Journal of Current Research in Oral Surgery
2025, Volume 5, Issue 2, Page No: 187-196

Available online at: www.tsdp.net

ISSN: 3062-3480

Original Article

Counterclockwise Rotational Orthognathic Surgery with Maxillary Wedge Osteotomy for OSA Treatment

Hiroshi Nakamura[1]*, Yuta Kato[1]

[1]Department of Oral Surgical Care and Dentistry, Faculty of Dentistry, Nagoya University, Nagoya, Japan.

***E-mail** ✉ hiroshi.nakamura@outlook.com

Received: 04 July 2025; **Revised:** 08 November 2025; **Accepted:** 11 November 2025

ABSTRACT

In patients with moderate to severe obstructive sleep apnea (OSA) who fail conventional management, orthognathic surgery—specifically maxillomandibular advancement (MMA)—has become a recognized therapeutic alternative. A maxillary wedge osteotomy, frequently executed in tandem with mandibular surgery, represents a surgical modality for addressing OSA. This case series documents six OSA patients lacking anteroposterior maxillary deficiency who received treatment via maxillary wedge osteotomy. A retrospective review was conducted of six consecutive patients who underwent maxillomandibular advancement (MMA) for obstructive sleep apnea (OSA), all operated on by a single surgeon between 2018 and 2024 at the Maxillofacial Surgery Unit of San Camillo-Forlanini Hospital in Rome, Italy. Patient evaluation employed a CAD/CAM-assisted protocol. Pre- and postoperative comparisons were drawn to gauge the intervention's success in ameliorating OSA-related measures. The surgical plan, developed digitally, comprised maxillary wedge osteotomy and bilateral sagittal split osteotomies (BSSO) of the mandibular ramus. Pre- and postoperative CT imaging, together with 3D reconstructions produced via dedicated software, displayed a counterclockwise rotation of the occlusal plane, yielding roughly 13 mm of mandibular advancement. The CT scans indicated substantial airway volume expansion consequent to the skeletal shift. Airway volume grew from 20.665 ± 546 mm^3 to 27.177 ± 446 mm^3. Counterclockwise rotational orthognathic surgery without maxillary advancement has been shown to meaningfully enlarge the posterior pharyngeal space while achieving favorable aesthetic results.

Keywords: Counterclockwise rotation occlusal plane, Airway obstruction, Obstructive sleep apnea, Virtual planning, CAD/CAM technology, Orthognathic surgery

How to Cite This Article: Nakamura H, Kato Y. Counterclockwise Rotational Orthognathic Surgery with Maxillary Wedge Osteotomy for OSA Treatment. J Curr Res Oral Surg. 2025;5(2):187-96. https://doi.org/10.51847/3NJPOd5hto

Introduction

Defined by recurrent episodes of partial or complete collapse of the upper airway during sleep that provoke intermittent hypoxemia and sleep disruption, obstructive sleep apnea (OSA) is a chronic respiratory condition [1]. It carries associations with heightened rates of hypertension, cardiovascular illness, metabolic dysfunction, stroke, and deterioration in quality of life.

Clinical signs

Both insomnia and obstructive sleep apnea (OSA) are linked with elevated risks of hypertension and cardiovascular pathology among older adults as well as younger military veterans [2].

Owing to structural modifications of the upper airway and an amplified susceptibility to pharyngeal collapse, obstructive sleep apnea (OSA) has been connected with a greater likelihood of difficult tracheal intubation. Separately, an enlarged neck circumference—commonly associated with obesity—has emerged as an independent predictor of challenging mask ventilation, further complicating airway management in this patient population [3]. Key pathophysiological drivers include intermittent hypoxemia, sustained sympathetic nervous system discharge, systemic inflammatory responses, and nocturnal blood pressure surges [4]. Acting in concert, these elements foster vascular injury and endothelial impairment, markedly elevating total cardiovascular risk. Ischemic stroke and obstructive sleep apnea (OSA) each represent highly prevalent disorders with substantial clinical, societal, and economic burdens. A mounting body of literature supports OSA as an independent risk determinant for cerebrovascular incidents, including ischemic stroke.

Therapeutic approach

Although first-line treatment typically involves conservative measures such as continuous positive airway pressure (CPAP), a considerable proportion of patients demonstrate inadequate long-term adherence or find CPAP intolerable [5, 6]. Within this landscape, orthognathic surgery—most notably maxillomandibular advancement (MMA)—has gained footing as an efficacious option for individuals with moderate to severe OSA unresponsive to standard therapies. Riley *et al*. [7] pioneered the maxillomandibular advancement (MMA) technique in the mid-1980s as a surgical remedy for obstructive sleep apnea (OSA). The procedure has shown particular utility in severe or treatment-refractory OSA, especially where both maxillary and mandibular advancement are indicated [8]. MMA operates by augmenting upper airway volume through forward displacement of the bony segments, thus enhancing airway patency during sleep. The technique's evolution has been propelled by the integration of digital planning technologies and a refined understanding of OSA pathophysiology, which has expanded candidacy to patients without conspicuous skeletal deformities. A breadth of studies demonstrates that MMA can achieve notable reductions in the apnea-hypopnea index (AHI), along with improvements in oxygen saturation and overall sleep architecture. The operation may also confer aesthetic and functional rewards, boosting patient satisfaction. However, given the procedure's intricacy, meticulous patient selection, multidisciplinary preoperative strategy, and comprehensive postoperative surveillance are imperative. Three-dimensional repositioning of the facial skeleton to widen the retropharyngeal space and improve upper airway patency can be achieved through maxillary wedge osteotomy, often performed in conjunction with mandibular advancement. A maxillary wedge osteotomy, frequently undertaken in combination with mandibular surgery, may serve as a surgical treatment pathway for obstructive sleep apnea (OSA). This case series report presents three patients with OSA and no anteroposterior maxillary deficiency who underwent maxillary wedge osteotomy.

Materials and Methods

A retrospective investigation was undertaken involving patients who had received maxillomandibular advancement (MMA) for the management of obstructive sleep apnea (OSA). All cases were treated consecutively by a single surgeon over the period spanning 2018 to 2024 at the Maxillofacial Surgery department of San Camillo-Forlanini Hospital in Rome, Italy. A purpose-designed informed consent document was created specifically for this research. Every intervention was carried out in conformity with the ethical standards detailed in the Declaration of Helsinki.

The following inclusion parameters governed entry into the study:

- A polysomnographically verified diagnosis of moderate to severe obstructive sleep apnea (OSA), defined by an apnea-hypopnea index (AHI) greater than 15.
- Evaluation by the hospital's multidisciplinary OSA team, incorporating a maxillofacial surgeon, dentist, pulmonologist, ENT physician, and bariatric surgeon, yielded a collective recommendation in favor of mandibular advancement (MA).
- Preoperative drug-induced sleep endoscopy (DISE) showing probable therapeutic gain from MA, corroborated by mandibular advancement maneuvers.
- Sound overall medical condition, presenting no impediment to general anesthesia (ASA physical status classification ≤ 3).
- Absence of any requirement for maxillary advancement.

Exclusion criteria

Subjects were ruled out from participation if any of the following circumstances were present:

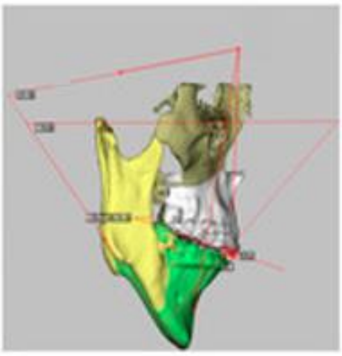
- Age falling within the pediatric bracket (< 18 years).
- Concurrent respiratory ailments or particular craniofacial malformations.
- Serious systemic disorders that would make general anesthesia inadvisable (ASA ≥ 4).
- A background of major cardiovascular illness.
- Psychiatric comorbidities.
- Syndromic diagnoses.
- Any history of prior orthognathic procedures.
- A necessity for maxillary advancement.

- Unwillingness to sign the informed consent.

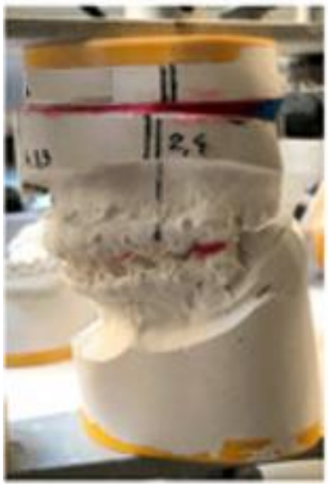
Demographic and clinical data were collected for each subject, including age, sex, and preoperative body mass index (BMI). The Pneumology Unit conducted polysomnographic assessments within a six-month window before the operation, and again at the six-month postoperative mark to assess treatment outcomes. A comparative workup was performed to examine how effectively each technique ameliorated the OSA-associated parameters. Patients underwent evaluation through a CAD/CAM-assisted protocol. A side-by-side analysis of preoperative and postoperative findings was conducted to assess the surgical intervention's capacity to improve OSA-related measures **(Figure 1).**

a)

b)

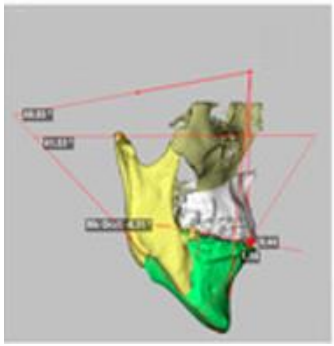


c)

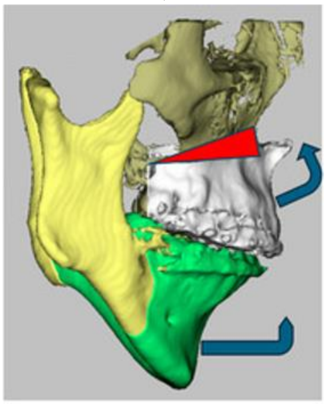


d)

e)



f)



g)

Figure 1. (a) Mounting of the models on a semi-adjustable articulator served as the initial step for appraising intermaxillary relations, enabling an in-depth look at occlusal function and skeletal

alignme nt. (b, c) A cephalometric study conducted before surgery bore out the necessity for mandibular a dvancement, with no evidence pointing toward maxillary advancement. (e) An articulator-based mock- up of the project ed postoperative state was produced by repositioning the models to mirror the expect ed skeletal and occlusal transformations. (f) At the same time, a software-driven cephalometric simulation incorporatin g mandibular rotation and forward movement was performed to estimate the three-dimensional consequences for the upper airway and facial aesthetics. (g) A comprehensive surgical roadmap was developed using specialized planning software, integrating skeletal repositioning with occlusal targets.

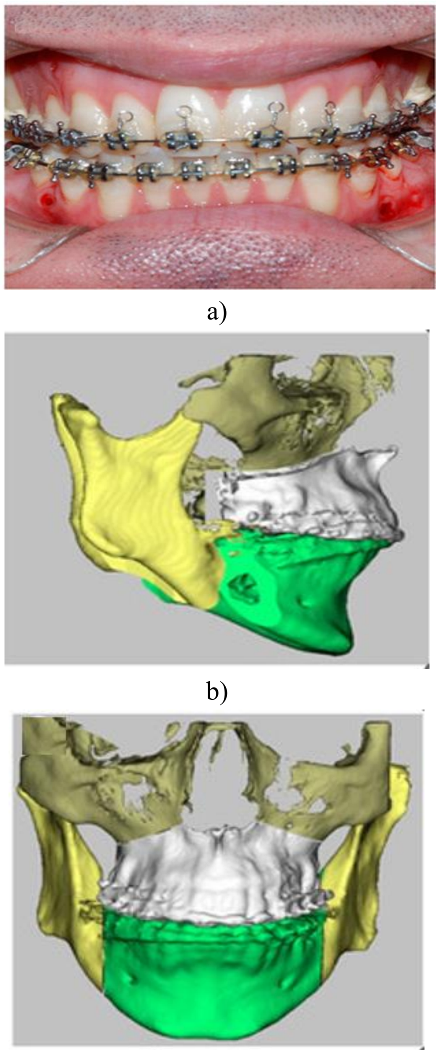
The study encompassed 6 patients afflicted with severe obstructive sleep apnea syndrome (OSAS) who were treated via mandibular advancement (MA) surgery without forward displacement of the maxilla. Their mean age stood at 41 ± 3 years; the sample comprised 5 males and 1 female.

Helical CT acquisitions were obtained for every patient to underpin virtual surgical planning, which, in turn, enabled the engineering of patient-specific cutting guides and fixation elements. Head and neck imaging was conducted with the patient lying supine and the head oriented in a natural posture. The resulting imaging data, fused with occlusal records taken from digital dental models and clinical photographs, were employed to build a three-dimensional depiction of the craniofacial skeleton, faithfully matched to the patient's natural head alignment. Both before and after surgery, assessments incorporated full-night polysomnography, which took place within the six months before the operation and was repeated at the six-month postoperative point. The respiratory and oxygenation data points listed below were recorded and subjected to analysis:

- Apnea–Hypopnea Index (AHI)
- Apnea Index (AI)
- Hypopnea Index (HI)
- Mean Apnea Duration
- Oxygen Desaturation Index (ODI)
- Mean Oxygen Saturation (SaO2)
- Lowest Oxygen Saturation (Nadir SaO2)
- Mean Desaturation Events
- Percentage of Time with SaO2 < 90%

Cephalometric plots for the periods before and after surgery were extracted from CT scan imagery by means of Dolphin 3D software (version 11.7; Dolphin Imaging & Management Solutions, Chatsworth, CA, USA).

The digital blueprint encompassed a maxillary wedge osteotomy together with bilateral sagittal split osteotomies (BSSO) of the mandibular ramus. Virtual trial runs of the maxillary wedge osteotomy and the mandibular repositioning were carried out, and both intermediary and final operative splints were conceived, adhering to a maxilla-first protocol **(Figures 1 and 2)**. These splints were subsequently brought to life through 3D printing. Building on the virtual surgical plan, CAD/CAM processes were used to produce polyamide cutting guides tailored to the predetermined osteotomies, as well as tailor-made titanium fixation plates. Both device categories were produced using 3D printing technologies. Segmentation of the CT images permitted simulation of the osteotomies and appraisal of the airway space. Moreover, patient-customized cutting guides and fixation plates were devised as an integrated component of the surgical preparation sequence.



a)

b)

c)

Figure 2. (a) View of the occlusal configuration after the operation, (b) Frontal depiction of the postoperative intermaxillary relationships, and (c)

Lateral depiction of the intermaxillary relationships attained postoperatively.

Surgical procedures

Access for the maxillary wedge osteot omy was gained through a cut placed within the upper oral vestibule, situated above the dental root tips and coursing from the right first molar region across to the left first molar. Reflecting a mucoperiosteal flap provided visualization of the maxillary bone surface. The cutting guide, designed to rest directly on the bone, was then fitted onto the maxilla. Both guides were firmly anchored using 2.0 mm-diameter screws. Execution of a Le Fort I osteotomy followed, carried out with a piezosurgical device. An additional osteotomy line was created at a more cephalic level, coursing posteriorly until it intersected with the Le Fort I cut. The osseous wedge delineated by these two cuts, which was wider anteriorly, was removed. Guided by the preoperative blueprint, the maxilla was shifted into its new orientation and fixated with bespoke titanium plates. The maneuver introduced a counterclockwise rotation to the maxilla, realigning its basal aspect with the superior osteotomy boundary. This step elevated the anterior maxillary segment, generating a counterclockwise pivot that altered the inclinations of both the occlusal and maxillary planes. With this reoriented, counterclockwise-rotated occlusal plane now established, the mandible was subsequently moved forward. This philosophy departs from traditional MMA approaches, in which the maxilla is frequently thrust too far forward, a move that risks creating an excessively sharp nasolabial angle and a facial profile that appears cosmetically strained. The rotational component delivered a modest 3 mm gain in maxillary position, an amount that nonetheless proved critical for opening the space needed to accommodate a comprehensive 13 mm mandibular advancement. Enabling a more pronounced mandibular projection in this manner maximized therapeutic yield. The assessment of the pharyngeal airway informed by DISE results was strictly restricted to morphological characterization.

Our operative sequence prioritized the maxilla over the mandible during maxillomandibular advancement (MMA), a choice grounded in both anatomic logic and functional aims. A principal justification for this order is the importance of reining in maxillary protrusion for aesthetic reasons, most notably to sidestep an excessively acute nasolabial angle alongside an artificial-looking facial contour. Addressing the maxilla as the first surgical step and imparting a counterclockwise rotation allowed us to reconstitute the occlusal plane. That newly set plane subsequently acted as a dependable template for the ensuing advancement and rotation of the mandible, guaranteeing that the lower jaw's final placement would be consonant with the maxillary position. Proceeding in this order makes occlusal matching easier and substantially increases the precision of the operation. Were one to reverse the sequence—advancing the mandible first, without the rotated maxilla serving as a landmark—it would become far more challenging to hit the intended functional and cosmetic targets. An added merit of this protocol is that it curbs the tendency, prevalent in standard MMA, to overexpose the maxilla. The measured rotation and intentionally limited 3 mm of maxillary movement provided sufficient territory for the full 13 mm of mandibular advancement, striking an optimal balance between airway expansion and the preservation of facial proportionality.

Bilateral sagittal split osteotomy (BSSO)

The operative method employed for the mandibular procedure did not differ between the two groups. A mucosal cut was made along the oral vestibule of the mandible, stretching from the first molar forward to the anterior extent of the mandibular ramus while following the trajectory of the oblique ridge. Elevating a mucoperiosteal flap uncovered the lateral face of the mandibular ramus, bringing into view the lingula (Spix spine) as well as the inferior alveolar nerve. A cutting guide supported by both teeth and bone was then applied, and a bilateral sagittal split osteotomy (BSSO) was concluded with a piezoelectric surgical device. The mandible was transferred to the position prescribed by the preoperative plan and secured with patient-specific titanium plates, so that its occlusal plane matched that of the maxilla. This relocation additionally involved a counterclockwise rotation of the mandibular body. Each patient received perioperative antibiotic coverage with bacampicillin, and a six-day postoperative oral course was prescribed.

Statistical analysis

Compilation and processing of the experimental data were performed using GraphPad Prism 9 (GraphPad Software, San Diego, CA, USA). The Kolmogorov–Smirnov test was applied to assess whether the continuous variables followed a normal distribution. Equality of variances, a prerequisite for Student's t-test, was checked beforehand through Levene's test. When variances were found to be equal ($p > 0.05$), the standard t-test was selected; under unequal variances, Welch's correction was substituted. Nonparametric assessment of categorical variables collected before and after the intervention was performed using the

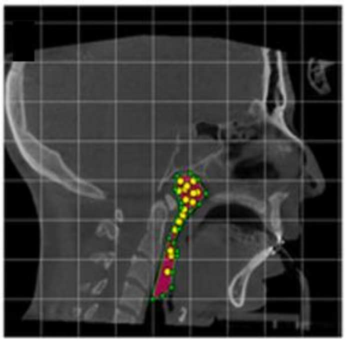
Mann–Whitney test. A p-value of less than 0.05 served as the threshold for statistical significance.

Results and Discussion

A side-by-side reading of the preoperative and postoperative CT studies, complemented by three-dimensional reconstructions built in dedicated software, uncovered a counterclockwise rotation of the occlusal plane that produced a mandibular advancement in the range of 13 mm. The CT dataset shows a striking increase in airway volume following skeletal repositioning. The volumetric measurement climbed from 20.665 ± 546 mm³ to 27.177 ± 446 mm³ **(Figures 3 and 4).**

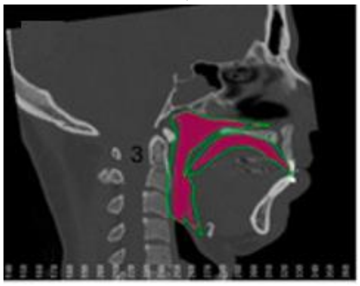
a)

b)

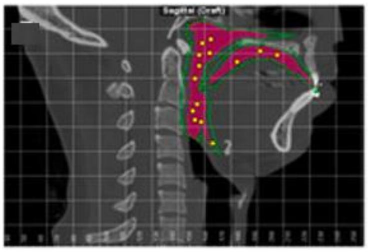


c)

d)



e)



f)

Figure 3. (a–c) Preoperative computed tomography (CT) datasets were scrutinized within dedicated surgical planning software, an environment that enabled three-dimensional mapping and volumetric quantification of the upper airway spaces. (d–f) Postoperative computed tomography (CT) datasets were similarly scrutinized within dedicated surgical planning software; a marked enlargement of the upper airway space is plainly visible.

a)

b)

Figure 4. Laryngoscopic visualization documents a shift in the geometry of the posterior airspace, transitioning from an elliptical configuration (a) to a rounded one (b) concurrent with an augmentation in volume.

Clinically meaningful gains were documented for each respiratory and oximetric endpoint tracked. The apnea-hypopnea index (AHI) decreased by over 90%, reclassifying patients from severe OSAS to breathing values within the normal range (< 5 events/hour). The apnea index (AI) fell sharply, reflecting what amounted to an almost total abolition of obstructive apnea episodes. Likewise, the hypopnea index (HI) was reduced to near-zero values, indicating that airflow during sleep had effectively normalized. The mean duration of obstructive respiratory events decreased from 21 ± 6 s to 6 s, thereby reducing both hemodynamic strain and the risk of prolonged oxygen desaturation **(Figure 5).**

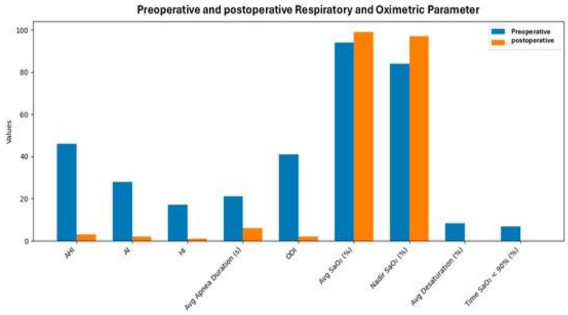


Figure 5. Respiratory and oximetric measures were recorded before and after the surgical intervention.

Data on respiration and oxygenation were compiled and examined before and after the surgical intervention, as summarized in **Tables 1 and 2**. Visualization of the pharyngeal region via laryngoscopy revealed a morphological transition, with the shape changing from a compressed appearance to a distinctly elliptical one **(Figure 4).** Upon statistical scrutiny, the respiratory measures returned to normal values, accompanied by a substantial improvement in systemic oxygenation; for every variable under investigation, P-values were < 0.0001.

Table 1. A comparison of respiratory and oximetric values obtained before and after maxillary wedge osteotomy paired with mandibular advancement.

Parameter	Preoperative	Postoperative	Clinical interpretation
Snoring	68%	0%	Complete elimination of snoring, suggesting a marked reduction in airway obstruction.
Apnea–Hypopnea Index (AHI)	46 events/hour	3 events/hour	More than 90% decrease, indicating normalization of breathing pattern during sleep.
Apnea Index (AI)	28 events/hour	2 events/hour	Substantial reduction in complete apnea episodes.
Hypopnea Index (HI)	17 events/hour	1 event/hour	Almost total resolution of hypopnea events.
Average Apnea Duration	21 ± 6 seconds	6 seconds	Marked shortening of apnea duration, implying reduced physiological stress.

Table 2. A comparison of oximetric values obtained before and after maxillary wedge osteotomy paired with mandibular advancement.

Parameter	Preoperative	Postoperative	Clinical Interpretation
Oxygen Desaturation Index (ODI)	41 events/hour	2 events/hour	Significant decrease in oxygen desaturation events.
Average Oxygen Saturation (SaO_2)	94 ± 2%	99%	Notable improvement in overall systemic oxygenation.
Nadir Oxygen Saturation (SaO_2)	84%	97%	Substantially higher lowest oxygen level, reflecting reduced hypoxic episodes.
Average Desaturation	8.4%	0%	Complete resolution of desaturation events.
Time with SaO_2 < 90%	6.9%	0%	Elimination of clinically relevant periods of hypoxemia.

Bringing together a maxillary wedge osteotomy and mandibular advancement produced a striking, clinically relevant enhancement in each of the respiratory and oximetric parameters that were tracked, a finding that validates the utility of this operative pathway for tackling obstructive sleep apnea syndrome (OSAS), particularly within patient subsets for whom maxillary advancement holds no indication.

Impact on respiratory and oximetric parameters

Snoring was completely abolished following the procedure, indicating significant alleviation of pharyngeal airway narrowing. A drop of more than 90% in the apnea-hypopnea index (AHI) reclassified readings from severe OSAS to a breathing pattern squarely within the normative range (< 5 events/hour). A steep reduction in the apnea index (AI) occurred, a change indicative of practically complete eradication of obstructive apneic episodes. In parallel, the hypopnea index (HI) approached zero, suggesting normalized airflow throughout the sleep period. The typical duration of obstructive events decreased sharply from 21 ± 6 s to 6 s, thereby diminishing both cardiovascular strain and the risk of sustained oxygen desaturation. When viewed as a whole, these outcomes bolster the case for deploying maxillary wedge osteotomy, in concert with mandibular advancement, as an effective surgical solution among appropriately selected OSAS patients—especially those for whom comprehensive maxillary forward movement is unnecessary yet anterior relocation of the mandible stands as a prerequisite for reestablishing upper airway conductance.

Advantages of wedge osteotomy

Conceived as a technical variant branching from the Le Fort I osteotomy, the maxillary wedge osteotomy makes possible a deliberate and measured forward swing of the mandible without imparting anteroposterior displacement to the upper maxilla, an effect that translates into improved retropharyngeal airway openness. This approach is commonly used alongside surgical mandibular advancement to enhance airway unblocking and is deployed in clinical scenarios without anteroposterior maxillary insufficiency. For individuals burdened with obstructive sleep apnea (OSA) yet exhibiting no clear anteroposterior maxillary deficit, wedge osteotomy of the maxilla, frequently bundled with other operative maneuvers, stands as a credible therapeutic alternative. While originally reserved for cases of maxillary hypoplasia, advances in surgery, combined with an increasingly sophisticated understanding of OSA's pathophysiology, have expanded the indications to include patients without discernible skeletal aberrations. In these cases, the aim shifts from esthetic or occlusal realignment to the functional objective of restoring airway patency. The quintessential candidate for MMA surgery is an individual grappling with moderate to severe OSA, or one whose mild OSA occurs alongside a congenital dentofacial malformation or disharmony [9]. Imposing a counterclockwise rotation upon the occlusal plane can serve as a maneuver to establish correct occlusion, even where sagittal maxillary deficiency is not present or where the advancement vectors of the mandible and maxilla are not in precise alignment [10]. Rotating the maxilla counterclockwise moves the pogonion forward, improving the facial profile and expanding the upper airway's volumetric capacity.

Comparisons with other studies

The investigation conducted by Christino *et al.* [10] established that for every single degree of rotation, the anterior mandibular point advanced by 0.71 mm. In a head-to-head analysis contrasting individuals whose MMA incorporated counterclockwise rotation (n = 19) against those treated without this component (n = 19), the rotated group outperformed on multiple fronts: a more sizeable AHI decrement (80% versus 62%), superior total volume expansion (45% versus 30%), greater augmentation of retropalatal volume (49% versus 43%), a larger boost in minimum axial area within the retropalatal segment (92% versus 76%), and a more dramatic increase in minimum axial area at the retrolingual level (97% versus 31%). The application of counterclockwise rotational orthognathic surgery has proven especially powerful, functioning not merely to enhance airway patency and mitigate OSA but also to refine facial aesthetics—thereby conferring a two-pronged reward spanning both function and form [11]. The tandem execution of a Le Fort I maxillary wedge osteotomy, featuring counterclockwise rotation with mandibular advancement, has been shown to meaningfully increase upper airway volume while lowering the Apnea-Hypopnea Index (AHI) among patients with obstructive sleep apnea [12, 13]. Introducing counterclockwise rotation to the occlusal plane, above all when undertaken as part of a maxillomandibular advancement (MMA), triggers considerable expansions in both total airway volume and minimum axial area, with magnitudes of effect that speak to robust improvements in upper airway patency [14, 15]. Those whose treatment included a counterclockwise rotation of the occlusal plane showed both a notable decrease in AHI and an increase in minimum oxygen saturation during sleep, changes that reflect tighter control of obstructive sleep apnea (OSA).

The data we have gathered are consistent with the accounts provided by other research groups [16].

Impact on airspace

Bringing the mandible forward through counterclockwise rotation concurrently shifts the hyoid bone along an anterosuperior trajectory, further augmenting upper airway expansion [3]. The gains documented across all parameters and airway dimensions under investigation, secured by counterclockwise rotation paired with mandibular advancement, tend to hold steady over time. Both the volumetric increase in the upper airway and the abatement of OSA symptomatology appear to endure well beyond the operative period, a finding echoed in the literature by other investigators [11]. The underlying mechanism involves forward repositioning of the maxilla and mandible, which exerts anterior traction on the soft-tissue envelope and the muscular apparatus that governs airway patency. More specifically, advancing the bony attachments of the anterior belly of the digastric, the mylohyoid, the genioglossus, and the geniohyoid muscles serves to anchor the tongue base along with the floor of the mouth in a more favorable position. To achieve a meaningful clinical payoff, it is generally advised that mandibular advancement reach at least 10 mm, while safeguarding occlusal stability and an acceptable facial aesthetic. The advent of three-dimensional surgical planning and the integration of digital workflows—encompassing CAD/CAM technology and guided surgery—have markedly raised the accuracy and predictability of operative results. Contemporary systematic reviews and clinical investigations substantiate the effectiveness of MMA in managing OSAS, with success rates exceeding 80% among appropriately selected candidates.

Meanwhile, the question of whether to sequence the procedure as maxilla-first or mandible-first remains a point of ongoing discussion; despite possible technical and occlusal nuances, the chosen order does not seem to sway functional endpoints substantially. This systematic approach aids in reconciling the interarch relationship and maximizing airway patency, both of which feed into the overall success of the intervention [17]. Notwithstanding the encouraging nature of these findings, several constraints warrant acknowledgment. To begin with, the cohort under study was comparatively small, a factor that may limit the wider applicability of the conclusions. In addition, the duration of postoperative surveillance was brief, precluding a thorough appraisal of long-term stability and relapse incidence. Moving forward, investigations that enlist larger sample sizes and incorporate extended follow-up timeframes will be essential to corroborate these early-stage observations.

Conclusion

Executing counterclockwise rotational orthognathic surgery while omitting maxillary advancement has demonstrated a capacity to meaningfully augment the posterior pharyngeal airway while simultaneously affording highly favorable cosmetic results. Provided that planning is carried out with due diligence, this method constitutes a sound alternative to traditional orthognathic strategies in the surgical management of obstructive sleep apnea (OSA).

Authors are encouraged to reflect on the findings and situate them within the framework of prior research and the original working hypotheses. The outcomes and their broader ramifications should be examined in as expansive a context as feasible. Potential avenues for subsequent investigation may likewise be underscored.

Acknowledgments: The authors would like to thank Mauro Di Beradino for providing the illustrations included in this work.

Conflict of Interest: None

Financial Support: None

Ethics Statement: The Hospital San Camillo-Forlanini in Rome, Italy, classified the study as exempt from ethical review because it poses only a negligible risk and involves the use of existing data containing only non-identifiable information about human beings. Written consent has been obtained.

References

1. Locke BW, Lee JJ, Sundar KM. OSA and Chronic Respiratory Disease: Mechanisms and Epidemiology. Int J Environ Res Public Health. 2022;19:5473.
2. Gaffey AE, Burg MM, Yaggi HK, Wang K, Brandt CA, Haskell SG, et al. Insomnia, Sleep Apnea, and Incidence of Hypertension and Cardiovascular Disease. medRxiv. 2025.
3. Seet E, Chung F, Wang CY, Tam S, Kumar CM, Ubeynarayana CU, et al. Association of Obstructive Sleep Apnea With Difficult Intubation: Prospective Multicenter Observational

Cohort Study. Anesth Analg. 2021;133(1):196-204.
4. He JM, Yang Y. Association between Neutrophil-Lymphocyte Ratio and All-Cause and Cardiovascular Mortality in Patients with Diabetes or Prediabetes with Comorbid Obstructive Sleep Apnea Symptoms: Evidence from NHANES 2005–2008 and 2015–2018. Front Endocrinol. 2025;16:1512621.
5. Weaver TE, Maislin G, Dinges DF, Bloxham T, George CFP, Greenberg H, et al. Relationship between Hours of CPAP Use and Achieving Normal Levels of Sleepiness and Daily Functioning. Sleep. 2007;30(6):711-9.
6. Knauert MP, Adekolu O, Xu Z, Deng A, Chu JH, Baldassarri SR, et al. Morning Chronotype Is Associated with Improved Adherence to Continuous Positive Airway Pressure among Individuals with Obstructive Sleep Apnea. Ann Am Thorac Soc. 2023;20(8):1182-91.
7. Riley RW, Powell NB, Guilleminault C, Nino-Murcia G. Maxillary, Mandibular, and Hyoid Advancement: An Alternative to Tracheostomy in Obstructive Sleep Apnea Syndrome. Otolaryngol Head Neck Surg. 1986;94(5):584-8.
8. Varghese R, Adams NG, Slocumb NL, Viozzi CF, Ramar K, Olson EJ. Maxillomandibular Advancement in the Management of Obstructive Sleep Apnea. Int J Otolaryngol. 2012;2012:373025.
9. Yu MS, Ibrahim B, Riley RW, Liu SYC. Maxillomandibular Advancement and Upper Airway Stimulation: Extrapharyngeal Surgery for Obstructive Sleep Apnea. Clin Exp Otorhinolaryngol. 2020;13(3):225-33.
10. Christino M, Vinha PP, Faria AC, Garcia DM, de Mello-Filho FV. Impact of Counterclockwise Rotation of the Occlusal Plane on the Mandibular Advancement, Pharynx Morphology, and Polysomnography Results in Maxillomandibular Advancement Surgery for the Treatment of Obstructive Sleep Apnea Patients. Sleep Breath. 2021;25(4):2307-13.
11. Choi JW, Jeong WS, Kang MK, Lee JY, Chung YS. Counterclockwise Rotational Orthognathic Surgery for the Obstructive Sleep Apnea in Class II Dentofacial Deformity: Polysomnography and 3D Computed Tomographic Analysis. Ann Plast Surg. 2021;86(6):640-6.
12. Shah N, Waite PD, Kau CH. A Combined Orthodontic / Orthognathic Approach in the Management of Obstructive Sleep Apnoea: Balancing Treatment Efficacy and Facial Aesthetics. J Orthod. 2020;47(4):354-62.
13. Jeong WS, Kim YC, Chung YS, Lee CY, Choi JW. Change in Posterior Pharyngeal Space After Counterclockwise Rotational Orthognathic Surgery for Class II Dentofacial Deformity Diagnosed With Obstructive Sleep Apnea Based on Cephalometric Analysis. J Craniofac Surg. 2017;28(5):e488-91.
14. Louro RS, Calasans-Maia JA, Mattos CT, Masterson D, Calasans-Maia MD, Maia LC. Three-Dimensional Changes to the Upper Airway after Maxillomandibular Advancement with Counterclockwise Rotation: A Systematic Review and Meta-Analysis. Int J Oral Maxillofac Surg. 2018;47(5):622-9.
15. Zinser MJ, Zachow S, Sailer HF. Bimaxillary “rotation Advancement” Procedures in Patients with Obstructive Sleep Apnea: A 3-Dimensional Airway Analysis of Morphological Changes. Int J Oral Maxillofac Surg. 2013;42(5):569-78.
16. Knudsen TB, Laulund AS, Ingerslev J, Homøe P, Pinholt EM. Improved Apnea-Hypopnea Index and Lowest Oxygen Saturation after Maxillomandibular Advancement with or without Counterclockwise Rotation in Patients with Obstructive Sleep Apnea: A Meta-Analysis. J Oral Maxillofac Surg. 2015;73(4):719-26.
17. Trevisiol L, Bersani M, Lobbia G, Scirpo R, D’Agostino A. Sequencing in Orthognathic Bimaxillary Surgery: Which Jaw Should Be Operated First? A Scoping Review. J Clin Med. 2023;12:6826.