

Microdebrider-Assisted Extended Uvulopalatoplasty

An Effective and Safe Technique for Selected Patients With Obstructive Sleep Apnea Syndrome

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Objective: To assess subjective and objective outcomes in selected patients with obstructive sleep apnea syndrome who underwent microdebrider-assisted extended uvulopalatoplasty (MEUP).

Design: Prospective study.

Setting: Tertiary referral center.

Patients: Fifty patients with obstructive sleep apnea syndrome who had substantial retropalatal obstruction and more than 10 events per hour on the respiratory disturbance index (RDI) and who underwent MEUP with 6 months of follow-up. Patients with a Friedman palate position of grade 4 and a tonsil size of grade 3 or 4 were excluded.

Intervention: MEUP was performed in each patient under general anesthesia. The procedure consisted of removal of the redundant mucosa, tissue above the muscular layer of the soft palate, and upper poles of the tonsils using a powered microdebrider.

Main Outcome Measures: Postoperative pain was evaluated using a visual analog scale. Before surgery and at 6 months after surgery, subjective outcomes were assessed using the Epworth Sleepiness Scale and the snoring scale, and objective outcomes were assessed using

overnight polysomnography variables (RDI, snoring index, and minimal oxygen saturation). Surgical success was defined as achieving a postoperative RDI score of fewer than 20 events per hour and a greater than 50% reduction in the preoperative RDI score.

Results: The mean (SD) visual analog scale scores were 3.9 (1.8) on the first postoperative day and 1.3 (0.9) on the seventh postoperative day. Compared with preoperative scores, postoperative scores statistically significantly improved on the Epworth Sleepiness Scale and on the snoring scale ($P < .01$ for both). The median RDI score decreased from 37.9 events per hour before surgery to 6.1 events per hour at 6 months after surgery, a statistically significant difference ($P < .001$). The median minimal oxygen saturation and snoring index scores also improved statistically significantly ($P < .001$ for both). The surgical success rate was 80% (40 of 50 patients). No postoperative bleeding or long-term velopharyngeal insufficiency was observed in any patient.

Conclusions: MEUP is an effective and safe surgical procedure to improve sleep apnea and snoring in selected patients with obstructive sleep apnea syndrome. The use of the microdebrider in extended uvulopalatoplasty is addressed herein for the first time (to our knowledge).

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UVULOPALATOPHARYNGOPLASTY (UPPP), first described by Fujita et al,¹ has become the mainstay of surgical treatment in patients with snoring or obstructive sleep apnea syndrome (OSAS). Although it remains an excellent modality for treating specific anatomical obstructions at the palatal level, the associated postoperative morbidity is distressing.² Uvulopalatopharyngoplasty consists of removal of the uvula, a portion of the soft palate, the palatine tonsils, and the

lateral pharyngeal wall. The major complications of UPPP include pain, bleeding, dysphagia, and pharyngeal symptoms.²⁻⁴ Significant morbidity in the early postoperative period and permanent sequelae are often associated with the total tonsillectomy and pharyngoplasty components of the surgery. To lower the risk of postoperative complications, UPPP may be modified for selected patients with OSAS.

The microdebrider, which has been widely used in sinonasal surgery for the past decade, was designed to provide real-

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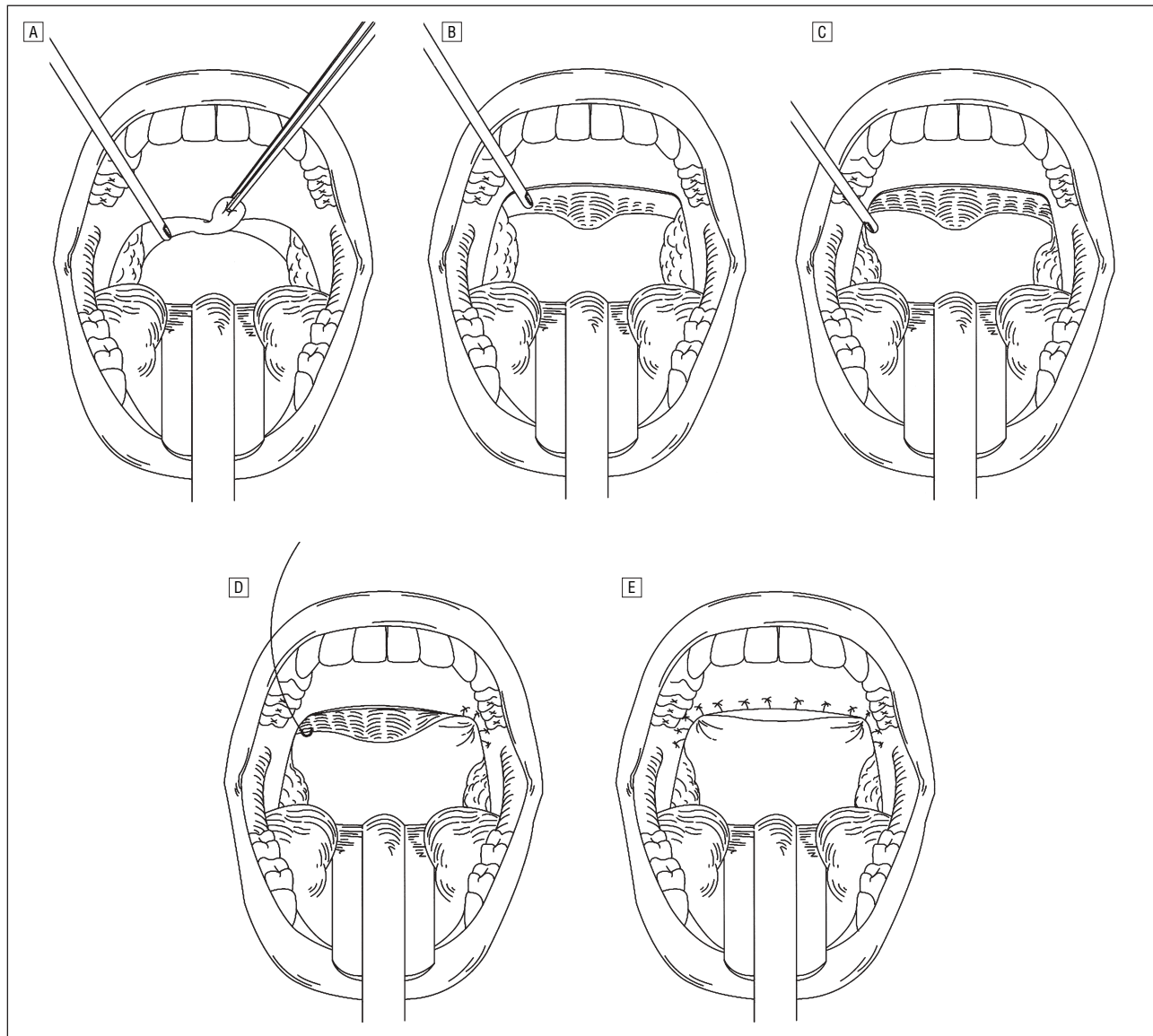


Figure. Procedure for a patient who has sleep apnea and a drooping soft palate and tonsil size of grade 2 (A-E). After traction of the uvular tip with forceps, a microdebrider was used to debride the mucosal web between the uvula and pillars in an oblique direction.

time suction and precise tissue resection without thermal injury.⁵ It is believed to cause less postoperative pain than electrocautery for tissue removal. However, the feasibility of using the microdebrider in OSAS surgery remains unexplored (to our knowledge). Microdebrider-assisted extended uvulopalatoplasty (MEUP) was developed in this study to correct retropalatal obstruction and to decrease postoperative morbidity in patients with OSAS. The study aimed to evaluate the efficacy and safety of MEUP using subjective and objective outcomes in selected patients with OSAS.

METHODS

INCLUSION CRITERIA

Fifty patients (44 men and 6 women; age range, 19-63 years [mean age, 43.4 years]) with OSAS underwent MEUP between September 1, 2004, and October 31, 2005. Each patient

had a complete workup, including a thorough medical history taking, physical examination, overnight polysomnography, and fiberoptic nasopharyngolaryngoscopy with Müller maneuver. Patients who had more than 10 events per hour on the respiratory disturbance index (RDI) and substantial retropalatal obstruction were enrolled in the study. Palate position and tonsil size were graded according to the Friedman classification.⁶ We excluded patients with a Friedman palate position of grade 4 and a tonsil size of grade 3 or 4.

SUBJECTIVE EVALUATION

The intensity of postoperative pain was assessed using a visual analog scale (VAS) (score range, 0-10). Each patient used a 10-cm horizontal line to mark and rate his or her pain, ranging from a score of 0 on the far left (representing no pain) to a score of 10 on the extreme right (representing the worst pain possible). The VAS provides an accurate description of a patient's perceived level of pain and is a highly reproducible measure of pain intensity.⁷ We investigated subjective outcomes

Table. Preoperative and Postoperative Polysomnographic Results Among 50 Patients

Variable	Minimum	Maximum	Median ^a	Interquartile Range
Preoperative				
Respiratory disturbance index score, No. of events per hour	10.9	94.9	37.9	37.8
Minimal oxygen saturation, %	52.0	86.0	76.0	12.0
Snoring index score, No. of snores per hour	24.2	900.1	292.3	308.2
Postoperative				
Respiratory disturbance index score, No. of events per hour	0.4	47.3	6.1	10.4
Minimal oxygen saturation, %	70.0	91.0	84.0	8.5
Snoring index score, No. of snores per hour	0.2	533.1	89.4	154.0

^a $P < .001$, Wilcoxon signed rank test.

using the Epworth Sleepiness Scale (ESS) and the snoring scale before surgery and at 6 months after surgery. The ESS is an 8-item self-administered questionnaire that is designed to quantify a patient's sleep propensity. Subjects rated each of the questions on a scale of 0 (no chance of dozing) to 3 (high chance of dozing), and the results were summed to produce a final score that ranged from 0 to 24.⁸ A snoring scale that ranged from 0 to 10 was used to estimate the degree of snoring. The bed partners of all subjects were asked to help establish this scale. A score of 0 represented no snoring at all. A score of 10 was indicative of when the bed partner moved out of the bedroom or avoided sleeping near the patient.⁹

OBJECTIVE EVALUATION

Overnight polysomnography was performed in each patient before surgery and at 6 months after surgery. Sleep study variables included the RDI, snoring index, and minimal oxygen saturation. The RDI score was the total number of apnea and hypopnea episodes per hour of sleep. Apnea was defined as cessation of airflow for at least 10 seconds. Hypopnea was defined as a 50% or greater reduction in the baseline ventilatory value for more than 10 seconds associated with a more than 4% decrement in oxygen saturation. The snoring index score was the total number of snores per hour of sleep time. MEUP success was defined as achieving a postoperative RDI score of fewer than 20 events per hour and a greater than 50% reduction in the preoperative RDI score.

SURGICAL TECHNIQUE

All operations were performed with the patients under general anesthesia using endotracheal intubation and artificial ventilation. The areas to be surgically removed were injected with lidocaine hydrochloride (10 mg/mL) in epinephrine acid tartrate (concentration, 1:100 000). A straight-powered microdebrider (2.9-mm blade; Xomed, Jacksonville, Florida) at a speed of up to 3000 rpm was applied to remove the drooping mucosal web between the uvula and pillars in an oblique direction (**Figure**). The tissue above the muscular layer of the uvula, as well as the uvular tip, was shaved. The soft palate mucosa and submucosa with gland, adipose, and fibrous tissues were then debrided down to, but not through, the muscular layer. The upper shaved boundary was 10 to 20 mm above the level of the trailing edge of the soft palate. Debridement proceeded to remove mucosa and submucosa of the supratonsillar area and continued to the upper poles of the tonsils. Hemostasis was achieved using bipolar electrocoagulation when necessary. The posterior pillar was then advanced in a laterocephalad direction toward the palatonsillar junction and was sutured to the residual mucosa of the anterior pillar using 3-0 polyglactin. The

nasal surface of the soft palate was imbricated, approximated, and sutured to the edge on the oral surface. Pain was controlled by administration of oral acetaminophen with codeine. Postoperative complications included bleeding, velopharyngeal insufficiency, nasopharyngeal stenosis, and pharyngeal symptoms.

STATISTICAL ANALYSIS

We used SPSS software (SPSS Inc, Chicago, Illinois) for statistical analysis. Median and interquartile ranges are given for descriptive statistics of polysomnography results. Body mass index (calculated as weight in kilograms divided by height in meters squared) and scores on the VAS, ESS, and Snoring Scale are given as mean (SD). Comparative analysis of the results was performed using Wilcoxon signed rank test. $P < .05$ indicated a statistically significant difference.

RESULTS

The mean (SD) body mass indexes (calculated as weight in kilograms divided by height in meters squared) were 27.8 (3.3) before surgery and 27.6 (3.3) at 6 months after surgery, a statistically nonsignificant difference ($P > .05$). The mean (SD) VAS scores were 3.9 (1.8) on the first postoperative day and 1.3 (0.9) on the seventh postoperative day. The mean (SD) preoperative scores on the ESS and the snoring scale were 9.78 (3.68) and 7.53 (2.04), respectively, compared with 5.18 (2.18) and 2.39 (1.33) at 6 months after surgery ($P < .01$ for both).

Before surgery, the minimum, maximum, and median RDI scores were 10.9, 94.9, and 37.9 events per hour, respectively, and the corresponding values at 6 months after surgery were 0.4, 47.3, and 6.1 events per hour, which were statistically significant differences ($P < .001$ for both medians). Also statistically significantly improved were the minimum, maximum, and median minimal oxygen saturation scores, which before surgery were 52%, 86%, and 76%, respectively, in contrast to those after surgery, which were 70%, 91%, and 84%, respectively ($P < .001$ for both medians). Similarly, the minimum, maximum, and median snoring index scores before surgery were 24.2, 900.1, and 292.3, respectively, whereas those after surgery were 0.2, 533.1, and 89.4 ($P < .001$ for both medians) (**Table**). The surgical success rate was 80% (40 of 50 patients).

Ten patients (20%) reported nasal regurgitation of liquids on swallowing during the first week after surgery,

but the symptom resolved within 1 month. Six patients (12%) had abnormal pharyngeal sensation lasting more than 6 months. We did not observe any postoperative bleeding or long-term velopharyngeal insufficiency in any patient.

COMMENT

Because tonsillectomy is a mandatory component of UPPP to treat patients with OSAS having substantial hypertrophy of the palatine tonsils,¹⁰ we enrolled only patients with OSAS to undergo MEUP who had tonsil size of grade 1 or 2. We also excluded patients with a Friedman palate position of grade 4, which indicated that the anatomical obstruction for OSAS was in the retroglottal space. We assumed that MEUP was the appropriate surgical technique for patients having OSAS with simple retropalatal obstruction and without sizable palatine tonsils.

Most of the postoperative pain following UPPP may be attributed to extracapsular tonsillectomy or thermal injury from electrocautery for tissue excision. It is believed that trauma to the surrounding pharyngeal musculature during tonsillectomy is responsible for much of the pain experienced during recovery.¹¹ We used microdebrider instruments that cut tissue using a small, rapidly rotating blade, while simultaneously suctioning the cut tissue away from the surgical field. This provided precise and complete tissue reduction without thermal damage or injury to the neighboring musculature. In contrast to UPPP, which exposes underlying musculature and nerve endings of tonsillar fossae, MEUP removes only the upper poles of the tonsils and leaves the underlying neurovascular bundle intact. Therefore, compared with UPPP, it was anticipated that patients might have less pain after MEUP. The mean VAS scores for postoperative pain in this study were lower than those reported in the literature for UPPP on the first and seventh postoperative days.^{12,13}

Retropalatal space is the most common site of obstruction in patients with OSAS. The major axis of apneic retropalatal space is oriented in the anteroposterior dimension; in contrast, the major axis of normal retropalatal space is oriented in the horizontal dimension.¹⁴ In other words, the main retropalatal space reduction in patients having sleep apnea occurs in the lateral dimension. Previous studies^{15,16} documented the importance of the lateral pharyngeal structures in mediating upper airway caliber. The MEUP technique excised the supratonsillar tissue and the upper poles of the tonsils, which allowed for advancement of the pharyngeal mucosa superiorly and laterally to enlarge the retropalatal space in lateral length. In addition, the nasal surface of the soft palate was imbricated to meet the cut edge on the oral surface to expand the retropalatal space in the anteroposterior dimension. Our procedure is associated with a high success rate and with notable improvement in subjective and objective outcomes.

Postoperative bleeding has been reported in 2% to 6% of patients after UPPP,^{4,17,18} whereas no patient in our series had this complication. This may be because UPPP

exposes a vascular-rich tonsillar bed, in contrast to the absence of underlying vascular exposure in MEUP. Velopharyngeal insufficiency subsequent to UPPP occurred in 56% of patients at 6 weeks and in 24% of patients at 1 year.¹⁹ In this study, 10 patients (20%) had velopharyngeal insufficiency the first week, but the symptom lasted less than 1 month after surgery. The decreased incidence of velopharyngeal insufficiency could be due to the preservation and imbrication of the muscle of the soft palate in our surgical procedure. Long-term pharyngeal symptoms, including a lump in the throat, an inability to clear phlegm, or a swallowing disturbance, were reported in 57.6% of patients undergoing UPPP,¹⁹ compared with 6 patients (12%) in the present study. The lower occurrence rate might be attributable to the limited tonsillectomy and pharyngoplasty performed in MEUP.

CONCLUSIONS

Results of this prospective study show favorable ESS, snoring scale, and polysomnography outcomes in selected patients with OSAS undergoing MEUP. Compared with UPPP, the benefits of our procedure are fewer complications and less pain. We believe that MEUP is an effective and safe technique for selected patients with OSAS.

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Author Contributions: Drs Huang and Cheng had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Cheng. *Acquisition of data:* Huang. *Analysis and interpretation of data:* Huang. *Drafting of the manuscript:* Huang. *Critical revision of the manuscript for important intellectual content:* Cheng. *Statistical analysis:* Huang. *Administrative, technical, and material support:* Cheng. *Study supervision:* Cheng.

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