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Review Article

Obstructive Sleep Apnea: An Overview on Features, Diagnosis & Orthodontic Management

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ABSTRACT

Obstructive sleep apnea is a chronic respiratory disorder characterized by repetitive episodes of upper airway obstruction. It is caused by various anatomic and physiological factors such as those related to muscle tone, small mandible, obesity, alcohol etc. With the increasing awareness of sleep apnea among the individuals now-a-days, it becomes important for an Orthodontist to have a thorough knowledge about the signs and symptoms of the condition and its management. This article brings about a brief review of few basic aspects of this disorder, diagnosis and treatment modalities.

Key Words: OSA, Orthodontics, Mandibular advancement devices

INTRODUCTION

Obstructive sleep apnea (OSA) , a sleep disorder and the most common form of sleep apnea - is characterized by apnea [cessation of breathing] or hypopnea [periods where the breathing patterns are superficial or irregular] caused due to repetitive obstruction of upper airways during sleep. [1] Though apneas with a duration of at least 10 s are considered important, most patients exhibit a duration of 15-20 s in length and lasting for nearly 1-3 min. [2]

CLASSIFICATION: [3,4]

Based on apnea/hypopnea index (AHI), there are Three degrees of severity: (In one hour)

1) Mild OSA – interruptions in respiration – 5 to 14 episodes
2) Moderate OSA - interruptions in respiration - 15 to 30 episodes
3) Severe OSA – interruptions in respiration - 30 or more

PREVALENCE AND RISK FACTORS:

Prevalence of OSAs increase with aging, despite it being occurring in both adults and children. More common in men than women., especially the middle aged adults who are obese. [1,5,6]

Risk factors include: Increased pharyngeal soft / lymphoid tissue, Obesity, Maxillary /Mandibular hypoplasia, Genetics, Nasal obstruction, Menopause, Hormonal imbalances and Alcohol. [1]

NORMAL SLEEP:

There are 2 forms of normal sleep namely Rapid eye movement (REM) and nonrapid

eye movement (NREM) and it is during the Stage 1 NREM the initiation of sleep occurs which passes the rest stages subsequently to reach REM sleep. [7-9] Breathing is regular, deep and slow in the stage 4 of NREM whereas sometimes periodic variation in breathing depth occur in stages 1and 2. This occurs as the wakefulness stimulus changes in a periodic way. During this breathing will be depressed and sleep deeper. With return to the normal, the wakefulness stimulus causes excitation of breathing. Carbon dioxide gas that is retained during sleep also contributes to this and this process is called as Cheyne-Stokes respiration. [10]

PATHOPHYSIOLOGY

During sleep, whenever there is inspiration, tongue reverts back against the wall of the pharynx due to the improper functioning of genioglossus muscles. Evidence now suggests hypotonia of dilating muscles of upper airway with pharyngeal wall invagination to be the cause of obstructed upper airway during sleep. Nasal airway also plays a significant role in total airway occlusion. Resistance to air flow is increased when there is any obstruction in the nasal airway, leading to increased inspiratory effort. This results in greater negative pressure in the pharyngeal airway resulting in its collapse. [11,12]

Table 1. CLINICAL PRESENTATION: [13]

Sr.No	
1	Snoring
2	Disturbed sleep and choking, gasping during the night (Apneic pauses)
3	Chronic nasal congestion
4	Increased body movements
5	Bruxism (nocturnal tooth grinding)
6	Dryness in mouth due to mouth breathing
7	Obesity
8	Fatigue
9	Irritability, frustration, impatience, depression, anxiety

Table 2. ADVERSE CONSEQUENCES OF OSA: [4]

Sr.No	
1.	Stroke
2.	Coronary artery disease
3.	Hypertension
4.	Inflammation, endothelial dysfunction and atherosclerosis
5.	Cardiac arrhythmias
6.	Congestive heart failure
7.	Metabolic consequences

OBSERVATIONS IMPORTANT FOR AN ORTHODONTIST:

1. Anatomical and craniofacial findings:

Various abnormalities related to skeletal anatomy and craniofacial region are presented in OSA patients that lead to obstructed upper airway during sleep. [14] Mandibular deficiency due to reduced length, enlarged soft palate, short cranial base and decreased cranial base angle, bimaxillary retrusion, increased lower facial height and inferiorly positioned hyoid. [15] The most routinely reported skeletal finding predisposing to OSA, by decreasing available oropharyngeal space is mandibular deficiency (related to maxilla). This leads to the posterior positioning of tongue with displacement of other soft tissues posteriorly resulting in constricted airway which is supported by the fact that anterior positioning of the mandible by appliances or surgery helps maintain upper airway patency decreasing the severity of OSA. [16]

2. Findings related to malocclusion and palatal anatomy:

Narrow maxilla is a predisposing factor as it decreases the oropharyngeal space available for the positioning of tongue. [17] Dental features presented in OSA patients are narrow maxillary and short mandibular arches, class II malocclusion, decreased overbite and crowding in mandibular arch. [18,19] The tapered type or the V palatal shape is used as a morphometric model to predict OSA. [20]

3. Cephalometric findings:

Cephalometric observations may be made with the routinely advocated lateral cephalogram by the orthodontists. It gives the details of both hard and soft tissue landmarks and the pharyngeal airways that can be measured and compared with the normal values.

Patient will exhibit a face and anterior cranial base that is retruded with a small cranial base angle, increased maxillomandibular plane angles and lower

face height and sometimes mandibular retrusion. All these contributing together to the decrease of airway space. [21] Other features are increased Frankfort mandibular plane angle and small SNA and/or SNB. [16]

4. Soft tissue findings:

Patient will have narrow retropalatal and retroglossal space, decreased angle between anterior nasal spine and uvula tip, thick soft palate and redundant tongue mass. [16]

DIAGNOSIS OF OSA

Diagnosis is carried out based upon:

1) Physical examination of areas like chest, abdomen and head/ neck, with clinical presentation such as Snoring, Sleeping habits, Mouth breathing etc. [2,4]
2) AHI index: The severity of OSA syndrome may be assessed by the pauses of breathing that occur in an hour and is called as apnea/hypopnea index (AHI) or the respiratory disturbance index (RDI). It is most routinely used. [22]
3) The Epworth Sleepiness Scale (ESS) is a reliable method used to evaluate the probability of a patient to fall asleep. Clinically, it divides patients into 4 categories based on the subjective daytime sleepiness (Table 3). [22]

Table 3. Epworth Sleepiness Scale

1	Normal range	ESS <11
2	Mild	ESS =11
3	Moderate	ESS =16
4	Severe	ESS >18

4) The Multiple Sleep Latency Test (MSLT): With the help of ECG, the time to fall asleep is evaluated in this test. This is carried out on at least four different occasions in a dark room over the day. This time period is termed as sleep latency. [22]
5) Polysomnography (PSG): It is the golden standard and most reliable technique used to diagnose sleep apnea and other sleep disorders. It is carried out in a laboratory where the patient is asked to stay overnight and his/her sleep is monitored during the study. During the study, the variables like airflow, body position, sleep continuity and stages, electrocardiogram, respiratory effort, movements, oxygen saturation etc are recorded. [2]

Treatment:

1) Behavioral interventions: weight loss, proper body position while sleeping.
2) Non-surgical options: oral appliance therapy (OA), continuous positive air pressure (CPAP),
3) Surgical options: orthognathic surgery, tracheostomy, glossectomy etc. [1]

CPAP:

Golden standard and choice of treatment for moderate to severe OSA. A constant pressure is delivered throughout inspiration and expiration and thus upper airway patency is maintained during sleep. Airflow is maintained at constant pressure with the help of a flow generator with a mask and tubing system. [4,23] It needs to be used constantly and for lifetime, thus having more patient compliance. [24]

Oral appliances:

Oral appliances are an alternative treatment modality. According to the guidelines of American Academy of Sleep Medicine, these are used for treatment of OSA ie mild and/or positional. These are of 2 types namely 1) devices that advance the mandible forward known as mandibular advancement devices and 2) tongue-retaining devices. [4]

With the help of these appliances the mandible is held forward and the upper airway patency is increased with reduction in pharyngeal collapse. Upper airway dimension is increased in mostly lateral direction at the velopharyngeal level, by which there will be anterior displacement of tongue. [25]

Indications for OAs:

1. Mild to moderate OSA patients.
2. Those with primary snoring.

3. Patients in whom CPAP therapy has failed.
4. Patients who does not want to undergo any surgery.
5. Can be used in association with CPAP to reduce AHI score for better pressure settings[1]

Mandibular advancement devices (MADs):

It is the most widely used appliance today. It advances the mandible and reduces the chance of upper airway collapse during sleep. These are worn during night time while sleeping to help maintain open airway by stabilizing the muscles and jaws.

Currently available types of appliances:

1) Monobloc appliance. Mandible cannot be advanced incrementally.
2) Two piece appliance with ability for incremental advancement.
3) Lateral movement of mandible and advancements in increments are permitted [12]

Tongue retaining mouthpieces (TRDs)

TRDs have a similar design as like MADs. The only difference is the presence of a small compartment that surrounds the tongue, using suction helping the tongue to be positioned forward and preventing it from falling back. Sometimes, the muscles that are attached to genial tubercles may not hold the base of tongue properly during sleep which leads to airway obstruction. TRD is a one piece appliance which also is designed to hold mandible ahead, thus also maintaining the tongue in forward position. There will be negative pressure and salivary adhesion resulting in the opening of airway by forward positioning of tongue. S, M, L and XL are the 4 sizes available with 2 versions - dent and non-dent. [1]

Oral appliances - Disadvantages

Long term skeletal and dental changes may be witnessed due to the reciprocal forces that are generated by the splints on the teeth and jaws. These even though attached to dental arches have extensions beyond these and thus apply pressure causing acute symptoms over gums and mucosa. Adverse effects include tooth pain, gum irritation, TMJ discomfort etc. Patients while using these should regularly visit their orthodontist and have adjustments done [12]

SKELETAL SURGERY:

The best treatment with good long-term stability for OSA is correcting the position of the jaws surgically. This includes either the maxillary and mandibular advancement and/or maxillary and mandibular expansion.

Inclusion criteria:

1. When Polysomnography is used as diagnostic method and AHI score is > 5, excessive daytime sleepiness and other clinical symptoms, decreased oxygen saturation.
2. Unsuccessful behavioral therapies like positional therapy, weight loss, , and the elimination of hypnotics or alcohol before sleeping.
3. Those able to tolerate surgery medically and psychologically.
4. If have compliance using oral appliances or CPAP, or choose surgery over others. [26]

CONCLUSION

Patient selection must be done by the physician and the required oral appliance will be selected by the orthodontist. Mandibular advancement appliances control and also guide the tongue muscles and activity with advancement of mandible. Care should be taken to see that oral appliances just simply not rotate the mandible downwards and backwards, which would otherwise result in constriction of hypopharynx and worsening of OSA. A good coordination between the attending physician and orthodontist which would help in rendering the appropriate treatment to the OSA patient with greater success rate.

REFERENCES

1. Ioana Maria Șimon, Mihaela Băciuț, Doina Todea et al. Orthodontic appliances in the management of obstructive sleep apnea syndrome – types and therapeutic indications. Pneumologia, 2018, vol. 67, no. 2, pg no. 62-66.
2. Kulshrestha R, Tandon R, Kinger S, Rohmetra A, Singh RV. Obstructive sleep apnea in orthodontics: An overview. Int J Orthod Rehabil. 2016;7: 115-8.
3. Flemmons WW, Buysse D, Redline S, Oack A et al. Sleep-related breathing disorders in adults: Recommendations for syndrome definition and measurement techniques in clinical research. The Report of an American Academy of Sleep Medicine Task Force. Sleep. 1999; 22(5):667-689.
4. Gharibeh T, Mehra R. Obstructive sleep apnea syndrome: natural history, diagnosis, and emerging treatment options. Nat Sci Sleep. 2010; 2:233-255.
5. Sam Jureyda and David W. Shucard. Obstructive Sleep Apnea- An Overview of the Disorder and Its Consequences. Semin Orthod. 2004; 10:63-72.
6. Tarek Gharibeh1Reena Mehra. Obstructive sleep apnea syndrome: natural history, diagnosis, and emerging treatment options. Nature and Science of Sleep 2010:2, 233–255.
7. Lowe AA, Ono T, Ferguson KA, Pae EK, Ryan CF, Fleetham JA. Cephalometric comparisons of craniofacial and upper airway structure by skeletal subtype and gender in patients with obstructive sleep apnea. Am J Orthod Dentofacial Orthop1996; 110:653-64.
8. Colt HG, Haas H, Rich GB. Hypoxemia vs sleep fragmentation as cause of excessive daytime sleepiness in obstructive sleep apnea. Chest1991;100: 1542-8.
9. Olsen KD, Kern EB. Nasal influences on snoring and obstructive sleep apnea. Mayo Clin Proc 1990;65:1095-105.
10. Strollo PJ Jr., Rogers RM. Obstructive sleep apnea. N Engl J Med 1996;334: 99-104.
11. Earle F. Cote (1988) Obstructive Sleep Apnea - An Orthodontic Concern. The Angle Orthodontist: October 1988, Vol. 58, No. 4, pp. 293-307.
12. Dr. Sathish Kumar N, Dr. Divya.Ketal. Obstructive Sleep Apnea -An Orthodontic review. IOSR Journal of Dental and Medical Sciences. Sep.- Oct. 2013.Volume 9, Issue 6, PP 68-72.
13. Agarwal L, Gupta A. Role of Orthodontist in Obstructive Sleep Apnea - An Orthodontic Review. J Orthod Endod. 2016, 2:3.
14. Ferguson KA, Ono T, Lowe AA, Ryan CF, Fleetham JA. The relationship between obesity and craniofacial structure in obstructive sleep apnea. Chest 1995;108:375-81.
15. Lam B, Ip MS, Tench E, Ryan CF. Craniofacial profile in Asian and white subjects with obstructive sleep apnoea. Thorax 2005;60:504-10.
16. Banabilh SM. Orthodontic view in the diagnoses of obstructive sleep apnea. J Orthodont Sci 2017;6:81-5.
17. Liu Y, Lowe AA, Zeng X, Fu M, Fleetham JA. Cephalometric comparisons between Chinese and Caucasian patients with obstructive sleep apnea. Am J Orthod Dentofacial Orthop2000;117:479-85
18. Banabilh SM, Samsudin AR, Suzina AH, Dinsuhaimi S. Facial profile shape, malocclusion and palatal morphology in Malayobstructive sleep apnea patients. Angle Orthod2010;80:37-42.
19. Banabilh SM, Suzina AH, Dinsuhaimi S, Singh GD. Cranial base and airway morphology in adult malays with obstructive sleep apnoea. Aust Orthod J 2007;23:89-95.
20. Kushida CA, Efron B, Guilleminault C. A predictive morphometric model for the obstructive sleep apnea syndrome. Ann Intern Med 1997;127:581-7.
21. Battagel JM, Johal A, Kotecha B. A cephalometric comparison of subjects

with snoring and obstructive sleep apnoea. Eur J Orthod2000;22:353-65.
22. Agarwal L, Gupta A. Role of Orthodontist in Obstructive Sleep Apnea - An Orthodontic Review. J OrthodEndod.2016, 2:3.
23. Redline S, Adams N, Strauss ME, Roebuck T, Winters M, Rosenberg C. Improvement of mild sleep-disordered breathing with CPAP compared with conservative therapy. Am J Respir Crit Care Med. 1998; 157(3 Pt 1):858- 65.
24. Epstein LJ, Kristo D, Strollo PJ Jr, Friedman N, Malhotra A, Patil SP, et al. Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. J Clin Sleep Med. 2009; 5(3):263-276.
25. Marklund. M. Update on Oral Appliance Therapy for OSA. Curr Sleep Medicine Rep .2017; 3:143–151
26. Richard L. Jacobson and Stephen A. Schendel. Treating obstructive sleep apnea: The case for surgery. Am J Orthod Dentofacial Orthop2012; 142: 434-42

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