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Role of Orthodontics in Obstructive Sleep Apnea- A Literature Review

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***Abstract*: Obstructive rest apnea (OSA) is a typical rest related breathing issue with significant impacts on the wellbeing and personal satisfaction of people experiencing it. Orthodontists ought to be very much aware of the side effects of this issue and adequately capable to perceive its signs and indications. Orthodontics is appropriate for treatment of obstructive sleep apnea patients because of their skill and information with respect to development and improvement of Oro-facial and dento-facial designs just as muscular, orthodontic and careful revision of the jaws and other supporting tissues. The point of this article is to give a standpoint to the fundamental job of orthodontists in the treatment of obstructive sleep apnea.**

***Keywords*: Nasal Obstruction, obstructive sleep apnea, orthodontics, sleeping disorder, snoring.**

1. Introduction

Obstructive Sleep Apnea (OSA) is a sleeping disorder which involves cessation or significant decrease in airflow in the presence of breathing effort. It is the common type of sleep-disordered breathing (SDB) which is characterized by recurrent episodes of upper airway collapse during sleep. Apnea is defined as the cessation of airflow for at least 10seconds as per the American Academy of Sleep Medicine. It is repeated episodes of partial or complete upper airway obstruction during sleep. It is classified as Mild, Moderate and Severe where Mild is 5 to 14, moderate KS 15 to 30 and severe is 30. It's a potentially life-threatening condition and also a public health condition. Symptoms of this OSA are snoring, sleepiness, and sleep apnea episodes. The severity of apnea is defined as the length of time in apnea event and % decreased oxygen desaturation.

2. Clinical Feature

The clinical feature is excessive sleepiness during daytime, morning headache, cardiopulmonary dysfunction such as hypertension, cardiac arrhythmias and heart failure. Impaired memory and concentration. Reduction intellectual ability, Disturbed personality & mood. The major symptoms of OSA are excessive sleepiness, impaired concentration & snoring even in day time. Incidence of OSA is measured as approximately 40% of adults over snore. Middle age 4% of men and 2% women are affected. Geriatrics 24-42% suffer respiratory Disturbance Index>5. Two-thirds are known to be obese. National Commission on Sleep Disorders Research (1993). 95% of patients with OSA may be undiagnosed. More prevalent than asthma, equally prevalent as diabetes.

3. Symptoms

Snoring (OSA is unlikely in the absence of habitual snoring), Apneic pauses, restless leg syndrome (RLS), restless sleep and increased body movements), Bruxism (nocturnal tooth grinding), Nocturnal and daytime enuresis, Sleep position (side and stomach sleepers) or neck hyperextension, Growth failure restriction, Sleepwalking or sleep terrors, Obesity are the most common symptoms.

1) Daytime symptoms can include:

Mouth breathing, due to adenoidal hypertrophy, and dry mouth Chronic nasal congestion, rhinorrhea, Aden tonsillar hypertrophy, Hypo nasal speech, Fatigue, Excessive daytime sleepiness: difficulty waking or falling asleep at school, Mood changes; irritability, low frustration tolerance, impatience, depression anxiety, and social withdrawal, a negative sense of well-being acting-out behaviors including aggression and hyperactivity, Cognitive impairment and poor school performance Inattention, poor concentration, and distractibility ADHD-like symptoms Infraorbital venous congestion.

4. Pathophysiology

Pathophysiology of OSA involves tissues laxity & redundant mucosa, anatomic abnormalities, Decreased muscle tone with REM sleep. Airway collapse, Desaturation, Arousal with the restoration of the airway, sleep fragmentation leading to hypersomnolence. The hypothesis states genioglossal that individuals with OSA have impaired genioglossal function, allowing the prolapse of the tongue against the posterior pharyngeal wall with inspiratory effort during sleep. The situation becomes complex when an invagination of the pharyngeal walls and general hypotonia of the dilating muscles of the upper airway can also be involved in allowing airway

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occlusion while sleeping. When nasal obstruction of the nasal airway resists airflow, it results in increased inspiratory effort and greater negative pressure in the pharyngeal airway. The suction increases the likelihood of collapse of the pharyngeal airway. Numerous factors predispose to obstructive sleep apnea, the most important being obesity structural abnormalities in the face, skull, or airways that cause some collapse in the upper airways and reduce air pressure can produce sleep apnea syndrome. Patients with micrognathia, adenoids, retrognathia, enlarged tonsils, tongue enlargement, acromegaly, and longer anterior facial height are especially predisposed to obstructive sleep apnea.

5. Etiology

Etiology is multifactorial, Anatomical factors & Neuromuscular factors. Etiology involves structural characteristics structural factors like inferior displacement of hyoid, Pierre Robin syndrome, downs syndrome, Arfan Syndrome, Prader-Willi Syndrome, High arched palate, Tori. Anatomical considerations like supine sleeping position, Bernoulli effect-compliance, or floppiness of airway walls. Anatomical factors resulting in narrowing of the pharynx, include skeletal (micrognathia, retrognathia). Soft tissue (macroglossia, tonsillar hypertrophy, fatty infiltration of pharyngeal tissue associated with obesity. Skeletal anatomy (micrognathia, retrognathia), involves infiltration positioned hyoid bone. Constricted osseous airways, skeletal abnormalities involve tonsillar hypertrophy and enlarged adenoids, long soft palate, macroglossia. Neuromuscular factors involve decreased activity of pharyngeal dilator muscles. Increased compliance of pharyngeal airway. Active inhibition of muscle activity during REM sleep. Alcohol, sedatives, & muscle relaxants. Complications include Desaturation (decreased oxygen) with compensatory polycythemia. Hypercapnia (increased carbon dioxide) with pulmonary hypertension. Systemic hypertension, Arrhythmias. Risk factors include obesity, body mass >28kg/m^2. increased age, male sex, Hypertension, Hyperthyroidism/Acromegaly. Use of sedatives/ narcotics/ alcohol and smoking.

6. Diagnosis

Diagnosis includes history taking, physical examination, radiographs, polysomnography. History includes snoring, restless sleep, morning headache, insomnia, excessive daytime sleepiness, personality changes, insomnia. Symptoms include loud snoring, excessive daytime sleepiness, Choking/gasping during sleep, Unrefreshing sleep, Daytime fatigue, and impaired concentration. Diagnosis includes Nocturnal symptoms include snoring, witnessed apnea, Nocturnal choking or gasping, Restless sleep, Insomnia. Daytime sleepiness-day time sleep can be assessed, subjectively and objectively using the Epworth sleepiness scale, symptoms also include fatigue, memory impairment, Personality changes, Morning headaches or nausea, Depression. Signs include obesity, Mandibular /Maxillary hypoplasia, Crowding of the oropharynx, large tonsils or tongue, Nasal and nasopharyngeal obstruction. Evaluation includes Thyroid function tests, Arterial blood gas, CBC, ECG, Echocardiography, Radiological studies, polysomnography. Radiography includes, Cephalometric involves Evaluation of airway, Adenoids, Tongue, CT evaluates volumetric reconstruction; disadvantages are cost, weight limitations, ionizing radiation, MRI evaluates excellent soft tissues anatomy, multiple planes, no ionizing radiation; disadvantages are cost, weight limitations, Noisy, Claustrophobia. Polysomnography involves simultaneous recordings of multiple physiological signals during sleep, evaluation The gold standard: Overnight polysomnogram, EEG, EOG, EMG, ECG, oronasal airflow, Chest wall effort, snore microphone, Oxyhemoglobin saturation, there are three characteristic patterns of apnea: Obstructive apnea, Central apnea, mixed apnea. Consequences include Congenital Heart Failure, Polycythemia &HTN, Arrhythmias, Attack of angina, snoring spouse syndrome, Loss of Memory, Traffic accidents. According to the Mallampati score which is a simple test that can be a good predictor of obstructive sleep apnea that is used to predict whether a patient might have obstructive sleep apnea. According to the score, the severity increases from class I to class IV. According to Class I, it's the complete visualization of the soft palate, according to class II it's the complete visualization of the uvula, class III visualization of only the base of the uvula, according to class IV it's the soft palate is not visible at all.

7. Treatment

1) Oral Appliance Therapy

Orthodontic appliances can be made in such a way that they can be worn permanently or removably depending upon the condition. The appliance is designed to bring the mandible and tongue forward, opening up the lower pharynx to allow unrestricted breathing.

2) Indications of Oral Appliance Therapy

Oral appliances are indicated in patients with primary snoring or mild OSA who do not respond for treatment with behavioral measures like weight loss or sleep position change; Patients with moderate to severe OSA should have an initial trial of nasal CPAP because greater effectiveness would be shown with this treatment pattern, with use of oral appliances; Oral appliances are indicated for patients with moderate to severe OSA who are intolerant of, or refuse treatment with, nasal CPAP, oral appliances are also indicated for patients who refuse or who are not willing for tonsillectomy and adenoidectomy, cranial facial operations or tracheostomy.

3) Oral Appliances

Dental devices like tongue retaining devices (TRD) and mandibular advancement appliances (MAA). A tongue retaining device is a splint that holds the tongue in place to keep the airway as open as possible. Mandibular advancement device (MAA) is the most common type of dental appliance in Obstructive Sleep Apnea. It helps in protruding the mandible forward, that way preventing upper airway collapse during sleep. Mechanism of action is like the oral appliances are worn only during sleep thus helping to maintain an open and unobstructed airway by stabilizing the lower jaw, tongue, soft

palate, or uvula. Mandibular advancement devices, the first use of mandibular advancement devices was suggested by Pierre Robin it protrudes the mandible forward, thus preventing or minimizing upper airway collapse during sleep.

4) Currently Used Appliances

- *First category*: one-piece appliance design, with no ability to advance the mandible incrementally.
- *Second category*: Appliance is two pieces in design that offer the potential for incremental advancement.
- *Third category*: Permits incremental advancement and lateral movement of the mandible.

Tongue retaining devices: Mainly a splint that holds the tongue in place to keep the airway as open as possible. Which are excellent devices for patients with Tempero mandibular joint sensitivity. Advantages are they do not require retention from dentition, minimal adjustments are required, and cause minimal sensitivity to teeth and temporomandibular joint.

5) Advantage of Oral appliances

Significant reduction in apneas in case of patients with mild-to-moderate apnea, by improving airflow for some patients with severe apnea, improvement, and reduction in the frequency of snoring and loudness of snoring in most patients and higher compliance rates than with CPAP.

6) Disadvantages of Oral appliances

Mandibular advancement splints can generate reciprocal forces on the teeth and jaw thus resulting in acute symptoms, as well as long-term dental and skeletal changes. In the case of mandibular advancement, splints are primarily attached to the dental arches, most extend beyond these and thus apply pressure to the gums and oral mucosa. These have side effects and complications that vary significantly between studies probably due to differences in the type and the design of the oral appliance, the degree of mandibular advancement, the frequency and duration of follow-up. During the acclimatization period, it is common for adverse effects to develop, which are usually minor and self-limiting. These include ptyalism, xerostomia, tooth ache, gum irritation, headaches, and temporomandibular joint discomfort. Patients should have regular visits with a health professional to check the devices and make adjustments as needed.

8. Skeletal Surgery

Surgical correction of the jaw position is one of the effective treatments for OSA, with long-term stability. The procedure can involve maxillary and mandibular expansion and/or maxillary and mandibular advancement. Orthognathic surgery is advised as it involves advancements that usually have to be over 10mm to be effective in treating OSA, so, typically maxillary advancement is also necessary.

9. Soft Tissue Surgery

uvulopalatopharyngoplasty (UPPP) is used in the reconstruction of the throat by resecting the posterior margins of the soft palate and redundant mucosa on the lateral pharyngeal walls, the success rate for this approach to sleep apnea is only 40%.

10. CPAP

A continuous positive airway pressure machine (CPAP) is a new device with a mask that fits snugly over the sleeper's nose. Which sends a continuous stream of air under positive pressure which is adjusted for each person using it to hold the throat open through the night while sleeping.

11. Conclusion

The impacts of untreated rest apnea on day-by-day exercises are different and it incorporates exorbitant daytime drowsiness, impeded mental capacity, state of mind heights and character changes. It is likewise related with a decrease in quality of life and there can be unfavorable changes on others like impaired relationship among mates, spouses and accomplices. Side effects of obstructive sleep apnea are noticed and these problems should be dealt with critically. Orthodontists should assume a functioning part in screening of patients for this illness and advice oral appliances, if necessary.

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