

Maxillomandibular Advancement for Treatment of Obstructive Sleep Apnea: A Meta-analysis.

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Abstract

IMPORTANCE:

Maxillomandibular advancement (MMA) is an invasive yet effective surgical option for obstructive sleep apnea (OSA) that achieves enlargement of the upper airway by physically expanding the facial skeletal framework.

OBJECTIVE:

To identify criteria associated with surgical outcomes of MMA using aggregated individual patient data from multiple studies.

DATA SOURCES:

The Cochrane Library, Scopus, Web of Science, and MEDLINE from June 1, 2014, to March 16, 2015, using the Medical Subject Heading keywords maxillomandibular advancement, orthognathic surgery, maxillary osteotomy, mandibular advancement, sleep apnea, surgical, surgery, sleep apnea syndrome, and obstructive sleep apnea.

STUDY SELECTION:

Inclusion criteria consisted of studies in all languages of (1) adult patients who underwent MMA as treatment for OSA; (2) report of preoperative and postoperative quantitative outcomes for the apnea-hypopnea index (AHI) and/or respiratory disturbance index (RDI); and (3) report of individual patient data. Studies of patients who underwent adjunctive procedures at the time of MMA (including tonsillectomy, uvulopalatopharyngoplasty, and partial glossectomy) were excluded.

DATA EXTRACTION:

Three coauthors systematically reviewed the articles and updated the review through March 16, 2015. The PRISMA statement was followed. Data were pooled using a random-effects model and analyzed from July 1, 2014, to September 23, 2015.

MAIN OUTCOMES AND MEASURES:

The primary outcomes were changes in the AHI and RDI after MMA for each patient. Secondary outcomes included surgical success, defined as the percentage of patients with more than 50% reduction of the AHI to fewer than 20 events/h, and OSA cure, defined as a post-MMA AHI of fewer than 5 events/h.

RESULTS:

Forty-five studies with individual data from 518 unique patients/interventions were included. Among patients for whom data were available, 197 of 268 (73.5%) had undergone prior surgery for OSA. Mean (SD) postoperative changes in the AHI and RDI after MMA were -47.8 (25.0) and -44.4 (33.0), respectively; mean (SE) reductions of AHI and RDI outcomes were 80.1% (1.8%) and 64.6% (4.0%), respectively; and 512 of 518 patients (98.8%) showed improvement. Significant improvements were also seen in the mean (SD) postoperative oxygen saturation nadir (70.1% [15.6%] to 87.0% [5.2%]; $P < .001$) and Epworth Sleepiness Scale score (13.5 [5.2] to 3.2 [3.2]; $P < .001$). Rates of surgical success and cure were 389 (85.5%) and 175 (38.5%), respectively, among 455 patients with AHI data and 44 (64.7%) and 13 (19.1%), respectively, among 68 patients with RDI data. Preoperative AHI of fewer than 60 events/h was the factor most strongly associated with the highest incidence of surgical cure. Nevertheless, patients with a preoperative AHI of more than 60 events/h experienced large and substantial net improvements despite modest surgical cure rates.

CONCLUSIONS AND RELEVANCE:

Maxillomandibular advancement is an effective treatment for OSA. Most patients with high residual AHI and RDI after other unsuccessful surgical procedures for OSA are likely to benefit from MMA.

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Lateral Pharyngeal Wall Tension After Maxillomandibular Advancement for Obstructive Sleep Apnea Is a Marker for Surgical Success: Observations From Drug-Induced Sleep Endoscopy.

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Abstract

PURPOSE:

The efficacy of maxillomandibular advancement (MMA) for obstructive sleep apnea (OSA) with anatomic airway changes has previously been studied using static imaging and endoscopy in awake subjects. The aim of the present study was to use drug-induced sleep endoscopy (DISE) to evaluate the dynamic upper airway changes in sleeping subjects before and after MMA and their association with the surgical outcome.

PATIENTS AND METHODS:

This was a retrospective cohort study of subjects with OSA who had undergone MMA at the Stanford University Sleep Surgery Division from July 2013 to July 2014. The subjects were included if perioperative polysomnography and DISE had been performed. The predictor variable was the perioperative DISE velum-oropharynx-tongue-epiglottis score. The outcome variables were the apnea-hypopnea index (AHI), oxygen-desaturation index (ODI), and Epworth Sleepiness Scale (ESS). A subgroup analysis was performed for the subjects who had undergone primary and secondary MMA. The statistical analyses included Cronbach's α coefficient, the McNemar test, and the independent Student t test. The P value was set at $<.01$.

RESULTS:

A total of 16 subjects (15 males, 1 female) were included in the present study, with an average age of 47 ± 10.9 years and body mass index of 29.4 ± 5.1 kg/m². Significant post-MMA decreases were found in the AHI (from 59.8 ± 25.6 to 9.3 ± 7.1 events/hr) and ODI (from 45 ± 29.7 to 5.7 ± 4.1 events/hr; $P < .001$). Greater improvement in the AHI occurred in the primary MMA group ($P = .022$). The post-MMA change in airway collapse was most significant at the lateral pharyngeal wall ($P = .001$). The subjects with the most improvement in lateral pharyngeal wall collapsibility demonstrated the largest changes in the AHI (from 60.0 ± 25.6 events/hr to 7.5 ± 3.4 events/hr) and ODI (from 46.7 ± 29.8 to 5.3 ± 2 events/hr; $P = .002$).

CONCLUSIONS:

Using DISE, we observed that after MMA, the greatest reduction in upper airway collapsibility is seen at the lateral pharyngeal wall of the oropharynx, followed by the velum, and then the tongue base. The stability of the lateral pharyngeal wall is a marker of surgical success after MMA using the AHI, ODI, and ESS.

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Maxillary expansion and maxillomandibular expansion for adult OSA: A systematic review and meta-analysis.

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Abstract

OBJECTIVE:

This study sought to systematically review the international literature for articles evaluating maxillary expansion and maxillomandibular expansion as treatments for obstructive sleep apnea (OSA) in adults and to perform a meta-analysis.

DATA SOURCES:

Nine databases (including MEDLINE/PubMed).

REVIEW METHODS:

Searches were performed through January 8, 2016. The PRISMA statement was followed.

RESULTS:

Eight adult studies (39 patients) reported polysomnography and/or sleepiness outcomes. Six studies reported outcomes for maxillary expansion (36 patients), and the apnea-hypopnea index (AHI) decreased from a mean (M) ± standard deviation (SD) of 24.3 ± 27.5 [95% CI 15.3, 33.3] to 9.9 ± 13.7 [95% CI 5.4, 14.4] events/hr (relative reduction: 59.3%). Maxillary expansion improved lowest oxygen saturation (LSAT) from a M ± SD of 84.3 ± 8.1% [95% CI 81.7, 87.0] to 86.9 ± 5.6% [95% CI 85.1, 88.7]. Maxillomandibular expansion was reported in two studies (3 patients) and AHI decreased from a M ± SD of 47.53 ± 29.81 [95% CI -26.5 to 121.5] to 10.7 ± 3.2 [95% CI 2.8, 18.6] events/hr (relative reduction: 77.5%). Maxillomandibular expansion improved LSAT from a M ± SD of 76.7 ± 14.5% [95% CI 40.7, 112.7] to 89.3 ± 3.1 [95% CI 81.6, 97].

CONCLUSION:

The current literature demonstrates that maxillary expansion can improve and maxillomandibular expansion can possibly improve AHI and LSAT in adults; however, given the paucity of studies, these remain open for additional research efforts.

KEYWORDS:

Maxillary expansion; Maxillomandibular expansion; Meta-analysis; Sleep apnoea syndromes; Systematic review

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Quality of Life Assessment After Maxillomandibular Advancement Surgery for Obstructive Sleep Apnea.

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Abstract

PURPOSE:

Although maxillomandibular advancement (MMA) surgery is highly efficacious for the management of obstructive sleep apnea (OSA), little information exists regarding the subjective effect of this treatment modality. The present study was undertaken to investigate the effect of MMA on patient-perceived quality of life (QOL) in OSA.

PATIENTS AND METHODS:

A retrospective cohort study of patients treated with MMA for OSA from May 2010 to April 2015 was performed. The primary outcome measure was a change in the QOL detected using the Ottawa Sleep Apnea Questionnaire (OSA-Q), which assesses the MMA-related changes in QOL with a 5-point Likert scale. The secondary outcome measure was a change in the apnea hypopnea index (AHI).

RESULTS:

Twenty-two patients participated in the present study. The mean maxillary and mandibular advancement were 8.36 and 11.08 mm, respectively. The AHI decreased from 42.4 to 6.9 events per hour postoperatively ($P < .001$). The QOL improved significantly after MMA (OSA-Q score 3.98 ± 0.35 ; $P < 0.01$). The sleep quality (4.35 ± 0.63), daytime function (4.13 ± 0.46), physical health (4.19 ± 0.45),

mental and emotional health (4.02 ± 0.55), and sexual health (3.78 ± 0.62) categories all improved postoperatively ($P < .001$). The MMA-related side effects did not adversely affect the QOL.

CONCLUSIONS:

MMA for OSA significantly improves patient's subjective overall QOL, with few MMA-related side effects.

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Long-Term Effectiveness and Safety of Maxillomandibular Advancement for Treatment of Obstructive Sleep Apnea.

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Abstract

STUDY OBJECTIVE:

To determine the long-term clinical effectiveness and safety of maxillomandibular advancement (MMA) for the treatment of moderate to severe obstructive sleep apnea (OSA).

METHODS:

A prospective two-center cohort study design was used to evaluate OSA patients who underwent MMA > 2 years ago. The primary outcome measure was the apnea-hypopnea index (AHI). Secondary outcome measures included blood pressure (BP), sleepiness (Epworth Sleepiness Scale [ESS]), and quality of life (Functional Outcomes of Sleep Questionnaire [FOSQ]).

RESULTS:

30 adult patients (80% men, age 50.5 ± 9.6 years [mean \pm SD]) participated in the study. The AHI decreased from a mean of 49 to 10.9 events/h ($p < 0.0001$) at the time of long-term evaluation (6.6 ± 2.8 years after MMA), with 46.7% of patients obtaining an AHI < 5 and 83.4% of patients attaining an AHI ≤ 15 events/h. The mean diastolic BP decreased from 83.7 to 79.0 mm Hg ($p < 0.05$). ESS decreased from a mean of 12.1 to 6.0 ($p < 0.01$). FOSQ increased from a mean of 12.6 to 17.3 ($p < 0.05$). Few long-term treatment-related adverse events occurred, which had minimal impact on quality of life (QOL).

CONCLUSIONS:

MMA is a clinically effective and safe long-term treatment for most patients with moderate-to-severe OSA as demonstrated by significant decreases in AHI, diastolic BP, and subjective sleepiness, with concomitant significant improvements in QOL. The results of this small cohort study suggest that MMA should be considered as the alternative treatment of choice for patients with severe OSA who cannot fully adhere to CPAP therapy.

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KEYWORDS:

apnea-hypopnea index; cohort study; daytime sleepiness; maxillomandibular advancement; obstructive sleep apnea; quality of life; safety; treatment outcome

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