Upper Airway Collapsibility and Surgically Assisted Rapid Palatal Expansion Outcomes: A Preliminary Analysis

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Abstract

- **Objective**: Explore the relationship between upper airway collapsibility obtained during drug induced sleep endoscopy (DISE) and clinical outcomes after surgically assisted rapid palatal expansion (SARPE) for obstructive sleep apnea (OSA).
- **Methods:** This retrospective analysis consisted of a cohort of patients who underwent drug induced sleep endoscopy with positive airway pressure (DISE-PAP) and SARPE from April 2018 to February 2023. DISE-PAP was performed pre-operatively to determine the pressure level at which inspiratory flow limitation was completely abolished (pharyngeal opening pressure). Baseline anthropometric/demographic data at initial presentation as well as pre- and post-operative sleep study and nasal obstruction symptom evaluation (NOSE) data were obtained.
- **Results**: There were 19 patients in this cohort. Patients were generally middle-aged (43.8 ± 12.3 years), White (84%), male (84%), overweight (28.5 ± 2.7 kg/m^2), had moderate OSA (25.9 ± 22.3 events/hour), and mean NOSE score 46.8 ± 24.9. The mean pre-operative PhOP was 7.9 ± 4.8 cm H_2O. AHI did not significantly change after SARPE, whereas NOSE scores significantly reduced (p=0.86, p<0.01, respectively). Lower PhOP values significantly correlated with greater reduction in AHI after SARPE (r=-0.54, p=0.015), but not with nasal obstruction improvement (r=0.08, p=0.76).
- **Conclusion:** In our cohort, SARPE did not significantly reduce AHI, although it did significantly reduce NOSE scores. Lower pre-operative PhOP was associated with better AHI reduction after SARPE. A larger study is needed to understand the role of SARPE in OSA treatment.

Background

- Airway collapsibility is a key component of obstructive sleep apnea pathophysiology
- Addition of positive airway pressure during drug induced sleep endoscopy (DISE-PAP) enables measurement of airway collapsibility
- Airway collapsibility during DISE-PAP predicts surgical outcomes for OSA (e.g. HGNS)
- Recently, degree of transverse maxillary deficiency (TMD) has been associated with increased tongue collapse on DISE and with higher airway collapsibility during DISE-PAP
- SARPE reduces AHI, but response rates remain variable

Can pre-operative airway collapsibility obtained during DISE help predict surgical outcome after SARPE?

Methods

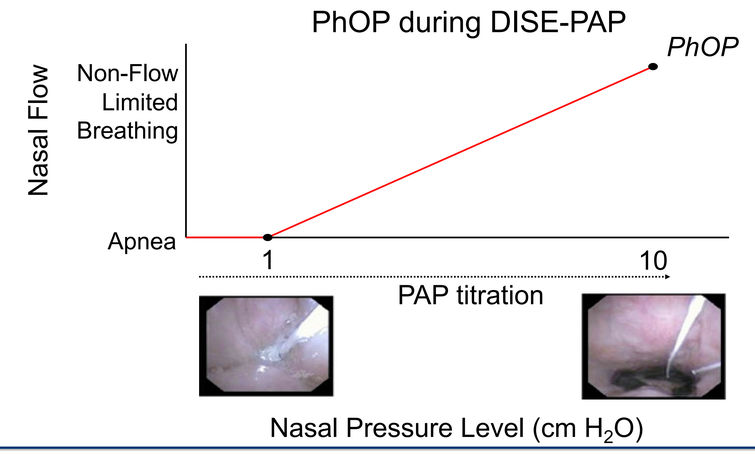
This retrospective study included a cohort of patients who underwent drug induced sleep endoscopy with PAP titration and surgically assisted rapid palatal expansion (SARPE) between January 2020 and December 2022.

Drug Induced Sleep Endoscopy with Positive Airway Pressure (DISE-PAP)

- Propofol-induced sleep
- Fiberoptic nasopharyngoscopy
- Concurrent pneumotachometer for objective nasal flow assessment
- Stepwise PAP titration until complete abolishment of flow limited breathing

Statistical Analysis

- Two-sided t-tests
- Regression Analysis



Results

Table 1: Patient Characteristics (n=19)

	Mean	SD
Male, (%)	84%	-
Age, years	43.8	12.3
BMI, kg/m^2	28.5	2.7
AHI, events/hr	25.9	22.3
NOSE	46.8	24.9

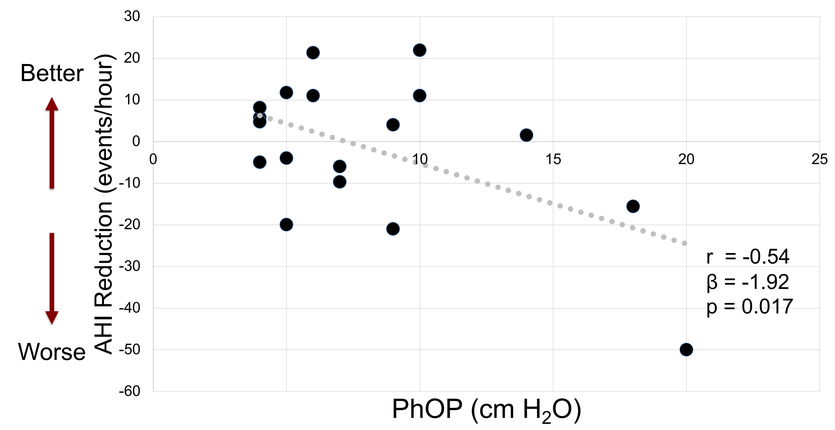
Collapse	0	1	2
Velum	6%	22%	72%
Oropharynx	44%	33%	23%
Tongue	0%	67%	33%
Epiglottis	50%	28%	22%

Table 2: Pre- and Post-operative Sleep Study Data

	Pre-SARPE	Post-SARPE	p
BMI	28.5 ± 2.7	27.8 ± 2.6	0.41
NOSE	**46.8 ± 25.6**	**16.1 ± 15.4**	**<0.01**
AHI, events/hr	25.9 ± 22.3	27.3 ± 25.7	0.86
Supine AHI, events/hr	35.4 ± 25.5	33.0 ± 27.2	0.77
Non-supine AHI, events/hr	17.2 ± 20.7	13.5 ± 19.1	0.6
O_2 Nadir, %	78.8 ± 12.2	79 ± 8.7	0.96
TST <90%, minutes	11.7 ± 21.9	9.6 ± 11.8	0.73

NOSE scores significantly reduced after SARPE

Figure 1: Pre-operative PhOP and AHI Reduction after SARPE



Mean pre-operative PhOP was 7.9 ± 4.8 cm H_2O. For every 1 cm H_2O decrease in PhOP, post-operative AHI improved by 1.9 events/hour after SARPE

Discussion

In our cohort of OSA patients who underwent SARPE for OSA, we found significant reductions in nasal obstruction scores after surgery, but not significant improvements in sleep study metrics. We also found that improvement in AHI was correlated with lower pre-operative PhOP, suggesting the value of pre-operative PhOP in patient selection for SARPE. However, this cohort is small and further studies with a larger sample size are needed to better characterize this relationship.

Future Directions:

- Larger sample size
- Sleep studies after expander removal
- Compare pre- and post-operative PhOP values to understand change in collapsibility after SARPE

Strengths:

- DISE-PAP is a controlled protocol with objective collapsibility measurement
- Patients had full-night efficacy studies post-operatively

Limitations:

- Single pre- and post-operative sleep study time points are prone to variability
- Small cohort of patients limits power
- AHI is not a perfect measure of treatment success
- Sleep study data confounded by presence of expander during study