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ASSOCIATION BETWEEN OBSTRUCTIVE SLEEP APNEA AND DENTISTRY

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ABSTRACT

Obstructive sleep apnea (OSAS) is a major public health burden, characterized by instability of upper airway during breath and also reported as independent risk factor for cardiac, neurologic, endocrine and perioperative morbidity. Despite the fact OSAS often goes off undiagnosed; we the dentists can pick out certain oral signs during regular dental recall visits. According to the concise review on OSAS 2011, orthodontic consultation is one of the recommended examinations before the surgical intervention for the treatment of OSAS. This article reviews about the significant concourse of the disease to any other systemic illness and also the precautions and investigations to be followed by the dentist when handling the OSAS patient. The dental side effect of long-term treatment with oral appliances is also highlighted.

KEYWORDS: Obstructive sleep apnea syndrome, orofacial findings, orthodontic examination, side-effects.

INTRODUCTION

In 1837, Charles Dickens was the first, who described Obstructive sleep apnea syndrome as “Pickwickian Syndrome”. Later, in 1956, Sidney Burwell was credited for recognizing certain signs and symptoms in OSAS patients and contrasting them between OSAS and other diseases.[1]

Obstructive sleep apnea, characterized by instability of upper airway during breath has now been identified as an independent risk factor for various systemic illness due to ephemeral

and periodic hypoxia in OSAS patients which results in transcription of TNFα and raises production of cytokine leading to systemic inflammation.[2,3,4]

Excessive day-time sleepiness, snoring, restlessness during sleep, sudden awakenings with choking sensation, intellectual impairment, personality changes, headaches are certain common symptoms of OSAS which can worsen the quality of life of the patient.[5,6] Apart from OSAS signs and symptoms, orofacial problems that are associated with OSAS are retrognathic mandible, high palatal vault, narrow dental arch, steep mandibular plane angle with long anterior lower face height and open bite tendency and enlarged soft palate and uvula may further compromise the airway.[7] As often OSAS is left undiagnosed, Dentistry can be the first profession who can screen out the disease during regular dental recall.[8]

The prevalence of the sleep disordered breathing in men in India is alarmingly high when compared with that of western countries stamping us with the major social health implication.[1]

Sleep apnea can be classified into two types: obstructive and central. As a dentist we need to have a clear picture of obstructive as one of the etiology being reduced retro palatal space and small jaw with overbite, whereas in central apnea is related to the instability of the respiratory control center in central nervous system.[11]

ETIOLOGY OF OBSTRUCTIVE SLEEP APNEA

In person with OSAS, throughout the night's sleep they will have episodes of apnea (complete stoppage of airflow) and /or hypopnea (partial obstruction in upper airway) for 10 seconds or may persist for long.[8] This blockage usually occurs due to collapse of pharyngeal tissue when muscle tone in back of the throat reduces during sleep.[6]

Certain anatomical and functional factors are responsible to provoke OSAS. They include.

Anatomical factors

1. Bone abnormalities

- Micrognathia and retrognathic mandible[9,10]
- Syndromes associated with craniofacial anomaly- Down, Crouzon, Apert and Pfeiffer etc.
- Dorsal-caudal position of hyoid bone in abnormal manner
- Abnormality of rhino pharynx[9]

2. Soft tissue abnormalities

- Abnormal morphology of nasal cavity or rhinitis
- Laryngomalacia and diseases related to larynx like webs or tumors
- Pharyngeal lymphatic tissue hypertrophy[9]

Functional factors

1. Cerebral palsy.[9]

RISK FACTORS OF OBSTRUCTIVE SLEEP APNEA

The risk factors of OSAS can be due to any factors that can cause narrowing of the upper airway ranging from anatomical or structural factors to the non-anatomical contributors such as obesity. Obesity poses a major risk as it is associated with sleep apnea in children leading to severe developmental issues such as attention deficit disorder, behavioral problems, cardiopulmonary problem and impaired visual perception.[12]

CLINICAL FEATURES

Common day-time signs and symptoms include:

- Day-time sleepiness
- Dry mouth
- Loss of concentration and poor memory
- Distress and frustration
- Morning headache
- Impotence and libido.[8,10-12]

Nocturnal signs and symptoms include

- Noisy snoring with suffocating sensation
- Incomplete night sleep
- Episodes of apnea and/or hypopnea
- Dribbling of saliva.[12]

The characteristic orofacial findings of OSAS during dental examination include maxillary and mandibular retrognathia, normal vertical pattern of the maxilla with the posterior rotation of the mandible. ANB line can be linear predictor of OSAS predisposition. Relative macroglossia and hyperactive muscle has been stated as one of the strong cause for pharyngeal obstruction.[12]

The other findings are

- Deviation of nasal septum
- Dental erosion on lingual surface of teeth due to difficulty in breathing
- Bruxism
- Gingival recession
- Enlarged tonsils
- Mouth-breathing habit
- Gingiva on anterior teeth appears erythematous
- Retrognathic mandible
- High palatal vault
- Narrow dental arch
- Steep mandibular plane angle
- Long anterior lower face height
- Anterior open bite
- Enlarged soft palate and uvula.[7,8,12]

The periodontal implications in OSAS can be discussed based on common comorbidities between these two.

- Risk factors are common to both the diseases.
- Oxidative stress
- Systemic inflammation can occur in the both the problems.[4]

CONSEQUENCES OF UNTREATED OBSTRUCTIVE SLEEP APNEA

1. **Cardiovascular System:** OSAS is closely related to increase in blood pressure.[9] A study published on 2015 reveals that untreated OSAS patients are in greater risk of having coronary artery disease, stroke and hypertension.[12] OSAS is also associated with arrhythmias and ventricular tachycardia.[13]
2. **Central Nervous System:** A number of studies have shown patients with untreated cases of OSAS often report with loss of concentration, frustration and distress due to combination of excessive day sleepiness and fragmented sleep during night.[9] These peoples are in greater risk of motor vehicle accidents.[8]
3. **Endocrine System:** A sleep related disorder can lead to insulin resistance and result in diabetes mellitus.[13] It was also found that patients had low level of IGF-1 and IGFBP-3.[9]

4. **Perioperative Complications:** It includes difficulty during intubation, increased chance of respiratory depression due to analgesic and anesthetics, prolonged stay in hospital, reintubation postoperatively, dysrhythmias.[13]

DIAGNOSIS

Diagnosis of OSAS is based on history of the patients, clinical evaluation and night sleep study called Polysomnography (PSG).[11]

1. **Patient history:** Symptoms like day-time sleepiness, loud snoring, gasping sensation, restless sleep or fatigue and mouth breathing provides evidence of upper airway obstruction.[9]
2. **Clinical examination:** Profile radiography is useful in evaluating the air passage and any enlargement in the palatine tonsils.[9] Endoscopy or laryngoscopy can also be used to assess upper airway.[2] Nasofibroscopy helps in examining rhino pharynx and nasal cavity and also rules out any nasal septal deviation.[9]
3. **Polysomnography:** Polysomnography night sleep study is the effective gold standard diagnostic methods for diagnosis of sleep related breathing disorder.[2] It is done in a sleep laboratory and it is performed overnight only under the monitor of a trained technician.[11] It includes: EEG (electroencephalogram), EOG (electroocculogram), EMG (electromyogram), ECG (electrocardiogram), breathing patterns, chest wall motion, oxygen saturation.[2, 5] After the procedure, episodes of apnea and hypopnea are noted at per hour of sleep and OSAS is graded accordingly.[1,11]

Apnea- Hypopnea Index (AHI): All airflow disruption that lasts two complete cycles is called apnea. The hypopnea is identified as the partial obstruction of more than 50% of the airflow. It is an index used to note number of episodes of apnea and hypopnea per hour of sleep.[12]

GRADES OF OSAS[12]

MILD	AHI: 5-15 episodes per hour Oxyhemoglobin saturation: 85-90%
MODERATE	AHI: 15-30 episodes per hour Oxyhemoglobin saturation: 80-84%
SEVERE	AHI > 30 episodes per hour Oxyhemoglobin saturation < 80%

4. **Other diagnostic procedures**

a) **Audio taping respiratory noises:** This test is performed by the parents using an audiotape which records and analyses the severity of snoring and changes in breathing pattern.[9]

b) **Videotaping child's sleeping images:** The technique is costly and sensitive; it makes use of cameras with infrared light and videotape with low light settings in assessing breathing pattern of the patient.[9]

c) **R_{χ} cephalometry of upper airway profile:** The airway passage and craniofacial structures are assessed in this procedure.[9]

Dental consideration in diagnosis: As a dentist one must examine the oropharynx region, tongue, uvula, soft palate and tonsils during clinical evaluation. The tongue volume is determined to indicate the air column obstruction with the help of Mallampatt index. The shape and volume of uvula and soft palate and position of mandible should be observed vertically and horizontally. With the use of radiography and tomography, the position of hyoid bone, mandible and bone structures of skull can be evaluated.[5]

MANAGEMENT OF OSAS

Obstructive sleep apnea can be treated effectively by surgical or non-surgical methods. An approach to OSAS depends on.

- Severity of condition of patient
- Records of apnea or hypopnea episodes per hour
- Relationship between OSAS and systemic complications.[12]

1. **Non-surgical methods**

A. **Conservative**

a) **Behavioral changes**: Weight loss and following healthy diet will eradicate the problem completely.[7,12]] Cessation of alcohol 3-5 hours before sleep can help in reducing the resistance of upper airway.[5] Nasal dilator strips or sprays can be used to reduce snoring to an extent and increase airflow to the air column.[11]

b) **Position therapy**: Side sleeping and positioning head at a higher level than the body helps in patients with mild OSAS symptoms.[11]

B. Mechanical

a) **Continuous Positive Airway Pressure (CPAP):** CPAP is the most effective treatment for relieving symptoms of moderate to severe cases of OSAS.[12] It consists of a mask which the patient has to wear during sleep over the nose or/and mouth.[10] It provides steady and continuous air pressure which can be adjusted to prevent the soft tissue in the back of the neck to collapse and cause upper airway obstruction.[6]

Jaradat. M and Rahhal. A (2015) reported that patients who had undergone CPAP therapy had low BMI. Thus, it caused weight loss in patients who are overweight.[12] Patients found constant singular pressure difficult to exhale.[11] So, to overcome the difficulty with the pressure provided by CPAP therapy, newer advances in the machine are available.[13] That involves Bi-level positive airway pressure and auto positive airway pressure (APAP).[11] APAP adjust itself to fulfill particular needs at any moment during the sleep.[13] Adaptive Servo- Ventilation (ASV) is used in patients who develop sleep apnea during initiation of CPAP therapy.[13]

2. Surgical methods

As we all know OSA is a sleep dependent anatomical problem. So, the aim of the treatment should be focused in anatomical variation.

a) **Adenotonsillectomy:** Removal of enlarged tonsils and adenoids are done in case of severe airway obstruction.[8] Jaradat.M and Rahhal. A (2015) mentioned that by performing Adenotonsillectomy, symptoms of OSAS is reduced to a great extent.[12]

b) **Somnoplasty:** It is a procedure done to remove soft tissues from upper airway using radiofrequency energy.[11]

c) **Uvulopalatopharyngoplasty (UPPP):** Removal of tissues from soft palate, uvula, posterior and lateral walls of pharynx is performed along with tonsillectomy to increase airflow.[8,11,12]

d) **Maxillomandibular advancement surgery:** In this invasive procedure, maxilla and mandible are repositioned forward to correct craniofacial abnormalities and obstruction of airway followed by advancement of genioglossus.[8,11]

e) **Nasal surgery:** It is a surgical procedure which corrects deviation of nasal septum and removes nasal polyps which causes nasal obstruction.[11]

Pharmacotherapy: Drugs such as tri cyclic antidepressants (Desipramine), Zolpidem, which are serotonergic, noradrenergic and which acts on the potassium channels can improve muscle responsiveness during airway narrowing.[3]

ROLE OF DENTIST IN THE MANAGEMENT OF OSAS

Orthodontic correction with use of oral appliances is one of the most effective and useful way of correcting OSAS by advancing the mandible and changing the tongue posture to improve the airflow in upper airway and reduce the incidence of supine apnea.[7,14,16]

Indications of Oral Appliance Therapy (OAT)

1. Mild to moderate symptoms of OSAS
2. Low BMI rate
3. 8mm or more mandible advancement
4. Intolerance or failure of CPAP therapy
5. Patients unwilling for surgery.[1, 6, 7]

Contraindications of Oral Appliance Therapy

1. TMJ disorders
2. Limited mandibular movements
3. Poor oral hygiene
4. Presence of 6 to 10 teeth or less than in each arch.[7, 8]

Types of oral appliances

1. **MAD(Mandibular advancement devices):** HERBST Appliance, Snore Guard.[1, 7]

This device advances the mandible in forward position to reduce the collapse of upper airway.[12] 3 to 5 mm advancement is seen with the use of this device. It is worn for 8 months.[8] It enlarges the upper airway in the lateral dimension of velopharyngeal space.

When evaluating the treatment response in the mandibular advanced cases complete response was found only in 53% of the population with the 3 month study period.[16] To optimize the treatment outcome with the minimal side effects mandibular advancement should be guided objectively by the overnight oximetry and symptomatic treatment which can achieved with the remote controlled mandibular advancement devices.[14] Factors contributing to the success of the mandibular advancement therapy are those having the high mandibular range of motions.

These are customized to patient's dentition as monobloc or two piece appliance. Modified monobloc have been proven to improvise the AHI index and also the sleep quality and day time performance in children.[12]

2. **TRD (Tongue retaining device):** Snor Ex. Soft Palate Lifter

It is rarely used but is efficient in holding the tongue in forward direction and prevents the displacement of the tongue posteriorly.[1,7,12] These devices are poorly tolerated, with inadequate device retention giving us potential risk.

3. **SPL (Soft Palate Lift):** It minimizes soft tissue vibrations that cause loud snoring.[7]

- On a study done on 1991, it was mentioned that orthosis improves Oxyhemoglobin saturation and episodes of apnea and hypopnea.[15]

ORAL CHANGES SEEN USING ORAL APPLIANCE

1. Reduced overjet and overbite
2. Proclination of lower anterior
3. Retroclination of upper anterior
4. Tipping of maxillary molars distally and mandibular molars mesially
5. Increase in mandibular plane angle and lower face height.[7,12,17]

SIDE EFFECTS

Dental side effects are minor and it usually reduces with the continuous use of the oral appliance.[18]

Adverse effects include

1. Pain in Temporomandibular region with clicking sound
2. Grinding of teeth
3. Xerostomia
4. Increased saliva secretion
5. Tenderness in gingiva
6. Occlusal changes like reduced overjet and overbite about 1 to 3 mm, proclined lower anterior and retroclined upper anterior.
7. Headache
8. Difficulty and pain during masticatory function
9. Discomfort of tongue.[7,12,17,18]

Side effects can be minimized with proper construction of oral appliance and with proper use by the patient.[12]

Providing the patient with information regarding the disadvantages is an essential element of the proposed treatment plan. Of most concern is the potential that the device may occasionally exacerbate Temporomandibular Joint Dysfunction or induce occlusal changes, which if left untreated can be source of significant morbidity.[18]

CONCLUSION

The prevalence of OSAS has an impact on quality and longevity of life. Thus, there is an urgent need to understand the condition to prevent any further complications. The effective management depends on accurate diagnosis of OSAS. Thus, this literature review explains how dentist can play a major role in diagnosis and management before the surgical interference.

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QUESTIONS

1. Who discovered Obstructive Sleep Apnea Syndrome as “Pickwickian Syndrome”?

a) Sidney Burwell
b) Widman
c) Charles Dickens
d) Pettersson

2. An hypopnea event is characterized by

a) A complete stoppage of airflow during sleep for 10 seconds or longer.

b) A desaturation of blood oxygen only

c) A partial stopping of breathing during sleep for 10 seconds or longer

d) A partial stoppage of airflow during sleep for 5 seconds or less.

3. Which of the following oral habit is associated with OSA?

a) Tongue-thrusting

b) Lip biting

c) Mouth breathing

d) Thumb sucking

4. Which of the following is the gold standard diagnostic method for diagnosing OSAS?

a) Radiographs

b) Polysomnography

c) Endoscopy

d) Nasofibroscopy

5. One of the most important risk for OSA is.

a) Smoking

b) Obesity

c) Diabetes Mellitus

d) Coronary artery disease

6. The oxygen saturation below 80% indicates what level of OSA?

a) Moderate

b) Severe

c) Mild

d) All the above

7. Which of the following is a tongue retaining device?

a) Soft palate lift

b) Snor Ex. soft palate lift

c) Snore guard

d) Herbst appliances

8. In which of the following Oral Appliances Therapy is not indicated?

a) Obesity

b) TMJ disorders

c) Mild symptoms of OSA

d) Failure of CPAP therapy

9. Adenotonsillectomy involves removal of which of the following?

a) Tongue

b) Soft palate

c) Enlarged tonsils and adenoids

d) Uvula

10. Side effects of Oral Appliance Therapy include which of the following:

a) Temporomandibular joint pain

b) Loss of hearing

c) Erosion of teeth

d) Open bite