The Effect of Upper Airway Surgery on Sleep Quality and Obstructive Sleep Apnea

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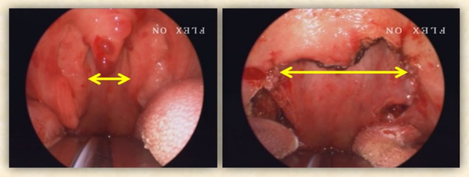
INTRODUCTION

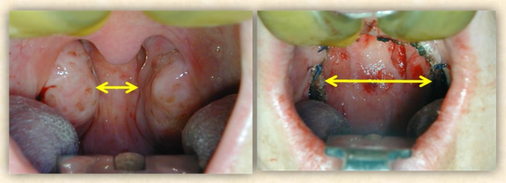
Obstructive sleep apnea (OSA) is a common sleep disorder due primarily to upper airway obstruction[1,2]. Continuous Positive Airway Pressure (CPAP) treatment is the primary treatment of choice for most patients with high success rate[3]. However, patients who do not tolerate or comply with the CPAP, may explore alternative treatment options including surgery and mandibular advancement device. Upper airway surgical modalities have been shown to have variable and limited success in treating OSA[4,5]. However, certain ethnic group, particularly Chinese, are known to be more susceptible to severe degree of OSA irrespective of body weight. This is due in part to the fact that Chinese patients have small and narrow upper airway anatomy and prone to obstruction[1]. For instance, a significant proportion of Chinese patients have redundant posterior tonsillar tissues with very narrow palatal arch causing obstruction of the nasopharynx airway. Consequently, Chinese patients (particularly who are non-obese) who have severe OSA due to isolated or predominantly nasopharyngeal airway narrowing may benefit from palatal surgery. In this study, the role of palatal surgery (UVPP) alone or in combination with other upper airway surgeries were analyzed to determine if this modality can be a reasonable treatment of choice for this ethnic group when CPAP treatment is not tolerated.

METHODS

A retrospective study to analyze the effect of either: (1) septoplasty (SP) and inferior turbinectomy (TR) only; or (2) in combination with Uvulopalatoplasty (UVPP) and tonsillectomy, on Chinese patients diagnosed with moderate to severe OSA was done. Inclusion criteria include failure to comply/tolerate CPAP treatment and failed conservative treatment for anterior nasal obstruction; clear and identifiable upper airway anatomical obstruction including septal deviation alone; significant and severe turbinate hypertrophy alone or a combination of both; narrow soft palatal arch, redundant posterior tonsillar pillar tissues (with or without adhesion to the uvula) and elongated uvula (Fig. 1) with narrowing of the nasopharynx airway confirmed by endoscopy, with or without tonsillar hypertrophy. Outcome measures were obtained from pre- and post-operative polysomnographs (PSG) where sleep parameters, AHI, and oxygen saturation were analyzed.



Subject: Between the years 2008 to 2015, there were total 41 subjects; with 18 subjects underwent SP and TR surgery and 23 subjects underwent multi-level upper airway surgery (UVPP/ Tonsillectomy / SP/TR). UVPP involves partial Uvulectomy and lateralization of the palatal arch and increasing the width of the nasopharynx airway (Fig. 2); TR entails surgical resection of the inferior turbinates.



Polysomnography: All data were taken retrospectively between 2008-2015. Standard overnight polysomnography included recording of EEG, submental and bilateral leg electromyograms. Airflow was measured by a nasal airflow pressure and snore transducer (BiNAPS) and respiratory effort by thoracoabdominal piezoelectric belts. Measurement of arterial oxyhemoglobin saturation was performed with a pulse oximeter (Oximax) with probed placed on patient's index finger. All signals were collected on a computerized polysomnography system (Sandman, Natus, Ottawa, Ontario, Canada). Body position was confirmed by direct observation of the patient by the sleep technician using an infrared camera. Sleep stages were scored in 30-s epochs using the AASM sleep scoring criteria. AHI was defined as the number of apneas and hypopneas per hour of sleep. Severity of sleep apnea was classified according to recommendations by the American Academy of Sleep Medicine[6].

Statistical Analysis: For all statistical analyses performed in this study, each subject contributed two data points for each sleep variable (pre- and post-surgery). The comparison of all measures was performed using repeated measures t-tests with one tail meathod. All data analyses were performed using the statistical package, IBM SPSS for Windows version 19. The values are all expressed as means +/- standard deviation. A p-value of <.05 was taken as statistical significant.

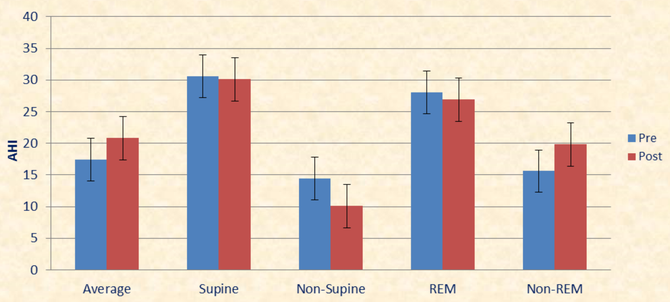
RESULTS

Patients with only SP and TR (n=18) failed to produce significant changes in sleep efficiency, sleep arousal (either spontaneous or respiratory related), or average AHI measures. Conversely, patients with UVPP and tonsillectomy in combination with TR and SP (n=23) had significant improvement in all categories of AHI (supine, non-supine, REM and non-REM), with 48-70% reduction in severity of OSA observed. While spontaneous arousals remain relatively unchanged, the degree of respiratory arousals was also reduced in this group. Subjective reports on sleep quality and breathing function improved in both groups of patients post-surgery. All patients tolerated UVPP well with no complications.

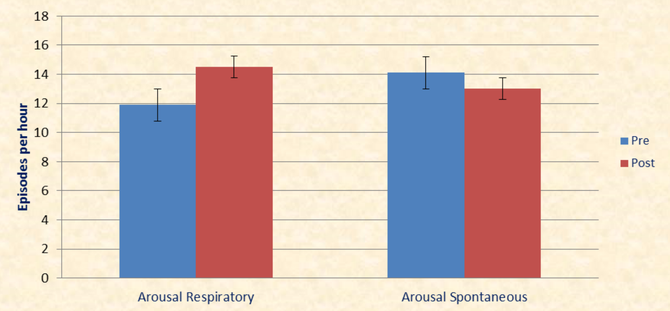
Surgery Type: Septoplasty & Turbinate Reduction Only

	Pre	Post	P-Value
AHI (average)	17.4	20.8	0.202
AHI (supine)	30.6	30.1	0.360
AHI (non-supine)	14.4	10.1	0.058
AHI (REM)	28.0	26.9	0.161
AHI (non-REM)	15.6	19.8	0.089
Arousal Respiratory	11.9	14.5	0.119
Arousal Spontaneous	14.1	13.0	0.457

Septoplasty / Turbinate Reduction



Septoplasty/Turbinate Reduction



Highlight:

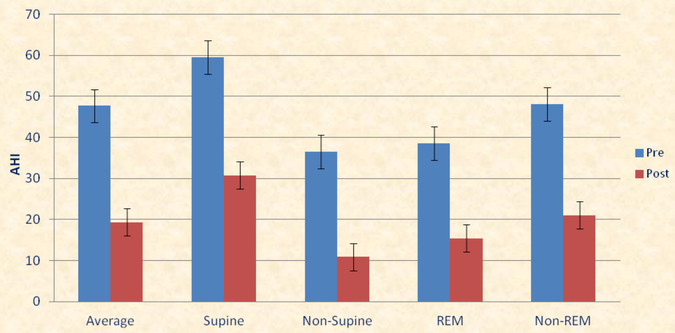
- Septoplasty and turbinate reduction did not alleviate OSA (moderate or severe).
- Patients who had septal surgery report better sleep quality and breathing function subjectively post surgery but no objective improvement is observed.

Surgery Type: Multi-Level Upper Airway Surgery

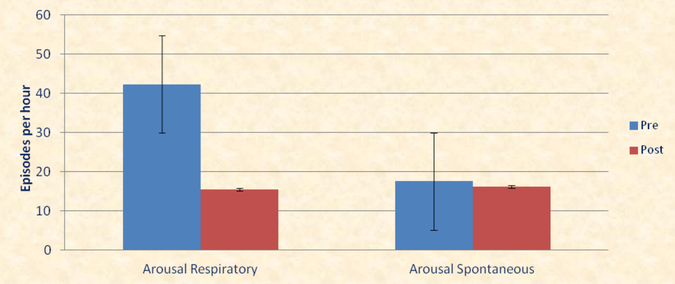
Combination of UVPP / TONSILLECTOMY / SEPTOPLASTY / TURBINATE REDUCTION

	Pre	Post	P-Value
AHI (average)	47.7	19.4	0.000
AHI (supine)	59.5	30.8	0.000
AHI (non-supine)	36.6	10.9	0.000
AHI (REM)	38.6	15.4	0.000
AHI (non-REM)	48.1	21.1	0.000
Arousal Respiratory	42.3	15.5	0.000
Arousal Spontaneous	17.6	16.2	0.28

UVPP/Tonsillectomy/Septoplasty/Turbinate Reduction



UVPP/Tonsillectomy/Septoplasty/Turbinate Reduction



Highlight:

- Chinese patients with isolated palatal narrowing and NP airway obstruction responded well to palatal surgery with over 48-70% reduction of OSA parameters
- Palatal surgery also improve sleep quality and reduce respiratory arousals.

CONCLUSION

Obstructive sleep apnea is commonly due to upper airway obstruction and obesity. However, Asians, particularly Chinese, are generally non-obese and upper airway anatomy, particularly obstruction of the nasopharyngeal airway, plays a major role in the pathogenesis of OSA in this ethnic group. Continuous Positive Airway Pressure (CPAP) is the primary treatment of choice for OSA. However alternative surgical options can be explored for those who are not able to use CPAP. Results from this study suggests that Chinese patients with isolated and identifiable palatal narrowing and small nasopharyngeal upper airway obstruction can benefit from palatal surgery UVPP (in combination with tonsillectomy and anterior nasal airway surgery). A greater role of palatal surgery as a primary treatment modality for those with definable nasopharynx narrowing who failed or unable to tolerate CPAP treatment is suggested. This study also confirms with other published reports that SP and TR alone have no significant benefit to treatment of OSA although both procedures do improve subjective nasal symptoms including better air entry and reduction of nasal obstruction sensation[4,5,] with subjective improvement of sleep quality. Patients who underwent both procedures have also been shown in other studies to have better compliance using CPAP, presumably due to easier air entry through the nose using nasal mask.

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