Maxillo Mandibular Advancement

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School of Medicine
Maxillo-Facial Clinic
SDB Surgery Course

AIMS Board
Italian Association
of Sleep Medicine
&
ENT-MaxilloFacial Joint Commission
MAXILLO–MANDIBULAR ADVANCEMENT (MMA)

First significant Series in SDB


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MMA in USA

Kezirian EJ, Maselli J, Vittinghoff E, Goldberg AN, Auerbach AD.

In 2006, an estimated 35,263 surgeries were performed in inpatient and outpatient settings, including 33,087 palate, 6561 hypopharyngeal, and

1378 maxillomandibular advancement procedures.

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LE FORT I
MAXILLARY ADVANCEMENT
OSTEOTOMY
Basic Procedures:
Mandibular Area

OBWEGESER-
DAL PONT
SAGITTAL MANDIBLE SPLIT
TECHNIQUE OSTEOTOMY

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courtesy of Prof. Claudio Marchetti
Lateral wall: osteo-muscular structures (pre–op)

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4.3.2 Maxillo-Mandibular Advancement (MMA): MMA is indicated for surgical treatment of severe OSA in patients who cannot tolerate or who are unwilling to adhere to positive airway pressure therapy, or in whom oral appliances, which are more often appropriate in mild and moderate OSA patients, have been considered and found ineffective or undesirable [Review Section 3.1; Figure 2, 3] (Option).
In patients with severe maxillomandibular deficiencies, MMA is usually a first-line treatment. However, it is highly successful in the treatment of OSA, even in subjects without obvious facial abnormalities [83]. For these subjects, there is no general agreement regarding whether MMA can be a first surgical approach [78, 80], or whether it should be considered only a phase-II surgery, for performance only in patients previously subjected to other (phase I, including palate, hyoid and tongue surgery) surgical treatments with an unsuccessful outcome [84].
Contraindications

- Inadequate facial bone framework (age, osteoporosis, etc.)
- Pathologic conditions in osteotomy areas (impacted teeth, granulomas, cysts, implants)
- Hypodontulia (relative)
- Biprotrusive facial profile (relative)
- High surgical & anesthesiological risk
- Psycologically not stable patients
### Phase II in Literature: Successes (%)

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Year</th>
<th>n Cases</th>
<th>Success %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waite &amp; Coll.</td>
<td>USA</td>
<td>1989</td>
<td>23</td>
<td>65%</td>
</tr>
<tr>
<td>Lachner &amp; Coll</td>
<td>USA</td>
<td>1990</td>
<td>13</td>
<td>85%</td>
</tr>
<tr>
<td>Prinsell</td>
<td>USA</td>
<td>1999</td>
<td>50</td>
<td>100%*</td>
</tr>
<tr>
<td>Delmae &amp; Coll</td>
<td>France</td>
<td>2000</td>
<td>20</td>
<td>75%</td>
</tr>
<tr>
<td>Lee &amp; Coll.</td>
<td>USA</td>
<td>1999</td>
<td>3</td>
<td>100%*</td>
</tr>
<tr>
<td>Wagner &amp; Coll.</td>
<td>France</td>
<td>2000</td>
<td>21</td>
<td>70.5%</td>
</tr>
<tr>
<td>Hendler &amp; Coll.</td>
<td>USA</td>
<td>2001</td>
<td>7</td>
<td>-Δ 86% CP</td>
</tr>
<tr>
<td>Li &amp; Coll.</td>
<td>USA</td>
<td>2000</td>
<td>25 (19)</td>
<td>95%*</td>
</tr>
<tr>
<td>Conradt &amp; Coll.</td>
<td>Germany</td>
<td>1997</td>
<td>15</td>
<td>80%*</td>
</tr>
<tr>
<td>Schelben &amp; Coll.</td>
<td>Germany</td>
<td>1994</td>
<td>21</td>
<td>90%</td>
</tr>
</tbody>
</table>

*Outside referral—severe OSAS.
Linee Guida in Roncochirurgia ORL

TAB. XXXIV ANALISI LETTERATURA:
AVANZAMENTO BIMASCELLARE per OSAHS

<table>
<thead>
<tr>
<th>N° lavori pubblicati</th>
<th>N° casi esaminati</th>
<th>Follow-up (media e min-max)</th>
<th>AHI preop. medio</th>
<th>AHI postop. medio</th>
<th>% di successi</th>
</tr>
</thead>
</table>

FIG.29 ANALISI LETTERATURA:
AVANZAMENTO BIMASCELLARE per OSAHS

SUGERY FOR OSA IN ADULTS: REVIEW AND META-ANALYSIS

Surgical Modifications of the Upper Airway for Obstructive Sleep Apnea in Adults: A Systematic Review and Meta-Analysis

Sean M. Caples, DO; James A. Rowley, MD; Jeffrey R. Peressl, DMD, MD; John F. Pallanch, MD; Mohamed B. Elamine, MBBCh; Shen G. Katz, DO; John D. Harwick, MD

"Center for Sleep Medicine, Division of Pulmonary and Critical Care Medicine, Mayo Clinic, Rochester MN; Division of Pulmonary, Critical Care, and Sleep Medicine, Harper University Hospital, Detroit MI; Marriotta, GA; Department of Otorhinolaryngology, Mayo Clinic, Rochester MN; Knowledge and Encounter Research Unit, Mayo Clinic, Rochester MN; Atlanta, GA; Department of Otorhinolaryngology, University of Florida, Gainesville FL

A substantial portion of patients with obstructive sleep apnea (OSA) seek alternatives to positive airway pressure (PAP), the usual first-line treatment for the disorder. One option is upper airway surgery. As an addendum to the American Academy of Sleep Medicine (AASM) Standards of Practice paper, we conducted a systematic review and meta-analysis of literature reporting outcomes following various upper airway surgeries for the treatment of OSA in adults, including maxillomandibular advancement (MMA), pharyngeal surgeries such as uvulopalatopharyngoplasty (UPPP), laser-assisted uvulapalatoplasty (LAUP), and radiofrequency ablation (RFA), as well as multi-level and multi-phased procedures. We found that the published literature is comprised primarily of case series, with few controlled trials and varying approaches to pre-operative evaluation and post-operative follow-up. We include surgical morbidity and adverse events where reported but these were not systematically analyzed. Utilizing the ratio of mean events per procedure, we used the change in the apnea-hypopnea index (AHI) as the primary measure of efficacy. Substantial and consistent reductions in the AHI were observed following MMA, adverse events were uncommonly reported. Outcomes following pharyngeal surgeries were less consistent, adverse events were reported more commonly. Papers describing positive outcomes associated with newer pharyngeal techniques and multi-level procedures performed in small samples of patients appear promising. Further research is needed to better clarify patient selection, as well as efficacy and safety of upper airway surgery in those with OSA.

Keywords: Obstructive sleep apnea, surgical modifications, maxillomandibular advancement, uvulopalatopharyngoplasty, multi-level surgery

## Study or Subgroup

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Ratio of Means [95% CI]</th>
<th>Ratio of Means [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conradt, 1997</td>
<td>0.17 [0.09, 0.30]</td>
<td></td>
</tr>
<tr>
<td>Conradt, 1998</td>
<td>0.09 [0.05, 0.19]</td>
<td></td>
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<tr>
<td>Deckerster, 2006</td>
<td>0.16 [0.10, 0.24]</td>
<td></td>
</tr>
<tr>
<td>Goh, 2003</td>
<td>0.16 [0.11, 0.24]</td>
<td></td>
</tr>
<tr>
<td>Gregg, 2003</td>
<td>0.34 [0.28, 0.41]</td>
<td></td>
</tr>
<tr>
<td>Hochber, 1997</td>
<td>0.00 [0.03, 0.09]</td>
<td></td>
</tr>
<tr>
<td>Kessler, 2007</td>
<td>0.11 [0.02, 0.49]</td>
<td></td>
</tr>
<tr>
<td>Prinzi, 1999</td>
<td>0.28 [0.05, 0.12]</td>
<td></td>
</tr>
<tr>
<td>Riley, 1990</td>
<td>0.12 [0.09, 0.16]</td>
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</tbody>
</table>

**Total [95% CI]**

0.13 [0.08, 0.20]

Heterogeneity: $I^2 = 91\%$; $I^2 = 91\%$;

Test for overall effect: $Z = 8.70$ ($P < 0.00001$)
Comparision of MMA efficacy to CPAP efficacy (considered as gold standard) for severe OSAHS in adult patients in a medium range of time follow up (12 months)
Intervention: Surgery
Maxillo-Mandibular Advancement (I)
our technique

Le Fort I Osteotomy
Titanium Plating x4

Maxillo-Mandibular Advancement (II)
our technique

Standard 11mm Advancement
Bicortical Screws
Obwegeser - Da Pont Osteotomy
Intervention: ventilation autoCPAP

- Same Medical Doctor (ADV) in all the cases
- Trained Operator (Dottorato in Medicina del Sonno, Clinica Neuro Università di Bologna)
- One week assistance
- Autotitration according Masa & Coll., 2004

Outcomes

according Sundaram & Coll., The Cochrane Collaboration, 2007

PRIMARY

- AHI (Apnoea Hypopnea Index)
- ESS (Epworth Sleepiness Scale)

SECONDARY

- Visual Analogue Scale-VAS (satisfaction)
- Complications (type & rate)
- Withdrawls
- Postoperative Morbidity
- Postoperative Mortality
- One Year Mortality
CONCLUSIONS

- In our small sample of adult subjects suffering from severe OSAHS within the limits of a one year survey MMA & CPAP demonstrated a comparable level of efficacy
- Further studies are mandatory in a larger group of subjects, with a more accurate analysis and a longer follow up
- Even if difficult, a RCT is possible in SDB Surgery

No statistically significant difference has been observed between the AHI improvement in MMA group and AHI improvement in the CPAP group (p=0.21).

No statistically significant difference has been demonstrated between the ESS improvement in the MMA group and the improvement in the CPAP group (p=0.20).
Complication Rate & Type in large series

<table>
<thead>
<tr>
<th>KRAMER &amp; COLL., 2004 N=1000</th>
<th>CHOW &amp; COLL., 2007 N=2910</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complication Rate: 6.4%</td>
<td>Complication Rate: 9.7%</td>
</tr>
<tr>
<td>Septal deviation 1.6%</td>
<td>Infection 7.4%</td>
</tr>
<tr>
<td>Non union 1.0%</td>
<td></td>
</tr>
<tr>
<td>Bleeding 1.1%</td>
<td></td>
</tr>
<tr>
<td>Infection 1.1%</td>
<td></td>
</tr>
<tr>
<td>Ischemic c. 1.0%</td>
<td></td>
</tr>
<tr>
<td>Insufficient fix. 0.5%</td>
<td></td>
</tr>
</tbody>
</table>

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INFRAORBITAL/MANDIBULAR NERVE dysfunction in MMA > 1 year (Literature)

- Zaytoun & Coll.1986 (26 cases) 28.8%
- Coghlan & Coll.1986 (19 cases) 65.8%
- Yoshida & Coll 1989 (23 cases) 15%
- Westernmark & Coll1998 (496 cases) 40%
- August & Coll.1999 (85 cases) 1.8-4.8%
- Ylikontola & Coll.2000 (30 cases) 31%
- Maurer & Coll. 2001 (507 cases) 28%
- Yip & Coll.2001 (50 cases) 22.78%
- Teerijoki & Coll.2004 (20 cases) 35-40%
- Jarroson & Coll.2005 (40 cases) 60-77%
- Al-Bishri & Coll.2004 (86 cases) 50%
- Al-Bishri & Coll 2005 (129 cases) 7.5-11.6%
- Colella & Coll.2007 (Meta-An) 12.8-18.4%

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MAXILLO–MANDIBULAR
ADVANCEMENT
(MMA)

personal series
N = 52

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PSG/ESS
Results 27/53

* CONTROLS: sex, age, severity matched OSAHS patients treated by nCPAP and studied without nCPAP during PSG

<table>
<thead>
<tr>
<th>Observations</th>
<th>MMA</th>
<th>controls*</th>
</tr>
</thead>
<tbody>
<tr>
<td>n.Cases</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td>M/F</td>
<td>24/3</td>
<td>15/3</td>
</tr>
<tr>
<td>Age(mean)</td>
<td>48.6</td>
<td>51.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AHI</th>
<th>58.3 -&gt; 5.8 p&lt;0.001</th>
<th>57.4 -&gt; 5.6 ns</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESS</td>
<td>11.6 -&gt; 7.3 p&lt;0.005</td>
<td>not available</td>
</tr>
<tr>
<td>BMI</td>
<td>32.4 -&gt; 30.6 ns</td>
<td>29.9 -&gt; 28.2 ns</td>
</tr>
</tbody>
</table>

| AHI<10        | 24/27 (88%)         | 0%              |
| ESS<10        | 26/27 (96%)         | NA              |

5/2/2012
MMA success rate vs preop RDI

Success rate vs RDI pre:

0 - 20  20 - 40  40 - 60  60 - 80

MMA success rate vs preop BMI

Success rate vs BMI pre:

0 - 20  30 - 32  33 - 34  >34

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Final Remarks

- MMA is very effective
- But technically demanding
- Time consuming
- In stay procedure
- With a potential risk of
- Dental malocclusion
- And sensory nerves deficit

- Applications are different according to the different Surgeon’s perspectives

THANK you for your attention