Sleep Related Breathing Disorders: What & Why A Dentist Should Know? An Overview Of Dental Sleep Medicine.

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Abstract: This article overviews the signs, symptoms, diagnosis and other facets of SRBDs (sleep related breathing disorders. Snoring and EDS (excessive day time sleepiness) are the commonest signs of OSAs (obstructive sleep apneas). OSA are known to impact cvs, respiratory & metabolic balance. A new paradigm has evolved inter-connecting SRBDs& chronic periodontitis. So as to help a dentist to diagnose & manage SRBDs in dental scenario. [Arora S NJIRM 2015; 6(5):94-102]

Key Words: Sleep apneas, SRBDs, OSA

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Introduction: Sleep and wakefulness is regulated and controlled by precise & well coordinated nervous system interrelationships involving various neurotransmitters. Normal sleep is controlled by three basic physiological phenomenon i.e. sleep homeostasis, circadian rhythm & sleep inertia.[1]

Sleep medicine a newer branch of medicine has evolved over last 50 years which diagnosis, evaluates and treats abnormal sleep phenomenon broadly termed as SRBDs (Sleep Related Breathing Disorders). SRBDs are known to cause heart ailments, nervous system breakdown, reduce the quality of life, road accidents,attention deficient hyperactivity disorders in children. Although PSG (Polysomnography) is a gold standard for diagnosing sleep disorders, the role of a dentist is also expanding in this field as there has evolved a scientific basis of correlation between oral tissue and structural abnormalities as a risk for sleep apneas & hypo apneas.[2] Latest scientific literature shows correlation between SRBDs &CVS, nervous system but also oral diseases such as periodontal diseases.

It becomes a prerogative as a dentist to diagnose, evaluate and screen OSA (Obstructive sleep apneas) in dental office and to treat either with Oral appliances and/or to refer such patients to a sleep therapist.

This article is an attempt to overview what and why a dentist needs to know about sleep related breathing disorders, it's implications and management in a dental office scenario.

History: There has been an interest in the nature of sleep and dreams throughout recorded history. Insomnia was reported in ancient Egyptian texts and opium was used as possibly the first hypnotic medication.[3] Sleep Medicine has only recently been recognized as a specialty wing of medicine. Its development is based on an amount of knowledge evolved concerning the physiology of sleep, circadian biology and the pathophysiology of sleep disorders.

The history of sleep dates back to the 1880s. However, the most significant developments that moved sleep forward in to the practice of medicine and eventually dentistry, occurred from 1950s on.[4]
1937 Loomis and collegues document the characteristics on an electroencephalogram of what is now known as NREM(non rapid eye movement) sleep.

In 1953 Dement &Kleitman discovered new sleep stage called REM(rapid eye movement) sleep. This stage of sleep is believed to be associated with dreaming.

1966 Researchers in Europe describe the clinical entity of sleep apnea syndrome. This condition is associated with obstructive apneas & symptoms of daytime sleepiness.

1968 A manual is developed for the scoring of sleep.

1970 Stanford university develop the first comprehensive sleep centre, and the ability to perform nocturnal polysomnography (sleep study) is developed.

In 1975 the association of sleep disorders(ASDC) is duly founded.

1978 The first issue of the journal sleep published
In the early 1990s there was establishment of sleep disorders dental society which led to the involvement of dentistry with sleep and sleep medicine.

1980 the first use report on successful use of oral appliance is published: the tongue retaining device.

1981 Sullivan and colleagues introduce a new treatment for sleep apnea: continuous positive airway pressure(cpap)

1991 dentistry becomes involved with sleep medicine through the establishment of sleep disorders dental society(SDDS)

1994 The American medical association recognizes sleep medicine as sub specialty.

1999 The ASDA organization changes it name as the American Academy of sleep medicine(AASM).

In 2000s the role of dentist in sleep medicine became more evident.

2000 A special interest section on oral appliances is established in AASM(ADSM). And in the same year SDDS becomes the Academy of dental sleep medicine.

2004 The American Board of Dental Sleep Medicine (ADSM) is established.

2006 the ADSM changes its name to the American Academy of dental sleep medicine (AADSM).[4]

<u>Normal Sleep in Humans - Stages and components of sleep:</u>
Described as a "reversible behavioral state of perceptual disengagement and unresponsiveness to the environment".[5]
Sleep can be classified as:

1. NREM (Non Rapid Eye Movement)
2. REM (Rapid Eye Movement)

NREM sleep usually precedes REM and sleep is scored in recording of 30 seconds (termed as Epoch) with stages of sleep defined by the visual scoring of three parameters:

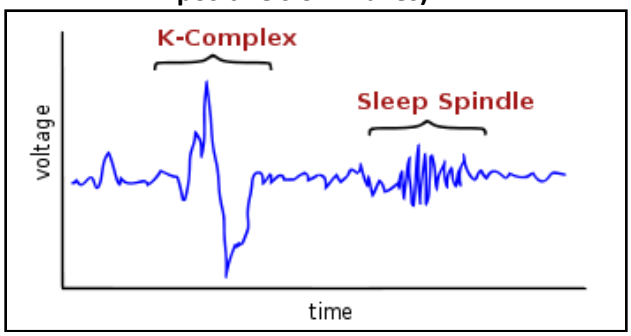
1. Electroencephalogram (EEG)
2. Electroculogram (EOG)
3. Electromyogram (EMG)

NREM sleep is further divided into 3 stages (Stage 1, 2 & Slow Wave sleep – SWS).

In stage – 1 there is reduced sensory stimuli, a dream like stage with sleep jerks due to sudden muscle contractions.

Stage – 2: Stage 1 progresses to this stage which features sleep spindles and K complexes (High amplitude negative sharp waves)[4]

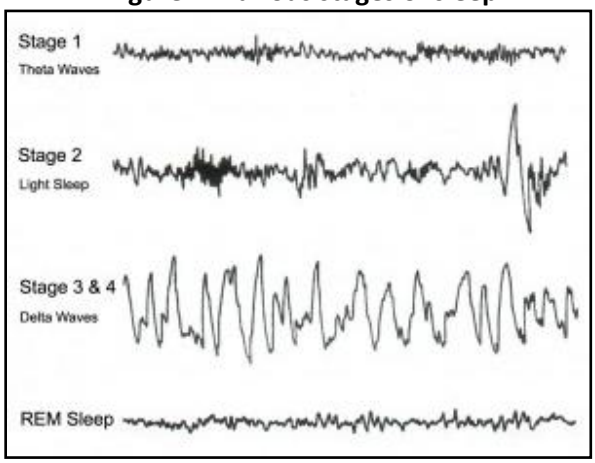
Figure 1: Sleep spindle (12-14 cps) & k complex (high amplituden negative sharp wave followed by positive slow waves).[5]



Short Wave sleep: stage 2,SWS & REM are all subjectively perceived as sleep.

Sleep Related Breathing Disorders (SRBDs): this is common term given to pathology or abnormalities in respiratory pattern such as apneas, hypopneas etc.[6,7]

Figure 2: Various stages of sleep.[5]



Obstructive Sleep Apnea (OSA) is the commonest of all SRBDs and is characterized by recurrent partial or complete collapse of pharynx causing cessation or impairment of breathing such as apneas and hyponeas. This results in loud snoring, inadequate stage 2 NREM, SWS & REM and oxygen desaturation in blood.[5]

Diagnosing and identifying Sleep related breathing disorders:

- Carefully obtained medical history
- Physical examination of full body and specifically Oro- facial region
- History of medications, alcohol, tobacco & caffeine abuse
- Laboratory tests

Specialized testing of sleep is termed as sleep study, performed to assess and diagnose sleep disorders. The most commonly used non-invasive tests are categorized into the following.[5]

A. Objective tests
B. Subjective tests

A. Objective tests

1. Polysomnography(PSG)[6]: according to American Academy for Sleep Medicine is the gold standard for identifying apneas and hypoapneas.[8] In this study electrodes are attached to the face, eyes and scalp to measure brain waves such as EEG, EOG & EMG during a night sleep. Other body functions during sleep such as airflow, breathing effort, blood oxygen levels, leg movements and electrocardiogram are also measured.

   The severity of sleep apnea is estimated based on the AHI(Apneahypoapnea index) which reflects the average number of apneas and hypoapneas per hour during sleep (table 1)

Table 1: Classification of severity of OSA[5]

Apnea hypoapnea index	Classification of severity
<5	Normal
5 – 15	Mild OSA
16-30	Moderate OSA
>30	Severe OSA

2. The Multiple Sleep Latency test (MSLT)[9]are a series of sleep studies aimed to measure daytime sleepiness. Based on the rationale that a sleepier falls to sleep how fast when given 4-5 opportunities to nap in a quiet, dark room during the daytime. The time period of sleep onset from wakefulness is measured to determine the Sleep Latency.
3. Maintenance of wakefulness test (MWT)[9] is similar to MSLT and is conducted to assess the individual's ability to stay awake when reclining in a quiet dark room.
4. Cephalometry[10] is used to examine upperairway and craniofacial structures.

B. Subjective tests:

Such as questionnaires: Epworth sleeping scale , Berlin questionnaire & STOP BANG questionnaire are used to diagnose SRBDs in a clinical scenario.

Table2: Epworth sleepiness scale (ESS)[12]

	Situation	Chance of Dozing				
1.	Sitting and reading	0	1	2	3	
2.	Watching Television	0	1	2	3	
3.	Sitting inactive in a public place	0	1	2	3	
4.	As a passenger in a car for an hour without a break	0	1	2	3	
5.	Lying down in the afternoon when circumstances permit	0	1	2	3	
6.	Sitting quietly after a lunch without alcohol	0	1	2	3	
7.	Sitting and talking to someone	0	1	2	3	
8.	In a car, while stopped for a minute in traffic	0	1	2	3	

ESS is a subjective way of assessing excessive day time sleepiness (EDS). The individual is assessed for the likelihood of falling asleep on a 4 point scale ranging from 0 to 3.

Classification of Sleep related breathing disorders[13]

Central apnea syndromes

- Primary central apnea
- Cheyne – Stokes respiration

- Periodic respiration of high altitude
- Central apneas caused by medicine or other substances
- Primary sleep apneas of new born

Obstructive apnea syndromes

- Obstructive apneas in adults
- Obstructive apneas in children

Hypoventilation / Hypoxia syndromes associated with sleep

- Non- obstructive alveolar hypoventilation
- Congenital central hypoventilation

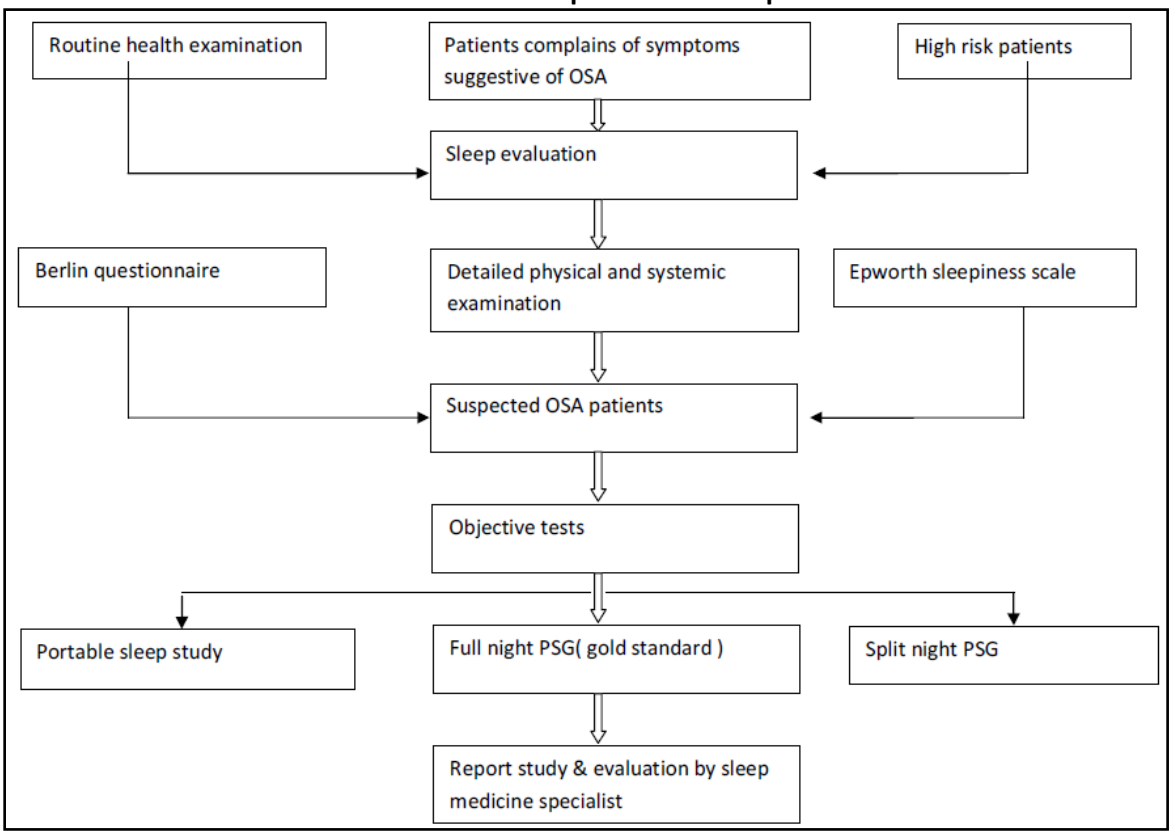
Undefined / Non specific sleep disorders

- Disorders without specific characteristics to allow their classification in any of the previous categories. Further investigation is required.

Clinical Evaluation & Approaches In Diagnosing And Assessing SRBDs in a Dental Office: The role of a dentist in screening OSA (Obstructive sleep apneas) is fast expanding as there are anatomical aberrations in the oro- facial region which could pre- dispose a patient as a risk for SRBDs. Studies have shown that a trained dentist is as likely to diagnose SRBDs as a physician.[14]

Also there is an evidence emerging of periodontal diseases as a risk for having a direct or an indirect link with OSA.

Flowchart 1: evaluation of patient with suspected OSA[11]



OSA, obstructive sleep apnea; PSG,polysomnography

History taking for diagnosis of SRBD:

As a dentist it is mandatory to know the signs and symptoms of obstructive sleep apneas before taking a careful history and conducting physical examination of a potential SRBD patient.

Signs and symptoms of Obstructive sleep Apnea syndrome can be broadly divided into[15] :

A. Nocturnal Symptoms:
   - Loud snoring
   - Choking during sleep
   - Cessation of breathing during sleep (Apneas witnessed by bed partner)
   - Sitting up for breath

- Abnormal motor activities (e.g. thrashing about in bed)
- Severe sleep disruption
- Gastro -oesophageal reflex causing heart burn.
- Nocturia and nocturnal enuresis
- Insomnia
- Excessive nocturnal sweating

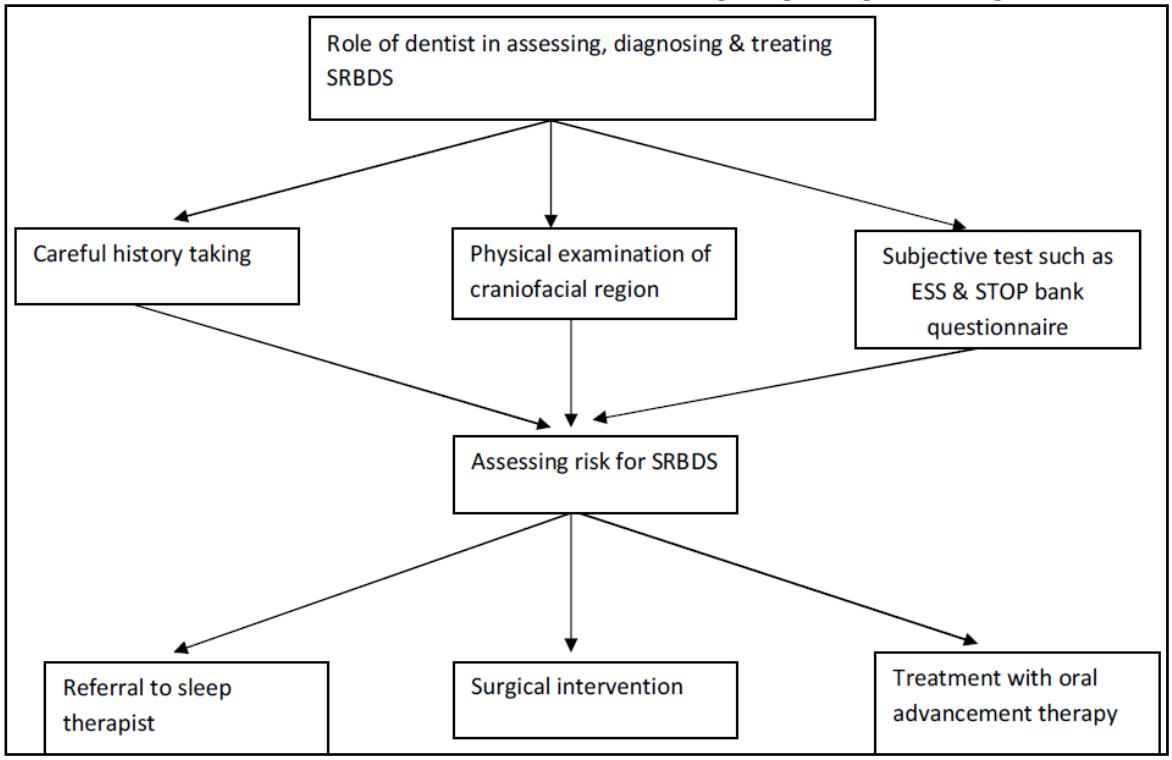
B. Daytime symptoms

- Excessive daytime somnolence
- Forgetfulness
- Personality changes
- Decreased libido and impotence in men
- Dryness of mouth on awakening
- Morning headaches
- Automatic behavior with retrograde amnesia
- Hyperactivity in children
- Hearing impairment in some patients.

Obstructive Sleep apnea is characterized by recurrent partial or complete collapse of pharynx causing cessation or impairment of breathing such apneas and hypopneas.

The two most cardinal symptoms of OSA are loud snoring and excessive daytime sleepiness. These two symptoms are most useful for the screening of patients with SRBDs.

Flowchart 2: Role of dentist in assessing, diagnosing & treating SRBDS



Clinicalcranio- facial screening by the Dentist that may indicate a risk for SRBDs[16]:

- Tongue :
  - ✓ Enlarged coated tongue with crenations at lateral borders
  - ✓ Obstructs view of oropharynx (Mallampati score)
- Teeth and periodontal structures:
  - ✓ Mouth breather resulting in gingival inflammation
  - ✓ Periodontal diseases
  - ✓ Xerostomia
  - ✓ Gingival recession
  - ✓ Sleep bruxism
  - ✓ Attrition
  - ✓ Abfraction
- Airway
  - ✓ Long slopping soft palate
  - ✓ Enlarged/swollen elongated uvula
  - ✓ Small nostrils/nares
    - Alar rim collapse with forced inspiration
- Extra- oral

- ✓ Chapped lips or cracking at the corners of the mouth
- ✓ Poor lip seal
- ✓ Mandibular retrognathia
- ✓ Long face (doliocephalic)
- ✓ Enlarged masseter muscle
- Posture of the head/ neck
- ✓ Forward head posture
- ✓ Loss of iordotic curve
- ✓ Posterior rotation of the head

Mallampati score/index is the way of observing the position of the tongue and the view it allows at rest indicating the risk for OSA. This score was later revised by Friedman and Tanyeri.[17]

Table 3: Malampati Index/Score

Score	What is observed with tongue at rest mouth wide open
I	Visualize the soft palate, uvula, tonsils and the oropharynx
II	Visualize the soft palate, most of the uvula, superior portion of the tonsils, not the oropharynx
III	Can see the soft palate but not the uvula, tonsils or into the oropharynx
IV	Cannot see the soft palate or any structures below this, can only see the hard palate

- Questionnaires such as ESS, Stop Bang & Berlin questionnaire can be used by dentist to evaluate the risk factor.

- Systemic impact & effects of SRBDs:

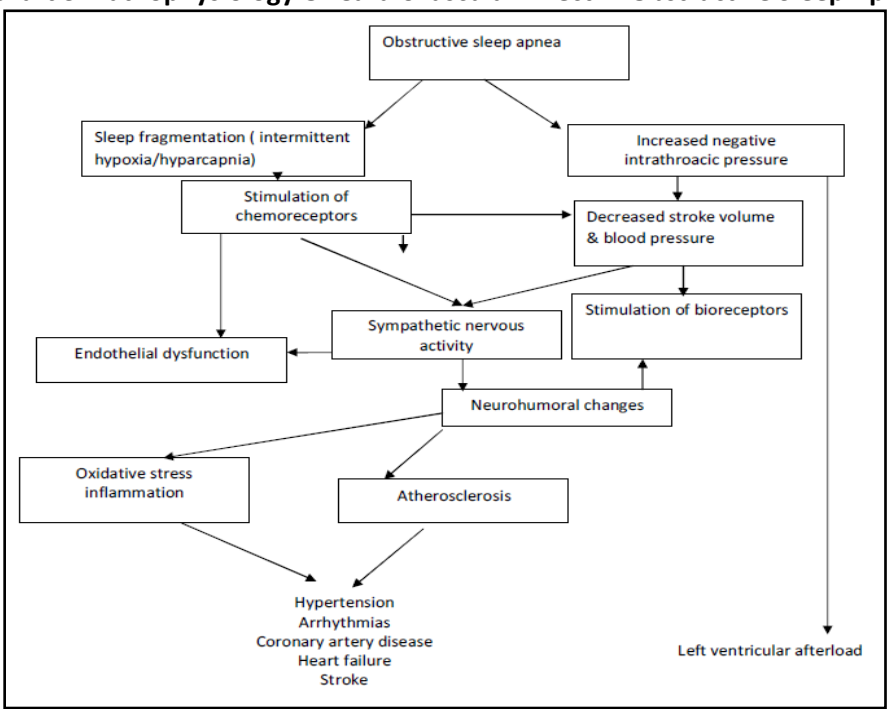
Can be broadly classified as cardiac&Non cardiac systemic effects.

Cardiac effects: involvement of CVS is the most common and serious complication of SRBDs.

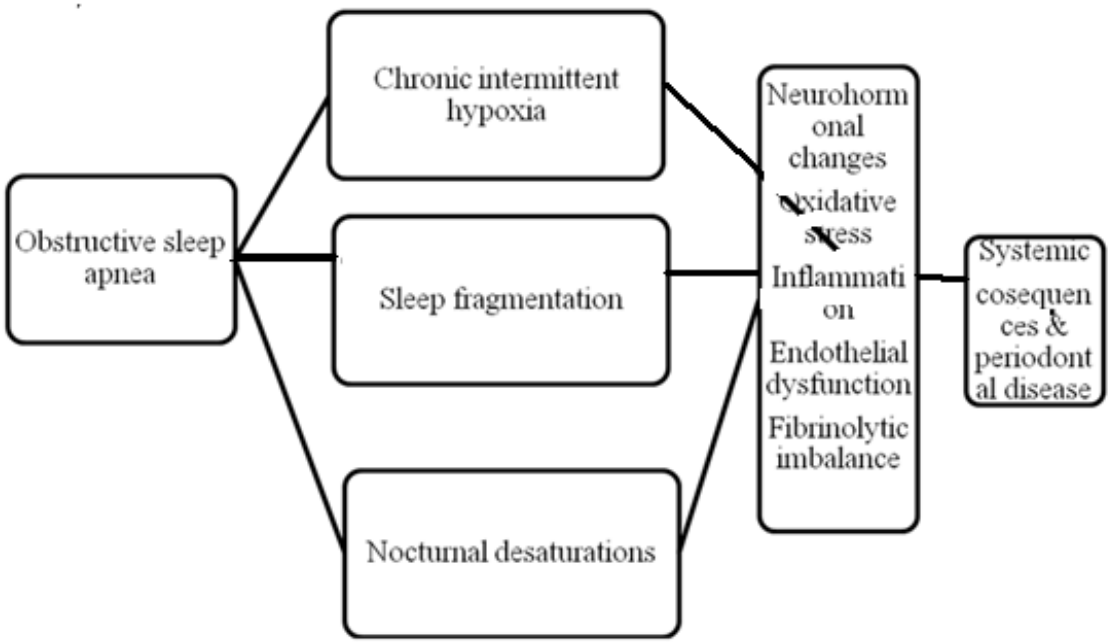
The complications are[18]:

- Hypertension
- Arrhythmias
- Heart failure
- Coronary artery disease

Flowchart 3: Pathophysiology Of Cardiovascular Effect In Obstructive Sleep Apnea[3 5]



Flowchart 4: Mechanism leading to sytemic consequences & periodontal disease of obstructive sleep apnea.(OSA)[5]



Non – cardiac systemic effects:

- Metabolic effects such as Insulin resistance and glucose intolerance leading to Type II Diabetes Mellitus[17,18] [19,20]Synergistic effect on Obesity.[21,22]
- Neurocognitive effect such as problems in verbal fluency. Memory, Attention Deficit Hyperactivity disorder and perception.[23]
- Psychiatric disorders such as depression, self blame.[24]
- Gastroesophageal reflux.[25]
- Chronic kidney disorders due to hypoxia induced dysfunction.[26]
- Erectile dysfunction in men[27]
- Other effects such as waking headaches, growth retardation.[28]

Association between Chronic Periodontitis and Obstructive sleep apneas (OSA)

Chronic Periodontitis is an inflammatory disease characterized by bacterial infection resulting in cascade of inflammatory response (Listgarten 1986).

There is plethora of evidence implicating CP as a synergistic cause of various diseases such as diabetes, adverse pregnancy outcomes, pulmonary and CVS diseases due to potential inflammatory pathways.

There has been a recent scientific evidence of association between CP & OSA as OSA also results in inflammatory responses of the host(Ryan ET Al 2005).Keller JJ et al carried out a population based study showing statistically significant difference in the prevalence of Chronic periodontitis in patients suffering from OSA and the controls (not suffering from OSA).

Management of Obstructive sleep apneas (OSA):

Broadly 4 treatment modalities either concomitantly or separately are performed with a multi- disciplinary approach depending upon the causation of OSA. These are[5]:

1. Continuous positive airway pressure (CPAP) also called Nasal continuous positive air pressure (nCPAP) .
2. Pharmacotherapy & life style modification
3. Surgical management
4. Dental management or Oral Appliance Therapy (OAT)

1. Continuous Positive Airway Pressure:

The basic principle is to maintain patency of the upper airway and consists of a

generator that directs air under pressure to flow into the patient via tubing. Same pressure is delivered during both respiration and expiration.

2. Pharmacotherapy: Plays a secondary role in treatment of OSA. These agents basically impact sleep patterns, promote ventilation and reduce nasal congestion.[29-31]. E.g. Protryptyline, Serotonergic agents, Modafinil.

3. Surgical Management: the surgical management is done in cases of definitive obstructive airway pressure. The procedures are broadly as under:
   - Corrective nasal septal surgeries like septoplasty for DNS.
   - Tonsillectomy
   - Uvulopalatopharyngoplasty
   - Tongue based reduction with or without Hyoid Suspension
   - Genioglossus
   - Maxillomandibular Advancement
   - Distraction Osteogenesis
   - Laryngeal Surgery
   - Tracheostomy

4. Oral Appliance Therapy : Broadly 2 types.[30 32]
   - Tongue Retaining Devices
   - Mandibular Advancement Devices.

Discussion and Conclusion: In the last decade scientific evidence has evolved showing link between SRBDs & periodontal diseases. This association could be attributed to the fact that there are cascade of inflammatory events seen in OSA and since periodontitis is a known inflammatory disease, there could be a plausible interconnect.

So as a dentist a sound knowledge of SRBDs is mandatory to diagnose & manage OSAs both as referrals & with OAT (oral advancement therapy).

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