

Obstructive Sleep Apnoea: An Orthodontist's Perspective

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Abstract: Obstructive sleep apnoea is a sleep disorder that involves intermittent cessation or significant decrease in airflow in the presence of breathing effort due to recurrent episodes of upper airway collapse during sleep. Patients with undiagnosed sleep apnoea represent a major public health problem. Dental professionals can help them in recognizing the sleep disorder and co-managing the patients along with a physician or a sleep specialist. Oral appliance therapy is an important treatment modality for sleep apnoea patients.

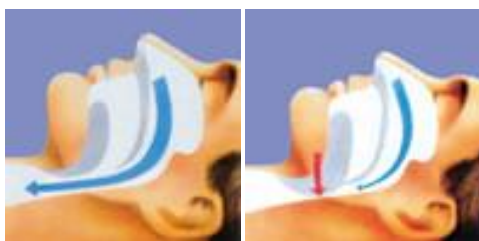
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I. Introduction

Greek term 'apnoea' implies 'without sleep'. Obstructive sleep apnea (OSA) is a sleep disorder that involves intermittent cessation or significant decrease in airflow in the presence of breathing effort due to recurrent episodes of upper airway (UA) collapse during sleep. Episodes may last 10 seconds or longer and commonly last 30 seconds or longer¹. Apnoea may occur hundreds of times nightly, 1-2 times per minute, in severe obstructive sleep apnoea patients, and it is often accompanied by wide swings in heart rate, a precipitous decrease in oxygen saturation, and brief electroencephalogram (EEG) arousals concomitant with breathing sounds as a bolus of air is exhaled when the airway reopens. Obstructive sleep apnoea events are most often associated with recurrent sleep arousals and hypoxia. Three cardinal symptoms of sleep apnoea include snoring, sleepiness, and significant-other report of sleep apnoea episodes.

Etiology And Pathogenesis

OSA is characterized by a collapsing of the tongue back out the pharynx during sleep. Typically this is because of large tongue, small air pathway or abnormal throat anatomy.



This blockage restricts breathing, lowering the concentration of oxygen in the blood until receptors in carotid sinus are altered to higher CO₂ levels in the body causing the patient to wake up and normal breathing is restored. When patient falls into deep sleep, tongue collapses again and another apnoeic episode takes place. Alcohol is frequently a co-factor because of its depressant influence on upper airway muscles and on arousal response that terminates each apnoea³. In most patients patency of the airway is compromised structurally and therefore predisposed to malocclusion. In minority of the patients, structural compromise is due to obvious anatomic disturbances such as adenotonsillar hypertrophy, retrognathia and macroglossia. However, in majority of patient's structural defect is simply a subtle reduction in airway size that can be appreciated as pharyngeal crowding and can be demonstrated by imaging techniques.

Prevalence

Breathing problems during sleep have an internationally reported prevalence of 3% to 27% for primary snoring, 4% to 20% for sleep-disordered breathing, and 1% to 10% for obstructive sleep apnoea (OSA). The adult prevalence rates of sleep disordered breathing are now available in many different countries after having large-scale epidemiological studies being conducted. For an overall estimation across different countries, it is

approximately 3 to 7 per cent for adult men and 2-5 percent for adult women in the general population. The increased prevalence of OSA among American Indians and Hispanic adults, and increased severity among Pacific Islanders and Maoris, were mainly explained by the increased obesity indices.

Signs And Symptoms

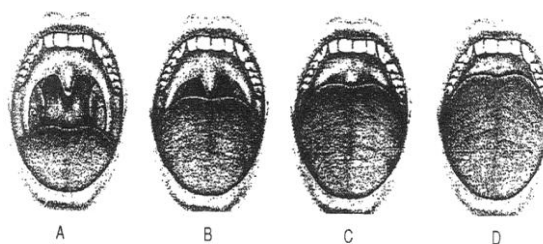
Nocturnal- drooling, xerostomia, sleep restlessness, witnessed apnoea, choking or gasping, diaphoresis. Diurnal- excessive sleepiness, morning headaches, non restorative sleep, GERD, impaired, concentration, depression, decreased libido, impotence, irritability.

Diagnosis

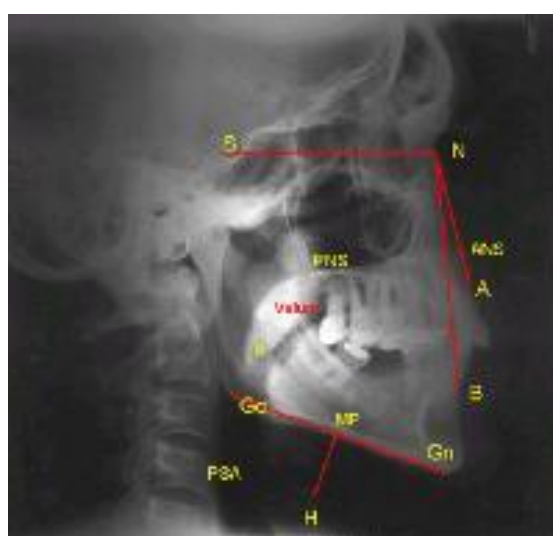
- Polysomnography is the gold standard for diagnosing OSA and consists of detailed overnight sleep study in a laboratory.



- The multiple sleep latency test (MSLT) is used to establish how rapidly the patients falls asleep to distinguish it from narcolepsy.
- The Epworth sleepiness scale is a questionnaire used to screen for sleep apnoea.
- The Mallampati score (grade 1-4) can be used as a predictor of sleep apnoea particularly in cases where an enlarged tongue seems to be the cause for airway obstruction.



- Lateral cephalometric radiographs reveal the diversion of airway column, position of hyoid bone and craniofacial skeleton for any maxillomanibular deficiencies⁴.



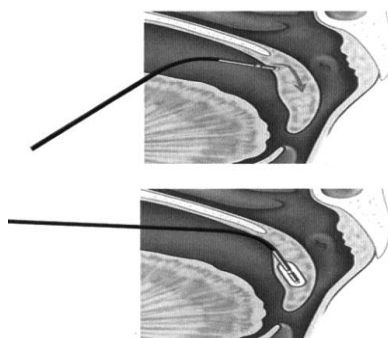
- Fibro-optic nasopharyngoscopy to examine three dimensional structure of the airway revealing any anatomic site of obstruction.
- CT and MRI.

Management:

1. Lifestyle changes such as weight management regime and positional therapy.
Body position greatly affects the number and severity of episodes of obstructive sleep apnoea, with at least twice as many apnoeas occurring in people who lay on their back as in those who sleep on their side.
2. Continuous positive airway pressure(CPAP)



3. Oral appliance therapy
4. Surgical management by uvulopalatopharyngoplasty, palatal pillar implant or somnoplasty.



Oral Appliance Therapy

The purpose of an oral appliance is to treat obstructive sleep apnea (OSA), primary snoring, and associated symptoms. Oral appliances are intended to decrease the frequency and/or duration of apnoeas, hypopnoeas, respiratory effort related arousals (RERAs) and/or snoring events^{5,6}. Oral appliances have been demonstrated to improve nocturnal oxygenation as well as the adverse health and social consequences of OSA and snoring. Oral appliances are indicated for patients with mild to moderate OSA and primary snoring.

Oral appliances are accepted therapy for patients with severe OSA who do not respond to or are unable or unwilling to tolerate positive airway pressure (PAP) therapies. Although oral appliances are typically used as a stand-alone therapy, they can serve as an adjunct to PAP therapy and/ or other treatment modalities for the management of OSA.

An oral appliance is custom fabricated using digital or physical impressions and models of an individual patient's oral structures. As such, it is not a primarily prefabricated item that is trimmed, bent, relined or otherwise modified. It is made of biocompatible materials and engages both the maxillary and mandibular arches. The oral appliance has a mechanism that allows the mandible to be advanced in increments of 1 mm or less with a protrusive adjustment range of at least 5 mm. In addition, reversal of the advancement must be possible. The protrusive setting must be verifiable. The appliance is suitable for placement and removal by the patient or caregiver. It maintains a stable retentive relationship to the teeth, implants or edentulous ridge and retains the prescribed setting during use. An oral appliance maintains its structural integrity over a minimum of 3 years.

Indications For Oral Appliance Therapy-

- Primary Snoring
- Selected Patients with OSA

- CPAP Intolerance
- Surgical Contraindications

Oral appliances, also called dental appliances or devices, may be an option for patients who cannot tolerate CPAP. The American Academy of Sleep Medicine recommends dental devices for patients with mild-to-moderate obstructive sleep apnoea who are not appropriate candidates for CPAP or who have not been helped by it. Oral appliances provide a simple, reversible, quiet, and cost-effective therapy for selected patients with OSA. The American Academy of Sleep Medicine (AASM) reviewed the available literature in 2006 and recommended that OAs may be used as first line therapy in adult patients with primary snoring, mild and moderate OSA and in patients with severe OSA who are intolerant of or refuse treatment with nasal CPAP. However, oral appliance therapy for OSA remains underutilised. OAs decrease OSA severity because of an increase in upper airway patency, stable anterior position of the mandible and advancement of the tongue and its attached structures.

OAs can be divided into two major types:

- 1) those that reposition the mandible and the attached tongue, the mandibular advancement splints (MAS) or mandibular advancement device (MAD).



1. TAP-Thornton Adjustable Positioner



2. Modified Herbst appliance

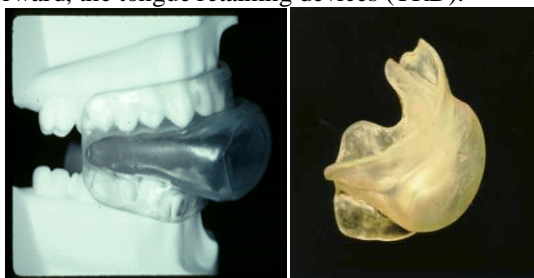


3. Forsus appliance

Mandibular Repositioning or Advancement Devices (MRD / MAD) function by engaging one or both of dental arches to modify mandibular protrusion and improve the velopharyngeal airway patency. The most common mandibular repositioning dimension quoted is 50-75 % of maximal protrusion (Approximately 5-7mm). As these appliances hold the mandible in antero-inferior position, these indirectly bring the tongue

forward as a consequence of muscle attachment and open up the posterior airway. The repositioning may also stretch and reduce the collapsibility of soft palate via its connection to the base of tongue and increase the superior airway space.

2) those that hold the tongue forward, the tongue retaining devices (TRD).



Tongue Retention –Tongue Retaining Devices (TRD) have an anterior hollow bulb, which creates a negative pressure vacuum when tongue is inserted. Tongue is held forward away from post pharyngeal wall, opening the airway. This appliance simultaneously modifies the position of the mandible

Although tongue repositioning devices and mandibular advancement devices have been standard appliances for treatment of OSA, a recent study by Venket R et al describes the use of four new appliances for managing sleep apnoea namely uvula lift appliance, uvula and velopharynx lift appliances, nasopharyngeal aperture guard and soft palate lift appliance and a conventional mandibular advancement appliance⁷. He concluded that nasopharyngeal aperture guard appliances were the best among the five type of appliances. Further studies would be required in this direction

Design Consideration Of Oa: Till date, more than 40 different OAs have been patented. Design variations depend upon, Method of retention, Flexibility of material, Adjustability, Vertical opening, Freedom of jaw movement

According to the material used these can be either polyvinyl vacuum formed thermoplastic appliances or those made of hard acrylic. According to adjustability these may be fixed or adjustable. While oral appliances have lesser efficacy in controlling OSA compared to CPAP, many studies suggest similar outcomes of these treatments in relation to improvements in blood pressure, endothelial function, sleepiness and quality of life. This discrepancy is generally hypothesized to be related to the greater acceptance and adherence to OA. Also, these studies are grounded on less than 30 randomized controlled trials published over the past 15 years with a large variability regarding study design, methodology, type of appliance and patient selection (mostly in mild to moderate OSA). There is only one study to our knowledge on cost-effectiveness which is based on assumptions and not on prospective data analysis. Buchner and collaborators have also confirmed the decrease in CV morbidity and mortality in successfully treated mild to moderate OSA, and interestingly they have not distinguished CPAP from OA. Despite the study being focused on CPAP, there were 20 patients amongst the 209 treated patients who actually used OA and not CPAP. El-Sohl and collaborators recently found an equivalent reduction in fatal cardiovascular events under CPAP and OA compared to untreated severe OSA patients, but their sample size was relatively small and the study design retrospective analysis.

It is clear that the effectiveness of a treatment, especially for chronic diseases is determined by a combination of efficacy and adherence. A major limitation of studies comparing OA and CPAP has been the lack of objective adherence monitoring for OA therapy.

Benefits of Dental Devices: Dental devices seem to offer the following benefits:

- Significant reduction in apnoeas for those with mild-to-moderate apnoea, particularly if patients sleep either on their back or stomach. They do not work as well if patients lie on their side. The devices may also improve airflow for some patients with severe apnoea.
- Improvement in sleep in many patients
- Improvement and reduction in the frequency of snoring and loudness of snoring in most (but not all) patients
- Few or no complications

Disadvantages of Dental Devices: Dental devices are not as effective as CPAP therapy. The cost of these devices tends to be high. Side effects associated with dental devices include:

- Night time pain, dry lips, tooth discomfort, and excessive salivation. In general, these side effects are mild, although over the long term they cause nearly half of patients to stop using dental devices. Devices made of softer materials may produce fewer side effects.

- Permanent changes in the position of the teeth or jaw can sometimes occur with long-term use⁸. Patients should have regular visits with a health professional to check the devices and make adjustments.

II. Conclusion

Given that OSA greatly increases a person's chance of heart attack, stroke and early death, early recognition and treatment becomes utmost important. Although this involves a multidisciplinary approach, role of Orthodontists is critical. Due to their expertise and familiarity with growth and development as well as orthopedic and surgical correction of the jaws, orthodontists are ideally suited to treat OSA patients. Major advances in the field of oral appliances have provided a solid evidence base for the use of oral appliances in the clinical management of OSA. As a simpler alternative to CPAP, oral appliances are often regarded by patients as a more acceptable treatment option for OSA.

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