue
- Diagnosed with mild to moderate obstructive sleep apnea by a sleep specialist following a hospital or home sleep study
- Moderate to severe OSA but cannot tolerate CPAP or refuse CPAP
- Do not respond to weight loss or change in sleep position
- Surgical corrections of nasal and throat obstructions did not solve the OSA completely
- Patient refuses surgical treatment

Summary and Conclusion

As I mentioned in the beginning there are three main ways to treat obstructive sleep apnea. Methods include CPAP, oral appliances and surgical corrections of the obstructed nasal or oral airways. Sometimes we need a combination of two of the three or all these to solve the problem. Oral appliances are the preferred method of treatment for many patients. The demand is extremely high since approximately 20% of adults have obstructive sleep apnea. The dental profession must make more of an effort to learn how to diagnose and treat patients with obstructive sleep apnea.