The Many Flavors of Palate Surgery – Which One is Best?

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Disclosures

• No industry disclosures
Outline

• General UPPP outcomes
• Modern UPPP concepts
  – Reconstructive
  – Anatomic
  – Functional
• UPPP Flavors
• Best Flavor!
UPPP & Physiology
The Efficacy of Surgical Modifications of the Upper Airway in Adults With Obstructive Sleep Apnea Syndrome

*An American Sleep Disorders Association Review*

Aaron E. Sher¹, Kenneth B. Schechtman² and Jay F. Piccirillo³

**Summary:** This paper, which has been reviewed and approved by the Board of Directors of the American Sleep Disorders Association, provides the background for the Standards of Practice Committee’s parameters for the practice of sleep medicine in North America. The intent of this paper is to provide an overview of the surgical treatment of obstructive sleep apnea syndrome, to provide the basis for the American Sleep Disorders Association’s practice parameters on this subject and to share our findings of metaanalysis of previously published studies regarding uvulopalatopharyngoplasty. We searched MEDLINE from January 1986 through April 1993, with an update in February 1995, to provide a review of the application of surgical modifications of the upper airway to treat adults with obstructive sleep apnea syndrome. Operations to treat obstructive sleep apnea syndrome include nasal septal reconstruction; uvulopalatopharyngoplasty; uvulopalatopharyngoglossoplasty; laser midline glossectomy; lingual-plasty; inferior segittal mandibular osteotomy and genioglossal advancement, with hyoid myectomy and suspension (the entire process is referred to as GAHM); maxillomandibular osteotomy and advancement, and tracheotomy. Papers included in metaanalysis provided preoperative and postoperative polysomnographic data on at least nine patients treated with uvulopalatopharyngoplasty for their obstructive sleep apnea. Analysis of the uvulopalatopharyngoplasty papers revealed that this procedure is, at best, effective in treating less than 50% of patients with obstructive sleep apnea syndrome. The site of pharyngeal narrowing or collapse, although identified by different and unvalidated methods, has a marked effect on the probability of success of uvulopalatopharyngoplasty. Patients who achieve a favorable response with uvulopalatopharyngoplasty tend to have less severe obstructive sleep apnea than those who do not. For patients who demonstrate retrolingual narrowing or collapse, other surgical modifications have been described, such as lingualplasty, GAHM, and maxillomandibular osteotomy and advancement. The studies to support the use of the surgical treatment of obstructive sleep apnea syndrome contain biases related to small sample size, limited follow-up and patient selection.

Sher, Sleep 1996;19:156-177
UPPP: Physiology

Palate Obstruction

Adapted from Table 7

Level 4

Sher, Sleep 1996;19:156-177
UPPP
&
Quantity of Life (Survival)
Mortality of Veterans with Sleep Apnea: Untreated versus Treated

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Introduction: Untreated obstructive sleep apnea (OSA) appears to increase mortality. The effect of treatment on mortality rate is unclear because most previous reports analyzed small samples and did not adequately control for comorbidity. We sought to determine whether providing a continuous positive airway pressure (CPAP) device or performing uvulopalatopharyngoplasty (UPPP) is associated with a decreased mortality rate relative to providing no treatment for OSA, in a large cohort with control for comorbidity.

Methods: This retrospective inception cohort study included all patients diagnosed with OSA in any Veteran Affairs (VA) inpatient facility 1991-2001 or outpatient facility 1997-2001. Subjects were identified by ICD9 diagnostic codes in the VA inpatient and outpatient treatment files. Treatment status (None, CPAP, UPPP, or tracheotomy) was determined by ICD9 or CPT procedure codes in these databases. Patients without a code for CPAP, UPPP, or tracheotomy were considered untreated. Patients undergoing tracheotomy were not included in this analysis, because indications for tracheotomy could not be determined. CPAP patients were provided a CPAP device, but usage data were not available. Sleep apnea severity data were not available. The Charlson Comorbidity Index was calculated from ICD-9 diagnostic codes from the year prior to inception into the cohort. Mortality data were extracted from VA Death Files. Survival time was calculated from the date of first diagnosis of OSA to date of death or 9/30/2002. Treatment groups were compared on mortality hazard with Cox regression, adjusting for age, sex, race, comorbidity, and inception year.

Results: The cohort consisted of 149,267 veterans, age 57+/-12 (mean+/-SD) years, 97% male. By September 2002, 16,967 of 116,678 untreated patients (14.5%), 3256 of 28,612 CPAP patients (11.4%), and 394 of 3977 UPPP patients (9.9%) were dead (untreated v treated, p<0.001). From the date of OSA diagnosis, untreated patients survived 3.6+/-2.3 years, CPAP patients survived 4.6+/-2.5 years, and UPPP patients survived 5.3+/-2.5 years (untreated v treated, p<0.001). After adjusting for the variables listed, untreated patients had 1.9 (95%CI 1.8-2.0, p<0.001) times greater hazard of dying at any time relative to treated patients. UPPP patients had a lesser mortality rate (p=0.006), longer survival (p<0.001), and lesser hazard of death (adjusted hazard ratio 0.57, 95%CI 0.39-0.81, p=0.002) relative to CPAP patients.

Conclusion: Treatment with CPAP or UPPP conferred a survival advantage over no treatment, after adjustment for age, sex, race, comorbidity, and year of OSA diagnosis. One cannot draw conclusions about the relative efficacy of CPAP and UPPP because CPAP usage data were not available.
UPPP: Quantity of Life

- UPPP = 3,977
- No Tx = 116,678
UPPP
&
Quality of Life
Studying Life Effects & Effectiveness of Palatopharyngoplasty (SLEEP) Study: Subjective Outcomes of Isolated Uvulopalatopharyngoplasty

Edward M. Weaver, MD, MPH\textsuperscript{1}, B. Tucker Woodson, MD\textsuperscript{2}, Bevan Yueh, MD, MPH\textsuperscript{2}, Timothy Smith, MD, MPH\textsuperscript{3}, Michael G. Stewart, MD, MPH\textsuperscript{4}, Maureen Hannley, PhD\textsuperscript{5}, Kristine Schulz, MPH\textsuperscript{6}, Milesh M. Patel, MS\textsuperscript{6}, David Witsell, MD, MHS\textsuperscript{7}, and the SLEEP Study Investigators

Objective. To test the hypothesis that uvulopalatopharyngoplasty (UPPP) improves sleep apnea--related quality of life (measured on the Functional Outcomes of Sleep Questionnaire [FOSQ]) at 3-month follow-up. Secondary objectives were to test (1) the stability of the outcomes at 6 months, (2) the effect on global sleep apnea quality-of-life change, and (3) the effect on sleep apnea symptoms.

Study Design. Multicenter, prospective, longitudinal case series.

Setting. Diverse university- and community-based otolaryngology practices.

Subjects and Methods. The cohort included 68 patients from 17 practices, with a mean ± standard deviation age of 44 ± 12 years and mean apnea-hypopnea index of 35 ± 32 events/hour. All patients underwent UPPP, defined as an open procedure modifying the shape and size of the palate, pharynx, and uvula, with or without tonsillectomy. Baseline data were collected on site before surgery, and outcome data were collected by mail 3 and 6 months after surgery, with follow-up rates of 51% and 50%, respectively.

Results. FOSQ scores improved from 14.3 ± 3.4 (scale 5-20, normal ≥17.9) at baseline to 17.2 ± 2.7 at 3 months (mean improvement 2.9; 95% confidence interval, 1.8-4.0; \( P < .001 \)) and 17.5 ± 2.5 at 6 months (mean improvement 3.1; 95% confidence interval, 2.0-4.2; \( P < .001 \)). All quality-of-life and symptom measures improved significantly at 3 and 6 months (all \( P < .05 \)).

Conclusion. This prospective, multicenter, university- and community-based study provides evidence that UPPP significantly improves disease-specific quality of life and sleep apnea symptoms in patients with sleep apnea. Validity may be limited.
UPPP: Quality of Life

![Bar chart showing FOSQ scores at different times after UPPP.](image)

- **FOSQ Score**
- **Time from UPPP**: 0 mos, 3 mos, 6 mos
- **Scores**: 14.3, 17.2, 17.5

* *p<0.001

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**Level 4**

Weaver, OtoHNS 2011;144:623-31
# UPPP: Symptoms

## Table 2. Outcomes Between Baseline, 3 Months, and 6 Months

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline, Mean ± SD</th>
<th>3 Months, Mean ± SD</th>
<th>6 Months, Mean ± SD</th>
<th>PValue&lt;sup&gt;a&lt;/sup&gt; (0-3 mo)</th>
<th>PValue&lt;sup&gt;a&lt;/sup&gt; (0-6 mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional Outcomes of Sleep Questionnaire (5-20)</td>
<td>14.3 ± 3.4</td>
<td>17.2 ± 2.7</td>
<td>17.5 ± 2.5</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>Secondary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epworth Sleepiness Scale (0-24)</td>
<td>12.9 ± 5.5</td>
<td>7.0 ± 4.7</td>
<td>6.9 ± 4.2</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
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<tr>
<td>Sleep apnea symptoms (0-5)</td>
<td>3.7 ± 1.1</td>
<td>1.1 ± 1.5</td>
<td>1.5 ± 1.7</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
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<tr>
<td>Awakening with headache, d/wk</td>
<td>1.7 ± 2.3</td>
<td>1.0 ± 2.1</td>
<td>1.0 ± 1.9</td>
<td>.048</td>
<td>.008</td>
</tr>
<tr>
<td>Sleep apnea problem VAS (0-100)</td>
<td>68 ± 30</td>
<td>24 ± 28</td>
<td>24 ± 27</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Snoring VAS (0-100)</td>
<td>53 ± 32</td>
<td>8 ± 12</td>
<td>18 ± 22</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Global sleep apnea QOL change, −7 to +7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>—</td>
<td>3.5 ± 2.6</td>
<td>2.5 ± 2.7</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Level 4 | Weaver, OtoHNS 2011;144:623-31
UPPP & Side Effect (CPAP Leak)
Influence of UPPP surgery on tolerance to subsequent continuous positive airway pressure in patients with OSAHS

Abstract  To investigate the effect of uvulopalatopharyngoplasty (UPPP) on post-surgery continuous positive airway pressure (CPAP) treatment during sleep in patients with obstructive sleep apnea–hypopnea syndrome (OSAHS). Thirty-one OSAHS patients after UPPP surgery were recruited and studied on for more than 12 months after the procedure. Among them, 24 patients were treated with classical UPPP (cUPPP), which removes all of uvula and part of the soft palate. Seven had modified UPPP (mUPPP), keeping part of the uvula. The control group was 31 years in age, body mass index (BMI) and apnea–hypopnea index (AHI) matched, and newly diagnosed OSAHS patients without prior treatment. A manual titration of CPAP was performed during both (NREM) and non-rapid eye movement (NREM) sleep in all 62 patients. Patients were asked to keep a supine position while sleeping during the test. When significant mouth air leakage occurred and/or titration worsened with an increase of CPAP pressure, the pressure level was considered as the highest CPAP (hCPAP) a patient can tolerate in that sleep stage. The CPAP machine used for titration could produce highest pressure at 20 cm H₂O. There were 74% (23/31) of UPPP patients who had less than 50% decrease in AHI, and 84% (26/31) of the 31 patients still had AHI>15 (range 16–110) during post-operation polysomnography (PSG) test. Most of them need further CPAP therapy. All of the untreated OSAHS patients could tolerate 17–20 cm H₂O of CPAP during sleep. None had severe mouth air leak before an optimal pressure was reached. In contrast, four in the surgery group failed to respond to CPAP treatment during both NREM and REM sleep and one more during REM sleep. All of the seven patients who had a mUPPP could tolerate CPAP. One of the three tested both before and after surgery failed in the CPAP treatment after surgery during REM sleep. UPPP may compromise nasal CPAP therapy in OSAHS, especially in procedures with greater resection of the soft palate.

Keywords  Obstructive sleep apnea–hypopnea syndrome · Continuous positive airway pressure · Uvulopalatopharyngoplasty
Influence of UPPP surgery on tolerance to subsequent continuous positive airway pressure in patients with OSAHS

• Classical UPPP = Excisional

• Modified UPPP = Uvula-sparing
<table>
<thead>
<tr>
<th></th>
<th>Classical UPPP (N=24)</th>
<th>Modified UPPP (N=7)</th>
<th>p</th>
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<tr>
<td>Severe Oral Leak</td>
<td>5/24</td>
<td>0/7</td>
<td>NS</td>
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Han, Sleep Breath 2006;10:37-42

Level 4
UPPP Modifications

• Reduce side effects
  – Preserve function

• Improve outcomes
  – Address specific anatomical or functional problem

• Multiple modifications
  – Reconstructive rather than excisional
UPPP Concepts

• Open & stabilize all dimensions of velopharynx & oropharynx
• Address anatomy
• Preserve function
Normal Oral Exam
Sample of UPPP Flavors

- Lateral Pharyngoplasty
- Expansion Sphincter Pharyngoplasty
- Palatal Advancement Pharyngoplasty
- Modified Australian UPPP
- Relocation Pharyngoplasty
- Suspension Palatoplasty
- Uvulopalatal Flap
- Z-Palatoplasty
- Barbed Suture Palatopharyngoplasty
Sample of UPPP Flavors

- Lateral Pharyngoplasty
- Expansion Sphincter Pharyngoplasty
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- Relocation Pharyngoplasty
- Suspension Palatoplasty
- Uvulopalatal Flap
- Z-Palatoplasty
- Barbed Suture Palatopharyngoplasty
Lateral Pharyngoplasty

Cahali, Sleep 2004;27:942-50
Adapted from Tables 3 & 4

<table>
<thead>
<tr>
<th>Category</th>
<th>UPPP (N=12)</th>
<th>Lateral PP (N=15)</th>
</tr>
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<tbody>
<tr>
<td>AHI</td>
<td>14%</td>
<td>62%</td>
</tr>
<tr>
<td>LSAT</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Delta</td>
<td>25%</td>
<td>60%</td>
</tr>
<tr>
<td>REM%</td>
<td>15%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Cahali, Sleep 2004;27:942-50
Thick Lateral Musculature
UPPP vs. ESP

![Graph comparing AHI levels between UPPPP and ESP procedures.](chart)

- **Baseline**:
  - UPPPP (N=22): 38
  - ESP (N=23): 44

- **Final**:
  - UPPPP (N=22): 20
  - ESP (N=23): 12

**References**

Pang, OtoHNS 2007;137:110-4
Lateral narrowing
Why Expansion Sphincter Pharyngoplasty?

- Stabilized lateral collapse
- Opens AP dimension
- Can be combined with other tech
Velopharynx

- Middle turbinate
- Inferior turbinate
- Palate
- Tonsil
- Epiglottis
- Tongue
- Genioglossus muscle
- Mandible
Velopharynx Narrow AP

- Middle turbinate
- Inferior turbinate
- Palate
- Tonsil
- Epiglottis
- Genioglossus muscle
- Mandible
- Tongue
Palatal Advancement

Woodson, OtoHNS 2005;133:211-17
UPPP vs. Palatal Adv

Adapted from Table 3

Level 2 | Woodson, OtoHNS 2005;133:211-17
Retropalatal Airspace
Why Palatal Advancement?

• Anterior reposition
• Can be combined with other flavors
• Salvage palate procedure
• Well tolerated
  – Less invasive than maxillary advancement
Best UPPP Flavor?
Best UPPP Flavor

• It depends!!
  – Anatomy
  – Pattern of obstruction
  – Goals
  – Surgeon
  – . . .
What UPPP Do I Use?
Why?

• Opens and stabilizes airway
  – Anterior-posterior (VP)
  – Lateral (VP, OP, HP)
  – Superior-inferior (uvula, lateral palate)

• Minimizes morbidity
  – Uvula / VPI
  – Palatal scar
UPPP Summary

• UPPP helps OSA

• Modern UPPP
  – Reconstructive
  – Anatomic
  – Functional

• Many UPPP flavors
The Many Flavors of Palate Surgery – Which One is Best?

REFERENCES


Han F, Song W, Li J, Zhang L, Dong X, He Q. Influence of UPPP surgery on tolerance to subsequent continuous positive airway pressure in patients with OSAHS. Sleep & Breathing 2006;10:37-42.


Woodson BT, Robinson S, Lim HJ. Transpalatal advancement pharyngoplasty outcomes compared with uvulopalatopharyngoplasty. Otolaryngol Head Neck Surg 2005;133:211-.