

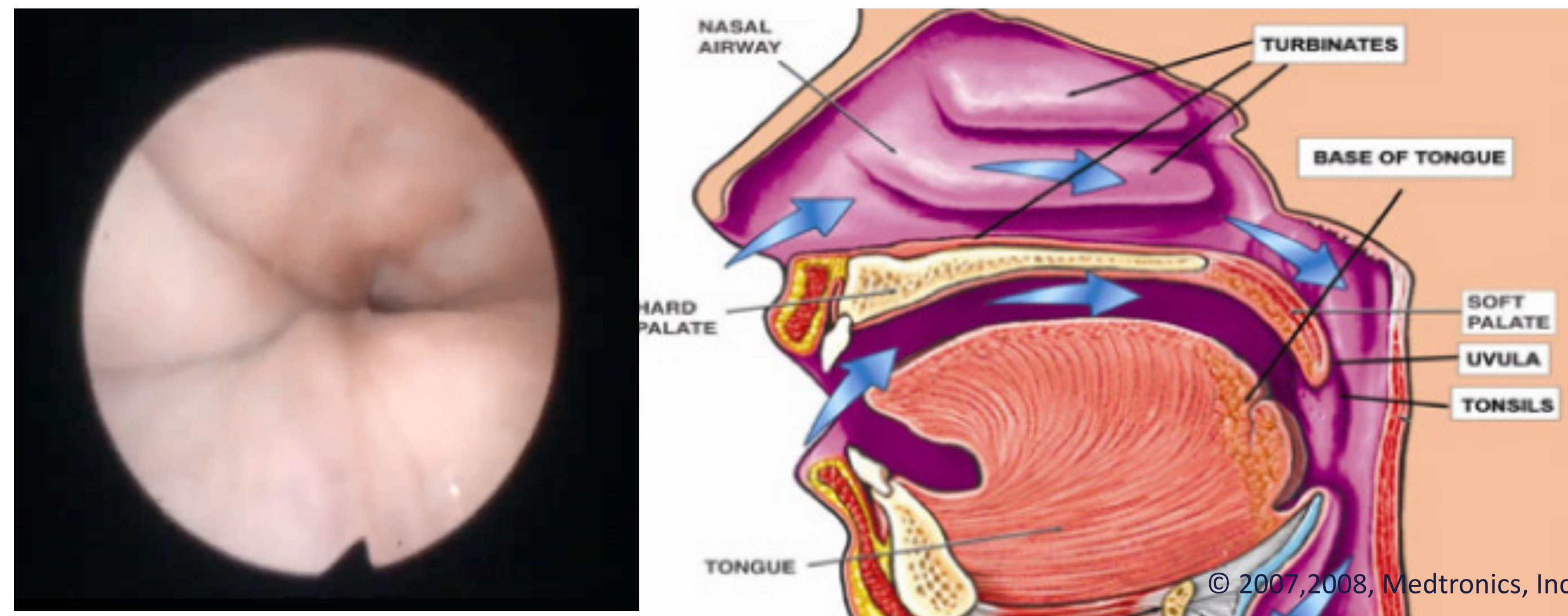
# Treatment of Obstructive Sleep Apnea with Maxillo-mandibular Advancement Surgery: Evaluation and Predictors of Success

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## Introduction

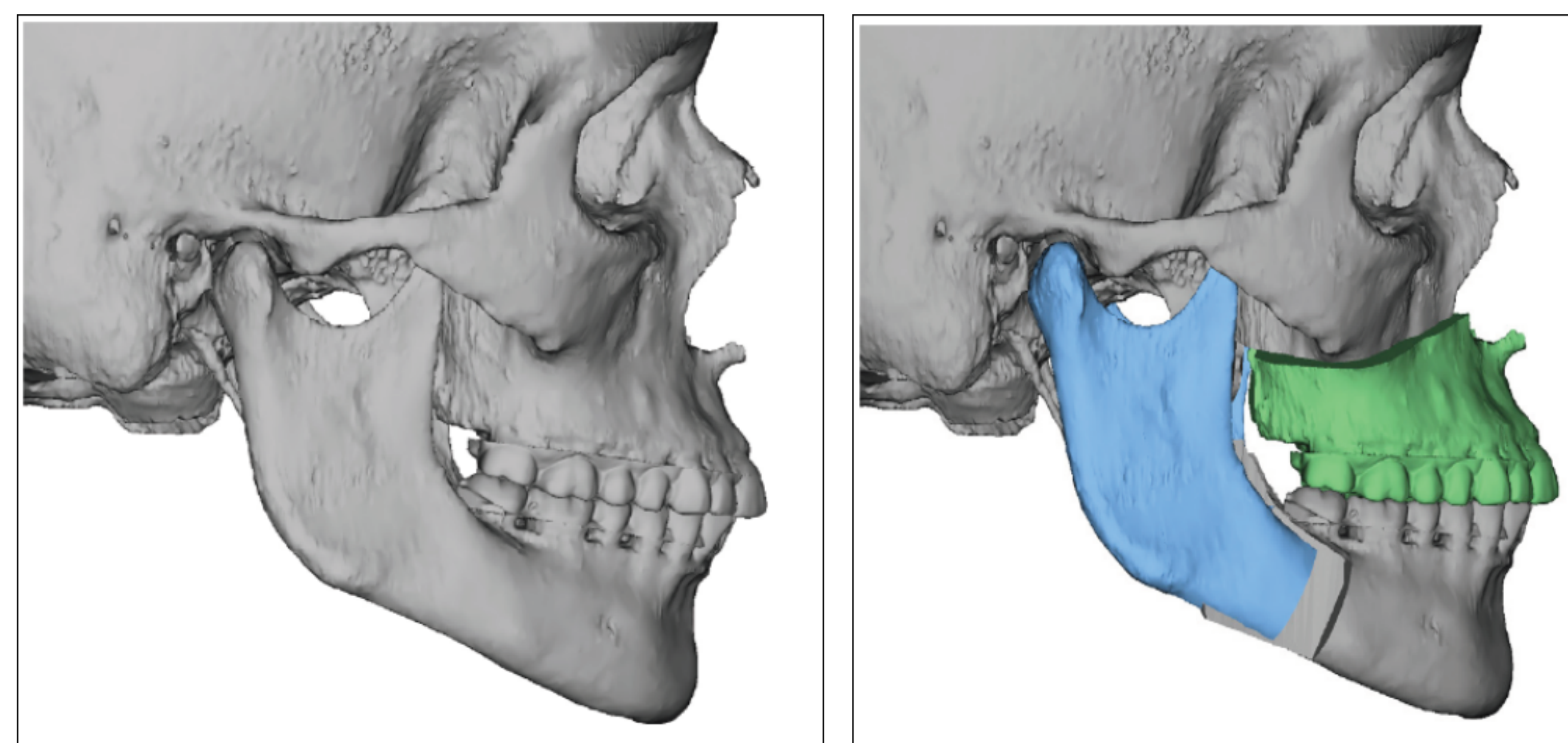
Obstructive sleep apnea (OSA) is a well-recognized disease entity affecting approximately 2% to 4% of the population. Maxillo-mandibular advancement (MMA) surgery is a highly successful surgical alternative to poorly tolerated CPAP therapy and achieves a success rate of 89% in the current literature. Our present study evaluates the effectiveness of MMA surgery in the treatment of patients with moderate to severe OSA based on Shers criteria of 50% reduction in AHI and AHI < 20. Radiographic and clinical treatment variables were evaluated in determining predictors of success for MMA in individuals with OSA.



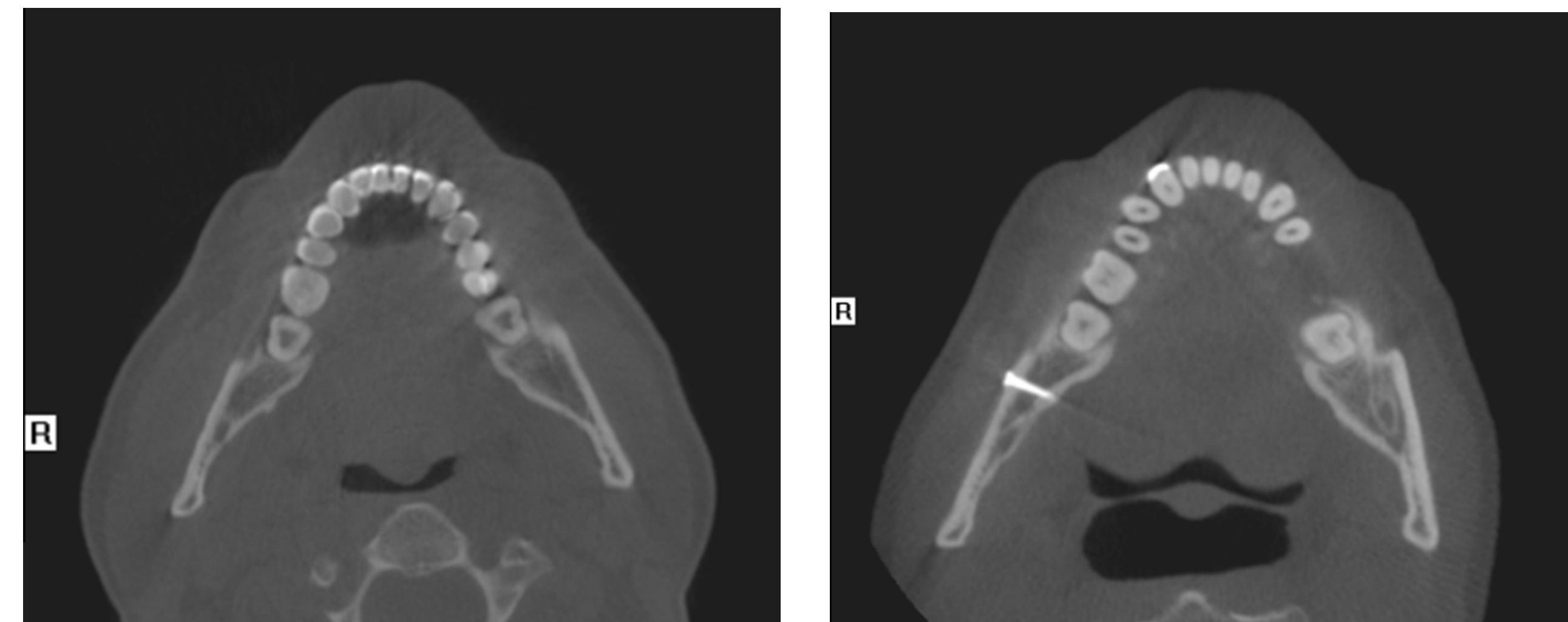
Above image (left) was completed during drug induced sleep endoscopy illustrating lateral wall collapse during inspiration with complete airway obstruction. The image (right) shows anatomical regions of multi-site obstruction seen in OSA.

## Methods

A retrospective study design was used to assess the outcomes of MMA in patients with moderate to severe OSA (apnea hypopnea index [AHI] >15 events per hour) at Thomas Jefferson University Hospital. Data collected included clinical, radiographic, and polysomnographic findings. Primary outcomes of interest included the AHI, minimal oxygen saturation, and BMI.



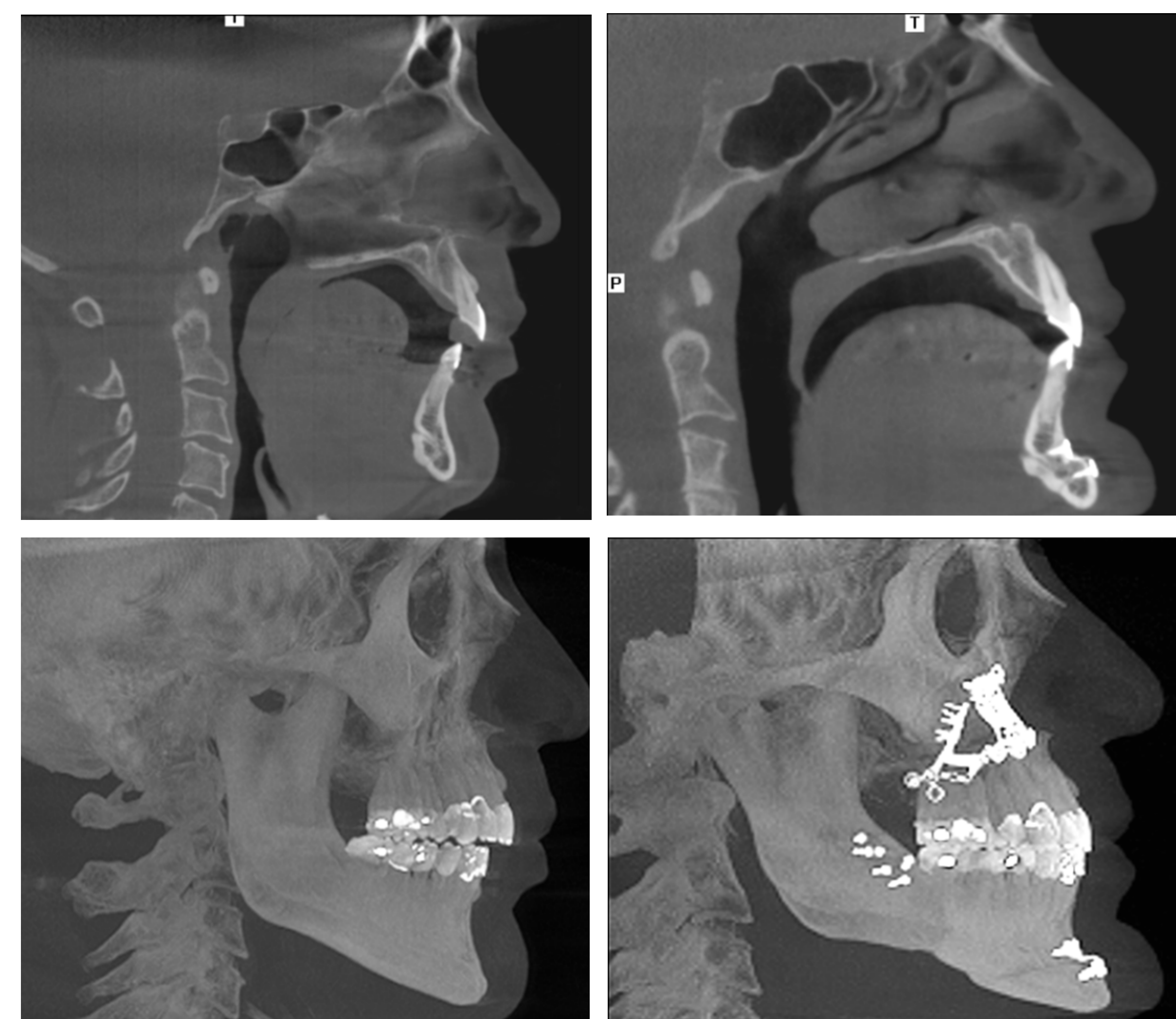
Above image (left) shows preoperative 3D model of the patients. The image (right) shows the planned surgical moves. The Lefort 1 osteotomy with advancement (Green) articulating with the bilateral sagittal split osteotomy with advancement (Blue). Bony advancement of the genial tubercles are completed without 3D planning.



Above image (left) shows preoperative cross sectional area of the posterior airway space at the level of the base of tongue. The image (right) shows the post operative axial slice of the same patient.

## Results

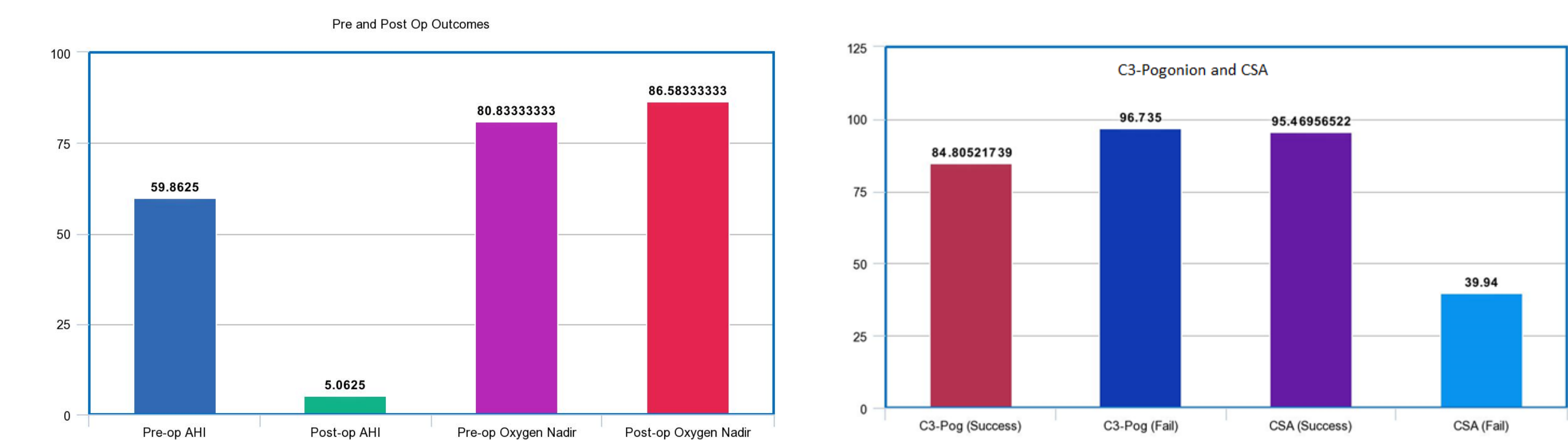
Twenty six patients met the inclusion criteria (mean age 50.33±9.7 yr). Mean advancement was 10.44 mm measured at Pogonion-Gonion with an achieved 3.6-fold increase in minimal cross-sectional area post-surgically. Patients showed a 91% decrease in mean AHI from 59.86 to 5.06 events per hour (P < .001). Minimum oxygen saturation increased from a mean of 80.58 to 86.23 post-surgically. The overall surgical success was 89% (24 of 26) based on an AHI of fewer than 20 events per hour. BMI, minimum oxygen saturation, and measured changes in posterior airway space were not statistically different between success and failure groups. Cephalometric points Pogonion-C3 (mean 85.75±6.7 mm) and Cross Sectional Airway (CSA) (mean 91.02±28.3 mm<sup>2</sup>) were statistically different between patients who achieved successful outcomes and those that did not.



Above image (left) shows the preoperative the posterior airway space with narrowing within the retro-lingual and retro-palatal regions. Image (right) shows post operative advancement with improvement in airway space. The images below illustrate the bony changes between -pre (left) and post (right) surgical intervention.

## Discussion

Evaluation of cephalometric points Pogonion-C3 were found to be statistically significant with an average of 84.8mm in the successful group and 96.7mm in the failure group. Longer Pogonion-C3 distances may be associated with larger neck circumference, increased redundant pharyngeal tissues, and macroglossia, however; further studies are needed. Cross Sectional Airway means were statistically different between the successful and failure groups with a CSA of 95.4mm<sup>2</sup> and 39.9mm<sup>2</sup>, respectively. Patients with a preoperative CSA >76.5mm<sup>2</sup> were found to have a higher chance of success per post op AHI. Larger pharyngeal volumes at baseline were more likely to have successful outcomes. Maxillofacial advancement is limited by muscular pull, soft tissue stretch and desired esthetic change; patient's with larger baseline pharyngeal volumes with likely have larger post-operative airway volumes resulting in successful treatment.



Above Table (left) shows change in AHI and oxygen nadir pre- and post- operatively. Table (right) shows pre-op C3-Pog and CSA between successful and failed groups base on Sher's Criteria.

## Conclusion

Maxillomandibular advancement surgery is a highly predictive and successful treatment option in patients with moderate to severe OSA achieving a success of 89% in our overall sample. Pogonion-C3 and CSA successfully predicted postoperative success. The lack of association between BMI, PAS and minimum oxygen saturation supports that OSA is a disease entity with a multifactorial etiology.

## References

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