Obstructive sleep apnea: A dentist update

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Abstract

Sleep breathing disorder includes snoring, airway resistance syndrome and obstructive sleep apnea. Dentists play an important role in managing patients with snoring and mild to moderate obstructive sleep apnea (OSA). This article provides an update on latest diagnostic aids and treatment options for OSA.

Key words: Obstructive sleep apnea, oral appliances, polysomnography

Introduction

The most common amongst sleep disorders which has caught a lot of interest in the past decade is obstructive sleep apnea (OSA). OSA is caused due to the cessation of airflow due to saturation of oxyhaemoglobin, which results in difficulty in breathing. Individuals with reduced upper airway space, craniofacial anomalies, and individuals who are obese are at an increased risk of obstructive sleep apnea.  

Etiopathogenesis

The upper airway of the patients diagnosed with OSA will have a blockage, which may be caused by a variety of anatomic or pathologic conditions. When many of these patients relax and fall asleep, the tongue drops back and comes into contact with the posterior and lateral walls of the pharynx. In others, the tongue may not actually contact the walls of the pharynx, but when the patient attempts to inspire, the negative pressure created will suck the tongue and pharynx walls together. In either situation, the patient has an upper airway blockage that prevents air from reaching the lungs. Pathophysiology of OSA is described in Figure 1. Patients with OSA invariably exhibits severe, chronic, loud snoring. It is characterized by a blockage in the upper airway, which prevents air from reaching the lungs.

Clinical features

The clinical features of OSA includes excessive sleepiness during the day, impaired motor vehicle co-ordination, being prone to accidents and impaired cognitive senses. The most common clinical feature
is headache, which is accompanied by fatigue, sleepiness and tiredness. All patients have an increased pharyngeal resistance during inspiration to counteract the reduced upper airway space, which leads to pharyngeal dilator muscle contraction to maintain the airway.

**Diagnosis**
OSA can be classified as mild, moderate or severe, based on the apnea hypopnea index (AHI). An index of fewer than five episodes per sleep hour is considered normal, 10 to 20 episodes per hour as mild, 20 to 40 as moderate and more than 40 is considered as severe.5

1. **Clinical data**
The patient history should include snoring or witnessed apnea, age and gender. On general examination, the patient needs to be evaluated for hypertension, body mass, neck length and pharyngeal airway. Epworth sleepiness scale is a questionnaire based evaluation of the patient’s level of daytime sleepiness, where “never doze” is considered as 0, “slight chance of dozing” as 1, “moderate chance of dozing” as 2 and “high chance of dozing” as 3.

2. **Physiologic testing (Attended or unattended, at home or in laboratory)**
**Polysomnography:** A polysomnography (PSG) is a physiological study, usually attended by a trained technologist, and performed for a minimum of six hours during a patient’s normal sleep. The study records sleep staging and other physiological variables. Sleep staging includes electromyography (EMG), electroencephalography (EEG) and electrooculography (EOG). The PSG summary report usually describes the overall respiratory disturbance index (RDI), RDI while supine and RDI while in Rapid Eye Movement (REM) sleep, and the lowest oxygen desaturation. The sleep architecture of the patient is displayed as a graph through the night, called a hypnogram. To establish optimal therapeutic pressure, Continuous positive airway pressure therapy (CPAP) is usually initiated during polysomnography in the sleep centre. The pressure is increased upwards in small increments until apneic episodes are controlled or eliminated; often, the patient then experiences increased or rebound REM sleep.

**Pulse oximetry:** Arterial oxygen saturation is monitored by pulse oximetry. Oximetry as the sole physiological parameter has been investigated as a diagnostic test for OSA. Derived data usually includes the total desaturations, the desaturation index (DI) or number of desaturations per hour and SaO2 level.

3. **Imaging**
An imaging technique should be inexpensive, non-invasive, allow 3D volumetric reconstructions of the upper airway and perform dynamic state-dependent imaging.

**Acoustic reflection:** It is a non-invasive, radiation-free imaging technique, which is based on analyzing sound waves reflected from the upper airway. Because it is both fast and reproducible, it allows dynamic imaging of the upper airway. Studies using acoustic reflection has demonstrated reductions in the upper airway area of apneics, compared with normal controls.

**Fluoroscopy:** Fluoroscopic studies have shown that the retroplatal area is the main region of closure in upper airway in sleep apnea patients.

**Nasopharyngoscopy:** Nasopharyngoscopy permits direct observation of the dynamics of the pharynx, and is mainly used in the nasal passages, vocal cords and oropharynx.

**Cephalometry:** To examine hard tissue, soft tissue and airway from profile view.

**Computed tomography:** 3D reconstructions of the airway, soft tissue and bony structures can be obtained through axial CT images. Volumetric CT studies in sleep apnea patients who are obese have demonstrated a small upper airway and a large tongue volume. Dynamic imaging with electron beam CT has provided detailed information about the changes in upper airway changes during respiratory cycle.
**MR imaging:** It allows for better understanding of the upper airway and soft tissue.

**Treatment**

The treatment mainly involves diagnosis, consultation and recommendations of the physician. Auxillary procedures include maintaining a healthy BMI, healthy diet, daily exercises, cervical pillow, cessation of smoking and alcohol and altering the patient’s sleep position. The use of an appliance to advance the mandible or some form of a surgical procedure comprises the most significant component of the treatment.²

Steps in treatment plan:

I. **Behaviour modifications:** Modifications in behaviours such as sleep position, alcohol use, sedative use, smoking and the patient’s weight.

II. **Medications:** Even though listed as an option for physicians, little success has been demonstrated with the use of medications by these patients.

III. **CPAP therapy:** The initiation of CPAP (Continuous positive airway pressure therapy) results in relief of upper airway obstruction. CPAP acts as a “pneumatic splint” for the upper airway, and improves the function of dilator muscle, ventilator driving and morphology of upper airway. (Figure 2)

**Figure 2:** Mechanism of action of continuous positive airway pressure therapy

IV. **Oral appliances:** Diagnosis by clinician is an essential requisite of the condition. Oral appliances are commonly made up of thermoplastic materials.⁶ Commonly used oral appliances are shown in Figure 3, and it includes mandibular repositioning device or mandibular advancement device (e.g., Herbst appliance⁷/snoreguard⁸/silencer⁹), tongue repositioning device or tongue retaining devices (TRD)¹⁰, soft

**Figure 3:** Oral appliances used for OSA
palate lifters\textsuperscript{12}, tongue trainers\textsuperscript{12} or a combination of oral appliance and CPAP.\textsuperscript{12}

\textbf{Indications for oral appliance:}

\begin{itemize}
  \item i. Patients who do not respond to change in behavioural measures like weight loss or changing sleep positions;
  \item ii. Patients who have mild snoring and mild form of OSA;
  \item iii. Patients with moderate form of OSA should be treated with CPAP and oral appliances; and
  \item iv. Patients who are contraindicated for surgeries like tonsillectomy and adenoidectomy.\textsuperscript{13}
\end{itemize}

\textbf{Mode of action:}

The oral appliances functions mainly by preventing the tongue from obstructing the posterior part of the pharynx (Figure 4). The tongue retaining device and the mandibular advancement device prevents the posterior movement of the tongue by their maxillary and mandibular components. In 20-75\% of patients with OSA, there was relief in apnea, as the oral appliance improved the blood oxygen saturation levels and the apnea-hypopnea index was reduced to half or to less than 10 events per hour. Reduction in AHI index to normal is seen in 50-60\% of patients.\textsuperscript{14, 15}

\textbf{Limitations to oral appliances:}

\begin{itemize}
  \item i. Minimum set of teeth to retain the appliance
  \item ii. Minimum amount of mandibular protrusion of 5 mm
  \item iii. Minimum bite opening of 25 mm
  \item iv. Patients who have TMJ pain, bruxism and are obese
  \item v. Does not address central and mixed sleep apnea.
\end{itemize}

\textbf{V. Surgical:}

The nasal airway has a unique function; it provides a level of resistance for the upper airway, which optimizes alveolar gas exchange, including recovery of heat and water vapour. Septal deviations, turbinate hypertrophy and polypoid disease can be corrected with septoplasty, turbinate reduction and polypectomy, respectively. Adenoid obstruction of the posterior choanae can be improved by adenoidectomy. Condition like chronic sinusitis, which is refractory to medical therapy, may require sinus surgery to establish proper sino-nasal drainage and ventilation.

\textbf{Uvulopalatopharyngoplasty (UPPP)}\textsuperscript{16}: This procedure is designed to decrease the oropharyngeal collapsibility by reducing the soft palate, uvula, pharyngeal walls and tonsils. Laser-assisted uvulopalatoplasty has shown a good success rate of approximately 85\% for snoring.

\textbf{Radiofrequency volumetric tissue reduction (RVTR)}\textsuperscript{17}: RVTR of the palate is currently indicated only for snoring patients with an Recommended Daily Intake (RDI) of less than 15. The energy is delivered to the palate in the midline. A lesion is formed in the palate, which results in coagulative necrosis and contraction, resulting in a volumetric reduction and stiffening of the soft palate.

\textbf{Midline glossectomy:} Laser midline glossectomy is accomplished by vaporizing a 2.5 to 5 cm rectangular portion of the midline tongue with a laser.

\textbf{Mandibular osteotomy with genioglossus advancement}\textsuperscript{17}: Genioglossus muscle is attached to the geniotubercle of mandible. A rectangular osteotomy around the geniotubercle is accomplished on the labial surface of the anterior mandible.

\textbf{Hyoid myotomy and suspension}\textsuperscript{18}: The purpose of this procedure is to alleviate the redundant lateral pharyngeal tissue or retrodisplaced epiglottis. The hyoid is dissected in the midline and the inferior muscle attachments are released. The suprahyoid muscles are left intact.
Maxillomandibular osteotomy and advancement: Maxillomandibular advancement (MMA) anteriorly repositions the maxillary and mandibular framework and their attending muscular attachments. This procedure addresses the retropalatal and retrolingual regions, provides the essential tension for the muscle and improves space for the tongue. MMA may be considered as the primary treatment for OSA, when diffuse complex or multiple sites of disproportionate anatomy exist in the oral and hypopharynx.

Palatal implants: Adding inserts into the soft palate and thereby increasing the stiffness of the palate.

Conclusion
OSA is one of the important causes for reduced or impaired quality of life. Along with proper physician consultation and correct diagnosis of the cause and severity of the sleep disorder, a dentist can help the patients live a better life.

References