
Oral and Maxillofacial approach for the treatment of Obstructive Sleep Apnea - Review

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Abstract

Obstructive Sleep Apnoea – Hypopnea Syndrome (OSAHS) is a potentially serious sleep disorder in which breathing repeatedly stops and starts during sleep. It is associated with significant co-morbidities affecting millions of people around the world. Many of these individuals remain undiagnosed while those who are diagnosed often exhibit poor compliance with the nightly use of Continuous Positive Air Pressure (CPAP), a very effective non-invasive modality. The growing failure and discomfort reported by the patients brought light into the possibility of other options such as oral appliance therapy and surgical therapy, with an absolute cure rate in moderate to severe OSAHS seen with Maxillo-Mandibular Advancement (MMA) surgery. The article reviews various Oral and Maxillofacial management options for the treatment of OSAHS with their success rates.

Keywords: Obstructive Sleep Apnoea – Hypopnea, Maxillo-Mandibular Advancement, Distraction Osteogenesis, Continuous positive airway pressure

INTRODUCTION

American Academy of Sleep Medicine defines obstructive sleep apnea (OSA) as a sleep-related breathing disorder that involves a decrease or complete halt in airflow despite an ongoing effort to breathe. It is a common disorder affecting 4% of males and 2% of the female population between the third and sixth decade of life [1] but it is documented that most of the cases remain undiagnosed. It is a serious disorder affecting the health and well-being of millions of patients worldwide. It is a risk factor for most of the cardiac, hepatic and renal problems [2]. Most patients with a history of stroke, arrhythmias, hypertension, diabetes and liver and kidney failure are knowingly or unknowingly associated with obstructive sleep apnea. It results in poor concentration, impairs job management and quality of life and affects the patient on an individual, community and professional level [3].

Patency of the airway, in most patients, is compromised due to structural and skeletal defects and are more prone to dental problems like microglossia, retroglossa, adenotonsillar hypertrophy etc. Obesity also contributes to the decrease in pharyngeal airway space by increasing fat deposition around the neck or superficially in the tongue.

STUDY CRITERIA

A systematic search of the databases was done in PubMed, Scopus, Google Scholar and Cochrane Central Register of Controlled Trials and Cochrane Database of Systemic Reviews. The collected lists of articles were reviewed further. The criteria for exclusion included reviews, preexisting congenital maxillofacial abnormalities and reviews without a well-defined criterion for the success of procedure and articles which used upper airway surgical procedure alone. Only the articles that used maxillomandibular advancement or distraction osteogenesis were included in this review (Table 1).

ETIOLOGY AND PATHOGENESIS:

The pharynx is the most common site of obstruction [28, 29]. This is due to the large tongue size, small airway and abnormal anatomy which causes a difficulty in breathing thus lowering the blood oxygen saturation until the carotid sinus is stimulated resulting the patient waking up to restore normal breathing. This cycle is repeated as soon as the patient falls asleep, with the tongue collapsing back to block the airway. This apneic episode can go on from 5 – 100 times a night or even more. The average number of episodes per hour of sleep is called Apnea-Hypopnea Index (AHI) and is classified into mild (5-15), moderate (15-30) and severe (>30) [30]. These episodes are frequently associated with snoring, but snoring is not a diagnostic factor for OSA.

CLINICAL FEATURES:

The common clinical features to identify obstructive sleep apnea could be broadly classified into nocturnal (witnessed pauses in breathing, loud persistent snoring, restless sleep, frequent visits to the bathroom, choking or gasping for air) and diurnal (daytime sleepiness, poor concentration, early morning headaches, irritability, falling asleep during routine activities, emotional instability, decreased sexual activity) signs and symptoms [3].

DIAGNOSIS

Examination should include assessment of systolic and diastolic blood pressure, neck girth, evaluation of upper airway to assess the status of uvula, soft palate, tonsils and tongue size, low level of hyoid bone or maxillo-mandibular deficiency [31].

- Mallampati Score (Grade 1 – 4) evaluates the size of the tongue in relation to the oral cavity. An increased score suggests that tongue could be the cause of obstruction [32].
- Epworth sleepiness scale is a questionnaire used as a
subjective measure of a patient’s daytime sleepiness. Other questionnaires include the Berlin questionnaire and the STOP-BANG Questionnaire (score of ≥ 3 is considered high risk) [33].

- Multiple Sleep Latency Test (MSLT) is carried to assess the rate at which the patient falls asleep. Patients with excessive daytime sleepiness will have an abnormal MSLT and will have an average sleep latency during the MSLT of less than 5 to 8 minutes [34].

- Lateral cephalometric radiographs are used to assess the size of the posterior airway space, the length of the soft palate and the distance from the mandible to the hyoid bone which are beneficial for decisions concerning surgical management. Cephalometric analysis is highly recommended in OSA patients in diagnosis and treatment planning [35].

- Three-dimensional models of the airway recreated from cone-beam computed tomography (CBCT) scans are used to assess anatomic constrictions [36].

- Mueller’s maneuver is a diagnostic technique to detect airway narrowing. It is performed by attempting to inhale against pinched-off nose and closed mouth with a fiber optic Naso pharyngoscope in place. The resulting negative inspiratory pressure will cause the walls of the upper airway to collapse in the narrowed airway [37].

- Polysomnography is the gold standard test. It is a detailed overnight sleep study which records many functions like brain activity, oxygen saturation, heart rhythm, breathing rate, muscle activity and eye movements. Respiratory disturbance index (RDI), AHI and oxygen desaturation index (ODI) are used as a screening and diagnostic test [38].

- Substitute to polysomnography in patients with a probability of moderate to severe OSA, a variety of portable devices which are used for in-home, monitoring the airflow, thoraco-abdominal movements and blood oxygenation are available [39].

Table 1: Studies reporting the surgical techniques for the treatment of OSAS

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Author</th>
<th>Year</th>
<th>Number of Patients</th>
<th>Surgical technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Riley et al. [5]</td>
<td>1993</td>
<td>91</td>
<td>MMA - Success rate – 96%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>239</td>
<td>Phase 1 (UPPP and/or genioglossus advancement with hyoid myotomy suspension) Success rate – 61%</td>
</tr>
<tr>
<td>5.</td>
<td>Prinsell et al.[8]</td>
<td>1999</td>
<td>50</td>
<td>MMA - Success Rate – 100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>Phase 2 : MMA - Success rate – 75%</td>
</tr>
<tr>
<td>9.</td>
<td>Li et al.[12]</td>
<td>2000</td>
<td>175</td>
<td>Phase 1: Success rate – 49.15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MMA after phase 1 failure: Success rate – 97%</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Wagner et al.[13]</td>
<td>2000</td>
<td>21</td>
<td>MMA -Success Rate – 70.5%</td>
</tr>
<tr>
<td>11.</td>
<td>Li et al.[14]</td>
<td>2000</td>
<td>19</td>
<td>Mental Transposition Success Rate – 25%</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>MMA - Success Rate – 94.74%</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Wang et al.[18]</td>
<td>2003</td>
<td>79</td>
<td>Distraction Osteogenesis Success Rate – 69.6%</td>
</tr>
<tr>
<td>17.</td>
<td>Dattilo and Drooger.[20]</td>
<td>2004</td>
<td>42</td>
<td>Phase 1 (Hyoid suspension, palatal surgery and genioglossus advancement) Success Rate – 80%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>MMA - Success Rate – 95%</td>
</tr>
<tr>
<td>19.</td>
<td>Dort et al.[22]</td>
<td>2006</td>
<td>33</td>
<td>Mandibular repositioning appliance Success rate – 49%</td>
</tr>
</tbody>
</table>
The main aim of the surgical therapy is to cure the disease but it is less significant than relapse after conventional MMA. Distractions of up to 25mm have been reported and relapse after distraction may be less significant than relapse after conventional MMA [49].

Even though DO is an alternative to MMA or used along with MMA to improve the condition, it is better to advance the mandible using DO instead of MMA because the procedure can be stopped once the estimated distance of distraction is obtained, gradual and incremental movement provides accommodation of the soft tissues and hence, improves the stability of the newly formed bone, less chance of inferior alveolar nerve damage and thus permanent paresthesia and temporomandibular joint damage can be avoided [26]. But, there are many drawbacks for DO such as prolonged treatment time, two operations (one each for the application and removal of the appliance), newly formed bone is weak and the presence of the distractor hinders proper mastication and speech and high patient compliance is required [50].

3. Maxillo-mandibular Advancement (MMA)

The MMA is considered as a phase 2 therapy due to its aggressive nature. It has consistently provided results which make it the most predictable surgical management. The best candidates for the surgery are the ones with severe maxillofacial skeletal deformities, particularly maxillomandibular arch retrusion. It causes an expansion in the skeletal framework which includes the nasal pharyngeal and hypopharyngeal airway thus leading to airway expansion and reduces lateral pharyngeal wall collapse.

Implications for MMA are patients with resolute OSA without compelling pharyngeal obstruction, patients with significant maxillomandibular deficiency, young patients who require permanent resolution of OSA, patients with inclination for competent single-stage surgery [10]. Maxillary advancement with LeFort I osteotomy pulls forward the velum and velopharyngeal muscles while
mandibular advancement with a bilateral sagittal split osteotomy (BSSO) and genioplasty advances the tongue and suprapharyngeal muscles. During MMA, the maxilla is generally advanced first with the mandible advanced into occlusion. Because many MMA patients have retrognathic mandible, the mandible is generally advanced more than the maxilla. The average age for MMA is higher than those for traditional orthognathic surgeries which puts the patient at a higher risk of anesthesia and surgery related complication vowing to the differences in parameters such as vascular supply, bone healing and stability [51]. The immediate post-operative edema is a serious concern in the outcome of MMA. Mild to moderate lateral pharyngeal edema and ecchymosis of the pyriform sinus and aryepiglottic fold have been seen in a number of patients. There is a 75 - 100% success rate with a 90% improvement in the quality of life in those who had MMA [52]. Success is defined as a reduction in the overall AHI by more than 50% and Lin HC et al noticed that the overall AHI reduced to less than 20% in 64% of the subjects [53]. Limitations of the procedure includes extent of advancement which is no longer than 10mm – 12mm due to soft tissue limitations, the tendency to relapse with longer advancement, invasive and complex surgery, complications such as potentially profuse bleeding, infection, paresthesia, change in occlusion and aesthetic changes.

CONCLUSION

OSA is a common disorder but not diagnosed routinely. It is a life long illness which involves multidisciplinary approach for the diagnosis and management. Medical professionals are becoming constantly aware of its existence and health impact. The field of sleep apnea surgery has swiftly advanced with contemporary instrumentation and surgical techniques. The dentists must also recognize this disorder by early evaluation and prudent approach for their patient. The treatment plan for the patient is specifically modified in relation to the status of the patient, underlining illness and austerity of OSA to achieve a harmonious state which requires continuous follow-up.

REFERENCES


