Modified Uvulopalatopharyngoplasty: The Extended Uvulopalatal Flap

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Objective: To investigate the surgical outcomes of a modified uvulopalatopharyngoplasty-extended uvulopalatal flap in the treatment of obstructive sleep apnea.
Material and Methods: Thirty-three consecutive patients with obstructive sleep apnea underwent extended uvulopalatal flap that consisted of bilateral tonsillectomy, dissection and removal of submucosal adipose tissue of the soft palate and supratonsillar area; imbrication; and reposition of the denuded uvulopalatal flap. Variables of polysomnography included the respiratory disturbance index, snoring index, and minimal oxygen saturation. Surgical success was defined as achieving the postoperative respiratory disturbance index to less than 20 events per hour and a greater than 50% reduction of the preoperative respiratory disturbance index.
Results: Six months after operation, 27 patients (81.8%) responded successfully. The mean respiratory disturbance index decreased from 41.6 ± 28.2 to 12.5 ± 18.1($P < .0001$), and the mean minimal oxygen saturation and snoring index improved significantly ($P < .0001$). The postoperative sequelae were mild with 3% of occasional nasal regurgitation.
Conclusions: The results in this series revealed that extended uvulopalatal flap improves obstructive sleep apnea with minimal adverse effect in selected patients, and this technique suggests a role of fat dissecting in the palatal surgery for obstructive sleep apnea.

It is well established that the retropalatal region is the most common site of obstruction in patients with obstructive sleep apnea (OSA).[1] Consequently, uvulopalatopharyngoplasty (UPPP) that consists of removal of the palatine tonsil, uvula, a portion of the soft palate, and the lateral pharyngeal wall is the most common surgical procedure for the treatment of OSA.[2] Although subjective improvement of symptoms including excessive daytime sleepiness and snoring have been acceptable,[3] the response rate on objective assessment based on polysomnographic (PSG) results has been no greater than 50%.[4] To improve the response rate, many modifications have been attempted; however, the results have been mixed.[5-9]

We report on an extended uvulopalatal flap (EUPF) technique designed to remove the adipose tissue of soft palate and tonsils to expand the velopharyngeal inlet in the anteroposterior dimension as well as the lateral dimension while preserving the palatal muscle to minimize the risk of postoperative velopharyngeal insufficiency. Objective PSG and subjective questions about surgical sequelae were used to evaluate the outcomes of this technique.

MATERIAL AND METHODS

Subjects

Thirty-three consecutive patients (32 men) with OSA (respiratory disturbance index [RDI] >5) were included in this prospective study. A fiberoptic endoscopy with Muller's maneuver was done to evaluate the level of obstruction in the upper airway. Only patients with type I obstruction were enrolled in this study.[10] Patients with macroglossia or retrognathia were excluded from the study. The mean age was 44.5 ± 9.2 years old (range 21-61

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Presented at the 6th Taiwan-Japan Otolaryngology Head and Neck Surgery Conference, Taipei, Taiwan, December 5-7, 2001.

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0196-0709/03/2405-0000$30.00/0
doi:10.1016/S0196-0709(03)00047-4

years), and the mean body mass index (BMI) was 26.7 ± 3.9 kg/m^2 (range, 19.6-38). The average weight was 77.7 ± 20.6 kg, which was overweight for middle age Taiwanese people.

EUPF Technique

The operation was performed under general anesthesia. Tonsillectomies were first completed before a triangular incision (1 cm) from the upper pole of tonsillar fossa toward the maxillary third molar was created by removing the mucosa and submucosal adipose tissue (Fig 1). The mucosal web between the uvula and posterior pillar was divided (0.5-1 cm) in an oblique direction along the uvula. Then the uvula and soft palate were retracted toward the hard–soft-palate junction. The border of the uvulopalatal flap was marked, and the final position of the uvula was made at 5 to 10 mm inferior to the border of the hard–soft-palate junction in the midline position. Left-angle scissors were used to dissect the plane between submucosal adipose tissue and muscle layer from the incision line toward the uvular tip (Fig 2). The uvular mucosa was divided along the uvular edge, and the uvular tip was excised to create the EUPF. The EUPF was imbricated and sutured to the residual mucosa of the soft palate with 2-0 Vicryl (Ethicon, Inc, NJ). The new tonsillar fossa was closed to decrease the dead space (Fig 3). The approximation of posterior and anterior pillars was achieved by using mattress sutures with maximal lateralization (Fig 4). Sagittal drawings to show the resection area and imblication are shown in Figures 5 and 6.

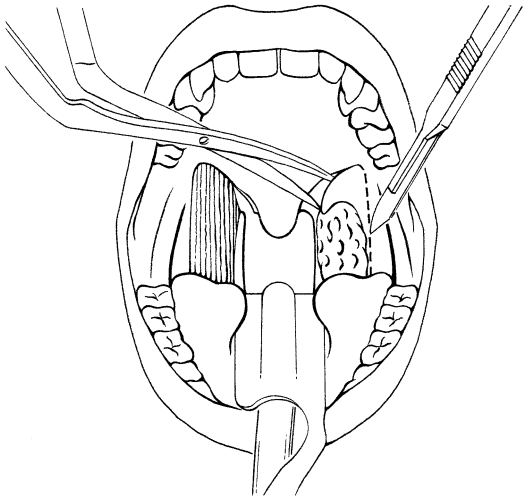

Fig 1. Left tonsillectomy was foremost performed; a triangular incision (1 cm) from the upper pole of tonsillar fossa toward third molar was incised with removal of mucosa and submucosal adipose tissue. Right tonsillar fossa was accomplished with enlargement in upper and lateral dimension.

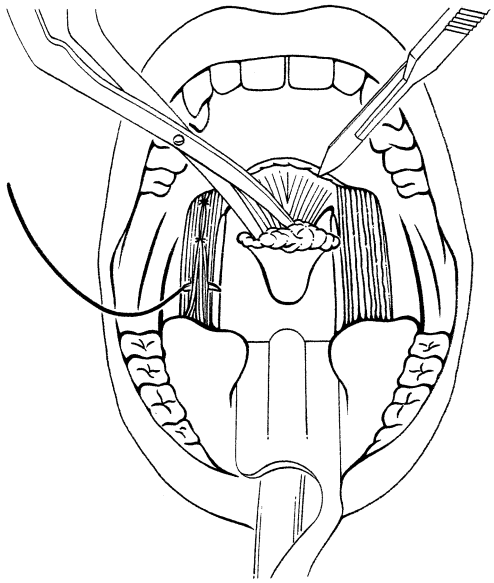

Fig 2. The mucosal web between uvula and posterior pillar was divided (0.5-1 cm) in an oblique direction along the uvula. An incision was made 5 to 10 mm below the posterior end of hard palate to upper margin of the tonsillar fossa in both sides. Left-angle scissors were used to dissect the plane between submucosal adipose tissue and muscle layer from the incision line toward uvular tip (stripping technique). The uvular tip was excised within the specimen.

Sleep Monitoring

Three variables of PSG were adopted to evaluate the surgical result: RDI, snoring index, and minimal oxygen saturation (MSAT). Postoperative PSG was performed 6 months after the operation.

Outcomes Assessment

Surgical success was defined as achieving the postoperative RDI to less than 20 events per hour and a greater than 50% reduction of the preoperative RDI. Postoperative sequelae including nasal regurgitation, swallowing disturbance, and hypernasality were subjectively questioned.

RESULTS

Thirty-three patients underwent EUPF and 5 patients underwent simultaneous nasal septal surgery. No airway compromise was found in the postoperative period. One patient was hospitalized because of minor bleeding in the inferior tonsillar fossa after severe coughing and was controlled by conservative treatment (bed rest and ice packing for 1 day). Dehiscence in the tip of the uvulopalatal flap was

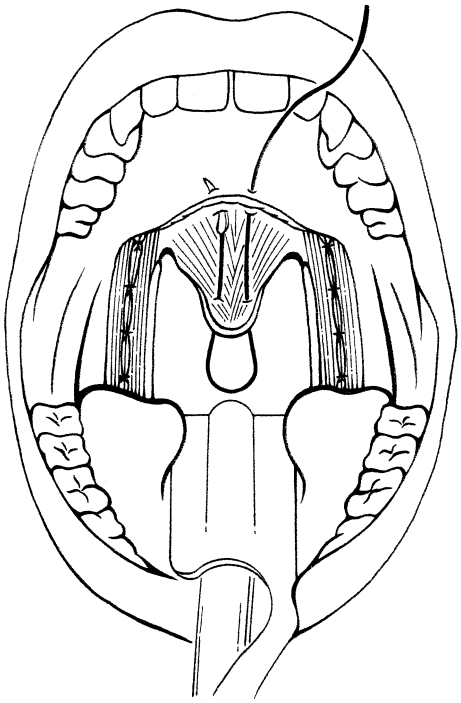

Fig 3. The denuded flap was imbricated and sutured to the proximal part of soft palate with 2-0 Vicryl. Bilateral tonsillar fossae were closed to decrease the dead space.

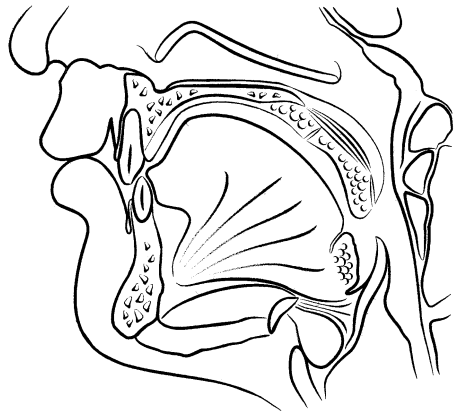

Fig 5. Midsagittal view showed the tissue to be resected between 2 arrowheads and in front of muscle.

noted in 2 patients on the 10th postoperative day; these wounds healed in 3 weeks without sequelae. No stenosis of palatal wound was noted. Although all of the patients lost weight postoperatively, most of the patients regained their weight before the postoperative PSG (26.7 ± 3.9 *v* 26.1 ± 5.0, P = not significant). Twenty-seven patients responded successfully (81.8%), and 14 patients (42.4%) achieved a postoperative RDI <5. The mean RDI decreased from 41.6 ± 28.2 to 12.5 ± 18.1($P < .0001$) (Fig 7). The mean snoring index fell from 241.6 ± 131.9 to 94 ± 131.9 ($P < .0001$). The mean MSAT increased from $80.4\% \pm 6.9\%$ to $87.8\% \pm 6.6\%$ ($P < .0001$) (Fig 8). All of the patients' sleep partner noted

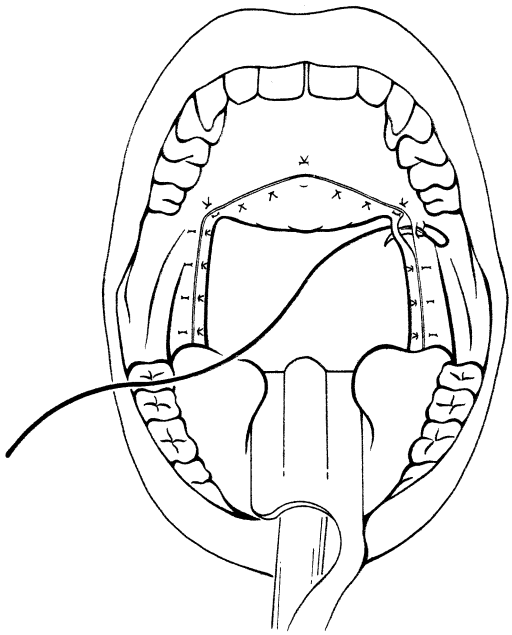

Fig 4. The approximation of posterior and anterior pillars was done in mattress suture with maximal lateralization.

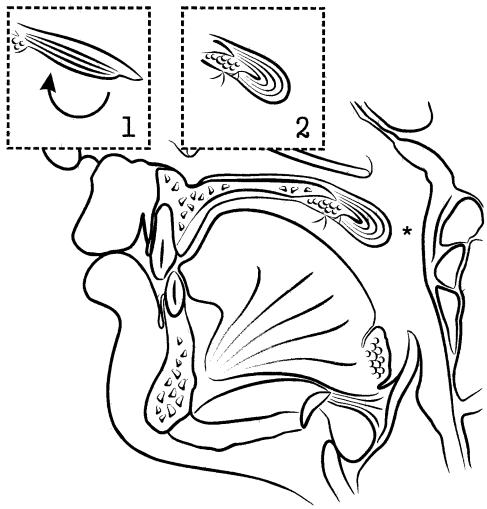

Fig 6. Imbrication technique was shown in small illustration 1 and 2; postoperative status revealed an enlargement in retropalatal space (*).

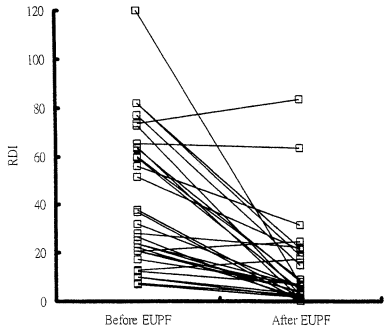

Fig 7. The RDI before and after EUPF; the change was significant (*P* < .0001).

improvement of snoring, with complete resolution in 6 patients (18.2%). Three months after operation, there was no swallowing disturbance or hypernasality; only 1 patient (3%) complained of occasional nasal regurgitation.

COMMENT

It is well recognized that obesity is a major risk factor of OSA.[11] It has also been shown that there is excess pharyngeal fat in subjects with OSA as compared with obese control subjects without OSA.[12] A histological morphologic study of anterior and posterior pillars and the uvula has shown that the amount of fatty infiltration in the pharyngeal tissue is excessive in patients with OSA.[13] Moreover, the percentage of uvula fat tissue was found to be related to the frequency of apneas and hypopneas in sleep.[14] Therefore, it is quite plausible that the fatty deposit in the upper airway could contribute to its narrowing and increases its collapsibility when the muscle tone is reduced during sleep. A previous study using magnetic resonance imaging to determine the sites and sizes of fat deposits in the upper airway found that large deposits of fat were present posterolateral to the oropharyngeal airspace at the level of the soft palate.[15] Thus, surgical removal of pharyngeal fat seems to be a logic option to expand the pharyngeal airway.

Schwab[16] showed that the major axis of minimal cross section area of retropalatal space (RP) is oriented in the anteroposterior dimension (lateral narrowing) in patients with OSA; in contrast, the major axis of RP in nonapneic people is oriented in the horizontal dimension. The EUPF technique described excising the mucosa and submucosal adipose tissue 1 cm above the tonsillar fossa in the lateral direction to create a supratonsillar space that allows for advancement of the palatal mucosa superiorly and laterally, thus can contributing to the increase of RP in lateral dimension.

McGuirt and coworkers[17] reported that patients with a history of prior tonsillectomy were less likely to have therapeutic improvement after UPPP. These authors speculated that the presence of palatine tonsil allows for the removal of additional lateral oropharyngeal tissues, thereby improving the success rate of UPPP. This may help to explain the higher success rate in our series because all of the patients had existing tonsillar tissues and tonsillectomy was performed in every patient even with small or buried tonsils. The wound closure facilitates maximal lateralization of posterior pillars and redundant posterior pharyngeal wall. The imbrication and reposition of the EUPF also raises the inferior margin of the uvulopalatal complex, thus further enlarging the RP airway in the anteroposterior dimension, which may reduce the possibility of persistent collapse at the proximal level of the resected soft palate.[2] The mucosal-covered palatal may also reduce the risk of cicatration along the resection margin of the soft palate as in UPPP, which can lead to narrowing of lateral dimension of RP.[2] Finally, the preserved mucosal edge of the soft palate may minimize the risk of dysphagia, which can occur because of the scar band created in the traditional UPPP.

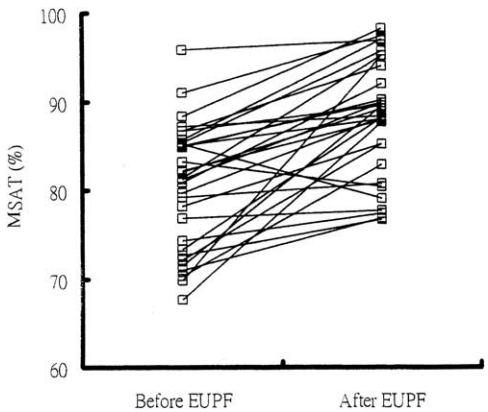

Fig 8. The MSAT before and after EUPF; the change was significant (*P* < .0001).

Postoperative hemorrhage is a potential complication after UPPP.[18] In this series, 1 subject with minor tonsillar bleeding was controlled using conservative treatment. Suturing of the muscle layer in tonsillar fossa facilitates maximal lateralization of the posterior pillar and may decrease the incidence of dehiscence in the tonsillar fossa, thus potentially reducing the risk of postoperative bleeding. Another common complication of UPPP appears to be velopharyngeal insufficiency, with a 24% to 56% occurrence from 6 weeks to 1 year.[19] In this series, only 1 patient (3%) complained of occasional nasal regurgitation in the 3 months follow-up. The patient with postoperative nasal regurgitation had significantly enlarged tonsils and a thin soft palate; a relatively wider RP was created after surgery, thus contributing to velopharyngeal insufficiency. Fat injection of the soft palate was suggested to improve this sequela. However, the patient felt no torment and declined the remedy. Otherwise, there was no persistent nasal regurgitation in this series. The decrease in the incidence of velopharyngeal insufficiency could be due to the preservation and imbrication of the muscle in soft palate to act during swallowing. The postoperative pain, from the experience of UPPP, could be significant and intolerant. Hence, we used intravenous ketoprofen (100 mg every 8 hours) for 2 days and dexamethasone ointment for wound application. The vast majority of patients in this series experienced a tolerant pain in the postoperative period. Another point that should be emphasized is not to create a postoperative soft palate in square shape to decrease nasal regurgitation.[8]

We have found no differences in age, sex, and BMI between responder and nonresponder in the age, sex, and BMI in our series. However, 4 of the nonresponders were found to have significant narrowing between posterior pillars (<1 cm) with minimal tonsillar tissue and thick posterior pillar. One remaining nonresponder was noted to have mild retrognathia and tongue base obstruction. This patient was managed with long-term nasal continuous positive airway pressure.

Dysphagia is a frequent complication after soft-palate modification for OSA in that 29% of the patients have persisting dysphagia after UPPP,[20] and 40% of the patients reported minor pharyngeal symptoms following laser-assisted uvulplalatoplasty in long-term follow-up studies.[21] We postulate that the scar band created at the free border of the soft palate after UPPP and laser-assisted uvulplalatoplasty is the likely cause of dysphagia. The scar created by the EUPF is moved superiorly to the firmer region of the soft palate near the hard-soft palate junction while preserving the mucosal surface at the free border. This may explain the no incidence of dysphagia identified in the 3 months after operation.

Finally, although the EUPF described is similar to the technique described by Powell et al.[22] The current technique advocates a fat dissecting technique with more extensive advancement flap to open up the RP in the anteroposterior dimension. The most significant difference, however, is the reconstruction of supratonsillar fossa with the lateralization of posterior pillars and redundant posterior pharyngeal wall to gain the lateral enlargement of the RP, which may improve the treatment result. The results of this study support the results from the prior study[22] advocating uvulopalatal flap for the treatment of OSA and should be considered.

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