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MAXILLO-MANDIBULAR ADVANCEMENT FOR OBSTRUCTIVE SLEEP APNOEA

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Abstract:
Maxillomandibular advancement (MMA) is a novel technique which treats obstructive sleep apnea by actual increament of retropalatal and retrolingual space and tightening the lateral pharyngeal wall. We have performed MMA in 5 patients with severe sleep apnea. Among them 2 had undergone previous soft tissue surgery with persistent OSA and 3 were offered MMA as first line of treatment after CPAP failure and/or noncompliance. All patients showed symptomatic improvement in respect of snoring, quality of sleep and excessive day time sleepiness. All of them achieved reduction of Apnea Hypopnea Index (AHI) by 50% and improvement in Lowest Oxygen Saturation Index (LSAT). For 3 patients AHI came down below 5. There was no postoperative complications.

Keywords : Sleep Apnea, MMA, Maxillo Mandibular Advancement, Surgery

Introduction

Obstructive sleep apnoea (OSA) is a common disorder characterized by the repetitive complete or partial collapse of the upper airway during sleep.
It results in intermittent hypoxaemia and hypercapnia, cortical arousals and surges of sympathetic activity. Pathophysiology of obstructive sleep apnea is complex. There is interplay between anatomical static and dynamic obstruction.
Soft tissue procedures involving palate, uvula, tongue base gives promising result in most of the cases. But patients with obvious midface or lower face deformity do not improve only from soft tissue surgery. These cases require bony procedures.
Maxillo-Mandibular Advancement (MMA) is one of the most effective surgery for these patients[1] . MMA achieves enlargement of the nasopharyngeal, retropalatal, and hypopharyngeal airway by expanding the facial skeletal framework via Le Fort I maxillary and sagittal split mandibular osteotomies.
Advancements of the maxilla and mandible increase tension on the pharyngeal soft tissue, thereby enlarging diameter of upper airway in all dimensions.

Material and Methods:

In last two years we have performed MMA in five patients with OSA. Among them, 2 patients had persistent OSA after phase 1 reconstruction. Others with obvious disproportionate maxilo-mandibular structures were offered for MMA after proper evaluation (picture 1).
Preoperative assessment included polysomnography, ENT and dental examination, drug induced sleep endoscopy and radiological assessment. Each patient was asked to fill up a questionnaire for assessment of day time sleepiness and quality of sleep. We used Epworth Sleepiness scale (ESS) and Pittsburg Sleep quality Index (PSQI) format for this purpose.
This was repeated after 2 months from surgery. Radiology included OPG, X-ray skull lateral view (picture 2) and CT scan of nose and paranasal sinuses

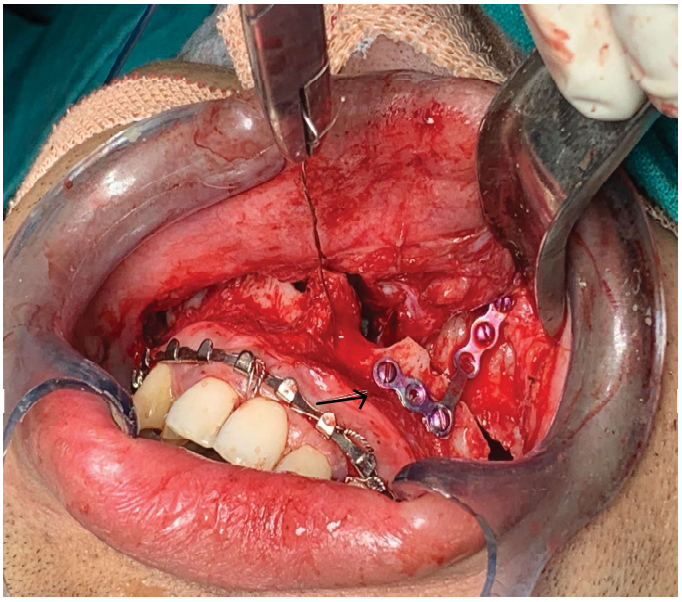
Picture 1: patient with severe OSA with small and retrograde maxilla, underwent MMA

Picture 2: Lateral view Xray Skull showing narrow retromaxillary and retrolingual space

Drug induced sleep endoscopy was combined with Esmach's maneuver to assess expected improvement in airway during mandibular advancement and also to rule out global hypotonia of airway musculature. Surgery was performed with maxillofacial team

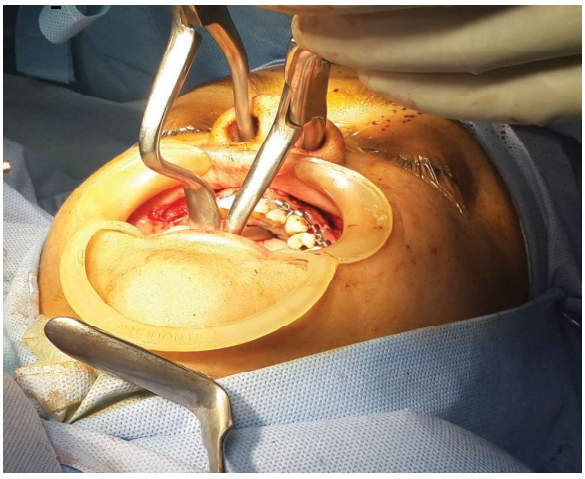
Dental work was done in advance one day before the surgery.

Local infiltration of 2% xylocaine with 1:80,000 adrenaline was given in oral mucosa. An upper buccal sulcus incision was given in the maxilla. Standard le fort 1 osteotomy cuts were made. Following pterygomaxillary dysjunction the maxilla was downfractured and mobilised . The maxilla was then advanced by approximately 10mm and fixation was carried out with miniplates in the pyriform area and buttress area (picture 3).



Picture 3: Maxillary Le forte 1 osteotomy, maxillary advancement (black arrow)

A buccal mucoperiosteal flap was elevated in the posterior mandible. Standard saggital split osteotomy cuts were made in the medial ramus, buccal shelf and a verical cut in the body of the mandible. A saggital split was carried out taking care to preserve the inferior alveolar neurovascular bundle. Following the split the maxillomandibuar fixation was done and miniplates used to fix the mandible. An anterior labial sulcus incision was made in the mandible for access to the bony chin and a advancement genioplasty was carried out followed by fixation (picture 4).



Picture 4: Surgical step showing Maxillary Advancement

At the end of the surgery the maxillomandibular fixation was removed.
Details of each case is depicted in table 1

Case	Phase 1 Surgery	Phase 2 Surgery
1	Nil	Septoplasty, turbinoplasty, MMA
2	Nil	Septoplasty, turbinoplasty, conchoplaty, MMA
3	Nil	Uvuloplasty, turbinoplasty, MMA
4	UPPP, septoplasty	MMA
5	UPPP, advancement genioplasty	MMA

Table 1: Surgical Procedure Details

Average postoperative hospital stay was 3 days with intravenous medication.
Only for one patient we performed preoperative tracheostomy to prevent desaturation from postoperative oedema because of very high AHI (67) and obesity. Tracheostomy was removed after 48 hours.
All other patients were managed in SICU for first 24 hours with head end inclined 30 degree. Intravenous steroid was given for 48 hours to prevent immediate desaturation caused by upper airway oedema. Narcotic analgesic was carefully avoided as per the practice protocol for any surgery in OSA patients. Pain management was done with paracetamol infusion. Strict monitoring was maintained after shifting to ward.
Haemostasis was given utmost importance to prevent aspiration of blood from osteotomy site or formation of haematoma. Meticulous oral and nasal suction was given from 2nd day to prevent nasal synechiae and infection at osteotomy sites. Patients were advised for weekly visit in ENT clinic as well as maxillofacial clinic for first one month. After 3 weeks the heavy rubber bands are changed to lighter ones depending on the occlusion. The patient was kept on a fluid diet for the next 3 to 4 weeks till the removal of arch bars. Soft diet was started thereafter and progressed gradually to a normal diet in a month. PSG was repeated after 2 months. ESS and PSQI score was taken at the same time.

Results:

Four male and one female patient participated in this study. All of them achieved AHI below 20 and 50% reduction of preoperative AHI. For 3 patients AHI came down below 5.
All the patients reported of definite improvement of quality of life, snoring scale and Epworth Sleepiness Scale (ESS) score.
Aesthetic changes were well appreciated by all patients with maxilla-mandibular disproportion.
Among others who were offered stage 2 procedures, one female patient was not happy about the facial morphology after surgery.

Parameters (mean)	Pre-operative	Post-operative
ESS	15	2.8
PSQI	14	3
AHI	44	5.3
LSAT	79	95.4

Table 2: Comparison of preoperative and postoperative parameters

Discussion:

Orthognathic surgery has been used to treat obstructive sleep apnea (OSA) since the mid-1980s[2]. Tracheostomy was the only curative procedure for severe OSA at that time.
Hence the paper by Riley et al highlighted maxillary, mandibular and hyoid advancement as alternative to tracheostomy. In 1981 Dr. Sullivan introduced Continuous positive airway pressure (CPAP) therapy for OSA[3]. In the same year the Fujita et al published their work on Uvulopalatopharyngoplasty (UPPP). UPPP was the first surgical approach for OSA. Initial few years UPPP showed good results. Later success rate decreased and the surgery was criticised in various papers[4]. Basically UPPP was designed for oropharyngeal obstruction.
Hence patients with hypopharyngeal obstruction did not get adequate result with UPPP.
Thereafter many techniques were introduced to address tongue base and lateral pharyngeal wall collapse. Different modifications of palatal surgery and tongue base reduction procedures showed promising result.
Multilevel surgery involving nose, palate, tongue along with minimal maxillofacial procedures like genioglossus advancement, hyoid advancement[5]. Multilevel approach increased the success rate of OSA surgery. But still none of the procedures have shown cure rate as compared to CPAP. This lacuna was filled by MMA for OSA patients. Though introduced even before UPPP, this procedure was not popular in those days. In current decades more number of cases and long term follow up have shown its superiority than any other single procedure. Current success rate according to PSG is 97 to 100%[6-8].

Selecting the surgical procedure for OSA patient is the key to surgical success. Riley and Powell proposed a surgical protocol for this[9]. Where in phase 1 was a conservative approach which included UPPP and/or mandibular osteotomy with genioglossus advancement-hyoid myotomy and suspension. Phase 2 was MMA, offered to the patients who did not achieve surgical cure with phase 1.
The surgical success rate for the 239 patients treated with phase 1 therapy was 61% (145 patients). Twenty-four patients who failed phase 1 treatment entered phase 2 treatment. The surgical success rate of phase 2 was 100%.
Riley and Powell have shown that 10 mm Advancement of the maxilla and mandible resulted in an impressive 97% cure rate in patients who had failed phase I surgery and 91% in patients treated solely by phase II surgery[10,11].
Airway obstruction in immediate postoperative period may develop from various causes.
Postoperative edema, pooled secretions and accumulated blood are major causes of airway compromise. Though rare, airway obstruction may be life threatening at time s after extubation[12].
Our case series is small in number. We did not have any complication. Nevertheless vigilant post-operative care is of utmost importance, especially for first two days after surgery.
Review articles and meta-analysis of large number of MMA surgeries have shown 1 % major and 3 % minor complication rates[1]. Among minor complication commonest is temporary paraesthesia of face.
In our experience, it may be little difficult to convince the patients for this surgery; compared to palatal soft tissue surgeries. Aesthetic changes must be informed to the patients beforehand. But compared to soft tissue procedures involving palate, tongue base this surgery is less painful and better tolerated.
All patients were satisfied after surgery in respect of quality of sleep and improvement in day time symptoms. Bed partners were asked about snoring of the patients. Four of them reported no snoring after surgery. One had occasional snoring of low grade but no apnea.

Conclusion:

Maxillomandibular advancement is an effective surgical option for OSA patients with high success rate and patient satisfaction. It is a safe procedure with short hospital stay.
This can be combined with nasal procedures and in some cases with UPPP or genioglossus advancement to avoid multiple procedures.
In appropriate cases with obvious facial deformity MMA should be offered as first option. This can prevent repeated surgical intervention and undertreating severe OSA cases.

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