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RESEARCH ARTICLE

OBSTRUCTIVE SLEEP APNEA

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Abstract

Obstructive sleep apnea is an under recognized and under diagnosed medical condition, with a myriad of negative consequences on patients' health and society as a whole. The most acting reason behind Obstructive sleep apnea given as in literature is due to recurrent episodes of upper airway (UA) collapse during sleep. Episodes may last 10 seconds or longer and commonly last 30 seconds or longer. From the mid-1990s to the present, we have seen an explosion of basic, clinical, and population research directed toward the prevalence, causes, consequences, and treatment of this long-standing, although only recently appreciated, problem. Sleep apnea has attracted a myriad of researchers from diverse disciplines and clinical subspecialties. At the same time, sleep apnea as a serious, undefined clinical problem has also given birth to many sleep medicine clinics throughout the western world. Finally, given the relatively high prevalence of this sleep-specific problem with potential carryover to daytime pathology, sleep apnea has provided great impetus to the growth of sleep medicine as a clinical and research specialty. Dentists have been involved in the collaborative evaluation and treatment of patients with OSA using oral appliances from 1980. Importantly, dentists play a crucial role in evaluating patients with OSA for the suitability of appliance therapy, choosing and adjusting the appliance and assessing the patient for adverse effects. To accomplish holistic treatment approach it is essential that dentists and the sleep medicine physician should work collaboratively. When this occurs, patients will have the best opportunity for the effective treatment of their OSA.

Introduction:-

Sleep is a critical determinant of health helping in fatigue reversal, biochemical refreshment, immune function, memory improvement and psychological well-being thus it is an essential part of one's lives. Snoring definitely becomes threatening when combined with impaired quality of sleep as in obstructive sleep apnea.

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The Greek word apnoea which means 'no breathing' is used when obstruction is total and term hypopnoea is used when obstruction is partial. In the modern medical perspective the first known descriptions of OSA date from 1966 when researchers in Europe described the entity of sleep apnea syndrome. OSA is a sleep disorder that involves intermittent cessation or significant decrease in airflow in the presence of breathing effort during sleep. OSA is associated with decreased quality of life, significant functional impairment, and increased risk of road traffic accidents. It is one of the most prevalent sleep related breathing disorders with a reported prevalence of approximately 3% in children and 24% in men and 9% in women aged 30-60 years of age[1].

Even though OSA has gained an increased interest in the last decades, the majority of subjects with sleep apnea remain undiagnosed.This is, at least, partly explained by the fact that OSA in many cases is asymptomatic in early stages. So, in order to diagnose subjects who will be benefited from a treatment the knowledge in risk factors and symptoms are crucial. Pre-existing pulmonary diseases, depressed the central nervous system, such as alcohol, sedatives, relaxation of the pharyngeal musculature and therefore airway occlusion and obesity are common risk factors[2].

The primary alarming sign of OSA are the recurrent episodes of upper airway (UA) collapse that may last 10 seconds or longer.OSA is characterized by a number of symptoms, of which intermittent upper airway obstruction during sleep, socially handicapping snoring, and daytime sleepiness are the most common[3].Sleepiness is one of the potentially most morbid symptoms of sleep apnea, owing to the accidents rate reporting to be 2–3 times higher than in matched control drivers[4].

Dentists have an important role in identifying patients by recognizing a small upper airway and other anatomic risk factors like reduced palatal crossbite, and reduced dentoalveolar transverse widths in the maxillary and mandibular arches for OSA. Dentists have been involved in the collaborative evaluation and treatment of patients with OSA using oral appliances since 1980[5].

OSA can be reversed quickly with appropriate titration of continuous positive pressure and use of proper oral appliances.

Early intervention with lifestyle counselling, surgery and orthodontic treatment may detect the progression of childhood OSA to adulthood OSA. This can only happen through better understanding and earlier recognition of the underlying mechanisms behind this and an intensive collaboration between different medical and dental specialities.

Classification

The American Sleep Disorders Association classifies OSA

The AHI is the number of apneas or hypopneas recorded during the study per hour of sleep. Based on the AHI, the severity of OSA is classified as follows:

1. **None/Minimal**: AHI < 5 per hour
2. **Mild**: AHI ≥ 5, but < 15 per hour
3. **Moderate**: AHI ≥ 15, but < 30 per hour
4. **Severe**: AHI ≥ 30 per hour

Prevalence

The reported prevalence of OSA has increased over time.Overall, OSA in the general adult population measured as ≥5 AHI/RDI ranged from 9% to 38%. In men this varied from 13% to 33%, and in women from 6% to 19%.[5] In some advanced age groups, however, the prevalence was as high as 84% overall, and as high as 90% in men.

In the first study from India, Udwadia and colleagues studied urban men between 35 and 65 years of age presenting to the hospital for routine checkup, and reported the estimated prevalence of OSA as 19.5%.[6] This result is comparable with the world wide prevalence rate.

While looking into the prevalence among children, OSA has been estimated to affect about 2-3.5% of children[7].

Etiology For Obstructive Sleep Apnea

Physical Factors:

1. **Sex**: In adults, the male-to-female ratio is approximately 3:1.[1]It has been reported that upper airway soft tissue structures are larger in men than in women.
2. **Age**: Obstructive sleep apnea prevalence increases 2-3 times in older persons (>65 y) compared with individuals aged 30-64 years[8].
3. **Obesity:**According to a study by Singh et al, in North Indian population, it was found that 33.5% of the obese population was at high-risk OSAS.[9]
4. **Ethnicity:**. Asians had a narrower cranial base angle; a feature which could increase their risk of OSA.

Structural Factors

1. **Large neck circumference**: In addition, neck circumference of 40 cm or greater had a sensitivity of 61% and a specificity of 93% for obstructive sleep apnea, regardless of the person's sex.
2. **Size of tongue**: the tongue in apnoeic was significantly larger (P = 0.001) and had an increased amount of fat (P = 0.002)[10].
3. **Upper Airway size and shape**:Anatomic alterations reducing airway like;
   - Posteriorly positioned maxilla and mandible
   - *Retrognathic mandibles*
   - *Micrognathia*
   - *Acromegaly*
   - *Overerupted anterior teeth*
   - *Downs' syndrome*

Craniofacial abnormalities

The cranial index was increased and the facial index was decreased in subjects with obstructive sleep apnea.

Hyoid position

Apneic children have also been found to have longer Hyoid-Mandibular Plane distance. The H-MP distance increased significantly with age regardless of snoring status.

Enlarged tonsils or adenoids

The main risk-factors for OSA in preschool children were adeno-tonsillar hypertrophy and recurrent respiratory tract infection,which will lead to reducing airway potency[11].

Non-Structural Factors

Additionally, environmental exposures include smoke, environmental irritants or allergens, and alcohol and hypnotic-sedative medications. who smoked tobacco were three times likely to be at high risk of sleep apnoea[12].

D.systemic factors:

Systemic hypertension,hypothyroidism, acromegaly independently predicted high OSA risk and that hypertensive patients had tenfold increase in the odds of high risk for sleep apnoea.

E.GENETIC FACTORS :

Increased but insignificant risk of OSA was observed in the subjects when compared on the basis of presence or absence of history of loud snoring in any first degree blood relative[13] .

Pathophysiology

Anatomic Alterations: Airway narrowing is a dynamic process, varying markedly among and within subjects and often includes the retroglossal and hypopharyngeal areas14. It is also widely observed that the airway length, from the top of the hard palate to the base of the epiglottis, is also increased in OSA patients15.

Disturbances In Neuromuscular Control

Chemoreceptive mechanisms are also important in influencing the output from the hypoglossal motor nucleus16. Elevation of CO2 due to increased apneas yields an increase in genioglossal activity which reduces the pharyngeal dilator tone at sleep onset and predispose to airwayobstruction.

Neurotransmitters And Neuromodulators Influencing Upper Airway

1. **Neurotransmitters:** A glycine antagonist can effect on genioglossus and tensor veli palatine muscle activity in an individual with obstructive sleep apnea by increasing its activity thus reducing the occurrence of OSA.
2. **Neuromodulators:** The neuromodulators effects both pre- and postsynaptic upper airway motor neurons.

Obesity And Lung Volume

Obesity and upper airway narrowing are inversely proportional, especially in the hypotonic airway present during sleep.

Airway Edema And Surface Tension

Accumulation of even relatively small amounts (100– 200 ml) of edematous fluid in the soft palate enlarges upper airway soft tissue structures in OSA patients and snorers. A higher surface tension in the upper airway wall of OSA patients has beenreported.17

Symptoms:

The symptoms manifested are broadly classified into nocturnal and diurnal symptoms based on the time of manifestations.

DIURNAL SYMPTOMS	NOCTURNAL SYMPTOMS
Morning confusion and headaches	Snoring
Dry mouth in morning	Choking or gasping at night
Excessive sleepiness	Night sweats, Nocturia
Decreased vigilance	Insomnia
Personality and mood changes, including depression and anxiety	Patient report of “Trouble Sleeping”
Cognitive deficits; memory and intellectual impairment	Non-restorative sleep (ie, "waking up as tired as when they went to bed")
Sexual dysfunction,decreased libido	

Table 1:- Nocturnal And Diurnal Symptoms Of OSA.

Signs Of OSA:

1. Increased neck circumference, body mass index
2. Airway obstruction with mallampatti score greater than III and IV
3. Enlarged tonsils occupying more than 40% of oropharyngeal width.
4. Enlarged nasal turbinates

Oral Manifestations

1. Forward tongue posture
2. Anterior Open-Bite and large Over-Jet
3. Steep mandibular plane
4. Large gonial angle.
5. Steep Occlusal Plane
6. Increased height of face
7. Bulky uvula
   - Large tonsils
   - Narrow and small pharynx
   - Airway space grading

Diagnosis

The diagnosis of OSA starts with a sleep history which should be taken during the routine health maintenance evaluation of the symptoms of obstructive sleep apnea patients at high risk for OSA.

History Taking

I. General History

History can be recorded by means of:

i. **Obesity** :The National Institutes of Health and WHO define each unit increase in BMI is associated with a 14% increased risk of developing sleep apnea, and a 10% weight gain increases the odds of developing moderate or severe obstructive sleep apnea by six times[20].
ii. **Hypertension** : The prevalence of hypertension in OSA patients is estimated between 30 and 70%. OSA was found to have the greatest association with resistant hypertension (64%)[21].

There are standardized questionnaires that could be used in primary care visits for screening patients with possible OSA and the recommended one is STOP-BANG questionnaire .It has 8 questions and more than 3 positive answersare considered diagnostic for OSA.

STOP

- Snoring: Do you snore loudly (louder than talking or loud enough to be heard through closed doors)? Yes No
- Tired: Do you often feel tired, fatigued, or sleepy during daytime? Yes No
- Observed: Has anyone observed you stop breathing during your sleep? Yes No
- Blood pressure: Do you have or are you being treated for high blood pressure? Yes No

BANG

- BMI: BMI more than 35 kg/m2? Yes No
- Age: Age over 50 years old? Yes No
- Neck circumference: Neck circumference greater than 40 cm? Yes No
- Gender: Male gender? Yes No

Table 2:- STOP_BANG Questtionnaire

Further a more comprehensive sleep history and physical examination are to be done.
Comprehensive Sleep History
Patient Questionnaire
In a patient suspected of OSA includes an evaluation for thefollowing are to be done:
Snoring : Habitual snorers with a snoring frequency of 3-4 times a week are more prone to sleep disordered breathing[22].
Witnessed Apneas or choking episodes :OSA is defined as either 5 obstructive events/hour of sleep with symptoms *or* 15 obstructive events without symptoms.
Total Sleep Amount : The total sleep amount is found to be reduced because of the sleep fragmentation caused by the increased respiratory effort in the presence of apneas and hypopneas.
Excessive Sleepiness: as explained by the assessment of sleepiness severity by the Epworth Sleepiness Scale.

Epworth Sleepiness Scale Questionnaire:
The patient should choose one of the 0-3 numbers as described below in the recent two weeks. Scores greater than 10 out of 24 are regarded as presence of daytime sleepiness.
0 = would never doze or sleep.
1 = slight chance of dozing or sleeping
2 = moderate chance of dozing or sleeping
3 = high chance of dozing or sleeping

Table 3:- Epworth Sleepiness Scale Questionnaire.

Caretaker Questionnaire:
Obtaining a history of snoring and/or sleepiness from someone who has observed the patient's sleep behavior is important.

Physical Examination:
Neck size:
A neck size greater than 40cm (16inches), regardless of gender, has sensitivity of 61% and a specificity of 93% for having obstructive sleep apnea syndrome[23].In children and youth, neck sizes significantly smaller than 18 in. were associated with OSA risk.

Body mass index:
An individual with a BMI of at least 25 kg/m2 has been found to have a sensitivity of 93% and specificity of 74% for having Obstructive Sleep Apnea[24].

Airway Evaluvation:
The evaluation of the airway begins at the tongue and proceeds into the oral pharynx.Friedman et al(1999)stated that patients with a Mallampati Score of III or IV are at a greater risk for sleep apnea.

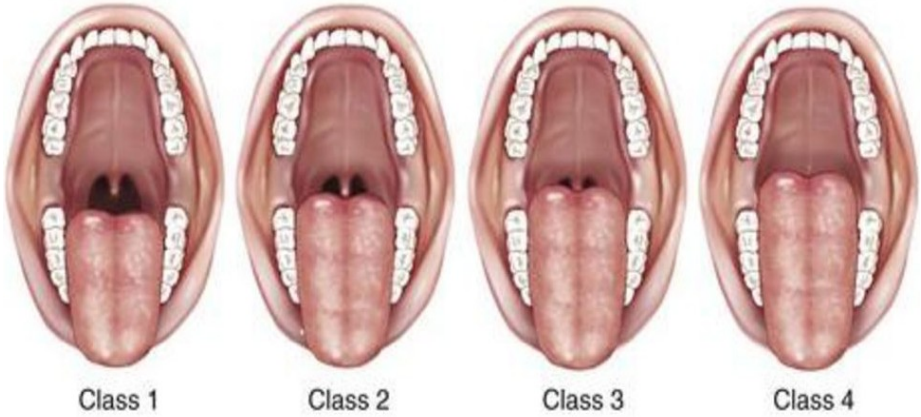


Fig 1:- Mallampati Scores.

I. **Tonsilar size Grading:**
II. It is graded on a universally recognized standard.

Grade 1 (tonsils occupy ≤20% of the oropharyngeal width)
Grade 2(Tonsils occupy 21%-40% of the oropharyngeal width)
Grade 3 (tonsils occupy 41%-60% of the oropharyngeal width)
Grade 4 (tonsils occupy 61%-80% of the oropharyngeal width)
Grade 5(tonsils occupy 61%-80% of the oropharyngeal width).

Table 4:- Tonsillar Grading.

The prevalence of OSA is more in children with grading more than 2.Butthere is only a weak association between tonsil size and OSA.

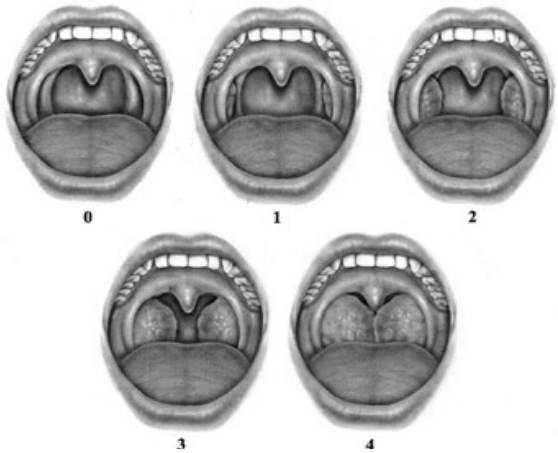


Fig 2:- Tonsillar Grading.

Nasal examination
Among the places of greatest resistance to nasal airflow are the vestibule and nasal valve area, determined by the alar cartilages, septum, and inferior turbinates[25].

Temporomandibular assessment:
Pre-existing TMJ findings should be noted, especially if mandibular advancement with an oral appliance is being planned.

Muscle Assessment
Many patients with sleep-related breathing disorders may be fatiguing the muscles of the head and neck region thus resulting in coexisting jaw, face, or neck pain.

Pulse Oximetry:
The best predicted cutoff for mild to moderate OSA patient diagnosis was (14.7800) with 87.88% sensitivity, 88.71% specificity. However, the optimal cutoff values for severe OSA diagnosis was (52.5500) with 86.67%sensitivity, 96%specificity.[26]

Upper Airway Imaging:
X-RAY Imaging
Cephalometry
Cephalometry is considered useful for evaluating and quantifying craniofacial (mandibular and hyoid position) and soft tissue structures in patients with retrognathia or micrognathia

Nasopharyngoscopy
Nasopharyngoscopy is commonly used to evaluate the nasal passages, oropharynx, and vocal cords. However, it examines only the lumen of the upper airway and does not provide measurement of the surrounding soft tissue structures.

Acoustic reflection
The phase and amplitude of the reflected sound waves can be transformed into an area-distance relationship by calculation of upper airway area as a function of distance from the incisors in the mouth.

Fluoroscopy
fluoroscopy can provide a dynamic evaluation of the upper airway during wakefulness and sleep, radiation exposure makes this study impractical for routine use.

Computed Tomography
Dynamic imaging of the upper airway can be performed with electron beam CT.But CT scanning has limited soft tissue contrast resolution, particularly for upper airway adipose tissue when compared to that of MR.

Magnetic Resonance Imaging
It provides excellent resolution of upper airway and soft tissue, measures cross-sectional airway area and volume, allows imaging in all 3 planes.

Diagnostic Testing
The two accepted methods of objective testing are in-laboratory polysomnography (PSG) and home testing with portable monitors (PM).

Polysomnography
First proposed by Holland et al in 1974. It is the gold standard diagnosis of sleep apnea.

Polysomnography is a physiologic study, performed for at least 6 hours during a patient's normal sleep hours. It is used to assess the severity of OSA.

The use of PSG requires recording the following physiologic signals: electroencephalogram (EEG), electrooculogram (EOG), chin electromyogram, airflow, oxygen saturation, respiratory effort, and electrocardiogram (ECG) or heart rate.and other parameters.

During analysis of the Polysomnography, each episode of apnea and hypopnea is identified and counted. In patients where there is a strong suspicion of OSA, if other causes for symptoms have been excluded, a second diagnostic overnight PSG may be necessary to diagnose the disorder

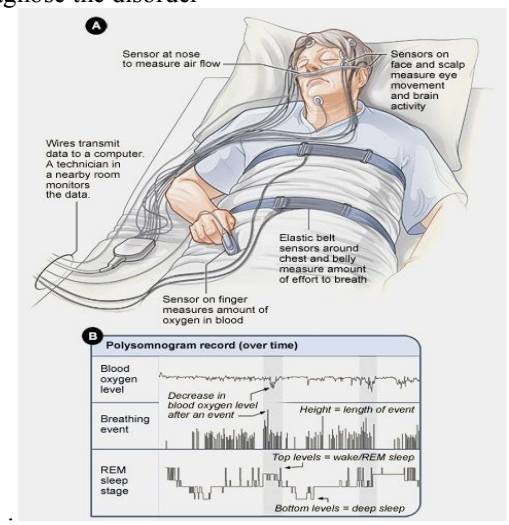


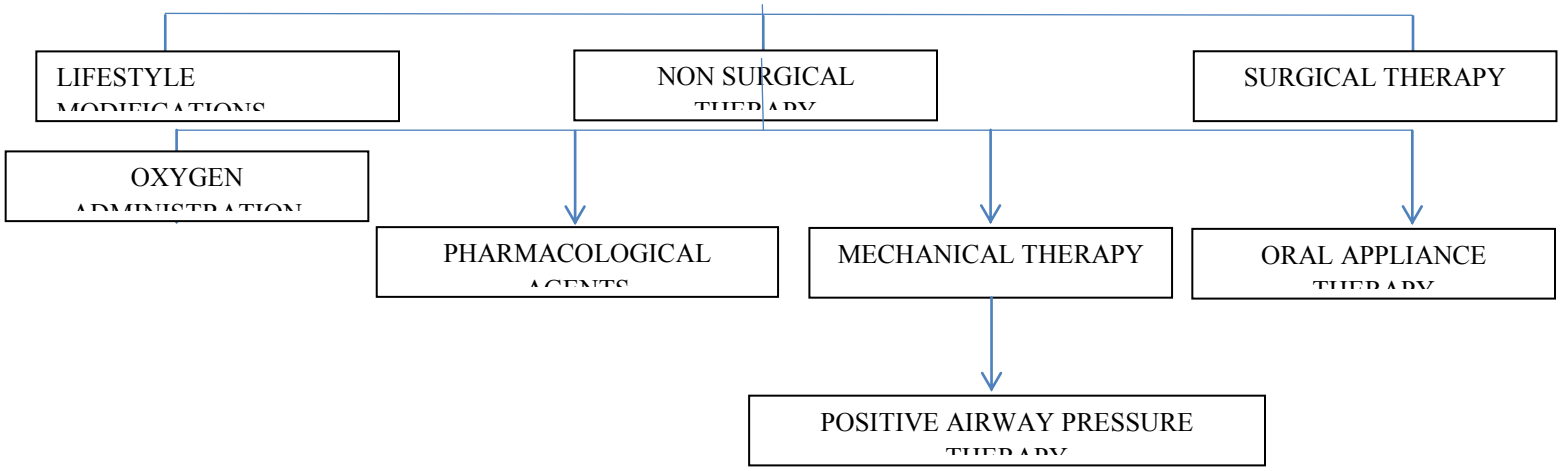
Fig 3:- Polysomnographic Monitoring.

Portable Monitor:
An effective portable monitor requires at least three channels to asses airflow, thoraco-abdominal movements, and blood oxygenation. Clinical practice guidelines from the American Academy of Sleep Medicine (AASM) indicate that portable monitoring may be used as an alternative to polysomnography to diagnose OSA in patients with a high pre-test probability of moderate to severe OSA.The term *RDI* has been defined.In PM it is the number of apneas + hypopneas divided by total recording time rather than total sleep time in PSG.

Laboratory Studies
Routine laboratory tests usually are not helpful in obstructive sleep apnea (OSA) unless a specific indication is present, such as the following:
1. Thyrotropin hormone level
2. An arterial blood gas determination

Other Tests
The other 2 types of miscellaneous tests are:
1. Multiple sleep latency test (MSLT):
2. Actigraphy:

Treatment



Flowchart 1:- Treatment Classification.

Lifestyle Modifications
1. Even a 10% weight loss can reduce the number of apneic events for most obese patients[27].
2. Individuals with apnea should avoid the use of alcohol for 4-6 hours prior to bedtime, and sleeping pills, which make the airway more likely to collapse during sleep.
3. Positional therapy: It was found that the position change from the supine to the lateral enlarged both retropalatal and retroglossal airways[28].

Non-Surgical Therapy
The different techniques available are as follows

Oxygen Administration:
O_2 therapy significantly improves oxygen saturation in patients with OSA. On the other hand, oxygen therapy also potentially increases the risk of hypercarbia. Hence, at present it is difficult to recommend oxygen therapy for patients.

Pharmacological Agents:

SL NO	DRUGS	EFFECTS ON OSA	DRUG DOSAGE
1.	Tricyclic anti-depressants	Improve OSA by increasing rapid eye-movement (REM) sleep latency while decreasing the overall	20 mg daily for 6 weeks

		amount of time spent in REM sleep.	
2.	Nicotine products	Gothe et al reported that the use of nicotine gum eliminated obstructive apneas in the first 2 hours of sleep	2-4mg nicotine gum at bedtime
3.	Methylxanthine derivatives	These agents work by blocking adenosine receptors and stimulating ventilatory drive.	400mg/ day
4.	Corticosteroids	Inhaled nasal corticosteroids can be used to improve airway patency.	2-3 puffs twice a day
5.	Leukotriene antagonists	This have been moderately successful in children due to the dominant expression on their tonsils .	4-5mg daily
6.	Nasal decongestants	act on arterioles in the nasal mucosa and cause vasoconstriction by stimulating alpha-adrenergic receptors.	2-3 puffs
7.	Thyroid hormone replacement	Patients with hypothyroidism frequently suffer from OSA, possibly due to weight gain and/or a reduction in ventilatory drive.	
8.	Hormone replacement	Menopause is considered a risk factor for snoring and sleep-disordered breathing that is thought to result from a loss of the protective effects of female hormones.	
9.	Wake promoting agents (Modafinil, armodafinil)	***B***eneficial in reducing the excessive sleepiness associated with OSA. A significant safety issue for modafinil is the possibility of developing Stevens-Johnson syndrome.	200-400mg daily
10.	Miscellaneous Agents	Additional therapies that have been studied in the treatment of sleep apnea include testosterone, agents for acromegaly, opiate antagonists, antihypertensives, glutamate antagonists, acetazolamide, physostigmine, tumor necrosis factor (TNF)-alpha agonists, and carbon dioxide inhalation.	

Table 5:- Pharmacological Agents.

Mechanical Therapy
It has three forms**:** continuous positive airway pressure,autotitration and bi-level positive airway pressure.

Continuous Positive Airway Pressure(CPAP)
Initially described in 1981 by Dr.Sullivan,Dr. Berthon-Jones,Dr Issa and Dr.Eves from Australia, nasal CPAP therapy is currently the treatment of choice for patients OSA.

Continuous positive pressure is applied to the UA with a nasal mask, nasal pillows, or oronasal mask. CPAP acts as a pneumatic splint to maintain UA patency during sleep, and it is effective in the treatment of sleep-disordered breathing.

Cpap Procedure
CPAP therapy involves a CPAP machine, which comprises the following:
A mask that covers nose and mouth, tube that connects the mask to the CPAP machine, blower unit that produces positive-pressure airflow.

The airflow is usually applied at the nose and is then directed through the upper airway.It increases the lateral dimensions of the upper airway and thins the lateral pharyngeal walls, which are thicker in patients with obstructive sleep apnea than in people without obstructive sleep apnea.

Fig 4:- CPAP Machine.

Benefits

1. lesser risk,and complications
2. Patient's perceived quality of life increases
3. Reduced daytime sleepiness
4. Reduction in BP levels with CPAP.
5. Reduces long-term morbidity and mortality from cardiovascular causes.
6. People who use CPAP for longer times each night (around 7 hours) have less daytime sleepiness and depression.

Disadvantages

1. Approximately 10-50% of subjects finds the CPAP intolerably uncomfortable and discontinues its use[29].
2. Results in reduced cardiac output and renal function.and subsequently pressure inside the sinus increases.
3. It results in drying of the airway mucosa.
4. The occlusion of the exhaust line could theoretically cause hyper-inflation of the lungs and perhaps even lung rupture.

Auto Nasal Continuous Positive Airway Pressure(Autotitration)

The device continuously adjusts the applied air-pressure to an optimum level throughout the night and appears to improve compliance. A single pressure level, as with standard continuous positive airway pressure could result in insufficient air pressure at certain times. Auto continuous positive airway pressure facilitates the process of optimal initial pressure titration, and thus eliminatesthe repeated titrations

Bilevel Positive Airway PressureTherapy(BiPAP)

In contrast to CPAP, BiPAP permits independent adjustment of the pressures delivered during inspiration and expiration ie, the prescribed pressure for inhalation (ipap), and a lower pressure for exhalation (epap).BiPAP machines are often prescribed to sleep apnea patients with high pressure settings or low oxygen levels,and are often used after CPAP has failed to adequately treat certain patients.

Oral Appliances

Oral appliances for repositioning the mandible were first developed by Dr. Pierre Robin. A minimum percentage of protrusion to effectively treat obstructive sleep apnea is 6-10 mm or up to 75% of the maximum protrusion the patient is capable of at the initial examination[30].

The three concepts for a dental appliance to modify the airway, depending on where the airway obstruction occurred are:

1. Mandibular repositioning
2. Tongue retention
3. Soft palate lifting

The most suitable design for the patient should be decided depending on factors such as diagnosis of sleep disorder, cost, parafunctional activity and occlusal registration.

Mandibular Repositioning Appliances:

Clinical guidelines recommend mandibular repositioning appliances ahead of CPAP in mild OSA and also in severe OSA when CPAP is refused or not tolerated.

Mechanism Of Action:
These appliances alter the jaw and tongue position by protruding the mandible forward, thus preventing the upper airway collapse. Both video endoscopy and MRI-guided studies have determined that these devices predominantly increase the volume of the airway at the level of the velopharynx.

USES:
To treat obstructive events, sleep fragmentation and oxygen desaturation, and also the symptomatic goals such as snoring, sleepiness, QoL.

Indications Of Appliances
1. a patient has at least 8 teeth in each arch
2. able to demonstrate a mandibular protrusion of at least 5 mm
3. a bite opening of greater than 25 mm.

Contraindications
1. Obstructive sleep apnea patients who present with severe TMJ pain.
2. Patients with significant bruxism can frequently damage mandibularprotrusion devices.
3. Very obese patients, with some exceptions.
4. Less than 6-10 teeth in each arch
5. Patient unable to protrude the mandible forward and open the jaw widely

The following are the appliances which will come under the rationale of mandibular advancing devices;

Anterior Mandibular Positioner
Anterior mandibular positioners (AMPs) have become increasingly popular as alternatives to continuous positive airway pressure for the treatment of obstructive sleep apnea. Thewidespread acceptance of anterior mandibular positioners is limited by an efficacy rate of 50-80% and an inability to predict which patients will respond to therapy.

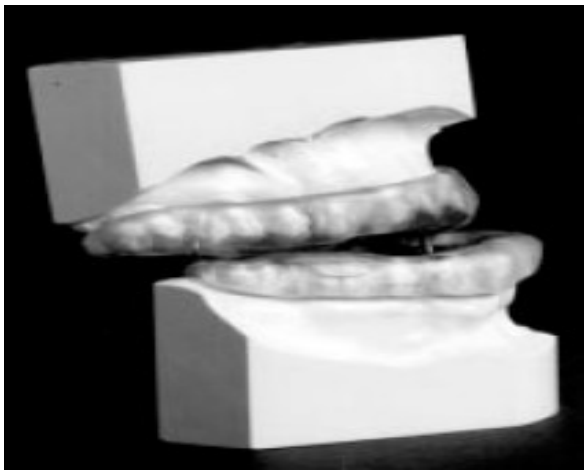


Fig 5:- Anterior Mandibular Positioner.

Elastic Mandibular Advancement Appliance (EMA)
The appliance is a simple, patient-friendly oral appliance created for noninvasive treatment of snoring and OSA. The primary treatment mechanism of the appliance is opening the bite and gently moving the mandible forward.

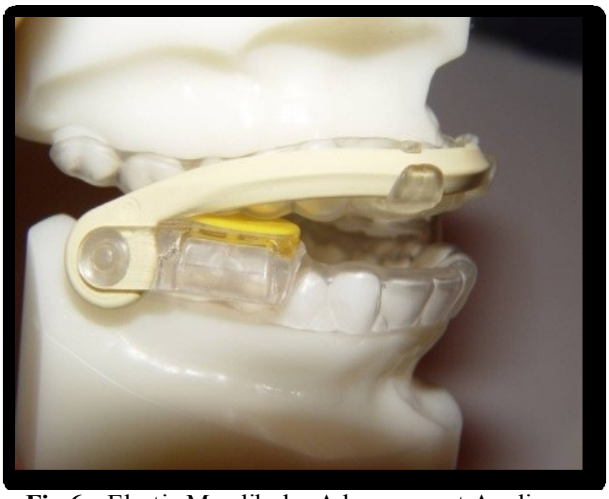


Fig 6:- Elastic Mandibular Advancement Appliance.

Thornton Adjustable Positioner

The TAP is the only mandibular advancement device that can be adjusted easily by the patient or practitioner while in the mouth. Most patients experience relief the very first night.

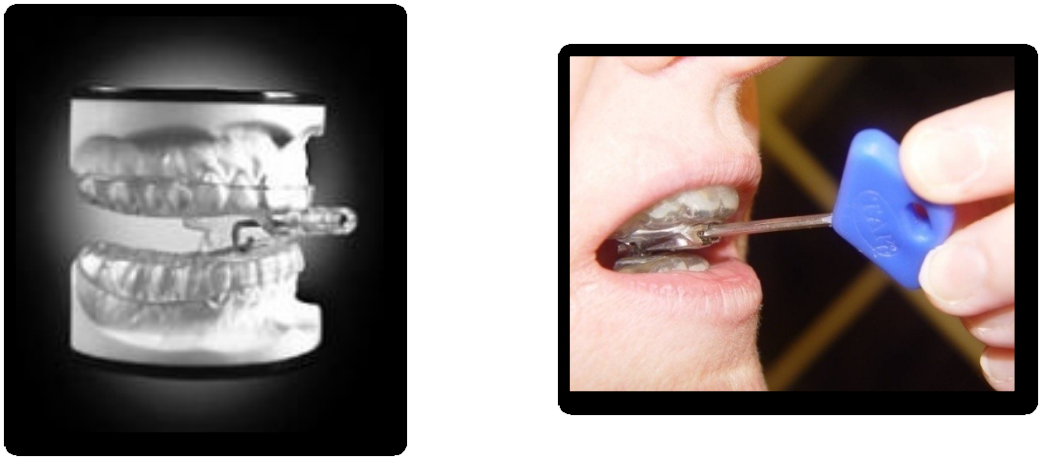


Fig 7:- Thornton Adjustable Positioner.

Oral Pressure Appliance:

It is a "combination" therapy which combines a nonadjustable MRD with continuous positive airway pressure . Pressures necessary to control snoring and obstructive sleep apnea are much lower when delivered through oral pressure appliance than when using nasal delivery.

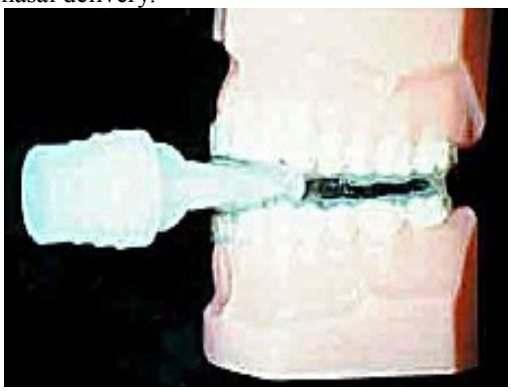


Fig 8:- Oral Pressure Appliance.

The Karwetzkyactivator :
Passive tooth-and tissue borne device .It is a bimaxillary, tooth- and tissue-borne activator with a loose fit.

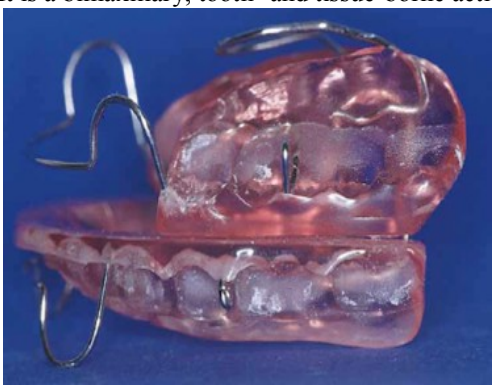


Fig 9:- Karwetzky Activator.

Adjustable Herbts Appliance
The greatest advantage of the Herbst appliance is that it allows for very quick, easy and accurate mandibular protrusive adjustability.

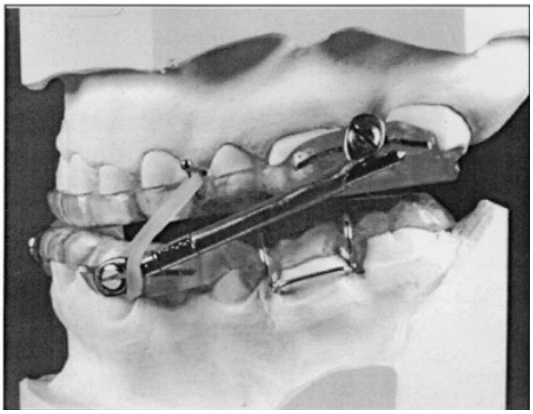


Fig 10:- Adjustable Herbst Appliance.

SNORE-AID
Snore-Aid plus is an adjustable mandibular bite plate that advances the mandible and repositions the tongue anteriorly and superiorly. Snore-Aid plus allows the patient to have their natural jaw motions while they sleep. Speaking, yawning, and swallowing are not impaired by Snore-Aid plus.

Fig 11:- Snore Aid Plus.

The Modified Monobloc:
The incisal edges and superior labial surfaces of the mandibular incisors were capped to prevent tipping.The construction bite positioned the mandible anteriorly into an edge-to edge incisal relationship, with a vertical bite opening of 2-3 mm.

Fig 12:- Modified Monobloc.

Therasnore
The TheraSnore is one of the few appliances that requires no laboratory construction and is easily fitted chairside from a boil and bite. The TheraSnore also allows the mandible complete vertical and lateral freedom of movement to ensure the problems associated with TMJ/TMD.

Fig 13:- Therasnore.

Klearway Tm Oral Appliance
It is a fully-adjustable oral appliance with a maxillary orthodontic expander to sequentially move the mandible forward.

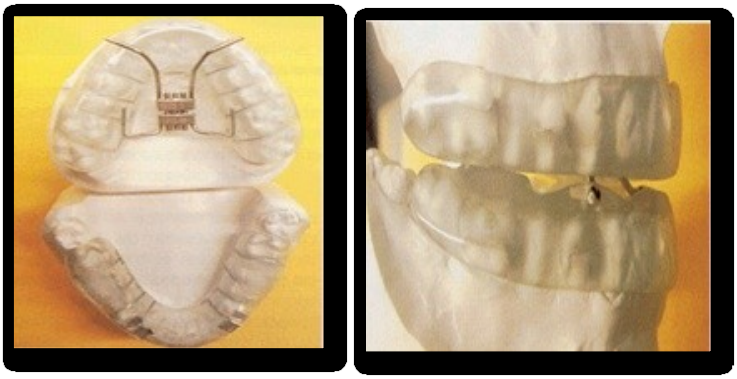


Fig 14:- Klearway TM.

Narval Cc Sleep Apnea Oral Appliance
This new generation custom-made mandibular repositioning device is recognised by many specialists as the most discrete and comfortable.It has a patented physiological articulation and unique comfortable splints to optimize patient acceptance and treatment efficacy.

Fig 15:- Narval CC sleep apnea oral appliance.

Meridian Pm Oral Appliance

The mandibular advancement device hold the lower jaw in a forward position which over time, can lead to bite changes and jaw joint pain.The Meridian PM, eliminates the potential jaw pain and supports oxygen exchange during sleep as well.

Fig 16:- Meridian PM oral appliance.

Tongue-Retaining Devices (TRDS)

Mechanism of Action-

Is a custom-made appliance designed to allow the tongue to remain in a forward position between the anterior teeth by holding the tongue in an anterior bulb with negative pressure during sleep.

Efficiancy:

TRD was found to be effective in 71% of the cases studied.

Advantages :

It cause minimal sensitivity in teeth or in the TMJ. Tongue-retaining devices appear to be effective in over 75% of the mild to moderate cases of obstructive sleep apnea. It is more easily tolerated and has fewer long-term compliance problems.

Disadvantages:

Users complained most about discomfort and excessive salivation. They presented no side effects in 30% of the cases[1].

The following are the appliances under the above rationale;

SNOR-X

The SNOR-X is a mouth guard that gently holds the tongue forward during sleep, keeping the upper airway open and free from obstruction. The prevention of this obstruction relieves snoring.

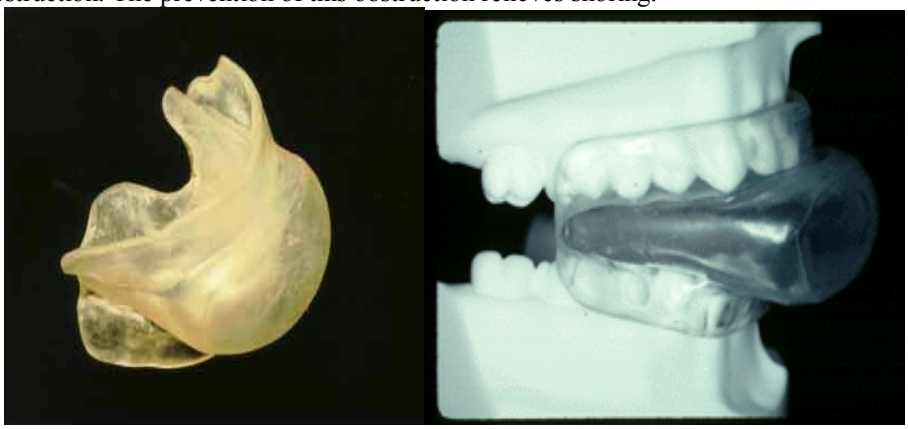


Figure 17:- Tongue retaining devices.

Nose Breathe Appliance

The tongue is held at the roof of the mouth and retained by a naturally occurring lip seal and tongue suction due to the negative pressure of the oral cavity.

Figure 18:- Nose Breath Appliance.

Aveo TSD

The aveoTSDanti-snoring aid was developed following several years of clinical research in the treatment of snoring and OSA.

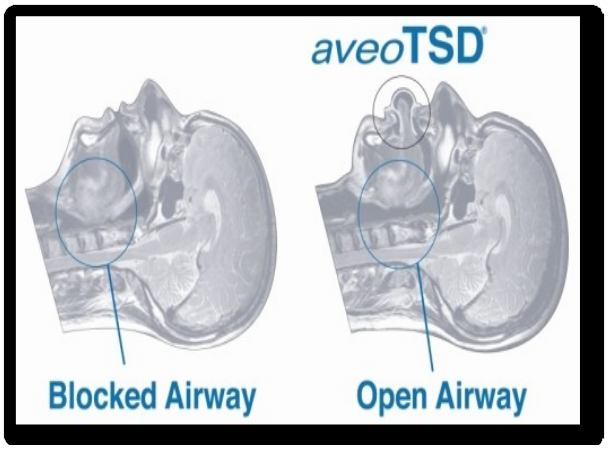


Fig 19:- Aveo TSD (Tongue Stabilizing Device).

Soft Palate Lifting Appliances
Mechanism of Action-
The prosthesis lifts and/or stabilizes the soft palate, preventing vibration during sleep.This significantly improves the upper airway passage dimension and thus eliminates snoring and airway obstruction and improves the overall quality of life of patient.Indicated in cases where elongated or bifid uvula was the cause for upper airway obstruction.

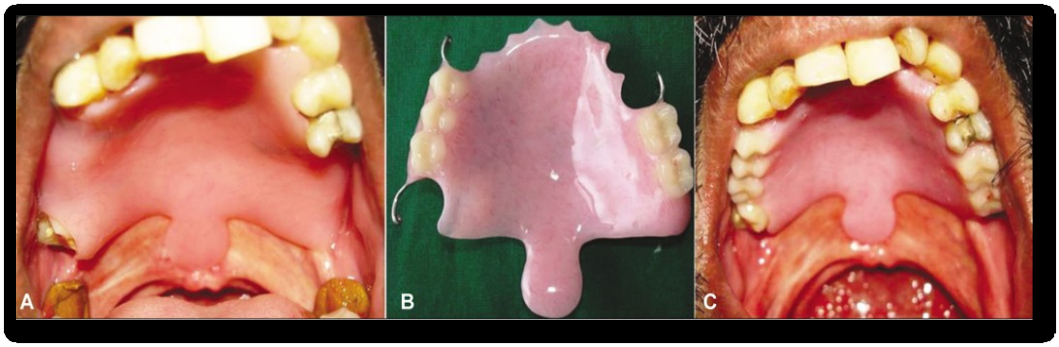


Fig 20:- Uvula Lift Appliance.

Surgical Therapy
Surgery is indicated in patients who have a specific underlying abnormality that is causing the OSA.Surgery may be initial therapy for patients with mild OSA if medical therapy is refused or rejected and if the patients are medically stable enough to undergo the procedure.

Indication For Surgical Therapy
1. indicated if non-invasive medical therapy, nasal CPAP, or OA fails to effectively treat obstructive sleep apnea or is rejected by the patient.
2. Apnea/hypopnea index of >20 events per hour of sleep, if accompanied by excessive daytime fatigue
3. Oxygen desaturation, 90%
4. Failure of medical management or patient rejects other therapies.
5. Presence of specific space-occupying lesion that causes an upper airway obstruction.

Types Of Surgical Procedures
Uvulopalatopharyngoplasty(UPPP)
UPPP is the most common surgical procedure performed for adults. Success rate is approximately 50% .It involves removal of the tonsils, the uvula, the distal margin of the soft palate, and the redundant pharyngeal tissue, as well as reshaping of the soft tissues in the lateral pharyngeal walls.

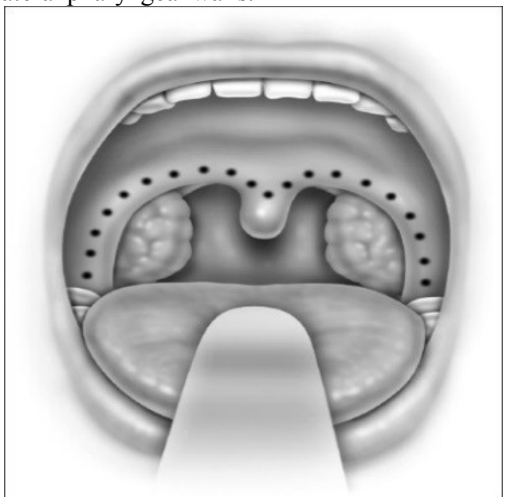


Fig 21:- Uvulopalatopharyngoplasty Line Of Incision.

Genioglossus Advancement With Hyoid Myotomy
The genioglossus muscle is repositioned anteriorly through an inferior mandibular osteotomy (genioglossus advancement). The hyoid is suspended to the superior edge of the larynx and fixed in this position, adding to the effect of genioglossus advancement.

Maxillomandibular Advancement Osteotomy
The midface, palate, and mandible are moved forward in this procedure, increasing the space behind the tongue and increasing tension on the genioglossus muscle.

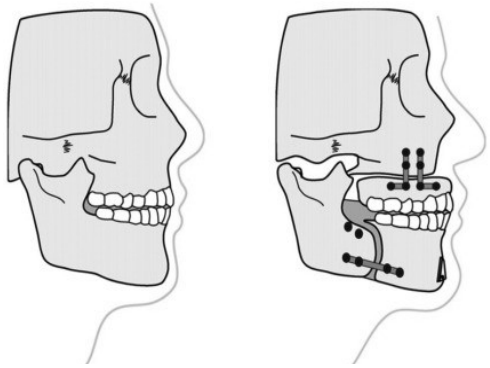
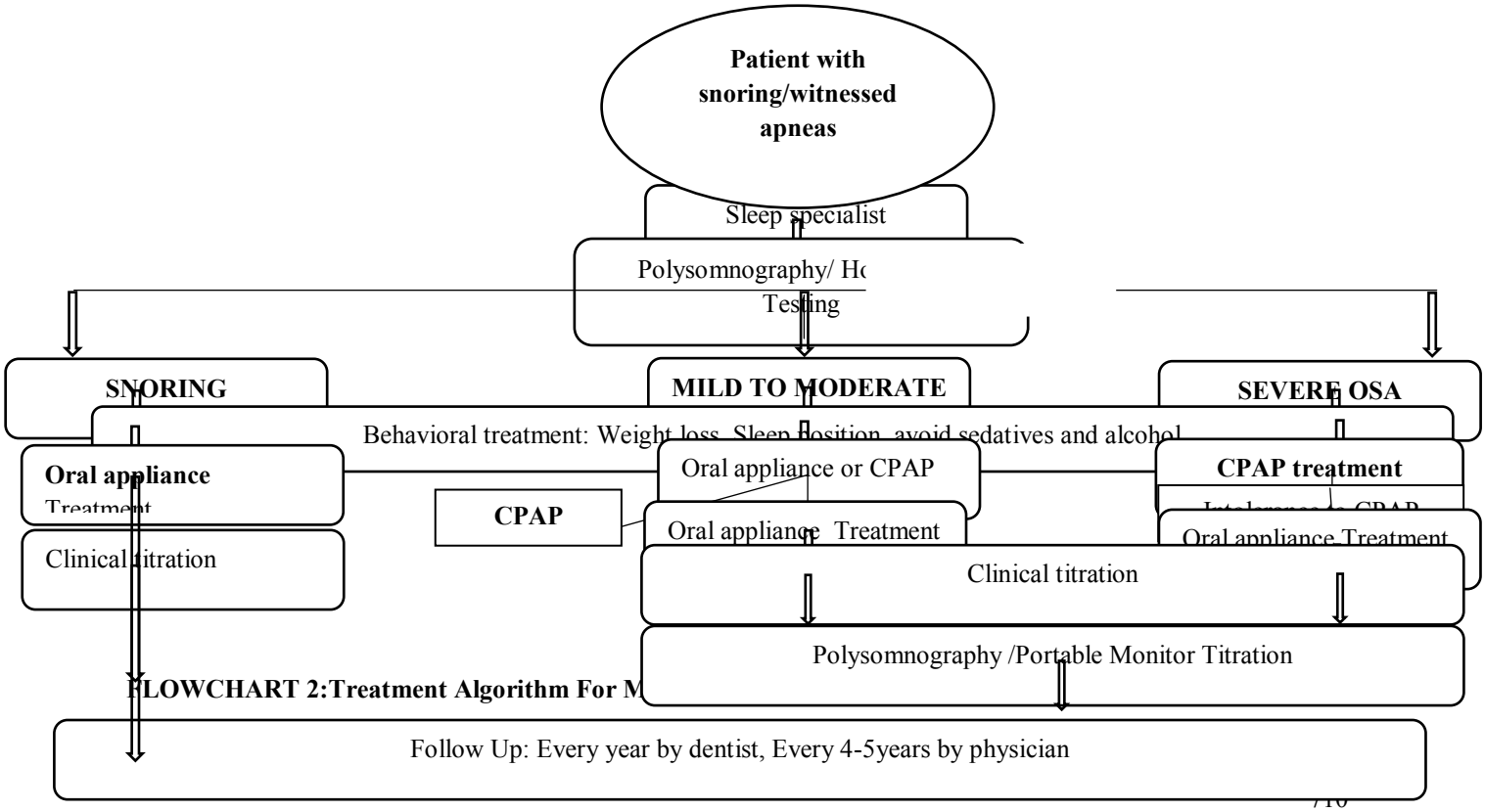


Fig 22:- Maxillomandibular advancement osteotomy.

Tracheostomy
This procedure bypasses the upper airway and is the most effective surgical procedure for treatment of obstructive sleep apnea; it is virtually 100% effective. Unfortunately, tracheostomy is a disfiguring procedure and decreases the patient's quality of life.

Other Surgical Options
1. Laser Assisted Surgeries:
2. Radiofrequency volumetric tissue reduction of the soft palate(somnoplasty
3. Bariatric Surgery



FLOWCHART 2:Treatment Algorithm For M

Conclusion:-

The rising trend of modern civilization to compete for a better living will probably make obstructive sleep apnoea an increasingly important public-health problem, especially in view of the neurocognitive and cardiovascular sequelae associated with this disorder.

Successful control of sleep apnea may also reduce subsequent risks for diabetes, hypertension, heart attack, stroke, arrhythmia, and premature death. In short, a surprisingly broad range of health benefits may be obtained when patient care is managed by a multidisciplinary clinical team, which can include various dental specialists, surgeons, and sleep medicine physicians. It would thus be important for dentists to make themselves aware of the procedures and responsibilites involved in multi-disciplinary management of OSA.

Thus, there can be no doubt that dentist has a vital role to play in identifying as well as treating OSA patients. It is however important for these patients to undergo regular medical referrals to monitor their condition and switch to an alternative treatment plan if required.

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