Role of Orthodontist in obstructive sleep apnea - An orthodontic review

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Abstract

Obstructive sleep apnea (OSA) is a common sleep associated breathing disorder with profound effects on the health and quality of life of individuals suffering from it. Orthodontists should be well aware of the symptoms of this disorder and competent enough to recognize its signs and symptoms. Orthodontics is well suited for treatment of OSA patients due to their expertise and knowledge regarding growth and development of oro-facial and dento-facial structures as well as orthopedic, orthodontic and surgical correction of the jaws and other supporting tissues. The aim of this article is to provide an outlook to the essential role of orthodontists in the treatment of this serious disease.

Keywords: Obstructive sleep apnea, Orthodontics, Sleep, Snoring.

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Introduction

Obstructive sleep apnea (OSA**)** is a sleep-associated disorder of breathing with a reduction or complete airflow obstruction despite an ongoing effort by patient for breathing. It usually occurs during sleeping, muscles undergoes relaxation and causes collapse of soft tissue present in the back of the throat which leads to upper airway blockage (Fig. 1). Consequently, there is partial and complete pauses in breathing that last at least 10 seconds during sleep. Then, blood oxygen saturation, with oxygen levels decreases abruptly and falls 50 percent or more in severe cases. The brain shows response when there is less oxygen and alerts the body which causes a brief arousal from sleep. This restores normal pattern of breathing. This pattern can occur hundreds times in one night. This results a fragmentation in sleep quality and produces an excessive sleepiness during daytime.[1,2]

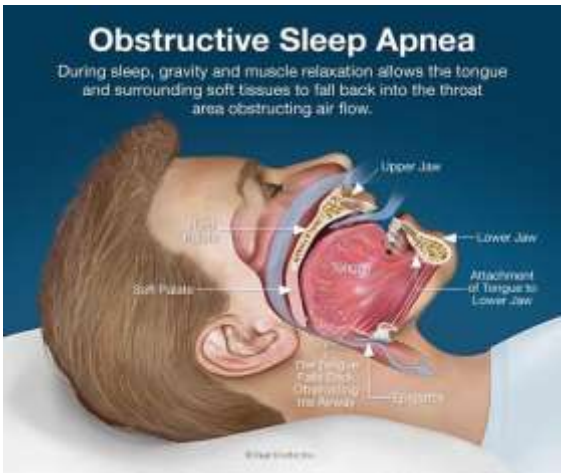

Fig. 1: Obstructive sleep apnea

Prevalence

Obstructive sleep apnea can occur in any age group, but it prevails mainly between of adults.[3]

Pathophysiology of obstructive sleep apnea

It has been considered that individuals with OSA have impairment in function of genioglossus muscle, which is a muscle of tongue. This causes the prolapse of the tongue against the posterior pharyngeal wall when there is inspiratory effort during sleep. Pharyngeal wall invaginates and airway occludes during sleep. Obstruction in nasal air flow increases air flow resistance, which in turn increases effort for inspiration and increases negative pressure in the pharyngeal wall airway (Fig. 2). This suction increases the chances of pharyngeal airway collapse.[4,5]

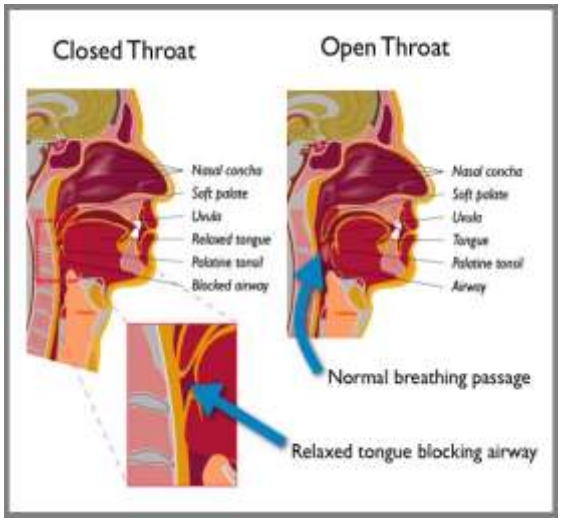

Fig. 2: Pathophysiology

Predisposing factors

Following are[6]:

- Obesity
- Presence of structural abnormalities that causes upper airway obstruction
- increasing age
- male gender
- smoking and alcohol consumption
- sedative drugs
- micorgnathia
- adenoids
- retrognathia
- enlarged tonsils
- enlarged tongue

Symptoms of obstructive sleep apnea[7]

- Snoring
- Apneic pauses i.e. choking, gasping, snoring during the night
- Restless sleep and increased body movements
- Bruxism (nocturnal tooth grinding)
- Nocturnal and daytime enuresis
- Neck hyper extension
- Growth failure restriction
- Mouth breathing, due to dryness in mouth
- Chronic nasal congestion
- walking during sleep
- Obesity
- Mouth breathing, due to dryness in mouth
- Fatigue
- Mood changes; irratitability, frustration, impatience, depression, anxiety.
- Aggression and hyperactivity
- Poor school performance
- Poor concentration, and distraction
- Infraorbital venous congestion

Features of Obstructive Sleep Apnea[8]

- excessive daytime sleepiness (Fig. 3)
- impairment in concentration
- snoring
- disturbed sleep
- choking episodes during sleep
- apnoeas
- personality changes
- nocturia
- decreased libido

Fig. 3: Day time sleepiness in OSA patient

Effects of obstructive sleep apnea[9]

- Fluctuations in oxygen levels
- Increased heart rate
- Chronic elevation in daytime blood pressure
- Increased stroke
- Heart disease
- Impairment in glucose tolerance and insulin resistance
- Impaired concentration
- Mood changes
- Increased motor vehicle accidents
- Disturbed sleep of the bed partner (Fig. 4)

Fig. 4: Disturbed sleep of other partner due to OSA patient

Diagnosis of obstructive sleep apnea

The frequency of pauses in breathing on an hourly basis is used for assessment of the severity of the obstructive sleep apnea hypopnea syndrome (OSAHS) and it is called the apnea/hypopnea index (AHI) or the respiratory disturbance index (RDI). It is the one most commonly used.[10]

OSAHS may be subdivided into three categories degrees of breathing abnormality, on the basis of AHI[11] (Table 1).

Table 1: Forms of OSAHS

S. No	Forms of OSAHS	AHI Score
1.	Mild	AHI 5-14/hr
2.	Moderate	AHI 15-30/hr
3.	Severe	AHI >30/hr
4.	Very severe	AHI >40/hr

a. **Subjective assessment of sleepiness**

Individuals with this disorder may present with non-specific symptoms such as poor concentration, irritability, personality changes and family problems. The patient should be asked the following questions:

- Are you falling asleep regularly against your will?
- Are you often feeling sleepy while driving?
- Are you having difficulty while working?
- Is surgery for snoring being performed?

The Epworth Sleepiness Scale (ESS) is a validated method used to assess the probability of falling asleep. The score subdivide the patients clinically into 4 categories (Table 2).

Table 2: Epworth Sleepiness Scale (ESS)

S. No	Types of Sleepiness	ESS Score
1.	Normal range	ESS <11
2.	mild subjective daytime sleepiness	ESS =11
3.	moderate subjective daytime sleepiness	ESS =16
4.	Severe subjective daytime sleepiness	ESS >18

b. **Objective assessment of sleepiness**

The Multiple Sleep Latency Test (MSLT) is used to measure the time to fall asleep (using EEG criteria). This is performed in a dark room on at least four separate occasions across the day. This period of time is called as sleep latency.

c. **Physical examination**

- Weight and height should be noted at the first clinic visit. Observe height and weight changes at all subsequent visits as approx 50% of patients with OSAHS are obese (BMI >30 kg/m2)
- Measure circumference of neck as patients with OSAHS often have increased neck circumference >17. (43 cm)
- Visually inspection for retrognathic mandible
- Assessment of patency of nasal airway
- Assessment of upper airway obstruction using indirect laryngoscopy if possible
- Inspection of the tongue for macroglossia
- Assess dentition for the presence or absence of teeth
- Assess pharynx for size of tonsil, appearance of uvula and size of lumen
- Measurement of BP
- Perform respiratory, cardiovascular and neurological examination for detection of any disease such as cor pulmonale, deformity in chest wall and myopathies.
- Observe the possibility of hypothyroidism, acromegaly and thyroid function tests should be indicated.

Tools used in diagnosis of obstructive sleep apnea

1. **Polysomnography (PSG):** Polysomnography records patterns of sleeping and breathing together. PSG is performed overnight at a sleep centre with the help of a technician. and a standard PSG typically consists of EEG, electromyogram, electro-oculogram, respiratory airflow, thoraco-abdominal movement and oxygen saturation tracings (oximetry).

Polysomnography requires about 30-60 minutes set up time before sleep and about 30 minutes detachment time in the morning. Staff should be present for at least ten hours overnight to perform and monitor this test[12,13].

2. **Oximetry:** Cheap recording pulse oximeters are readily available; therefore oximetry is used as the first screening tool for OSAHS. These are spectrophometric devices that are used for the detection and calculation of the differential absorption of light by presence of oxygenated and deoxygenated haemoglobin in blood. This is an method for detection of the blood oxygen saturation.[14]

Treatment of obstructive sleep Apnea

Treatment options can be broadly divided into[15]:

1. Behavioral interventions
2. Non-surgical options
3. Surgical options.

1. **Behavioral interventions:** Since patients with obstructive sleep apnea are obese, therefore patients should be advised to undergo weight reduction therapy as it improves symptoms of OSAHS and other related disorders. Smokers should be advised to stop smoking for general

health. Alcohol should not be used and drugs and sleeping tablets should be avoided as this may decrease airway dilator function and worsen OSAHS. Positional therapy is for patients who suffer from mild OSA. Patients should be advised from sleeping on their backs and head of the bed is raised to reduce symptoms.[16]

2. **Non-surgical interventions**
   a. **Continuous positive airway pressure (CPAP):** CPAP is the treatment option for moderate to severe cases of OSA. A continuous positive airway pressure machine is a new device with a mask that fits snugly over the nose of patient. It transmits a continuous flow of air and keeps the throat open throughout the night (Fig. 5).

Fig. 5: Continuous positive air pressure

Continuous positive airway pressure (CPAP) functions like a pneumatic splint and keeps the airway patent during sleep breathing. It works by means of a flow generator that delivers positive pressure through air tube to a nasal mask worn by the patient. This generation of airflow keeps the airway open and prevents pauses in breathing and restores normal oxygen levels. Newer CPAP devices are quite small, light and available with different mask sizes to achieve a good fit.[17,18]

Major side effects of CPAP are significant epistaxis, paranasal sinusitis but they are rare.

b. **Oral appliance therapy:** Orthodontic appliances should be fabricated in a way that it can be worn by the patient either in a permanent or removable manner depending upon the condition of the patient. These appliances bring the mandible and tongue forward, opens up the lower pharynx and allows continuous breathing during sleep.[19,20] Examples are tongue retaining devices (TRD) and mandibular advancement appliances (MAA) (Fig. 6, 7).

Fig. 6: Tongue Retaining Device

Fig. 7: Mandibular advancement devices

Indications

- Patients with snoring or mild OSA who do not respond for treatment with behavioral measures.
- Patients with moderate to severe OSA who refuse treatment with nasal CPAP.
- Patients who are not appropriate for tonsillectomy, adenoidectomy, and tracheostomy.

Mechanism of action

Oral appliances are used only during sleep which repositions the lower jaw, tongue, soft palate or uvula and maintains an open and unobstructed airway. It protrudes the mandible and tongue forwards and prevents upper airway collapse during sleep (Fig. 8, 9).

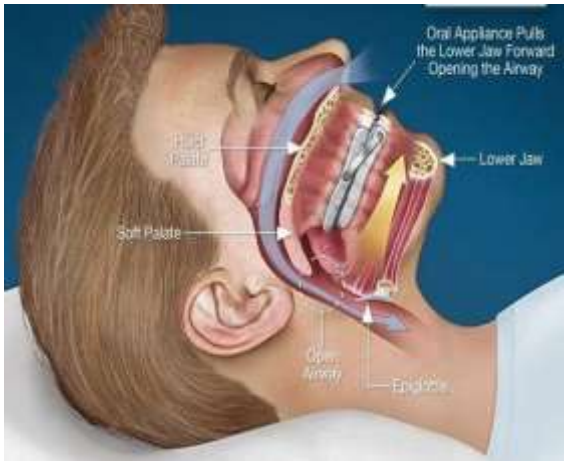

Fig. 8: Oral appliance in OSA patient

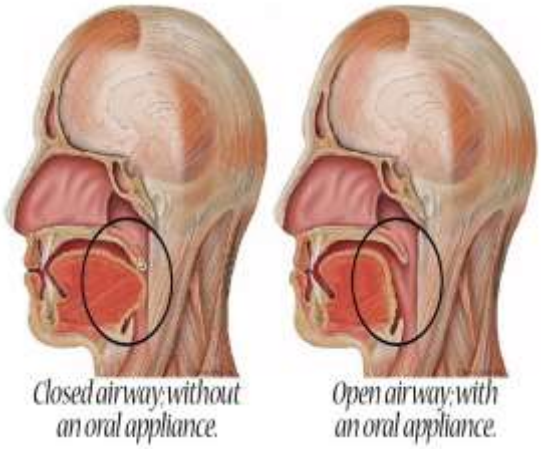

Fig. 9: Comparison between open airway and closed airway with oral appliance

Advantage of Oral appliances

- Significant reduction in breathing pauses
- Improvement of airflow for some patient with apnea
- Reduction in the snoring and
- High compliance level as compared to CPAP.

Disadvantages of Oral appliances

Reciprocal forces are generated on the teeth and jaw by mandibular advancement splints which results in dry mouth, gum soreness, salivation, tooth pain, headaches, and TMJ problems.[21,22]

c. **Surgical interventions:** Surgery is considered when noninvasive therapy such as CPAP and oral appliances has been not successful. It is done in a situation when there is any deformity in anatomic structure that can be later on corrected to eliminate the breathing problems. It addresses the problem by reduction of tissue from the soft palate, uvula, tonsils, adenoids or tongue[23].

Many different surgical approaches have been used in the treatment of OSAHS.

1. **Uvulopalatopharyngoplasty (UPPP):** It is the reconstruction of the throat by resection of posterior margins of the soft palate and unwanted mucosa present on the pharyngeal walls.[24]
2. **Adenotonsillectomy:** It is the surgical removal of the tonsils and adenoids and it is the most common treatment option for children with OSA.
3. **Tracheostomy:** Tracheostomy was the first surgical treatment for OSAHS and bypasses the obstruction completely.[25,26]

Other surgical techniques:

1. **Bariatric (weight reducing) surgery:** Weight influences the severity of OSAHS and weight loss is an effective treatment for OSAHS in some patients.[27]
2. **Nasal surgery:** Nasal surgery reduces nasal airflow resistance and reduces pressure and improves compliance with nasal CPAP.[28]

Consequences of untreated OSAHS

It includes road traffic accidents work due to day time sleepiness. Untreated OSAHS is associated with a multifold increase in risk of accidents. Patients may also experience impaired concentration due to tiredness, increased irritability, depression and mood changes. There is an increased risk of high blood pressure and may have a slightly increased risk of angina, heart attacks and strokes (Fig. 10, 11).[29]

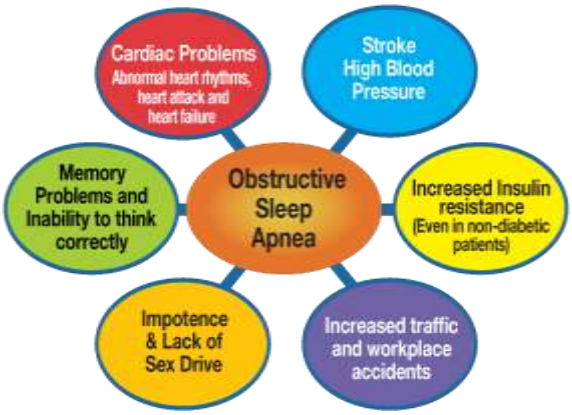

Fig. 10: Consequences of OSA

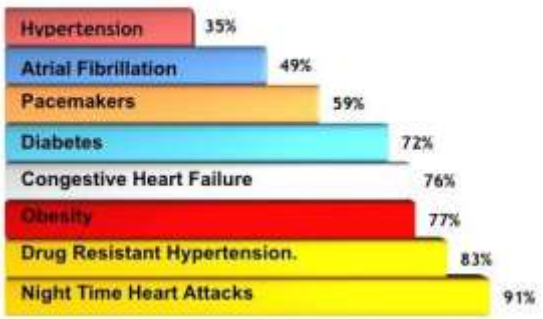

Fig. 11: Disease associated with OSA

Conclusion

The effects of untreated sleep apnea on daily activities are multiple and it includes excessive daytime sleepiness, impaired cognitive function, mood elevations and personality changes. It is also related with a reduction in quality of life and there can be adverse changes on others such as impaired relationships between spouses and partners. Symptoms of sleepiness sleep apnea are observed and these disorders need to be treated urgently. Orthodontists should play an active role in screening of patients for this disease and advise oral appliance therapy, if needed.

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