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Obstructive Sleep Apnea – Hypoapnea Syndrome: A Review

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Abstract

Obstructive sleep apnea syndrome (OSA); a common, chronic disorder associated with sleep and breathing that results in disabilities ranging from pathologic sleepiness to respiratory complications and cardiovascular disorders. The condition is closely related to upper airway obstruction which develops during sleep with various manifestations including snoring, hypoapneas, and apneas. In children, the causes of obstructive sleep apnea often involve enlarged tonsils or adenoids; dental conditions such as a large overbite. In adults, many factors are associated with the condition and the most common cause of OSA is excess weight and obesity, often associated with the soft tissue of the throat and mouth. Undetected OSA becomes a factor in the propagation of, depression, hypertension, heart disease, and even death.

Obstructive sleep apnea as a pathological condition can be treated by various means which may be conservative approaches such as lifestyle changes ranging from weight loss, alcohol, and tobacco cessation. The modalities of treatment may also include Continuous positive airway pressure, oral appliances, and surgical procedures.

Introduction

Obstructive sleep apnea (OSA) is a condition that is primarily identified by the number of recurrent episodes of partial or complete airway obstructions during sleep which results in repeated episodes of apneas and hypoapneas[1]. The quantitative measure of each episode is measured by the severity using the apnea – hypoapnea index. The index is a measure of the mean number of hypoapneas or apneas per hour, occurring during sleep[2].

None/Normal	AHI is < 5 per hour
Mild	AHI ≥ 5 per hour, but < 15 per hour
Moderate	AHI ≥ 15 per hour, but < 30 per hour
Severe	AHI ≥ 30

Daytime sleepiness has been classified as mild, moderate and severe based on the level of impact that sleepiness has on one's social life, as defined by the American Association of Sleep Medicine. The quantitative measure used is the Epworth sleepiness scale (ESS)

Epworth Sleepiness Questionnaire For a Medicare subsidised sleep study a patient must score 8 or more.

How likely are you to doze off in the following situations?	No Chance	Slight Chance	Moderate Chance	High Chance
Sitting and reading	○ 0	○ 1	○ 2	○ 3
Watching television	○ 0	○ 1	○ 2	○ 3
Sitting inactive, in a public space	○ 0	○ 1	○ 2	○ 3
Lying down to rest in the afternoon when circumstances permit	○ 0	○ 1	○ 2	○ 3
Sitting and talking to someone	○ 0	○ 1	○ 2	○ 3
Sitting quietly after a lunch without alcohol	○ 0	○ 1	○ 2	○ 3
As a passenger in a car for an hour without a break	○ 0	○ 1	○ 2	○ 3
In a car, while stopped for a few minutes in traffic	○ 0	○ 1	○ 2	○ 3
TOTAL SCORE:				

'STOP BANG' Questionnaire For a Medicare subsidised sleep study a patient must score 4 or more.

Do you Snore loudly?	○ Yes	○ No
Do you often feel Tired?	○ Yes	○ No
Has anyone Observed you stop breathing or choking/gasping during your sleep?		
Do you have or are you being treated for high blood Pressure?	○ Yes	○ No
Is your Body mass index more than 35 kg/m²?	○ Yes	○ No
Are you Aged older than 50?	○ Yes	○ No
Is your Neck size: For male 17 inches / 43cm or larger? For female 16 inches / 41cm or larger? (measured around adams apple)	○ Yes	○ No
Is your Gender male?	○ Yes	○ No
TOTAL 'YES' ANSWERS:		

Prevalence of OSA

The number of reported incidents and the prevalence of sleep apnea as a whole has improved greatly over the past few years with various new technological advents in the field of diagnostic equipment used to measure the oxygen desaturation, apnea, and hypoapnea.

Based on various studies, OSA prevalence as measured in the general adult population (age ≥18years) was ≥5 AHI/RDI ranges from 9% to 38%. The influence of gender was noted, in men, variations from 13% to 33%, and in women from 6% to 19% were documented. At the clinically important ≥15 AHI level, the prevalence in the overall adult population (aged >18 years) varied from 6% to 17% although higher (36%) in the older groups[3].

Associated Factors

Age

The prevalence of OSA has been reported to increase with age, independent of obesity and other risk factors. The prevalence of OSA shows a marked increase even after the age of 60 years, contrary to snoring, In a study conducted by Bixler *et al.* the findings revealed an increase in OSA in people >65 years of age, but the frequency of the syndrome reduced. This could be an indication that self reported snoring & doctor-diagnosed OSA show similar age distributions, with a decline in older age groups. This is contrary to age distributuion of OSA with AHI≥5,that increased with age[4].

Obesity

Obesity has been a major risk factor in the presence of snoring & sleep apnea as large fraction of patients with OSA were overweight. Reports of caloric restriction and bariatric surgery as a treatment of OSA are abundant. Males show a greater risk of developing OSA than females[6], due to a rise in their AHI corresponding to weight gain, unrelated to initial weight, age, ethnicity, or waist circumference.

In a study by Young *et al* , analysis revealed that 58% of moderate-severe cases of OSA is attributed to a BMI of ≥25 kg/m2. These findings emphasize the need for long term weight loss programs and an effective treatment modality to prevent OSA and consequently the epidemics of obesity. Both lean and non – obese subjects and those obesity and fat necks suffered from sleep apnea. Studies by Franklin *et al.* report that OSA was seen in 39% of women of normal weight but only 0.1% of them had severe sleep apnea[5].

Smoking

Smoking as a causative agent could be attributed to underlying mechanisms such as inflammation of airway, instability of sleep among others from, overnight nicotine withdrawal. In the study by Wetter *et al,* . reports indicated that dose-response relationship exists, between severity of sleep apnea and smoking . The heavy-smokers were at highest risk, but former-smoking was found, unrelated to snoring and OSA[7]. Although such studies were carried out, smoking has yet to be established as a risk factor in OSA. The study conducted by Sleep Heart Health Study, revealed that smokers, had a lower incidence of OSA than non-smokers, data is still unavailable on the impact of smoking, on incidence and remission of OSA[2].

Alcohol

Alcohol consumption has a direct impact on the neuromotor system by affecting the upper pharyngeal airways, resulting in hypotonia in the oropharyngeal muscles. Studies by Svensson *et a.* shows the correlation between alcohol dependence and snoring in lean women whose BMI< 20KG/m2[8].

This shows the major impact of alcohol-induced reduction of motor control in upper airways in lean women, with uncompromised upper airways from fat deposits and overweight.

Excessive daytime sleepiness

One of the most common and noted symptoms of OSA is excessive daytime sleepiness. The incidence of which is increasing in the general population, as a result of which there is a rise in the incidence of vehicular accidents.

General population studies reveal a correlation of daytime sleepiness to OSA and snoring. Wisconsin Sleep Cohort Study revealed that 23% of the females with an AHI ≥5 reported excessive daytime sleepiness as compared to only 10% of non-snoring females. The counter prevalence in males showed 16% and 3% respectively[9].

Hypertension

Hypertension and OSA are prevalent in society, and multiple individuals suffer from both. The study by Peppard *et al* examined the odds ratios, at a 4-year follow-up in 709 middle-aged participants for the presence of hypertension, in the Wisconsin cohort, all investigated with polysomnography, at baseline. Compared with subjects with no OSA, the adjusted odds ratio for prevalent hypertension at follow-up was 2.03 (95% CI) for mild OSA (AHI, 5-14.9) and 2.89 (95% CI, 1.46-5.64) for moderate to severe OSA (AHI ≥15)[10].

Although OSA and hypertension are correlated, the impact is not very well pronounced in overweight and obese subjects, as seen in normal weights. Among 6,120 participants in the Sleep Heart Health Study, An AHI of ≥15, was independently associated with hypertension, in subjects aged <60 years, with an adjusted odds ratio of 2.38 (95% CI, 1.30-4.38), , while no such relationship was found between sleep apnea and hypertension among subjects above that age.

The Effects of treatment modalities using CPAP in treating OSA in hypertensive patients and less clear and have shown mixed results

Coronary artery disease

Coronary artery disease and OSA show strong association based on various cross-sectional studies but is frequently undiagnosed.

Cross-sectional epidemiologic studies have reported positive association in self-reported coronary artery disease and snoring or objectively measured OSA, in the Sleep Heart Health Study, among 6,424 participants who underwent in-home polysomnography, Shahar *et al.* reported that, subjects with the highest quartile of AHI >11, showed an adjusted odds ratio of 1.27 of self-reported coronary artery disease. Studies conducted on large populations regarding OSA and the incidence reports of coronary artery disease are still inadequate[11]

Stroke

Clinical cohorts reveal an important link between OSA and stroke. In a study conducted by Spriggs *et al.* patient followup 6 months or until death, revealed that two factors that affected mortality of the patient were previous stroke and regular snoring.

1022 patients investigated in the study by Yaggi *et al.* on clinical grounds, revealed that OSA had a significant impact on the risk of stroke and/or death and that the increase in risk was not dependent or affected by other factors[12].

A 10 year follow up study by Valham *et al.* revealed a dose-response relationship of AHI at baseline in patients with coronary artery disease and the incidence of stroke. Coincidentally, the manifestation of OSA, and not central sleep apnea, in the stroke survivors was an important predictor of early death[13].

Diabetes mellitus

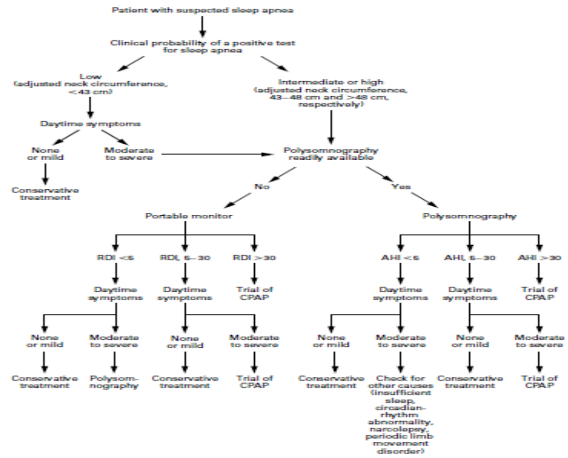
Several common risk factors are shared by OSA and diabetes mellitus. Reports in general population cross-sectional studies reveal that type 2 diabetes mellitus (Insulin resistance) coexist, independent of other confounders such as obesity.

Longitudinal studies on OSA as a risk factor for future diabetes mellitus have not been conclusive. The Wisconsin Sleep Cohort Study, conducted over 4 years with 1387 subjects, revealed that the risk of developing diabetes mellitus did not vary significantly among those with AHI ≥15 and those with AHI <5. An independent association was established by Botros *et al.*, between sleep apnea at baseline and diabetes incidence in an observational cohort study including 1,233 consecutive patients without diabetes[14].

Diagnosis

Polysomnography

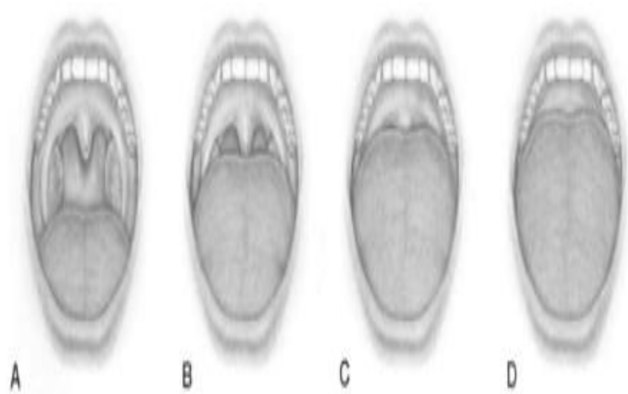
Despite advances in newer diagnostic modalities and imaging technologies, the diagnosis of OSA is still a challenging task. Overnight polysomnography (PSG) study in a sleep laboratory is considered the most reliable confirmatory investigation for OSA. It comprises of assessment of electrocardiogram, electrooculogram, electroencephalogram (EEG), the airflow, oxygen saturation, chin electromyogram, and heart rate. The cessation of breathing for at least 10 seconds is defined as Apnea. A decreased effort to breathe at least **50%** less than the baseline and with at least a 4% decrease in SaO is defined as Hypopnea, RDI was calculated as the sum of total events (apneas and hypopneas) per hour[15].



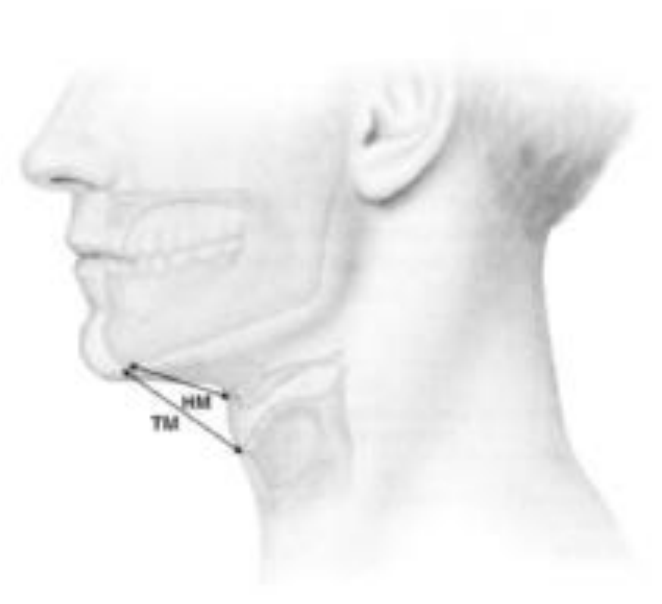
Physical examination

The MMP was assessed for each patient based on the visualization of the oropharynx. A modification of Mallampati's technique used for evaluation of the oropharynx, the patient was evaluated in mouth open, without protrusion of tongue. The patient is asked to open the mouth widely with tongue in place and oropharyngeal crowding is graded as follows:

1) Grade I: visible tonsils, pillars, and soft palate (Fig. A);
2) Grade II: visible uvula, pillars, and upper pole (Fig. B);
3) Grade III: visible soft palate (partial); the tonsils, pillars, and base of the uvula is not seen (Fig. C)
4) Grade IV. Only the hard palate is visible (Fig. D).



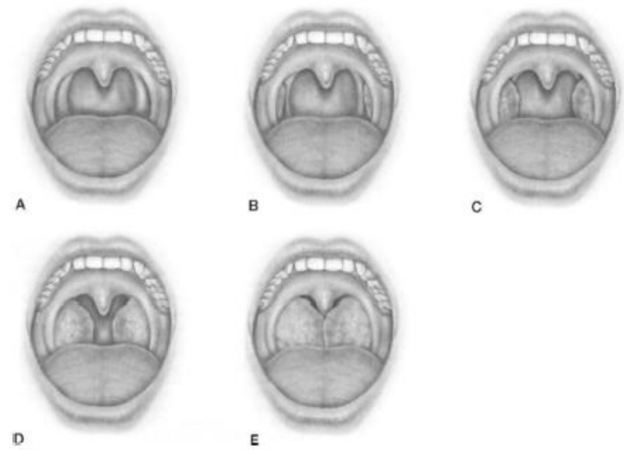
Thyroid-mental distance from thyroid notch to mental prominence and HMD from the hyoid bone to the mental prominence were measured in all patients with their heads in natural head posture in an upright seated position at the end of expiration phase and without swallowing. The Natural head posture was obtained by having subject look into their pupils reflected on a mirror to be located at eye level



The tonsils were graded.

- Zero was used to denote that the patient had a tonsillectomy (Fig. A).
- Grade I tonsils present in the tonsillar fossa, barely visible behind the anterior pillars (Fig. B)
- Grade II tonsils were visible behind the anterior pillars (Fig. C).
- Grade III tonsils extend to three-quarters of the way to midline (Fig. D).
- Grade IV tonsils completely obstructing the airway, ("kissing" tonsils) (Fig. E).

Weight (kg) and height (m2) of the patients were recorded at the initial visit and the BMI (kg/m2) was calculated using the formula BMI = weight (kg)/height2 (m'). The BMI was graded as grade 0 (<20 kg/m2), grade I(20 kg/m2-25 kg/m')), grade I1 **(25**kg/m2-30 **kg/m2),** grade I11 **(30** kg/m"-40 kg/mz>), and grade IV (greater than **40** kg/m2) according to previously published standards for obesity

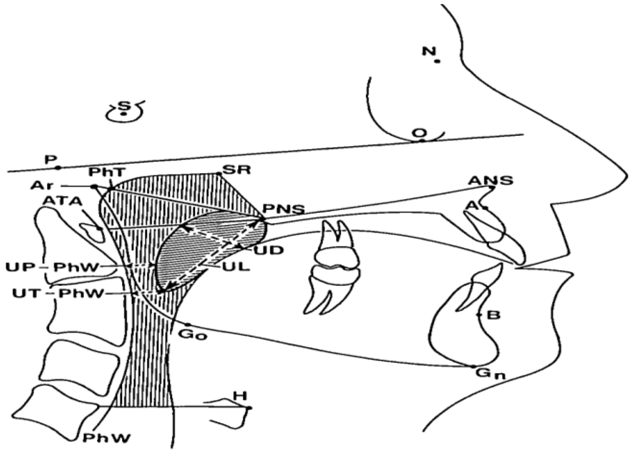


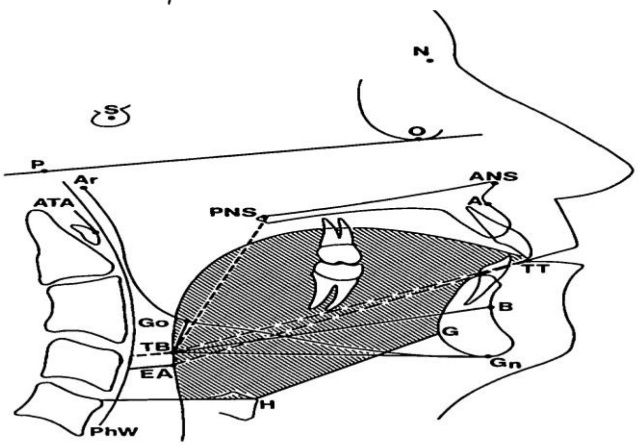
Based on Friedman staging groups can be divided into favorable and unfavorable characteristics. Small tonsils (tonsil grades 1 and 2) are considered unfavorable, whereas large tonsils (tonsil grades 3 and 4) are a favorable surgical characteristic.

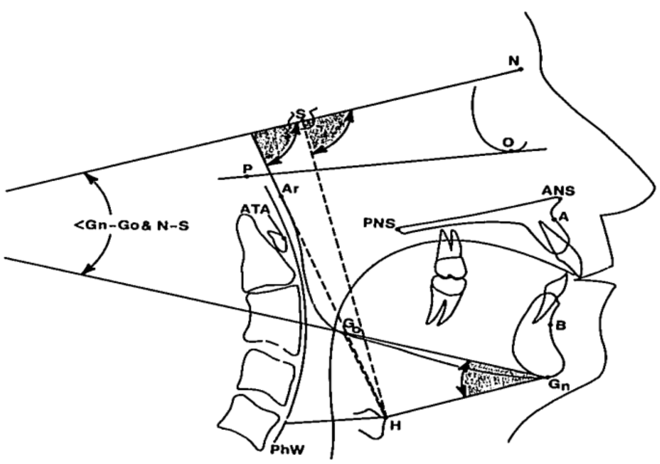
Cephalometric Evaluation

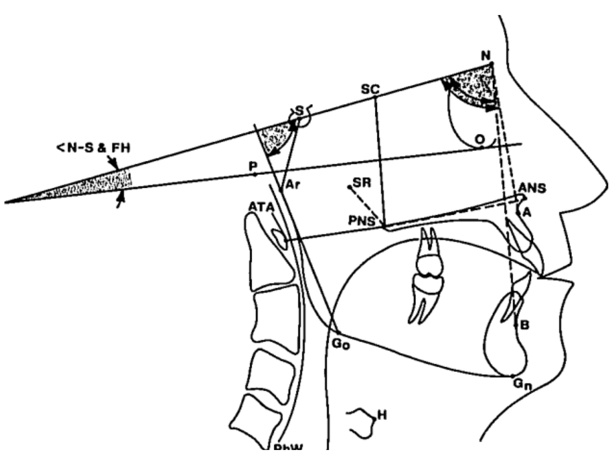
Various studies were conducted in the evaluation of OSA based on cephalometric analysis, which was carried out on various soft and hard tissue landmarks. Borowiecki *et al.* in his study conducted on 30 adult patients who were diagnosed with OSA against control of 12 controls analyzed that in patients with OSA certain features were prominently seen[16]:

- Enlarged tongue and soft palate
- Inferiorly displaced hyoid bone
- Inferior displacement of the mandibular body(elongated face)
- Retropositioned and elongated hard palate
- Reduced Oropharyngeal and hypopharyngeal airway space









Treatment

The treatment for OSA can be classified into various modalities:

- Continuous Positive Airway Pressure
- Surgery
- Oral appliances

Continuous Positive Airway Pressure

Recommendations for treating OSA, based on the apnea–hypoapnea index or on the severity of oxygen desaturation, are empirical. PSG studies obtained before and after treatment reveals that CPAP immediately reverses apnea and hypopnea. Certain randomized, placebo-controlled trials, CPAP has revealed a decrease in somnolence and improvement in the quality of life, mood, and alertness.

The compliance with CPAP in short term duration ranges from 50 – 80%, and the average duration of use may vary from 3.4 – 4.5 hrs per night. The CPAP may seem obstructive to some patients and cause frustration due to frequent mask leaks and nasal congestion. Long term use may be useful in patients who present with a history of snoring, high AHI and severe daytime sleepiness.

To maximize the likelihood of long term use, intensive support is a necessity in patients. The symptoms and quality of life must be assessed in patients presenting with unclear relation between the symptoms and abnormal sleep patterns.

The Nose and Nasal CPAP

One of the major predictors of acceptance, adherance and successful use of CPAP is increased resistance to the therapy. The increased rewsistance is often associated with oral appliance failure for OSA. Multiple reports of small surgical studies support the notion that CPAP pressure can be decreased and adherence can be increased by means of nasal or selected pharyngeal surgery.

Surgery

The goal of reconstructive surgery has been the improvement of form and function by modifying the tissue. Reconstructive surgery of the upper airway for the treatment of OSA includes a wide variety of procedures involving multiple upper airway structures. Although the biggest problem lies in the lack of adequate data[18-20].

Surgery for OSA includes a range of reconstructive procedures that involves the bypass or modification of[17]:

- Supraglottic,
- Hypopharyngeal,
- Oropharyngeal,
- Nasopharyngeal,
- Nasal airways.

The modification of the structures may involve reconstructive surgery of skeletal or soft tissues or both.

The widely accepted notion is that surgery as a procedure is ultimately effective in the alteration of size, shape, volume, and compliance of upper airway structures.

A useful way to approach surgery is to assess the surgical intent, which can be classified into 3 general surgical approaches for OSA.

The assessment of the surgical intent is a useful method to classify the surgical approaches into 3 categories:

- The ancillary use of surgery to assist other therapies. An often-used example is nasal surgery to improve pap use and outcomes.
- Surgery may attempt to be curative. In adults, isolated pathologies causing osa are infrequent, but they do occur, and correcting these may eliminate the osa.
- Surgery can be for "salvage," following the failure of medical or other treatment options.

Nasal Surgery

The Primary route of ventilation in humans has been the nasal airway, both during sleep and awake. The impact of the nasal airway quality on sleep, sleep-disordered breathing, OSA syndrome, and OSA is incompletely understood.

Anatomically, the nose has 3 segments:

- the nasal valve
- the nasal cavum
- the nasopharynx

Common nasal procedures include

- septoplasty
- nasal turbid surgery
- nasal valve surgery
- adenoidectomy
- obstructive lesions (nasal polyps)

The effect of nasal surgery on snoring, for most patients, is partial effectiveness. The selection of patients, who are most likely to benefit is yet to be determined.

Although nasal procedures can be performed under local anesthesia and sedation, due to a reduction in risk, many OSA patients tend to have nasal procedures done under general anesthesia, where the risks of increased anesthesia must be weighed against the benefits21-26.

Tonsillectomy

The effect of adenoidectomy and tonsillectomy in pediatric patients can be significant on AHI, quality of life and even the cognitive abilities. Although these procedures are common, they should not be considered curative in caser of OSA patients[27-31]

Uvulopalatopharyngoplasty

Uvulopalatopharyngoplasty modifies the upper pharynx and palate. Initially, developed as a treatment modality for snoring[32-41]. It was subsequently modified by Fujita to treat sleep apnea. Although initially revolutionary, it was soon replaced by PAP therapies in many patients.

The adverse effects associated with the procedure are common and include minor difficulties with swallowing, dry throat, sensation of foreign object, and sensation of phlegm.

The effectiveness of uvulopalatopharyngoplasty varies. Its use is controversial. The variability of effectiveness is only partially understood. Failure is probably due to inadequate airway diagnostics, failure of technique, and failure of the application. Diagnostic prediction of the procedure has been improved by means of

- Freidman staging system (1 to 4);
- Modification of the Mallampati classification (1 to 4);
- Presence or absence of severe obesity (body mass index 40 kg/m2);
- Major craniofacial abnormalities

Procedures which involve suspension of hyoid bone have been reported to be useful, as they allow the support of lower pharyngeal and supraglottic tissues, without the assitance of major skeletal reconstruction. The success has been variable, but most studies support that the procedure can be performed with low morbidity when used in combination with other procedures such as uvulopalatopharyngoplasty

Maxillofacial Surgery

Maxillofacial surgical procedures can range from skeletal procedure involving only mandible, or mandible and lower maxilla advancement . But such procedures are generally poorly accepted by patients with mild or moderate manifestation.

Oral Appliances

The purpose of Oral appliances is to improve upper airway structureand prevent the collapse by alteration of position of the jaw and tongue. The most common mode of action is by means of positioning the lower jaw in a more forward position, thus they are named as:

- Mandibular advancement devices (MAD)
- Mandibular advancement splints(MAS)
- Mandibu;lar repositioning appliances(MRA)

The effects of MADs studied by means of imaging techniques, reveals an enlargement of upper airway space, in lateral dimension (velopharyngeal region). Laterla expansion is by means of tissue connections to lateral walls and ramus of mandible.Aletrnative designs involve the protrusion of tongue instead of mandible (Tongue retaining devices TRD).

To further enhance and improve the effectiveness of MADs in treatment of OSA, invole recent techonologies which include, remotely controlled mandibular advancement sleep studies and objective adherence monitoring capabilities.

The use of Oral appliances has been as an alternative to OSA ptients, who are dissatisfied/ unwilling for other therapies or complex interventions[47-49].

Types of Oral Appliances

Mandibular advancing devices

The oral appliances in use for the treatment of OSA generally involve the traditional dental techniques of attaching the device to one or both dental arches, thus allowing the modification of mandibular posture.

As with all oral appliances, those used in the treatment of OSA, construction requires dental impression, bite registration, and fabrication in a dental laboratory. The appliances produce and advancement in the mandible, and may also provide a downward rotation.

Oral appliances that attach to both arches, may result in the restriction of mouth opening, by means of clasps and elastic bands. Others allow for relatively free mouth opening. The designs of the appliance could vary based on the need of the patient, to incorporate tubes, openings for oral breathing and pressure relief, or the posterior extension of the maxillary component[42, 44, 45].

The Klearway^{tm} is a new adjustable anterior mandibular advancement oral appliance. It is a custom-built oral appliance fashioned from a thermoactive acrylic resin that becomes more compliant with heating.

The maxillary and mandibular components are joined by an adjustable screw mechanism that provides for a gradual protrusion of the mandibular component in increments of 0.25 mm over a total range of 11 mm. The design of the screw mechanism allows for 1–3 mm of lateral jaw movement and 1–5 mm of vertical jaw movement, thereby reducing the risk of temporomandibular joint and jaw muscle discomfort.

Tongue retainers

Another oral appliance which focuses on reposition the tongue in a forward posture is the TRDs. This device allows for tongue to be secured by utilizing the negative pressure in a soft plastic bulb; a flange, positioned between the lips and teeth, holds the device and tongue anteriorly

As with all oral applainces, the fabrication is initated by dental impressions, but a prefabricated version is now available

Mechanism of Action

The desired outcome in the use of oral appliance therapy is to alter the position of upper airway structures and enlarge the airway space or alternatively reduce the collapsibility

Mandible-advancing oral appliances have been shown, via cephalometric radiographs, to increase various upper airway dimensions in patients when they are awake. One appliance altered the posterior airway space and enlarged it, while two others were unable to produce similar results. These observations were made in an awake state, thus external bias was present in the study, as these appliances are meant to be used during sleep. The studies reveal that airway patency can be positively influenced by these oral appliances, by their activity in altering the upper airway spaces[50].

Efficacy

- **Evaluation of clinical utility**

Efficacy for these oral appliances includes their effects on snoring and sleep apnea as well as their secondary consequences, including sleep disturbance, sleepiness, and any putative long-term sequellae.

- **Effects of snoring**

Most studies conducted have reported subjective effects on snoring, and objective measurements being few in number. Snoring is best controlled by CPAP, followed by oral appliances, and intraoral placebo devices respectively.

- **Sleep and sleepiness**

PSG studies on oral appliance effectiveness ahows an increase in slow wave and REM stage sleep, consequently a decrease in sleep fragmentation, mid-sleep wake time and arousals.

- **Short term effects on OSA**

The AHI is effectively reduced in CPAP,OA and placebo interventions, with CPAP showing greatest effect in both AHI and nightly oxygenation.

- **Oral Appliances Compared to Inactive Appliances**

Three crossover studies of active and inactive (single dental plate) OA_m also confirm OSA improvement specific to the mandibular advancement device, with reductions in both NREM and REM AHI, and improvement in arousal index, oxygen saturation, and REM sleep time. Reduced snoring was also found to be specifically related to the action of mandibular advancement both by objective measurement using a sound meter and by subjective bed partner assessment.

- **Degree of Protrusion**

The mandibular protrusion varied from patient to patient, ranging from 6 to 10mm, or 50-75% when patient was asked to protrude the mandible on request.

The results of various studies reveal that mandibular protrusions have a beneficial effect with an increased protrusion producing decrease in respiratory events, and in the number of 4% oxygen desaturations occurring during nocturnal oximetry.

- **Effects on Upper Airway Size**

Simple active anterior movement of the tongue or mandible can increase cross-sectional airway size in subjects with and without OSA. Passive mandibular advancement during general anesthesia stabilizes the upper airway by increasing airway size in both the retropalatal and retroglossal area and by reducing closing pressure. The increase in pharyngeal airway space and volume has been demonstrated in other imaging modalities (CT, MRI)

- **Degree of Vertical Opening**

The Oral appliance causes an inevitable opening of the mouth, as some thickness is incorporated into the appliance. In a crossover trial comparing the effect of 2 different vertical openings (4mm and 14mm), there was no significant effect on the AHI of the patient, although patient preference was for smaller vertical opening[46]. However, increased vertical opening had an effect on the upper airway patency, thus the amout of vertical opening has to be kept to a minimum, to prioritize patient tolerance

Tongue Repositioning Devices

The use of TDs is indicated in those OSA patients with a large tongue, or those who exhibit poor compliance to MADs. There devices can be custom made or prefabricated. The patient positions the tongue forwardly into the bulb to create negative pressure, the action is repeated and tested to find a suitable position where the effects of snoring are reduced. Once the appliance use is regularized, overnight testing is advised to assess the clinical response objectively.

Dental Follow-up

The appliance use has to be observed for usage, side effects, complications and the degree of advancement in the follow up visits, initially at 1-2 week intervals. Assess for subjective changes in the symptoms of OSA. Check for any damage in the appliance, repair, adjust or further advance the appliance if necessary. No studies have evaluated the ideal frequency of follow up visits, but regular assessments in the early stages of therapy is important to manage any side effects, compliance or potential discontinuation of the appliance. Regular dental assessment is advised every 6 months for the first few years, followed by yearly evaluation to ensure the integrity of oral structures.

Medical Follow-up

Following treatment by Oral appliances resulting in improvement of snoring and other symptoms, the dentist must refer back to the attending clinician to reassess or repeat overnight assessment. Medical follow-up is a necessary aspect of holistic treatment, to evaluate the treatment response and prevent the recurrence of OSA. A follow-up polysomnogram or an attended Cardiorespiratory sleep study is cconducted to verify the effectiveness of the appliance.

Dental contraindications

- Inadequate number of healthy teeth (Periodontally sound) in both arches(less than 6-10 teeth.)

- Patient inability to protrude the jaw forward or open widely without any significant limitation
- Moderate to severe TMJ disorders, which limit the ability to protrude the jaw, or limit mouth opening
- Significant Bruxism may cause damage to the appliance.
- Patients wearing full dentures

Side effects and complications

Excessive salivation and transient discomfort is commonly seen after awakening, in the initial stages of appliance use. TMJ discomfort and change in occlusive alignment have also been reported. In a study conducted on 20 patients, 3 reported of TMJ pain as the reason to discontinue treatment, which later alleviated with stoppage of treatment. Based on published reports, the use of Appliance therapy has reported the complications of TMJ pain and occlusal changes, although uncommon, the long term effects are not well defined.

The forces delivered by the appliance are directed distally in the upper posterior dentition, and anteriorly in the lower anterior dentition. In the long run, this affects dentition by pushing the lower teeth anteriorly and the upper teeth distally, resulting in loss of chewing contact areas, and a decrease in overjet and overbite.

Conclusion

Obstructive sleep apnea is a highly morbid yet normally overlooked condition, which has led to many motor vehicle accidents as a result of day time sleepiness, increased risk of stroke, and various other systemic disorders.

The importance of which is gradually gaining momentum in both the medical and dental fraternities.

The condition is documented in various fields of research ranging from sleep and respiration to orthodontic intervention, yet a consensus is to be reached on the treatment or combination therapies that may be used as an adjunct or curative therapy for the condition

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