

# Sleep Apnoea: Etiology, Surgical Management and Appliance Therapy

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## ABSTRACT

**Sleep apnoea is one of the common sleep disorders. It is a condition in which breathing stops for more than ten seconds during sleep. It is a major, though often unrecognized, cause of daytime sleepiness. A sleeping person normally breathes continuously and uninterrupted throughout the night. A person with sleep apnoea, however, has frequent episodes (up to 400-500 per night) in which he or she stops breathing. This interruption of breathing is called "apnoea." Breathing usually stops for about 30 seconds; then the person usually startles awake with a loud snort and begins to breathe again, gradually falling back to sleep.**

**Key Words: Obstructive Sleep Apnoea, Central Sleep Apnoea, Orthognathic Surgery, Mandibular Advancement Device**

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## INTRODUCTION

Upper airway sleep disorders (UASDs) includes conditions affecting upper airway that diminish sleep time and/or sleep quality, resulting in patients manifesting symptoms such as day time sleepiness, tiredness and lack of concentration. Patients with UASD are more prone to accidents.<sup>1</sup> **Sleep Apnoea** is defined as the cessation of airflow, a complete obstruction for at least 10 seconds with a concomitant 2 to 4% drop in arterial oxygen saturation. Hypopnea is characterized by a reduction in airflow of at least 30 to 50% with a drop in oxygen saturation. Apnoea hypopnea index (AHI) is the average number of apnoea and hypopnea per hour of sleep<sup>2</sup>

Sleep apnoea can be further characterized into three types: central sleep apnoea (CSA), obstructive apnoea (OSA), and complex or mixed sleep apnoea (i.e. a combination of central and obstructive) constituting 0.4%, 84% and 15% of cases respectively. In CSA, breathing is interrupted by a lack of respiratory effort; in OSA, there is a physical block to airflow despite adequate respiratory effort, and often snoring is present caused by abnormal airway (base of tongue and soft palate) anatomy and altered respiratory control mechanisms.<sup>3</sup>

Some of the major signs and symptoms of sleep apnoea are:- loud and chronic snoring, choking or gasping during sleep, long pauses in breathing, daytime somnolence, morning headaches, anxiety.

The severity of OSA is classified on the basis of the patient's AHI index into three categories:<sup>3</sup>

1. Mild OSA (5 to 15 events per hour)
2. Moderate OSA (15 to 30 events per hour)
3. Severe OSA (more than 30 events per hour)

## ROLE OF DENTIST IN MANAGEMENT OF SLEEP APNOEA

A **dentist** may be first health care provider to identify an individual with sleep apnoea because of several signs like: a neck circumference more than 42.5 cm, excess fat deposition in the palate tongue and pharynx causing narrowing of airway, micrognathia, soft palate is elongated and enlarged and is positioned posterior to pharyngeal wall, uvula is not seen during phonation<sup>5</sup>

## TREATMENT MODALITIES OF SLEEP APNOEA<sup>6,7</sup>

- 1) Lifestyle changes :lose weight, quit smoking, avoid alcohol and sleeping pills, Maintain regular sleep hours.

- 2) Medical modalities: it includes-treating the underlying condition, using supplemental oxygen while sleeping, use of breathing devices:- like nasal continuous positive airway pressure (CPAP) which has proven to be very effective.
- 3) Dental management includes,
  - 3.1 Devices/Appliances: two basic types recognized are; mandibular advancement device and tongue retaining devices.
  - 3.2 Besides these oral appliances,
    - orthognathic surgeries like maxillomandibular advancement, genial advancement with or without hyoid suspension, septoplasty and turbinate reduction.
    - Soft tissue surgeries like uvulopalatopharyngoplasty, laser assisted uvulopalatopharyngoplasty (LAUPP), tracheostomy.
  - 3.3 Implant retained oral devices in edentulous patients: As dental appliances require retention in patient dentition, edentulous patient do not qualify for this treatment, so in these patients implant retained oral devices can be used, and also mandibular and tongue advancement splints can be used. **Wearing complete denture** during sleep improves apnoea hypnoea index of most edentulous sleep apnoea patients. In contrast, some patients suffer from apnoea hypnoea index increases. Therefore, careful monitoring and evaluation should be done, when complete dentures are fabricated for edentulous patients.

## DISCUSSION

### 1.1 Obstructive sleep apnoea<sup>5, 7,8</sup>

Obstructive sleep apnoea/hypnoea syndrome (OSA/HS) may be defined as the coexistence of unexplained excessive daytime somnolence with at least five obstructed breathing events occurring per hour of sleep. Apnoeas are defined in adults as breathing pauses lasting > 10 sec and hypnoeas as > 10 s events where there is continued breathing but the ventilation is reduced by at least 50% compared to the previous baseline during sleep. As a syndrome, OSA/HS is the association of a clinical condition with specific abnormalities on testing ; asymptomatic individuals with abnormal breathing during sleep should not be categorized under OSA/HS. In most population based studies focusing on sex-specific prevalence , a 2- 3 fold greater risk for men compared with women has been reported, but little progress has been made in understanding the reasons for the risk difference. OSA prevalence appears to increase steadily with age in midlife. Several studies have found OSA to be highly prevalent in age group of 65 and above.

#### Etiology :-

- **Obesity:-** Obese individuals with especially increased obesity in the neck region, are at a greater risk of developing OSA, because the fat tissue further tends to constrict the airway. **C.F.Ryan et al** found that obesity may occur as a consequence of a regulatory failure of energy intake or energy expenditure.
- **Enlarged tonsils, enlarged tongue , jaw deformities, malignancy in neck, blocked nasal passages:-** **T.Young et al** contributed that in some people, the airway is blocked by enlarged tonsils, an enlarged tongue, jaw deformities, or growths in the neck that compress the airway. Blocked nasal passages may also play a part in some people.
- **Alcohol or Tranquilizers:-** People who consume alcohol or take tranquilizers in the evening lower their "respiratory drive" in the nervous system, reducing breathing rate and strength thereby worsening the situation, because these factors relax the neck muscles.
- **Risk factors:-** Risk factors for developing OSA are: Male sex, Pregnancy, A family history of the disorder, Smoking.

### 1.2 Central sleep apnoea

Central sleep apnoea is a condition characterized by respiratory pauses due to a lack of respiratory effort. These occur occasionally in normal subjects, particularly at sleep onset and in rapid eye movement sleep. Recurrent CSA is most commonly found in the presence of cardiac failure or neurologic disease, especially stroke.

#### Etiology:-

In central sleep apnoea, the airway remains open, but the **nerve signals controlling the respiratory muscles** are not regulated properly. This can cause wide fluctuations in the level of carbon dioxide (CO<sub>2</sub>) in the blood. CSA occurs

during sleep because when a person is awake, breathing is usually stimulated by other signals, including conscious awareness of breathing rate.<sup>7,8</sup>

### 1.3 Mixed sleep apnoea:-

A combination of the two forms is also seen in some individuals, and is called mixed sleep apnoea. **Mixed sleep apnoea** episodes usually begin with a reduced central respiratory drive, followed by obstruction.

### 1.4 Symptoms of sleep apnoea:-

OSA and CSA have similar symptoms. The most common symptoms include:

- Daytime sleepiness
- Morning headaches
- Snoring
- A feeling that sleep is not restful
- Disorientation upon waking
- Poor judgment
- Personality changes
- Nocturia

### 1.5 Diagnosis:-

#### 1.5.1 Medical diagnostics<sup>9,10</sup>

Excessive daytime somnolence (EDS) is the complaint that usually brings a person to the doctor. A careful medical history includes questions about alcohol or tranquilizer use, snoring (often reported by the person's partner), and morning headaches or disorientation. A physical examination of the throat should be done carefully, to look for narrowing or obstruction. Blood pressure is also measured. Measuring heart rate or blood levels of oxygen and CO<sub>2</sub> during the daytime is not done usually, since these are abnormal only at night in most patients.

Confirmation of the diagnosis usually requires **polysomnography** study, and is conducted during an overnight stay in a specialized sleep laboratory with computerised recording equipment and the presence of technical staff. Other tests include :-Nasopharyngoscopy, Neurophysiologic tests, Throat microphone, Respiratory tests, Cardiological tests, Apnoea/hypopnoea index (AHI), Fibreoptic endoscopy

A clinician may perform an awake video **nasopharyngoscopy** under local anaesthesia, asking the patient to perform a reverse-Valsalva manoeuvre (i.e take a deep inspiration with a closed nose and mouth) in order to locate the site of airway collapse (base of tongue, pharyngeal walls or soft palate).

**Neurophysiologic tests** help in determining the sleep stage and arousals [electroencephalography/ EEG, electromyography/EMG (sub-mental muscle tone) and electrooculography(eye movements)]

**Throat microphone** detects snoring sounds.

**Respiratory tests** measure oxygen intake [oro-nasal airflow, rib cage and abdominal wall motion, arterial oxyhaemoglobin saturation)

**Cardiological tests** document secondary cardiovascular changes (electrocardiograph/ ECG and blood pressure)]. Recently, some institutions have begun to document SAHS by use of a portable sleep monitoring device in the patient's home.

The **apnoea/hypopnoea index (AHI)** [also termed the respiratory disturbance index (RDI)] is used by many clinicians to confirm the diagnosis and to quantify the severity of illness. The AHI is calculated by adding the number of apnoeas (cessation of breathing for 10 seconds or more) and hypnoeas [reduction in tidal volume accompanied by a 3% or greater fall in oxygen saturation (SaO<sub>2</sub>) or arousal from sleep] for the duration of the study and dividing that by the number of hours slept. Mild SAHS is defined as an AHI of 5–20 per hour of sleep, moderate SAHS as an AHI of 20–40 per hour of sleep and severe SAHS as an AHI greater than 40

#### 1.5.2 Dental diagnostics<sup>11,12,15</sup>

Quite often, a dentist may be the first healthcare provider to identify an individual with SAHS because its pertinent signs and symptoms are often identifiable in the dental practice. Some of the most common findings in the medical

history include: age over 45, male gender, daytime sleepiness, snoring, hypertension, difficult tracheal intubation for the administration of a general anesthetic, and type 2 diabetes mellitus.

Common clinical findings include:

- ❖ **mild-moderate obesity**, [a body mass index(BMI, greater than 29 kg/m<sup>2</sup>) and a neck circumference greater than 42.5 cm (subcutaneous masses externally compresses the pharynx),
- ❖ excess fat deposition in the palate and tongue (possibly causing a **truemacroglossia**) and pharynx (intraparyngeal/visceral fat masses narrow the airway).
- ❖ Individuals with small (**micrognathia**) and repositioned (**retrognathia**) jaws are also at risk. The tongue, be it enlarged or of normal size but with reduced functional space (relative macroglossia) is forced posteriorly toward the pharyngeal wall and superiorly above the plane of occlusion.
- ❖ Similarly, the soft palate (which is usually elongated and enlarged) is positioned posteriorly, adjacent to the pharyngeal wall.
- ❖ The uvula is not usually seen during phonation as it lies below the base of the posterior/superiorly positioned tongue

It's not uncommon for dentists to be consulted by physicians and asked to obtain and evaluate **lateral cephalometric radiographs** of patients with suspected SAHS. The radiographs of individuals with SAHS commonly presents as a retropositioned maxilla and mandible, a shortened cranial base, an inferiorly set hyoid bone, enlarged soft palate and tongue, and a narrowed posterior airway spaces

## 1.6 TREATMENT<sup>12,13,14,15</sup>

The management of these patients is carried out by multidisciplinary approach which includes :-

### 1.6.1 Behavioral changes;-

Treatment of obstructive sleep apnoea begins with :-

- Reducing the use of alcohol or tranquilizers in the evening,
- Weight loss is also effective,
- Changing sleeping position may be effective; Turning to sleep on the side may be enough to clear up the symptoms. Raising the head of the bed may also help.
- Opening of the nasal passages can provide some relief. There are a variety of nasal devices such as clips, tapes, or holders which may help. Nasal decongestants may be useful, but should not be taken for sleep apnoea without the consent of the treating physician.

### 1.6.2 Oxygen and drug therapy

Supplemental night time oxygen can be useful for some people with either central and obstructive sleep apnoea.

### 1.6.3 Drugs

The drugs that have been most commonly prescribed in an attempt to treat OSA include;-Progestogens, Acetazolamide, Theophyllines , Anti depressants

### 1.6.4 Mechanical ventilation

In individuals afflicted by moderate to severe sleep apnoea, the most successful treatment is night time use of a ventilator, called a CPAP machine. **Richard et al** reported long term compliance with nasal continuous positive airway pressure (CPAP)therapy after 3 years study in sleep apnoeic patients. **Somers et al** contributed that increase in blood pressure can also be reversed by CPAP therapy.

### 1.6.5 Surgery:-

The surgeries which can be performed are following:-

- Tracheostomy: Tracheostomy was the first successful surgical treatment for OSAS and has virtually a 100% success rate because it bypasses the obstruction of the upper airway completely.
- Uvulopalatopharyngoplasty: Fujita and colleagues were the first to describe the use of uvulopalatopharyngoplasty (UPPP) for treating OSAS in 1981." This procedure involves shortening the soft

palate, amputating the uvula, and removing redundant lateral and posterior pharyngeal wall mucosa from the oral pharynx.

- Hyoid suspension surgery: HSM is performed in conjunction with tracheostomy. This method enhances the anterior superior repositioning of the tongue base, enlarges the airway in a lateral dimension, and partially separates the tongue base from the lower airway by an infrahyoid myotomy.<sup>12</sup>
- Genioglossus advancement: Genioglossus advancement surgery is indicated for patients whose examination and cephalometric analysis are consistent with abnormalities of the craniofacial skeleton.
- Septoplasty and turbinate reduction: These are the most commonly employed surgeries for sleep apnea in patients with nasal obstruction, including deviated septum and enlarged turbinates, and have been proved helpful in some patients, especially by allowing the patient to better tolerate
- Orthognathic surgery: Surgical advancement of the mandible repositions the anterior belly of the digastric, mylohyoid, genioglossus, and geniohyoid muscles forward, which results in pulling of the tongue upward and away from the pharynx. Advancing the maxilla pulls the soft tissue of the palate forward and upward which in turn also pulls the palatoglossal muscles and increases tongue support. Riley et al. evaluated patients and concluded that there is an excellent chance of correcting the obstructive process using orthognathic surgery. It proved to be as effective as CPAP.<sup>15</sup>

Pre-surgical evaluation, which includes polysomnography, physical examination, cephalometric analysis and fiberoptic pharyngoscopy plays a vital role in determining the site of obstruction.

**1.6.6 Oral appliances** :- Oral appliance therapy was initially endorsed as effective management of obstructive sleep apnoea by the American Academy of Sleep Medicine in 1995. In 2005, the Standards of Practice Committee of the AASM updated the practice parameters for the use of oral appliances and approved them as appropriate first line therapy for snoring, mild and moderate obstructive sleep apnea.<sup>13</sup>

The base of the tongue is moved farther from the airway tissues to a position where contact and obstructions are less likely or unable to occur. Increased airway volume leads to a slower rate of flow, which increases air pressure (Bernoulli's Principle), and as such increased tone is imparted to the tongue by the stretching of the masseter muscles.

Finally, as the hyoid bone is raised and advanced by the action of the digastric muscles, greater stability of the airway musculature is achieved and resistance to airflow is further decreased.

The first type of oral appliance is known as a tongue retaining device or TRD. The second type is variously called an oral protrusive device (OPD) or mandibular advancement device.

**Mandibular splint** or **Mandibular Advancement Splint (MAS)** commonly known as "mandibular advancement devices," "sleep apnea oral appliances," and "sleep apnea mouth guards." treat snoring and sleep apnea by moving the lower jaw forward slightly, which tightens the soft tissue and muscles of the upper airway to prevent obstruction of the airway during sleep.



**MANDIBULAR ADVANCING SPLINTS**

#### **Appliances for edentulous patients:-**

Edentulous OSAHS patients are generally excluded from MRA therapy (**Hoekema et al. 2004**). In theory, a considerable proportion of OSAHS patients do not qualify for MRA therapy. This study demonstrated that placement

of endosseous implants, in order to stabilize and retain an MRA, is worth the consideration in edentulous OSAHS patients.

### CONCLUSION

Treatment of sleep apnoea requires multidisciplinary approach which include, life style changes, oxygen and drug therapy, mechanical ventilation, uvulopalatopharyngoplasty, orthognathic surgery, and occlusal appliances like mandibular advancing splints, tongue retaining device. These oral devices appear to work best for patients with mild-to-moderate OSA, and in some cases can postpone or prevent the need for surgery. Their rate of patient compliance is about 50%; most patients who stop using oral appliances do so because their teeth are in poor condition

### REFERENCES

- [1]. Chiramana Sandeep, Anne Gopinadh, Muvva Suresh Babu et al "Revival of the Eclipsed: The 5th Dimension of a Prosthodontist INTERNATIONAL JOURNAL OF DENTAL CLINICS 2011;3(1):71-74
- [2]. Padma A, Ramakrishnan N, Narayanan V. Management of obstructive sleep apnea: a dental perspective. Indian Journal of Dental Research 2007;18(4):201-9.
- [3]. Ivanhoe JR, Cibirka RM, Lefebvre CA, Parr GR."Dental considerations in upper airway sleep disorders: a review of the literature." The Journal of Prosthetic Dentistry 1999;82(6):685-98.
- [4]. Yoshida K. Prosthetic therapy for sleep apnea syndrome. The Journal of prosthetic Dentistry 1994; 72(3):296-302
- [5]. Block A J, Boysen P G , Wynne JW , et al "Sleep apnoea, Hypnoea and oxygen desaturation in normal subjects". The New England Journal of Medicine,300(10), 1979
- [6]. Melvin L and Ergun O "Mass Loading, Sleep Apnoea, and the Pathogenesis of Obesity Hypoventilation". AM Rev Respira Dis 1982;126:640-645
- [7]. Haponik E F, Smith P L , Bohlman ME et al " Computerized Topography in Obstructive Sleep Apnoea". Am Rev Respr Dis 1983 ;127: 221- 226
- [8]. L ' E strange PR , Battagel PM , Nolan PJ et al " The importance of a multidisciplinary approach to the assessment of patients with obstructive sleep apnoea". J Oral Rehab 1996 (23) ;72-77
- [9]. Javaheri S, Parker TJ, Liming JD et al " Sleep Apnoea in 81 Ambulatory Male Patients with Stable Heart Failure". Circulation.1998;97:2154-2159
- [10]. 27. Battagel JM, L'Estrange PR, Nolan P et al "The role of lateral cephalometric radiography and fluoroscopy in assessing mandibular advancement in sleep-related disorders. Eu.J. of Ortho 1998;20 :121-132
- [11]. 42.. Jauhar.S, Lyons MF, Banham SF et al "The attitudes of general dental practitioners and medical specialists to the provision of intra-oral appliances for The Management of Sleep Apnoea And Snoring" British Dental Journal 2008; 205: 653-657
- [12]. 43. Huseyin Kurtulmus, DDS, PhD & H. Serdar Cotert, DDS, PhD "Management of Obstructive Sleep Apnea with a Mandibular and Tongue Advancement Splint (MTAS) in a Completely Edentulous Patient. A Clinical Report. Journal of Prosthodontics 18 (2009) 348-352.
- [13]. 44 Arisaka H , Sakuraba s, Tamaki K "Effects of Wearing Complete Dentures During Sleep on the Apnea-Hypopnea Index" Int J Prosthodont 2009;22:173-177
- [14]. 45. Ogawa T, Ito T, Cardoso MV et al " Oral appliance treatment for obstructive sleep apnoea patients with severe dental condition" Journal of Oral Rehabilitation 2011 38; 202-207
- [15]. Prachi Gupta, RamThombare, A. J. Pakhan et al "Cephometric Evaluation of the Effect of Complete Dentures on Retropharyngeal Space and Its Effect on Spirometric Values in Altered Vertical Dimension" ISRN Dentistry Volume 2011, Article ID 516969, 9 pages.