



OBSTRUCTIVE SLEEP APNEA IN ADULTS: A REVIEW

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ABSTRACT

The clinical manifestations of Obstructive sleep apnea are related to obstruction of the upper airway, fragmented sleep, and the respiratory and cardiovascular consequences of disordered breathing. Excessive daytime somnolence is a key feature of OSAS resulting from disrupted sleep. Patients may report that they frequently fall asleep during the day while driving, working, reading and watching television. The present review article describes the investigation and management of Obstructive sleep apnea.

INTRODUCTION

It takes its name from the Greek word *apnea*, which means "without breath." Sleep apnea means "cessation of breath." It is characterized by repetitive episodes of upper airway obstruction that occur during sleep, usually associated with a reduction in blood oxygen saturation.^[1] People with sleep apnea literally stop breathing repeatedly during their sleep, often for a minute or longer and as many times.^[2] Estimated to affect 2% of middle-aged women and 4% of middle-aged men. In 1918 Sir William Osler coined the term "Pickwickian" to refer to obese, hypersomnolent patients.^[3-6] In 1956 Dr. Burwell and colleagues in describing several obese, hypersomnolent patients with respiratory and cardiac failure coined the term "Pickwickian Syndrome". It wasn't until 1965 that a French group of investigators, Dr. Gastault and colleagues made the important observation that "Pickwickian" patients had repetitive apnea events while asleep.^[7-11]

Following this, Dr. Kuhlo and colleagues (1969) described a marked improvement in patients treated with tracheostomy. In 1978, Dr. John Remmers described the interaction between sleep, the breathing muscles of the chest and the muscles of the upper airway which explained why the upper airway collapses during sleep, leading to obstructive sleep apnea.^[3,5]

APNEA

An apnea is defined as a cessation of airflow that lasts at least ten seconds.

HYPOPNEA

A hypopnea is defined as a significant reduction in airflow lasting at least ten seconds. Hypopnea is a 30% or greater reduction in flow associated with a 4% drop in oxygen saturation.

RDI INDEX

The American Academy of Sleep Medicine (AASM) rates the average number of obstructive sleep apnea events per hour as Respiratory Distress Index (RDI).

An RDI^[3-8] of

- 0 to 5 is normal
- 5 to 20 is mild
- 20 to 40 is moderate
- over 40 is considered severe

SYMPTOMS

Excessive daytime sleepiness, frequent episodes of obstructed breathing during sleep.

Because many patients are not aware of their heavy snoring and nocturnal arousals, it is helpful to question the bedroom partner.

Associated features may include

- Loud snoring
- morning headaches
- unrefreshing sleep,
- a dry mouth upon awakening
- chest retraction during sleep in young children (chest pulls in)
- high blood pressure,
- overweight
- irritability, change in personality
- depression, difficulty concentrating
- excessive perspiring during sleep ,heartburn,
- reduced libido, insomnia
- frequent nocturnal urination (nocturia),
- restless sleep, nocturnal snorting, gasping, choking (may wake self up)
- rapid weight gain, confusion upon awakening .

PATHOGENESIS^[11-12]

During inspiration a negative intrapharyngeal pressure develops but airway collapse is prevented by the action of the pharyngeal abductor and dilator muscles.

These muscles are activated rhythmically during daytime respiration but, they become hypotonic during sleep, and airway stability becomes dependent upon pharyngeal

size and pharyngeal tissue compliance. Apnea occurs when the throat muscles and tongue relax during sleep and partially block the opening of the airway.

As yet, little is known about the compliance of the pharyngeal tissues. However, conditions that reduce airway dimensions result in OSA.

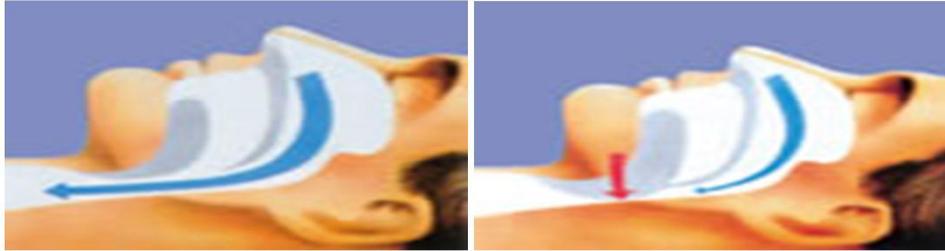


Figure 1 Position of tongue and Throat

PREDISPOSING FACTORS

1. Age due to loss of muscle mass is common and replacement with fat, leaving the airway narrow and soft.
2. Men have a greater risk for OSA.
3. Retropositioned maxilla and mandible.
4. Obesity: Rivlin suggested that peripharyngeal deposition of fat may have contributed to sleep apnea.
5. Habitual snoring – Many, but not all individuals with sleep apnea experience.
6. Symptoms of snoring, gasping, and choking during sleep.
7. Family history – Inherited characteristics in the face and neck can cause breathing abnormalities.
8. Immune abnormalities –IL-6 and TNF-alpha may both play a role in obesity as well.
9. Individuals with severe heartburn (Gastroesophageal reflux disease, or GERD) appear to be at higher risk.
10. Enlarged tonsils and adenoids, the main causes of OSA in children.
11. Drugs - increases the degree of relaxation of the upper airway muscles and interfere with the brain's arousability
 - a. Alcohol
 - b. Sedative drugs (eg. benzodiazepines - valium, ativan)
 - c. Sleeping pills

- d. Anaesthetics.
- e. Narcotics (codeine, morphine).

12. Smoking, which can cause swelling of the upper airway.
13. Hypothyroidism, acromegaly, amyloidosis, vocal cord paralysis, Marfan's.
14. syndrome and Down syndrome.
15. Nasal congestion.
16. Neuromuscular disorders such as postpolio syndrome can result in inadequate.
17. neuromuscular control of the upper airway and lead to obstructive sleep apnea.

INVESTIGATIONS^[1,3,9-12]**RADIOGRAPHS**

Radiographic studies that have been found to be useful include lateral neck films that can demonstrate adenotonsillar hypertrophy and some other airway lesions.

The significant advantages of cephalometry are its easy access, low cost, and minimal radiation.

The exposure should be taken at the end of the expiration.

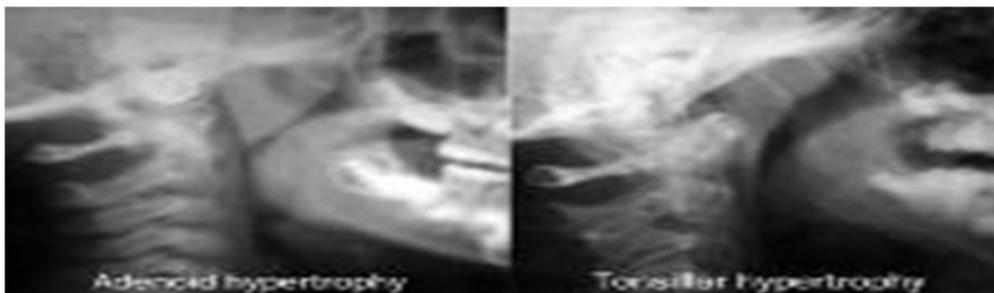


Figure 2: Radiographic examinations

CEPHALOMETRIC VALUES

MP-H is the distance between the mandibular plane and the hyoid bone. The reference range is 11-19 mm. The longer the distance, the higher the possibility of the patient having OSA.

PSN-P is the length of the velum of the palate. The reference range value is 37 ± 3 mm.

G is the width of the velum of the palate. The reference range is 6-10 mm.

PAS is the PAS or retroglossal space; the reference range is 10-16 mm.

Retropalatal space is the narrowest measurement between the posterior surface of the velum of the palate and the posterior pharyngeal wall.

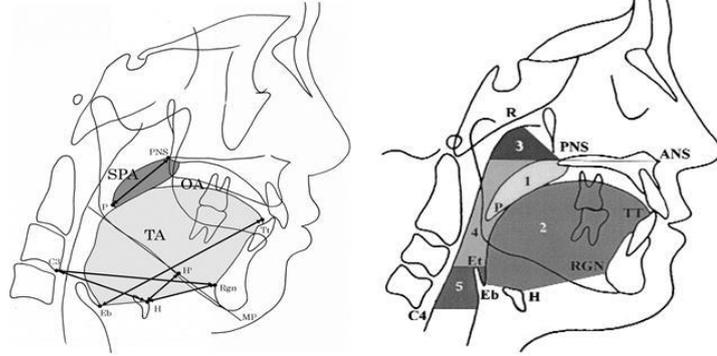
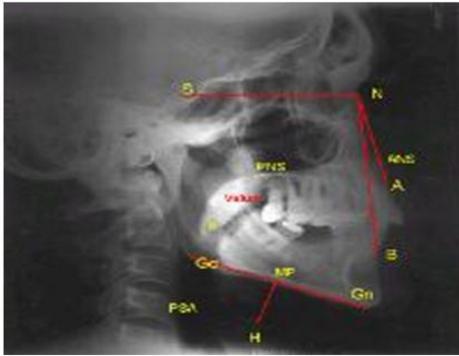


Figure 3: CEPHALOMETRIC CHARACTERISTICS OF OSA

TREATMENT OPTIONS^[12-19]

Selection of treatment(s) for individual OSA patients should be based upon balanced consideration of disease severity and site(s) of obstruction, subjective symptoms, risks of morbidity and mortality, and patient choice.

Treatment effectiveness is variable and dependent on patient needs. It is believed that treatment must be evaluated over time for good patient outcome.

NONSPECIFIC THERAPY

These measures should be included in the treatment of all patients with OSA but should be used exclusively only in patients with very mild apnea whose main complaint is snoring.

- *Losing weight.*
- Avoidance of alcohol for 4-6 hours prior to bedtime, and sleeping pills.
- Positional therapy can be used to treat patients whose OSA is related to body positioning during sleep.

Positional therapy has its limits, but it has been tried with success in some patients.

SPECIFIC THERAPY

The specific therapy for sleep apnea is tailored to the individual patient based on medical history, physical examination, and the results of polysomnography.

Medications are generally not effective in the treatment of sleep apnea.

OXYGEN ADMINISTRATION

1. Oxygen is sometimes used in patients with central apnea caused by heart failure. It is not used to treat obstructive sleep apnea.
2. Supplemental oxygen may be helpful in patients who have frequent and severe desaturations.
3. Oxygen at the correct flow rate when used in conjunction with nasal CPAP, however, in many cases corrects this problem.
4. It is essential for the appropriate oxygen flow rate and appropriate nasal CPAP pressure to be determined while the patient is being monitored during nighttime sleep in a qualified sleep disorders center or apnea laboratory.

Physical or Mechanical Therapy

Patients with mild apnea have a wider variety of options, while those with moderate to severe apnea should be treated with nasal CPAP.

Positive Pressure Therapy

It has three forms:

1. Continuous Positive Airway Pressure (Cpap),
2. Autotitration
3. Bi-Level Positive Airway Pressure.

In 1981 Drs. Sullivan, Berthon-Jones, Issa and Eves from Australia published the first account of treating sleep apnea patients with continuous positive airway pressure (CPAP) thus initiating the most common and successful treatment, currently known, for this disorder.

MECHANISM OF CPAP

CPAP, is administered at bedtime through a nasal or facial mask held in place around the patient's head.

The mask is connected to a small air compressor which sends air under pressure through the tube into the mask, where it imparts positive pressure to the upper airways.

This essentially "splints" the upper airway open and keeps it from collapsing in the deeper stages of REM sleep.

Regardless of the mechanism used it is desirable to use the lowest possible pressure to eradicate the sleep apnea. It is necessary to titrate the pressure to each individual patient during a polysomnogram.

Approximately 55 percent of patients who use CPAP do so on a nightly basis for more than four hours. It is the most commonly prescribed treatment for OSA.

CPAP decreases blood pressure, primarily in patients with severe OSA.

(Becker, 2003; Pepperell, 2002; Faccenda, 2001). Evidence also suggests that CPAP may improve left ventricular ejection fraction in patients with congestive heart failure and OSA (Kaneko, 2003).

ADVANTAGES

- Tissues are prevented from collapsing during sleep, and apnea is effectively prevented without surgical intervention.
- Daytime sleepiness improves or resolves.
- Heart function and hypertension improve.
- Quality of life improves.
- Survival rates may increase, according to some studies.
- Therapy improves obstructive sleep apnea, mixed apneas and some central apneas.

DISADVANTAGES

Many patients find the mask uncomfortable, claustrophobic or embarrassing.

Since CPAP is not a cure and must be used every night for life, non-compliant patients experience a full return of obstructive sleep apnea and related symptoms.

The sound of the machine may be disruptive.

Side effects may include

1. Difficulty exhaling, Inability to sleep, nasal congestion nosebleed sore eyes, sore or dry throat.
2. Headaches, abdominal bloating, chest muscle discomfort.
3. Mask-related problems such as rash, skin abrasions, and conjunctivitis (from air leakage).

Auto titration devices are designed to provide the minimum necessary pressure at any given time and change that pressure as the needs of the patient change.

The AutoSet acts by monitoring the patient's inspiratory flow-time curve. Monitoring and responding to the flow-

time curve, reduces the number of respiratory events and arousals improving sleep quality.

Bi-level positive airway pressure

Because the air pressure required to prevent respiratory obstruction is typically less on expiration than on inspiration, bi-level positive airway pressure machines are designed to sense when the patient is inhaling and exhaling and to reduce the pressure to a preset level on exhalation.

Bi-level positive airway pressure machines usually are used when the patient does not tolerate CPAP or when the patient has more than one respiratory disorder.

(Tan, L'Estrange EJO 2002) showed that the MAA may be a suitable alternative to nCPAP in patients with mild or moderate OSA and were well tolerated and preferred by the majority of subjects.

PHARMACOLOGICAL AGENTS

Thyroid hormone supplementation might lead to significant correction of the apnea if this is the sole problem. Control of blood sugar levels has, however, had at best a moderate effect in controlling the diagnosed obstructive sleep apnea.

Certain medications which increase respiratory drive are helpful in some patients.

PROGESTATIONAL AGENTS

Estrogen has shown to be used in central sleep apnea and obesity hypoventilation syndrome. not used in obstructive type.

OPIOID ANTAGONISTS AND NICOTINE

Shown to improve oxygenation. not clinically useful as these are short acting and disrupt sleep cycle

ACETAZOLAMIDE

Produces metabolic acidosis and stimulates ventilatory control centrally. very useful in periodic breathing and central sleep apnea. may be helpful in OSA

Tricyclic antidepressants

Protriptyline has been used in people with mild apnea and snoring with mild success.

It increases upper airway neuromuscular activity and decreases REM sleep. Protriptyline is not considered primary therapy for OSA.

Consider use in a person with mild apnea who does not want CPAP or an oral appliance.

Modafinil

May exert stimulant effects by decreasing GABA-mediated neurotransmission. Improves wakefulness in patients with excessive daytime hypersomnolence.

Central nervous system stimulants

NON AMPHETAMINE- Used for treatment of fatigue without interfering with normal sleep architecture. They promote wakefulness.

THEOPHYLLINE- Evidence exists to support its use in central sleep apnea. Also reduces obstructive events but causes severe sleep disruption

The search for a pharmacological agent to treat OSA has been disappointing though some patients respond to treatment.

SURGERY

Historically, surgical procedures for OSA treatment have included intranasal procedures, *reduction glossectomies*, *uvulopalatopharyngoplasty procedures* and *tracheostomy*.

DISADVANTAGE

The pain and expense of the surgery and the relatively poor long-term success rate because the obstruction is often present at multiple levels.

USES

1. Surgery may be appropriate for patients who cannot comply with or are not appropriate candidates for conservative therapies or nCPAP alone.
2. The type of surgery performed should be based upon the specific pathophysiology of a patient's condition.
3. Syndromic patients

Careful and thorough preoperative examination by radiography, imaging, and direct visualization is needed

to identify the airway obstruction site(s) and to select the appropriate surgery.

NASAL, SEPTAL AND ADENOID SURGERY

Weak or malpositioned cartilages around the nostrils can impede nasal breathing as will a droopy nasal tip or excessively narrow nostrils.

The nasal turbinates may become chronically enlarged usually as a result of allergies. Reduction in the size of the turbinates (*Turbinoplasty*) will improve nasal air flow.

If the septum is crooked, it may cause blockage of the nasal breathing passage. It is corrected by *septoplasty*.

An enlarged adenoid may occasionally interfere with breathing. An *adenoidectomy* removes this excess tissue to allow for unrestricted airflow through the nasal passages and upper throat.

TONSILLECTOMY

The removal of redundant tissue by tonsillectomy increases the caliber of the pharynx thereby reducing blockage to breathing.

Since the quality and quantity of tissue of the throat changes after tonsillectomy there can be a *subtle alteration in voice quality*.

In a mature adult, pain following tonsillectomy can be unpleasant, but is reasonably well controlled with prescription medication.

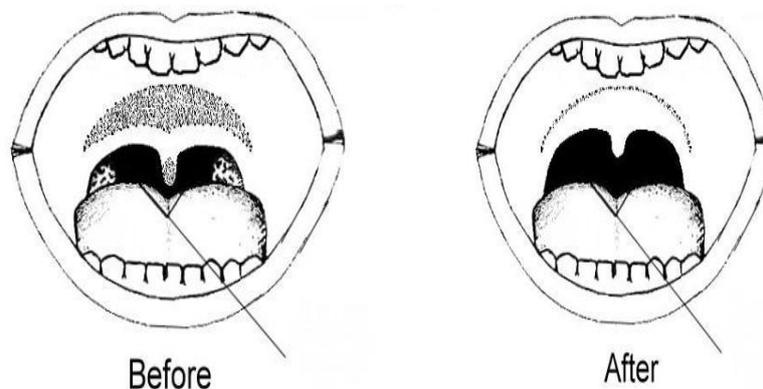


Figure 4: Tonsillectomy

GENIOGLOSSUS TONGUE ADVANCEMENT

The procedure is done through an incision below the gingiva in front of the mandibular anterior teeth.

After creating a small rectangular bone window, the tendons that attach the tongue to the jaw are pulled forward on a small bone fragment.

This produces a larger space between the back of the tongue and the throat thereby creating a wider airway.

There is minimal if any alteration in facial appearance. This operation is often performed in tandem with at least one other procedure such as the UPPP or hyoid suspension.

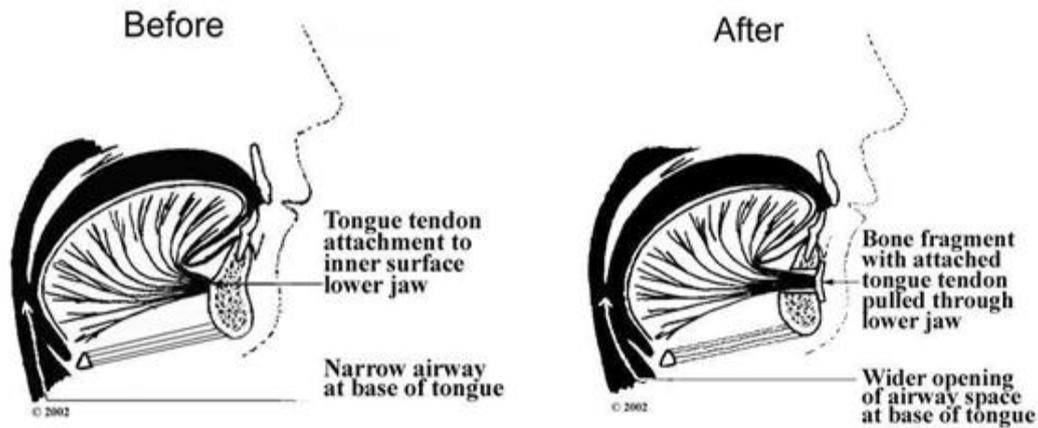


Figure 5: Surgical positioning of tongue muscles

MIDLINE GLOSSECTOMY

The efficacy of midline glossectomy (MLG) following failed UPPP is relatively low and is variably affected by body weight and OSA severity; the long-term outcome after MLG is unknown.

CONCLUSION

- Sleep-breathing disorders are potentially life threatening; therefore, the diagnosis and treatment of these diseases are the domain of the medical profession.
- The prevailing opinion is that patients should be treated only with a referral by a physician.
- *As orthodontists we have a significant role in the diagnosis of sleep apnea and the oral appliance therapy to improve the quality of life to the apnea patients.*

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