**Journal of Research in Medical and Dental Science**
**2022, Volume 10, Issue 10, Page No: 086-090**

Available Online at: www.jrmds.in
eISSN No.2347-2367: pISSN No.2347-2545

# Obstructive Sleep Apnea: A Comprehensive Review on its Diagnosis and Orthodontic Management

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## ABSTRACT

*Obstructive Sleep Apnea Syndrome (OSAS) is a respiratory sleep disorder that has serious consequences for one's health and the patients' quality of life. Orthodontists must recognise the disorder's signs and symptoms and offer orthopaedic, orthodontic, or surgical treatment between the jaws despite the fact that standard care is represented by orthodontics, Continuous Positive Airway Pressure (CPAP). Treatment with various oral appliances is possible with positive outcomes in carefully selected cases The main aim of this article is to explain the role of an orthodontist in the management of OSA, as well as a review of the main orthodontic therapeutic strategies that have been validated.*

**Key words:** Obstructive sleep apnea, Orthodontic treatment

**HOW TO CITE THIS ARTICLE:** Devashree Joshi, Pratiksha Lakhe, Priyanka Niranjan, Obstructive Sleep Apnea: A Comprehensive Review on its Diagnosis and Orthodontic Management, J Res Med Dent Sci, 2022, 10 (10): 086-090.

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**Received:** 02-Aug-2022, Manuscript No. JRMDS-22-47383;
**Editor assigned:** 04-Aug-2022, PreQC No. JRMDS-22-47383 (PQ);
**Reviewed:** 18-Aug-2022, QC No. JRMDS-22-47383;
**Revised:** 03-Oct-2022, Manuscript No. JRMDS-22-47383 (R);
**Published:** 13-Oct-2022

## INTRODUCTION

Obstructive Sleep Apnea (OSA) is a sleep disorder distinguished by apnea or periods of superficial or irregular breathing patterns (hypopnea) resulting from repetitive narrowing and collapsing of the upper airways during sleep. It is a typical chronic sleep related respiratory illness accompanied by sleep disruption, oxygen desaturation, and severe daytime lethargy. OSA is the most common type of sleep apnea, accounting for 85% of all cases. During sleep, partial or total breathing pauses lasting for at least ten seconds cause blood oxygen levels to drop by 50% or more in individuals with severe forms of the disease [1,2]. When there is reduced oxygen supply, the brain responds by notifying the body, causing a short waking from sleep. This restores the usual respiratory rate. This process can repeat itself numerous times in a single night. This leads to a fragmentation of sleep quality and excessive drowsiness during the day [3,4]. The Each hour of sleep, average frequency of apneas and hypopneas are measured in sleep analysis.

## LITERARTURE REVIEW

On the basis of number of interruptions and degree of severity, OSA is divided into three types:

- **Mild OSA:** It is when patient experiences 5 to 12 episodes of Apnea in one hour.
- **Moderate OSA:** When patient experiences 15 to 30 apneas within an hour.
- **Severe OSA:** When patient experiences more than 30 episodes of apnea within an hour.

### Prevalence

OSA generally affects people of any age; however it is most common in people in their forties and fifties. OSA affects at least 5% of men and 3% of women during the day, resulting in daytime sleepiness. OSA breathing symptoms are present in about 24% of males and 9% of women, whether with or no daytime drowsiness. Approximately 85% to 95% of persons with OSA are still unrevealed. OSA affects roughly 3% of children and is particularly prevalent during the preschool years [5-8].

### Risk factors

- Obesity, particularly adiposity in the upper body.
- Mandibular or maxillary hypoplasia is examples of cranial abnormalities.
- Tonsillar hypertrophy and increased pharyngeal soft or lymphoid tissue.
- Nasal obstructive disease (septal deviation, rhinitis).
- Abnormalities in the endocrine system (hypothyroidism, acromegaly).
- Genetic inheritances.
- Post-menopausal females.

- Excessive liquor consumption.

**Symptoms**

Obstructive sleep apnea has varied symptoms which include excessive daytime sleepiness, morning headache, short-term attention and memory impairment, personality changes, decreased alertness, which can lead to work, or road accidents; gastroesophageal reflux, hypertension, and impotence are the most common morning symptoms. Witnessed apneas, snoring, sleep disturbances; panting, suffocation feelings, and nycturia are all night time symptoms [9]. This results in poor work or school performance, cognitive deficits, and depression. OSA is rapidly being labelled a public health hazard; necessitating action should be taken to prevent it. Early diagnosis is the key for excellent treatment results.

**Diagnosis**

When a patient is a diagnosed case for OSA, an overnight Polysomnography (PSG), also known as a sleep study, is used to confirm the diagnosis. The Respiratory Disturbance Index is drawn from the findings of a sleep study (RDI). This is an indicator that counts how many apnic (total cessation of breathing) and hypnic occurrences happen per hour of REM and non-REM sleep. A person with a respiratory index of 20 has 20 apnic or hypopnic occurrences every hour, for example. The following is a list of respiratory index. Index value 5 is regarded as normal; RDI 5-15 is regarded mild; index value 15-30 is regarded as severe. If the patient denies to have a sleep study the subsequent treatment modality is undertaken which include placement of oral appliance, for which it is advised to get a consent from the patient before proceeding an oral appliance in their mouth.

**Tools for diagnosis of obstructive sleep apnea**

**Polysomnography:** Polysomnography is a technique that tracks both sleeping and breathing cycles. A standard PSG consists of EEG and oxygen saturation results and is performed overnight at a sleep centre with the assistance of a technician/assistant (oximetry). Before falling asleep, polysomnography requires about 30 minutes of setup time and roughly 30 minutes of separation time in the morning. To execute and monitor this test, technician should be present for minimum ten to eleven hours all night [10-12].

**Oximetry:** oximetry is frequently employed as the alternative screening method for OSAHS since it is cost effective and is easily obtainable. These are specttrophometric instruments that detect and calculate the difference in light absorption caused by the presence of oxygenated and deoxygenated haemoglobin in plasma [13]. This is a technique advised for identification of blood oxygen level.

**Treatment**

The treatment of OSA involves a wide range of medical and dental specialties, with many treatment options available. Patients with OSA have eight surgical therapy options and five conventional treatment options, according to the American Association of Sleep Medicine (AASM) [14]. All OSA affected people should give up drinking and tranquillizers. Weight loss promotes airway patency in some people by reducing apneic episodes. Pharmacotherapy's role in OSA is unknown, and the viability of potential pharmacotherapeutic therapies for OSA has yet to be determined.

The therapy options can be categorised into three groups:

- Sleep hygiene, ideal body position when sleeping and weight reduction are examples of behavioural therapies. Factors that may aggravate the risk of OSA are treated in cognitive behaviour therapy.
- Continuous Positive Air Pressure (CPAP) and Oral Appliance therapy (OA) are two non-surgical alternatives [15].
- Glossectomy,uvulopalatopharyngoplasty, adenotonsillectomy, tracheostomy, nose surgery, maxillomandibular advancement surgery (orthognathic surgery) are some of the surgical therapeutic interventions [16].

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**Non-surgical treatment modalities**

**Continous positive air pressure:** CPAP is the gold standard method for managing OSAs and is the primary treatment option for individuals with moderate to severe sleep apnea, irrespective of comorbidities, or for patients with mild sleep apnea and cardiovascular comorbid conditions like hypertension, coronary artery disease, or previous cerebrovascular accidents [17]. CPAP is a prominent treatment for OSA that upholds upper airway patency during sleep by delivering a consistent pressure throughout inspiration and expiration. It includes of a flow generator that employs a tubing system to deliver airflow at a continuous and same pressure to the patient through a mask. Nevertheless, adverse effects such as irritation, pressure sensitivity, claustrophobia, skin problems or lesions induced by the mask, mouth dryness, or nasal symptoms lead the majority of patients to stop treatment [18]. CPAP therapy is a lifelong treatment whose effectiveness is dependent on its regular use. Adherence to treatment is crucial, with CPAP compliance estimated to be between Fifty and Eighty percent of patients [19]. CPAP (continuous positive airway pressure) works like a pneumatic device to keep the airway open while napping. This airflow creation keeps the airway open, reduces breathing cessations, and recovers normal $O_2$ levels. Newer CPAP systems are compact, light-weight, and come with a variety of mask sizes for a suitable fit [20,21]. Severe epistaxis and paranasal congestion are the most common CPAP harmful effects [22]. Non-invasive ventilation is another

alternative. Nasal sprays can also be used [23]. It delivers favourable pressure respiratory assistance without the use of a cannula through nasal or facial masks [24].

**Oral appliances:** In order to better understand the tongue/mandible volume fraction in children, researchers used neuroimaging (MRI) for early diagnosis and treatment management [25].

Depending on the clinical history, orthodontic devices should be constructed in such a way that they can be used either permanently or detachable. This equipment move the jaw and tongue in forward direction, widening the lower pharyngeal area and allowing for uninterrupted inhalation and exhalation while sleeping. Tongue Retention Devices (TRD) and Mandibular Advancement Appliances are two examples (MAA).

MADs keep the jaw in a forward direction during sleep to keep the airway passage clean. MADs are splints that hold the lower jaw and tongue bulging during rest, exposing the airway, permitting for normal inhalation, and providing rapid relief [26]. They can be made to order or off the shelf, and they can be titratable or non-titratable. Maxillary expansion [27] and maxillomandibular advancement procedures have been shown to improve tongue placement, lower nasal airway obstruction, and minimise or eliminate OSA symptoms. MADs are more commonly prescribed than CPAP due to the patient's higher comfort and lower. Inadequate teeth to sustain the device, periodontal concerns causing tooth movement, active temporomandibular joint disorder, limited jaw mobility, such as an optimum protrusive distance less than 6 mm, and lack of sufficient manual dexterity or motivation to insert and eliminate the MAD are all factors that limit the use of MAD [28].

**Advantages**

- Considerably lowered breathing pauses
- Improved airflow for some apnea patients
- Reduced snoring and
- High regulatory level when subjected to CPAP.

**Disadvantages**

Mandibular advancement splints exert reciprocal stresses on the teeth and jaw, resulting in dry mouth, gum irritation, salivation, tooth ache, migraines, and TMJ issues.

**Tongue retaining mouthpieces**

TRDs have a small chamber that fits over the tongue and uses suction to keep it held forward, preventing it from sliding back into the airway, similar to MADs. The muscles linked to the genial tubercles may hold the lower portion of the tongue inadequately during sleep, obstructing the passage. The tongue retaining device is a one piece dental appliance that combines considerable mandibular protrusion with tongue retention in the anterior region. By opening the oropharyngeal passages, negative pressure and salivary adherence keep the tongue in an anterior position. These devices are typically employed in patients who are unable to have their mandible moved forward sufficiently. Although TRD has been demonstrated to be effective in the treatment of snoring, sleep apnea, and daytime sleepiness in limited populations, its tolerability has been found to be lower than MAD in some studies, and these appliances are not commonly suggested or used.

**Surgical treatment modalities**

When conventional therapy, such as CPAP and mouth appliances, has failed, surgery may be considered. When there is a malformation in anatomic architecture that can be repaired afterwards to minimize breathing issues, this procedure is used. It works by removing tissue from the “soft palate”, “uvula”, “tonsils”, “adenoids”, and “tongue” to solve the problem [29]. In the treatment of OSAHS, a variety of surgical methods have been used.

**Uvulopalatopharyngoplasty (UPPP):** It is the removal of the soft palate's posterior borders as well as any undesired mucosa on the pharyngeal borders to restore the throat.

**Adenotonsillectomy:** It is the most common therapeutic option for children having OSA and involves surgical removal of the tonsils and adenoids.

Tracheostomy: The first surgical intervention for OSAHS was a tracheostomy, which totally overcomes the barrier [30].

**Other surgical interventions:**

**Bariatric (weight reducing) surgery:** Weight affects the severity of OSAHS, and in some patients, reduction in weight is a beneficial cure for OSA [31].

**Nasal surgery:** Nasal surgery increases nasal CPAP compliance by reducing nasal airway resistance, pressure, and compliance.

**Consequences of untreated OSA**

Obstructive sleep apnea has a remarkable influence on one's standard of living and is linked to a range of undesirable health and security implications, such as cardiovascular events and car accidents. Excessive daytime sleepiness and impaired neurocognitive performance can be caused by short sleep duration. Sleep deprivation can have long-term health repercussions, including early death, cardiovascular disease, and diabetes development. Patients may also have trouble concentrating owing to exhaustion, irritability, sadness, and mood swings. There is a higher chance of excessive blood pressure, as well as a minor increase in the risk of angina, cardiac arrest, and seizures.

## DISCUSSION

Andreea Codruta Coman, et al. Cristina Borzan, et al. conducted a study in 79 sleep apnea subjects diagnosed with OSA using cardiorespiratory portable monitoring, under CPAP therapy, monitored in our Sleep Laboratory from January 2011 to December 2014. The quality of life in sleep apnea was better after CPAP

therapy than from baseline, according Calgary Sleep Apnea Quality of Life Index.

Serena Iacono Isidoro, et al. Adriana Salvaggio, et al. studied that perceived Health Related Quality of Life (HRQOL) is impaired in Obstructive Sleep Apnea (OSA). Two hundred ninety-seven consecutive outpatients were evaluated, before first clinical visit and nocturnal diagnostic examination (Time A), and after diagnosis disclosure (Time B). They concluded in the study that diagnosis communication improves patients' HRQOL, regardless of the severity. Changes in HRQOL after diagnosis disclosure may be due to patients' motivation for medical check and diagnostic expectations.

Erla Bjornsdottir, et al. Brendan T Keenan, et al. A total of 793 (96.5%) subjects were taken for the study. The study was conducted to draw a conclusion about difference between quality of life of treated obstructive sleep apnea patients and untreated patients. They concluded that untreated patients landed up on CPAP therapy within one year. Sleep cycle was slightly improved and quality of life was better.

S. Raghavendra Jayesh, et al. and Wasim Manzoor Bhat, et al. presented an overview on Mandibular Advancement Device (MAD). The primary purpose of MAD is to move the mandible forwards relative to maxilla in ordered to widen the airway to prevent to closure. Mandibular Advancement Device (MAD) has been a novel method in the management of OSA. They showed the improvement of quality of life with usage of MAD's. They concluded that using MAD's are useful modalities for treatment of obstructive sleep apnea [32,33].

## CONCLUSION

Sleep disorders are very widespread in the overall population, impacting 16% to 45% of the global population. The sleep pattern can be influenced by a variety of elements, including individual characteristics, cognitive functioning, physiological or emotional illness, and sleep environment settings.

Excessive daytime sleepiness, poor cognitive performance, mood elevations, and personality changes are all repercussions of untreated sleep apnea on daily activities. It's also linked to a decrease in quality of life, and it can have negative consequences for others, like strained relationships between families and companions. Tiredness and sleep apnea symptoms have been identified, and these illnesses must be properly diagnosed. Children should be involved in more physical activates and should avoid sitting ideal at home.

Orthodontists should assess patients for this condition and, if necessary, prescribe oral appliances. The orthodontist's role in the management of OSAs is highlighted in this article. Despite the fact that there are potential medicinal options available, CPAP and OAs is the most frequently employed disease specific therapy.

Orthodontists should take an active part in patient screening and, if necessary, recommend OAs therapy. OAs can be an effective treatment option for mild to intermediate OSA, but they must be monitored closely due to individual differences in response to this therapy. For a successful outcome, parents and patients must cooperate, as well as good interdisciplinary cooperation between the orthodontist and the sleep physician.

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