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Obstructive Sleep Apnoea – An Orthodontist's Perspective

Shawn Ann[1], Asavari Desai [2], Supriya Nambiar [3], Nidhin Philip[4]

[1]Resident,Department of Orthodontics,Manipal College of Dental Sciences,Mangalore,Manipal Academy of Higher Education.
[2]Associate Professor, Department of Orthodontics,Manipal College of Dental Sciences,Mangalore,Manipal Academy of Higher Education.
[3]Professor and Head, Department of Orthodontics,Manipal College of Dental Sciences,Mangalore,Manipal Academy of Higher Education.
[4]Associate Professor, Department of Orthodontics,Manipal College of Dental Sciences,Mangalore,Manipal Academy of Higher Education.

Email id: [2]asavari.laxman@manipal.edu

Abstract: Obstructive Sleep Apnoea (OSA) is a common chronic sleep disorder affecting the upper airway, resulting in an intermittent stoppage in breathing due to which the person has sleep fragmentation. This was first described in the fictional literature by Charles Dickens and later emerged as a global condition identified by the medical world. Being a multifactorial condition, the treatment demands a collaborative effort from different fields of medicine and dental sleep medicine. Orthodontists,being experts in the craniofacial region play a fundamental role in the therapy of OSA. With proper diagnosis and utmost care, OSA can be recognized and managed at an early stage through an interdisciplinary approach, thereby arresting the progression to more severe forms.

1. INTRODUCTION

The fast-paced lifestyle of the current generation has taken a grave toll on the sleep and wakefulness cycle. The pursuit of sleep is of utmost concern as any hindrance in the sleep cycle has profound implications on the day-to-day activities of a being. An individual's understanding of the workings and consequences of sleep irregularities has become imperative over the past few decades, now reaching a point where it is common knowledge that ignoring sleep-related issues lead to poor clinical outcomes.

Patients often lament about plethoric sleepiness, cognitive dysfunctions, and depressive symptoms. All these manifestations can be related to sleep disordered breathing. Sleep disordered breathing is a collective term coined for multiple conditions where a partial or complete cessation of breathing occurs several times in the night, thereby inhibiting the normal sleep pattern and resulting in fragmentation of sleep. The American Academy of Sleep has cited Obstructive Sleep Apnea ('OSA') to be one such disorder. (Behrents et al., 2019) One of the most relevant findings which led to significant progress in the field of sleep medicine came about 38 years back when Colin Sullivan published a paper on, 'Reversal of obstructive sleep apnoea by continuous airway pressure applied through the nares' in The Lancet.(Sullivan et al., 1981) The novel development of a simple method to reverse the airway occlusion in patients with a severe form of the disease using a nasal mask has made a profound impact on the patient's habit as they could now have an uninterrupted sleep all night.(Sullivan et al., 1981)

As described by Gastaut *et al.,* there are three different types of apnoea. (Gastaut H , Tassinari CA, 1966)

1. Obstructive – A continuous ventilatory effort even after an occluded upper airway, shown by the rib cage's movement and abdomen. (Gastaut H , Tassinari CA, 1966)
2. Central- The breathing effort is absent due to the suppression of diaphragm motor nerves caused due to a temporary decrease in the pontomedullary respiratory rhythm generation, which causes a fall in the partial pressure of co2 during the absence of airflow. (Eckert and Malhotra, 2008)
3. Mixed - As the name says, it shows features of both central and obstructive apnea. They resemble a central apnoea initially,followed by the features of an obstructive apnoea. Recent evidence, however, shows that mixed apnoeas are obstructive, but the ventilatory efforts are not detected in the early stage of apnoea.

A fractional or total occlusion of the upper airway at regular intervals leading to a reduced or total cessation of airflow, even after a continuous ventilatory effect, is a characteristic of OSA.The upper airway collapses due to the various structural abnormalities in the craniofacial region, reducing the body's oxygen delivery. This, in turn, causes a temporary stoppage of breathing, which can have severe implications on an individual's overall health and well-being. Thus, a collapse of the upper air passage is a telltale sign of obstructive sleep apnoea. (Vos et al., 2007)

The fragmentation of one's sleep caused by the intermittent stoppage in breathing results in excessive daytime lethargy and impaired cognitive functioning. The risk of diurnal hypertension, nocturnal dysrhythmias, pulmonary hypertension, right and left ventricular failure, myocardial infarction, and stroke are extreme in such individuals. It has an adverse effect on the social life of an individual affecting the work performance. Although ambiguous due to the lack of organized studies, a link between OSA and road traffic accidents must not be ignored. (Garbarino et al., 2016)

The effects of OSA on human life have deemed it a public health issue. There is an issue of lack of diagnosis of patients with clinical OSA, which is the case for 85% of the populace (Young et al., 2002). The failure to diagnose the disease correctly is due to unawareness, primitive knowledge, and lack of sleep medicine training. Creating a better understanding amongst the populace and the medical world of the effects of the life-threatening condition and its losses can be a significant step in mitigating this. (Schlosshan and Elliott, 2004)

Being a common multifactorial disorder, it demands the attention and care from different fields of medicine, inclusive of dentistry. There has been much disagreement on the role of orthodontists in OSA screening and therapeutic approach. It is accepted that the diagnosis and management of this sleep disorder is something that orthodontists alone cannot aid in. Only a collaborative interdisciplinary approach from professionals in sleep medicine and dental sleep medicine can help provide a definitive diagnosis of OSA. Specifically, orthodontist's aids in identifying the various dentofacial characteristics of the condition and managing the disease with a collaborative effort with other fields. (Behrents et al., 2019)

Due to the orthodontists' profound knowledge in the field of growth and development of the craniofacial structures, they can be considered the best in relieving or curing the symptoms. Patients exhibiting primary snoring with mild apnoea are suggested oral appliance therapy as the first treatment choice. Weight loss, control of the sleeping posture is also found to be effective in correcting this condition.

A reduction in the number of occupational accidents, benefits for work processes and business and drastic improvements to the work performance is to be expected in individuals who benefit from the early identification and successful treatment of OSA.(Garbarino et al., 2016)

Prevalence

Literature shows varying results in assessing the prevalence of this medical condition.
Even in countries where the condition is widely recognized, there is a lack of diagnosis amongst highly symptomatic patients.

Gender

OSA is more prevalent in men by 2-3 times more than in women. It has been hypothesized that one of the critical factors for the predominance is hormones. The women who are at the premenopausal stage and women who have attained menopause and yet receive hormonal therapy have a lesser prevalence of OSA. When comparing postmenopausal women and men, prevalence is still lesser in postmenopausal women, even after discounting for age and BMI.(Tsai et al., 2003)
The high central fat deposition in men could contribute to the prevalence. The fat accumulation in the neck can result in the airway's compression and, thereby, OSA.

Age

This prevalence is 2-3 times higher in people aged 65 and more significant than middle-aged people between 30-64 years.Development of OSA due to anatomical factors can worsen with aging, mainly because of the increased fat deposition around the pharynx.(Malhotra et al., 2006) The genioglossus reflex decreases with age(Marcus et al., 2004). Both these factors can increase the susceptibility of upper airway collapse with aging. (Eckert and Malhotra, 2008)

Ethnicity

Studies of different populations suggest that Caucasians have less prevalence of OSA in comparison with African Americans (Young et al., 2002)

Obesity

There is a two-fold increase in the prevalence of OSA in obese individuals than normal-weight people(Romero-Corral et al., 2010).Fat deposition is increased in tissues around the pharyngeal wall, which results in a narrow lumen and increased chances of the collapse of the airway,both of which can predispose to OSA. Increased neck circumference has a positive co-relation with OSA, which suggests that the narrowing of the airway could also be due to the compression by the superficial fat mass.(P.C. Deegan, 1995) Fat deposition around the thorax can cause a decrease in the functional residual capacity and chest compliance, causing an increasing demand for oxygen.(Naimark A, 1960)

Pathophysiology Of Obstructive Sleep Apnoea

Due to its complexity, there is a lack of appreciation for the elementary pathophysiology of OSA. (P.C. Deegan, 1995) The human airway comprises various muscles and soft tissues, yet are absent a bony skeletal part.Also, the region from the hard palate to the larynx is collapsible. Increased collapsibility of the upper airway, predisposed further by an impaired neuromuscular tone, can cause occlusion of the air passage at unfavorable times during sleep(Eckert and Malhotra, 2008)

A continuous ventilatory effort to maintain the airflow results in increased serum carbon dioxide (hypercarbia) and decreased serum oxygen (hypoxemia). The increased ventilatory effort results in cortical arousal from sleep, which raises sympathetic neural activity, leading

to increased heart rate and blood pressure and a tendency for cardiac arrhythmia. With the cortical arousal from sleep comes an increase in airway patency and resumption of normal airflow, subsequent return to sleep, and a recurrence of sleep-related upper airway collapsibility. Multiple reoccurrences of disruption to breathing can happen every hour for the entire duration of the patient's sleep. (Dempsey et al., 2010)(P.C. Deegan, 1995)

The multifactorial etiology exacerbates the complexity of OSA. Such etiologies involve the craniofacial structures, neuromuscular tone, and other related factors. The collapse of the upper airway is influenced further by hormonal fluctuation (e.g., pregnancy or menopause), obesity, rostral fluid shifts, and genetic predisposition that influences craniofacial anatomy. Various factors, ranging from upper airway anatomy to central respiratory control mechanisms, interact to produce OSA's clinical syndrome. Different factors will predominate in individual patients, but all clinically significant OSA patients have a multifactorial etiology rather than any single causative factor. This wide range of presentation leads to variations in management approach and differences in treatment response. (Kim et al., 2014)(Browman et al., 1984)(Tagaya et al., 2012)

Risk Factors

There exist several structural or anatomic abnormalities that can reduce the upper airway patency.

The conditions like obesity (where one's body mass index is >=30 kg/m2), menopause, male sex, and increasing age.

Retrognathia, long and narrow faces, dolichocephalic facial type, midface deficiency, narrow and deep palate, anterior open bite, steep mandibular plane angle, and lower hyoid position are some of the craniofacial features that may show a predisposition to OSA.

Clinical Presentation

Patients usually present with the cardinal feature of chronic and loud snoring, interrupted sleep, daytime sleepiness, morning headaches, and difficulty concentrating (Escourrou et al., 2015).

Hypertension, left ventricular hypertrophy, myocardial infarction, nocturnal angina, arrhythmias, heart failure, and cor pulmonale are some of the severe cardiovascular problems patients face. (Shahrokh Javaheri, MD, a Ferran Barbe, MD, b Francisco Campos-Rodriguez, MD, c Jerome A. Dempsey, PHD et al., n.d.) They also present with depression, delirium, anxiety, and severe behavioral problems. Hormonal disorders, such as hypothyroidism, acromegaly, and diabetes, are also noted.

There are reports of a greater incidence of refractory epilepsy, stroke, and headache on walking. Other observable features include increased sensitivity to opioids and sedatives, nocturia, impotence, and erectile dysfunction. (Schlosshan and Elliott, 2004)

Role Of Orthodontics In Adult Osa

A significant number of OSA subjects usually goes unrecognized. Young et al. concluded that 93% and 82% of women and men, respectively, go undiscovered(Young et al., 2002). After an initial screening for OSA, vulnerable patients identified by the orthodontist are then referred for diagnostic evaluation. Before proceeding with OSA's therapeutic measures, it is imperative to confirm and assess the condition's presence and severity. The physicians may prescribe orthodontic appliances or procedures in selected adult patients as part of OSA management once they arrive at the diagnosis.

OSA's diagnosis comprises of sleep history followed by physical examination and objective examination of the sleep-disordered breathing. There is an equal emphasis on respiratory events

during sleep and features such as daytime sleepiness and cognitive impairment. Sleep oriented history can be acquired during a routine health check-up or as part of a comprehensive evaluation of OSA. A thorough history, physical examination, and subjective diagnosis of the clinician features alone can identify only 50 % of the patients with sleep apnoea. (Epstein et al., 2009)("Predictive Value of Clinical Features in Diagnosing Obstructive Sleep Apnea," 1993)

Medical And Dental History

Familiarity with the symptoms of OSA is a pre-requisite for orthodontists when confirming the condition's presence. While screening adult patients for OSA, a proper assessment of the patient's height, weight, and neck size is unavoidable. In a routine health check-up, it is essential to include questions on sleep, whether the patient snores loudly, whether they face excessive sleepiness during the day, their performance at work, and road accident history. There should be a focus on the average sleep time of an individual and the pattern of sleep. A patient's medical history should be studied to identify whether the patient is obese, hypertensive, Type-2 diabetic, or has congestive heart failure. Identifying such factors is extremely useful as these patients are highly susceptible to OSA (Epstein et al., 2009)(Behrents et al., 2019)

A thorough sleep-oriented history is vital to identify and pinpoint some more symptoms such as morning headaches, abrupt awakening, waking up with a dry mouth or sore throat, difficulty concentrating and shortness of breath, disordered mood, lack of attention, memory problems, and restlessness sleep. The importance of the part played by the patients' partner in bed in the screening, and proper diagnosis of OSA is undeniable

There are a few simple and cost-effective methods to screen the severity of sleepiness. They are the Epworth Sleep Scale(ESS), Berlin questionnaire, and STOPBang questionnaires. ESS is a commonly used questionnaire consisting of 8 different points indicating different situations to evaluate sleepiness levels during the wakefulness of OSA patients. Since it detects the anomalies in the level of daytime sleepiness, irrespective of its cause, it cannot be considered as a suitable screening tool for OSA. STOPBang is another easy-to-use, and understandable questionnaire, consisting of 8 closed-ended questions, four are sleep-related, and the rest is based on the demographics, including BMI, age, gender, and circumference of the neck. Simultaneously, these questionnaires are easy to use, giving us an idea about the severity of the condition. (Gibson, 2004)(S.-J. Kim, n.d.)

Clinical Examination

An essential component in the identification of subjects with OSA is an orthodontists' clinical examination. The modified Mallampati classification can be made use of by the orthodontist along with the regular clinical examination. It is used to describe the patency of the oral airway. This is a visual method used to detect the difficulty in performing endotracheal intubation. A visual examination of the distance from the tongue's base to the mouth's roof is conducted. This space gives the clinician an idea about the amount of space available for intubation. (Friedman et al., 1999)

The patient has to keep the mouth wide open with the tongue in the normal position. It helps visualize the oropharynx.

Four different grades have been identified. (Friedman et al., 1999)

1) Grade I: Soft palate, tonsils, faucial pillars are visible
2) Grade II: The uvula, pillars, and upper pole are visible

3) Grade III: Only a part of the soft palate is visible, and the tonsils, pillars, and base of the uvula are not visible.
4) Grade IV: The Soft palate is not visible at all.

Orthodontists can look for specific characteristics which indicate the presence of OSA : (Epstein et al., 2009)(Bacon et al., 1990) (Ang et al., 2004)(Banabilh et al., 2010)

1. Circumference of the neck -For women, neck circumference should be less than 16 inches. Moreover, for men, it should be less than 17 inches.
2. Body Mass Index greater than 30 $kg/m^{2.}$
3. Modified Mallampati grading of 3 or 4
4. Backwardly positioned jaws.
5. Brachyfacial pattern, Convex facial profile
6. Hypertrophy of the adenoids and tonsils
7. Enlargement of the uvula
8. High arched palate
9. The deviated nasal septum, Nasal polyps, hypertrophy of the turbinates, and other such abnormalities.

10.Crico-mental space- The crico-mental space is considered to be a predictor for OSA. A ruler is used to create a line from the cricoid cartilage to the mentum, with the head in the natural head position. The line is bisected, and the perpendicular from the crico-mental line to the neck is measured. If the measurement is 1.5 cm or less, the possibility of OSA was more.(Tsai et al., 2004)

2. RADIOGRAPHIC EXAMINATION

Lateral Cephalogram
Lateral cephalogram, though used frequently in an orthodontic practice, possess a major limitation in describing mediolateral dimensions in the oropharyngeal airway. This dimensional limitation misleads the clinicians with inaccurate information on the volume and minimal cross-sectional area of the airway.

Cone-Beam Computed Tomography (Cbct)
The images are useful in diagnostic and morphometric analysis of the hard and soft tissues in routine orthodontic treatment, but have certain limitations in OSA diagnosis, as they do not provide the positional and functional differences during sleep and wakefulness nor any information on the neuromuscular tonicity or the real unction of the airway.

It is a snapshot of a specific moment of the breathing cycle, and there is currently no minimal cross-sectional area or volume of the airway that has been ratified as a minimum threshold level at which an individual is more prone to OSA. Thus, although it is encouraged the orthodontist takes orthodontic records, no radiographic methods have been recorded to have the desired sensitivity or accuracy to serve as an OSA risk assessment tool. Three-dimensional imaging of the airways is not a proper risk evaluation or screening method and should not be used to diagnose sleep apnea or other SRBD's. It should, however, be used when available for monitoring or treatment considerations. An analysis of the airway and surrounding structure is to be conducted if radiographic records are taken as part of orthodontic diagnosis and treatment planning. (Sittitavornwong et al., 2009)(Vos et al., 2007)

Computerised Tomography

CT has many advantages in comparison to the other diagnostic modalities used for OSA. This technique provides excellent detail about the structures of the airway and associated area. Patient acceptance is more remarkable as the technique does not require any invasive procedure or anesthesia of the airway, which could hamper the physiological airway processes. (Anch et al., 1982)

The main problem with this technique is the difficulty in constant monitoring of the sleep during the scan. The technique is also expensive and possesses the risk of radiation exposure

COMPUTATIONAL FLUID DYNAMICS (Sittitavornwong et al., 2009)(Ghoneima et al., 2015)(Wootton et al., 2014)

CFD is a branch of science used extensively in biomedical research to study the flow of liquids, and it deals with solving the numerical equations governing the flow of fluids.

CFD is the most accurate method to reproduce or simulate the three-dimensional airway and airflow through it. It stimulates the airway's velocity and pressure, thereby giving a basic idea of its function. This method involves constructing a geometry model from 3D-CT or MRI scans, from which a numerical mesh is generated. Once the mesh is generated, numerical simulations can be made in the airway to assess the flow properties. This comprehensive technique that combines fluid dynamics and a three-dimensional model is a non-invasive and reliable tool to assess the airway's function and geometry.

Studies have proved that the results obtained with CFD based on the drop in pressure of the pharynx had a closer association with OSA's severity than just the use of anatomical parameters. This technique is also used to evaluate a therapeutic measure's efficacy by considering pre and post-treatment models. CFD thus remains a superior and advanced technique in the evaluation of airway collapse.

Management Of Osa

OSA is a chronic condition that needs multidisciplinary long-term management. The different therapeutic options represent a step-wise approach that initiates a conservative approach to behavioural or lifestyle modification followed by medical intervention, including CPAP and oral appliances, and finally, surgical options. According to the American Academy of Sleep Medicine, CPAP is the frontline choice for patients experiencing different levels of severity of OSA. Orthodontists, being a part of the multidisciplinary team, should provide adequate treatment when necessary. (Behrents et al., 2019)

The objective is to achieve a regular breathing pattern during sleep and eliminate excessive daytime sleepiness, causing unwanted effects. The treatment also provides patients with a good quality of life with no side effects or risks.

- *Positive Pressure Therapy*

Positive airway pressure (PAP) therapy is considered the platinum option for treating adults suffering from OSA. The devices increase the pressure of the upper airway above a 'critical' pressure value below which the airways collapse and thus functions as pneumatic support that helps sustain airway patency. Through a nasal or oronasal mask, the patient is connected to the device overnight or during sleep hours at a set positive pressure. For each patient, adequate pressure is reached after singular or several nights of PAP titration. This method is indicated in all patients with an AHI higher than 15, independently from the presence of comorbidities, type of work, and severity of symptoms; if the AHI is above five and below 15, PAP is indicated in the presence of symptoms (i.e., sleepiness, impaired cognition, mood disorders) or the presence of hypertension, coronary artery disease or previous cerebrovascular accidents. It is common in most cases for PAP treatment to be lifelong. The commercialisation of the PAP

ventilators over the past decade has guaranteed greater assuage and efficacy for patients. (Epstein et al., 2009)(Ngiam et al., 2013)(Randerath et al., 2011)

The bi-PAP method works by delivering higher pressure during inspiration and a lower pressure during expiration. Both mechanisms use air pressure to correct sleep-disordered breathing. The main difference it holds over CPAP is that bi-PAP delivers two positive airway pressure levels, whereas CPAP delivers a single pressure. The non-invasive method of bi-PAP is lauded by patients who show great intolerance to the conventional CPAP. According to several contemporary systematic reviews, it has been concluded that, from an adherence standpoint, both CPAP and bi PAP are equals in effect. (Giles et al., 1996)

Auto-adjusting or smart CPAP or self-adjusting PAP devices are much more sophisticated and have in-built micro-processing sensors that enable the technician to detect and treat OSA. During different situations, the signals produced are sensed by the built-in microprocessor, which determines the device's response. Hence, the current devices can differentiate between obstructive and central apnoea, detect Cheyne-stoke's breathing, hypoventilation, and detect the upper and lower airway resistance. (Antonescu-Turcu and Parthasarathy, 2010)

Long term weight reduction as indicated and positional therapy, i.e., avoidance of sleeping on the back, are other treatment options. (Frank et al., 2015)

Orthodontic Management In Adult Osa

The orthodontic treatment and management of OSA should be done only after a referral from a physician. Before initiating treatment, the orthodontist should describe the treatment modalities to the patient and make patients actively participate in the entire management process. The orthodontist should record the duration of oral appliance usage by the patient and should be able to come to a realistic conclusion on the success rate of the treatment. Patient compliance, the necessity for a follow up in the long term, and the effects of treatment should be well understood by the patient and the orthodontist who plays a significant role in educating the patient. (Behrents et al., 2019)

Oral Appliance Therapy

When it comes to treating patients with mild or moderate OSA and patients who exhibit high disease intolerance towards CPAP, oral appliances have gained credit as an alternative. Pierre Robin put forward the idea of using oral appliances to relieve the upper airway obstruction. The patient readily accepts the OAs in comparison to CPAP. Appliances are easy to use, portable, not requiring an electric source, and are indicated in patients with OSA, be it mild or moderate, and in patients who show intolerance to Nasal CPAP.

Soft palate lifters (SPL), tongue retaining devices (TRD), or Mandibular advancement appliances (MAA) are some of the common oral appliances in use. They vary based on the coupling design, mode of activation and fabrication, degree of vertical opening, titration capability, lateral jaw movement, and whether they are custom made or pre-fabricated. (Tsai et al., 2003)

It is to the upper and lower dental arches that the advancement appliances are attached to protrude the mandible mechanically. Furthermore, thereby, pulls the tongue and soft palate forward. They are also known as mandibular advancement devices or mandibular repositioning appliances. The patency of the airway enhances with the jaw being postured forward.

Commercially available MRDs can be sorted into two groups: custom fabricated and pre-fabricated. Custom fabricated MRDs require impressions and models. By incorporating a protrusion modifying mechanism, the devices can be non-adjustable and adjustable. Adjustable

MRDs require that the patient or dentist manually adjust them, and they are the standard of care. The pre-fabricated group is also known otherwise as boil & bite. Being less effective than custom-fabricated devices, they are only used as a trial device to calculate the patient threshold for jaw advancement or used as a temporary solution during dental work. The Thornton Adjustable Positioner, Herbst Oral Appliance, Resmed Narval, and Clearway Oral Appliance are some of the FDA cleared devices currently on the market. These devices include a mechanism to modify the amount of protrusion manually. (24)

As prospective means for predicting AMP treatment outcomes, Remotely Controlled Mandibular Positioners (RCMPs) are currently in demand. Its application is such that the patient is fitted with an oral trial piece during a sleep study. A stepping motor, when attached to the appliance, protrudes or retrudes the mandible.A remotely stationed technician directs this procedure. While restricting movement in other dimensions, it does allow for small precise movements in the anterior-posterior dimension. The progressive advancement of the mandible during sleep, climaxing when the respiratory events are eliminated, makes the process akin to a CPAP titration study. (Tsai et al., 2003)

Patient Selection For Oral Appliance Therapy

Some requirements prioritize specific candidates for OA therapy. Healthy teeth and alveolar ridge to retain the device, the absence of temporomandibular disorders (TMD), and sufficient protrusive jaw function are some of them. Reports of using a dental implant-retained MAS and mini-implants in edentulous and partially dentate patients show that the lack of sufficient teeth may not be a contraindication. (Escourrou et al., 2015)

Periodontal disease may pose contraindication to OA therapy, making a comprehensive temporomandibular joint (TMJ) assessment a pre-requisite. The prevalence of TMD in OSA subjects has been reported to range from 2% to 52%. Half of the subjects reported complaints of myofascial pain associated with and without limited mouth opening and arthralgia.

Titration Of Oral Appliance

The proper position to which the mandible is advanced, assisted by the oral appliances, is approximately two-thirds of the maximum protrusion. The amount of protrusion can be titrated or increased until optimum symptom relief is obtained. However, this is done only after a period of accommodation, based on subjective feedback from the patients' side regarding their sleep quality and recognizable OSA symptoms. Unattended portable monitors, usually type 3 or 4, may be used by the orthodontist to define the mandible's optimal target position. Then the orthodontist and the physician involved discussing the possibility of further titration or alternative treatment after the said physician has requested a sleep study with the OA in place. (Behrents et al., 2019)

In the documentation of nasal obstruction, surgery for the correction of the deviated septum, correction of the inferior turbinate, and polypectomy can be fundamental to tolerate nCPAP better.

OSA treatment in children requires highly effective surgical procedures such as Tonsillectomy and adenoidectomy.

Adverse Effects Of Oral Appliances

There is high reliance by OAs on teeth and alveolar ridges for retention as it helps advance the mandible forward. Mandibular advancement splints generate reciprocal forces on the teeth and jaw, resulting in acute symptoms and long-term dental and skeletal changes. Most mandibular advancement splints extend beyond the dental arches to which they are primarily attached and apply pressure to the gums and oral mucosa. (Schlosshan and Elliott, 2004)

The development of adverse effects such as excessive salivation, mouth dryness, tooth pain, gum irritation, headaches, and temporomandibular joint discomfort, during the accommodation period, are often minor and self-limiting. Adaption to OA takes a few days and sometimes a few weeks, and it is in this period that such symptoms may arise. However, the more severe and persistent side effects during the initial and later treatment stages that can impact OA compliance and should be addressed immediately include arthralgia, myofascial pain, teeth pain, and occlusal changes.

DENTAL AND SKELETAL CHANGES WITH ORAL APPLIANCES (Spicuzza et al., 2015)(Giles et al., 1996)
Some of the candidates' observable changes were facial height changes, increased facial height, changes in teeth and jaw positions, occlusion changes, incisor inclination, and molar positional changes.

A modest increase in overjet was reported in a recent pilot study evaluating an orthodontic oral appliance specifically designed to counteract OA's reciprocating forces.The extend of bite change depends on the intercuspation's importance, overbite locking the bite, duration, and frequency of use. The effects of long term changes in occlusion, overbite/overjet, and mandibular length appear negligible. Even in unfavorable effects, the OA therapy cessation is never requested by the patients who tolerate and accept these effects.

Surgical Treatment
In the quest for a conclusive treatment option for OSA, the role of surgery has explicitly been looked into.

Studies by Dempsey et al. show that the recurring sites where the obstructions occur are the nose (polyposis, congestion, chronic rhinitis) and the oropharyngeal tract (collapse of the retropalatal and retro-lingual regions due to macroglossia, low lying soft palate, or enlarged tonsils).After a careful and accurate detection of the obstructed site, surgery assists in removing the cause of the obstruction to the upper airway and widening the passage.

Present-day surgical procedures involve the oropharyngeal tract, the nose, tongue, and craniofacial structures.Owing to several sites of obstruction, the surgical procedures also are diverse, ranging from minimally invasive techniques where the patient is administered anesthesia as an outpatient procedure) to much more invasive ones.

3. CONCLUSION:

OSA is a common chronic disorder affecting the patency of the upper airway. This condition was first described in the fictional literature by Charles Dicken's and later it has emerged as a global condition identified by the medical world.
Though it has a multifactorial etiology, with a complex interaction between various factors, anatomic and neuromuscular, it usually goes unnoticed and unrecognized. An awareness on the signs and symptoms of OSA, and the aftereffects of the disease should be created among the populace and general physicians to improve the recognition of the condition.

Utmost care should be taken while coming to decisions regarding the diagnosis of this life-threatening disease. The treatment aims at an interdisciplinary approach from different fields of sleep medicine and dental sleep medicine. Orthodontists, with their thorough knowledge in the growth and development of the craniofacial morphology can contribute to the screening of OSA. The final decision on the treatment method adopted should be made by a physician.

Thus, after an extensive overview of the condition, the pathophysiology, management, it is quite encouraging to observe the significant strides made in progressing towards better care and awareness among the medical community and the general public. With more involvement from practiced experts along with an interdisciplinary approach from the various fields, this condition is but a mere hindrance in the pursuit of blissful and undisturbed sleep.

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