

# Arco-palato-uvular flap: a new surgical technique for the treatment of palatal snoring in tonsillectomized patients

## Arko-palato-uvular flep: Tonsillektomili hastalarda palatal horlama tedavisine yönelik bir cerrahi teknik

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**Objectives:** We describe a new surgical technique called "arco-palato-uvular flap (APUF)" which can be used for the surgical management of palatal snoring in previously tonsillectomized patients.

**Patients and Methods:** Among patients who were admitted to the Military Hospital of Novi Sad between January 2000 and December 2004, 36 patients (19 males, 17 females; mean age 45.3 years; range 21 to 60 years) who had previously undergone tonsillectomy for various reasons and who were thought to have palatal snoring based on physical and endoscopic examinations were evaluated on the basis of the visual analog scale (VAS), Epworth sleepiness scale (ESS) and apnea hypopnea index (AHI) scores and underwent APUF surgery after giving informed consent.

**Results:** Twenty-seven patients with a body mass index (BMI) of  $<30 \text{ kg/m}^2$  had socially-bothersome snoring and nine had mild sleep apnea (AHI 5-15/hour,  $\text{SO}_2 >90\%$ ). The mean visual analog scale scores were  $8.6 \pm 1.0$  preoperatively and  $2.3 \pm 1.5$  postoperatively. The Epworth Sleepiness Scale scores averaged  $10.0 \pm 3.0$  preoperatively and  $4.0 \pm 1.0$  postoperatively. In patients with mild apnea, the average preoperative AHI was  $11.58 \pm 3.58$  and dropped to  $4.75 \pm 2.92$  postoperatively. Statistical analysis revealed significant reductions in all variables ( $p < 0.001$ ).

**Conclusion:** The APUF procedure may treat palatal snoring and mild obstructive sleep apnea in previously tonsillectomized patients by widening the oropharyngeal airway, and stabilizing the uvulopalatal segment. Further studies are needed to determine the long-term success rates of the technique and to modify the patient selection and exclusion criteria.

**Key Words:** Arco-palato-uvular flap; palatal surgery; primary palatal snoring; surgical treatment.

**Amaç:** Bu çalışmada, daha önce tonsillektomi uygulanmış hastalarda palatal horlamanın cerrahi tedavisinde kullanılabilir "Arko-palato-uvular flep (APUF)" isimli yeni bir cerrahi teknik tarif edilmektedir.

**Hastalar ve Yöntemler:** Ocak 2000 - Aralık 2004 tarihleri arasında Novi Sad Askeri Hastanesi'ne horlama yakınmasıyla başvuran hastalar arasından, önceden çeşitli nedenlerle tonsillektomi yapılmış olan ve fizik ve endoskopik muayenede palatal horlaması olduğu düşünülen 36 hasta (17 kadın, 19 erkek; ort. yaş 45.3 yıl; dağılım 21-60 yıl) görsel analog ölçek (GAÖ), Epworth uyukluluk skalası (ESS) ve apne hipone indeksi (AHI) puanları temelinde değerlendirildi ve hasta onam formu alındıktan sonra APUF cerrahi işlemi uygulandı.

**Bulgular:** Vücut kütle indeksi (VKİ)  $<30 \text{ kg/m}^2$  olan 27 hastanın sosyal sıkıntı verici horlaması ve dokuz hastanın hafif şiddetli uyku apnesi (AHI 5-15/saat,  $\text{SO}_2 >90\%$ ) mevcuttu. Ortalama görsel analog ölçek skoru ameliyat öncesi  $8.6 \pm 1.0$ , ameliyat sonrası ise  $2.3 \pm 1.5$  idi. Epworth uyukluluk skalası ortalama skoru ameliyat öncesi  $10.0 \pm 3.0$  ve ameliyat sonrası  $4.0 \pm 1.0$  idi. Hafif şiddetli apnesi olan hastalarda ortalama AHI ameliyat öncesi  $11.58 \pm 3.58$ 'di, ameliyat sonrasında ise  $4.75 \pm 2.92$ 'ye düştü. İstatistiksel analiz tüm değişkenlerde önemli azalmalar ortaya koydu ( $p < 0.001$ ).

**Sonuç:** Arko-palato-uvular flep işlemi önceden tonsillektomi uygulanmış hastalarda palatal horlama ve hafif şiddetli obstrüktif uyku apnesini orofarengal hava yolunun genişletilmesini ve uvulopalatal segmentin stabilizasyonunu sağlayarak tedavi edebilir. Tekniğin uzun süreli başarı oranlarının anlaşılması ve hasta seçim ve dışlanma kriterlerinin değiştirilmesi için daha ileri çalışmaların yapılması gerekmektedir.

**Anahtar Sözcükler:** Arko-palato-uvular flep; palatal cerrahi; primer palatal horlama; cerrahi tedavi.

Received / Geliş tarihi: March 18, 2011 Accepted / Kabul tarihi: June 5, 2011

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Presented at the 13<sup>th</sup> Military Medicine Congress 1-5 June 2008, Kuşadası, Turkey (Bu çalışma 13. Askeri Tıp Komitesi Kongresi'nde poster olarak sunulmuştur 1-5 Haziran 2008, Kuşadası, Turkey).

Many palatal procedures have been described for the treatment of primary palatal snoring. Different reconstructive techniques can change the form, function and physiology of the upper airway by modifying or removing tissues. Many obstructive sleep apnea (OSA) patients have multi-level abnormalities of the anatomic airway. Diagnosing and understanding these sites of obstruction during sleep is challenging and there is no standard therapy for OSA patients. Patient-specific or obstruction site-specific approaches are required for successful treatment of OSA. Uvulopalatopharyngoplasty (UPPP) and its modifications have well documented complications including mucosal breakdown, palatal swelling and velopharyngeal insufficiency. More targeted procedures such as radiofrequency and sclerotherapy often require more than one treatment for optimal palatal stiffening and are difficult to perform in the thinned posterior pillars and palatal muscles of patients who have had a previous tonsillectomy.

We describe a new surgical technique entitled "arco-palato-uvular flap (APUF)" which can be used for the surgical management of snoring in previously tonsillectomized patients. This technique is less invasive than other UPPPs and allows possible future revision. It consolidates and stabilizes the uvulopalatal segment and rear palatal arch and frees the inferior border of the soft palate and uvula while simultaneously enlarging the oropharyngeal airway. Unlike other UPPPs, the uvula, palatal arches and free palate edges are incorporated in the flap design instead of being excised.

## PATIENTS AND METHODS

### Subjects and screening

Thirty-six patients (19 males, 17 females; mean age 45.3 years; range 21 to 60 years) were selected among all patients with snoring who consulted at the Military Hospital of Novi Sad between January 2000 and December 2004, on the basis of history, physical and endoscopic examination, partner rating of snoring using a visual analog scale (VAS) and Epworth sleepiness scale (ESS). Included were patients with informed consent between the ages of 18 and 70 with no significant comorbidities, who had a history of previous childhood tonsillectomy and persistent snoring with uvulopalatal flutter, examination findings of a wide, loose soft palate with floppy rear palatal arches predisposed to collapse during sleep (Fujita

type 1 retropalatal obstruction) and body mass index (BMI)  $<30$  kg/m<sup>2</sup>. A VAS of snoring noise during sleep was administered to subjects and their bed partners to assess snoring levels (Appendix A). The scale ranged from 0 (no snoring noise) to 10 (extreme noise causing the bed partner to leave the room). All subjects were asked to complete the ESS and underwent whole night polysomnography including airway pressure fluctuation monitoring (Apnea Graph MRA, Medical-Euro Sleep Center, Belgrade). The patients underwent the APUF surgical procedure (described below) and followed up after one, six and twelve weeks. A repeat VAS and ESS were administered after healing for comparison with preoperative scores. In addition, the apnea graph was readministered to patients with preoperative mild apnea, but not to the non-apneic snorers. Statistical analysis was performed using paired difference t-test.

### Surgical technique

The Military Hospital Ethics Committee of Novi Sad, Serbia approved the proposed surgical technique. All procedures were performed under general anesthesia, but may be performed under local anesthesia in selected subjects. About 1.5 to 10 ml Lidocaine HCl 2% + 1:100.000 Epinephrine (xylocaine® with Epinephrine 20 mg/0.01 mg/ml carpules, AstraZeneca AB, Sodertalje, Sweden) was injected into the lower border of the soft palate and root of the uvula (This may be preceded by topical soft palate anesthesia with Lidocaine 10% pump spray (Xylocaine® AstraZeneca AB, Soder talje, Sweden) when local anesthesia is used). An Ellman Sugitron 4.0 MHz radiowave surgical apparatus unit (Ellman international Company Oceanside, New York, USA) was set on a combined cut and coagulation mode at medium power level with a snare wire active electrode used as a knife. A horizontal mucosal incision of approximately 0.5 cm was made through the free edge of each posterior pillar superior to the tongue base and carried superomedially along the inferior border or free edge of the soft palate toward the uvula on each side, resecting the tip of the uvula (figure 1). Submucosal dissection was performed from the incised lower border of the soft palate, undermining 0.5 cm of underlying soft tissue in a superolateral direction (figure 2). The underlying soft tissue was bunched superiorly and laterally in the direction of the curvilinear incision to form an arco-palato-uvular flap, and fixed with braided absorbable Polyglactin 910 (Vicryl™, Johnson & Johnson

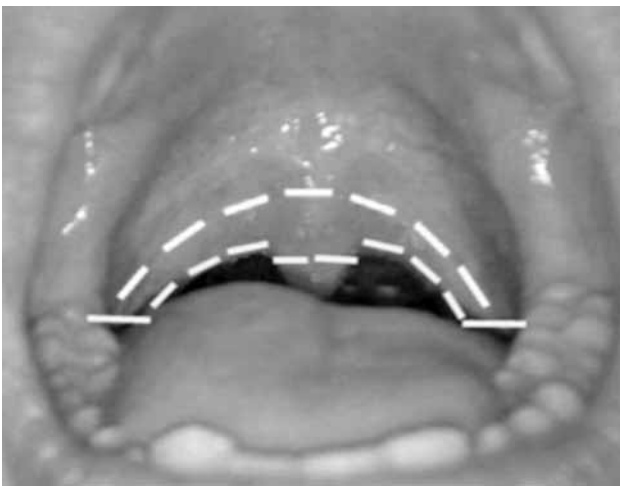


**Figure 1.** Horizontal mucosal incisions (dashed lines) approximately 0.5 cm made through the free edge of each posterior pillar superior to the tongue base and carried superomedially along the inferior border of the soft palate toward the uvula on each side, resecting the tip of the uvula.

Ethicon, Cincinnati OH, USA) 4-0 interrupted sutures with an RB-1 needle (figure 3). Patients were discharged the next day on an analgesic regimen.

### RESULTS

Of the 36 patients, 27 (16 males, 11 females; mean age 40.2 years; range 21 to 60 years) had socially bothersome snoring and nine (6 males, 3 females, mean age 50.4 years; range 40 to 60 years) had mild sleep apnea [apnea/hypopnea index (AHI) less than 15,  $SO_2 > 90\%$ ; table 1]. In all patients, the



**Figure 2.** Submucosal dissection from lower border of soft palate (lower dashed line) undermining 0.5 cm of underlying soft tissue in supero-lateral direction (upper dashed line).

primary level of obstruction was within the upper pharyngeal region based on flexible endoscopy and apnea graph monitoring. Preoperative averages for VAS were  $8.6 \pm 1.0$  and for ESS were  $10.0 \pm 3.0$ , while postoperative averages for VAS were  $2.3 \pm 1.5$  and for ESS were  $4.0 \pm 1.0$  (figure 4 and 5). In patients with mild apnea, the average AHI was  $11.6 \pm 3.6$  preoperatively, and  $4.8 \pm 2.9$  postoperatively (figure 6). Statistical analysis revealed significant reductions for all variables ( $p < 0.001$ ).

Postoperative examination typically revealed clearly visible fuller, fattened functional free edges of the repositioned palatal arch (figure 7). There were no observed clinically significant morbidities such as postoperative scarring, fibrosis or velopharyngeal insufficiency. There was no improvement of snoring in two patients, who were successfully treated with additional continuous positive airway pressure (CPAP). One patient complained of a mild degree of mouth dryness and two reported globus sensation.

### DISCUSSION

Numerous surgical and non-surgical procedures have been described for OSA management. The success of management is dependent on accurate airway diagnostic assessment, correct procedure selection, effective procedures and successful technical execution. Surgical intervention seems a more desirable option for young to middle-aged individuals who yearn to remain free of the harsh sentence of nightly attachment to a CPAP device for a long time, perhaps for life.<sup>[1]</sup> Madani et al.<sup>[2]</sup>



**Figure 3.** Underlying soft tissues bunched superiorly and laterally to form an arco-palato-uvular flap, and fixed with braided absorbable interrupted sutures.

**Table 1.** Patient characteristics age, sex, SaO<sub>2</sub>, body mass index etc.

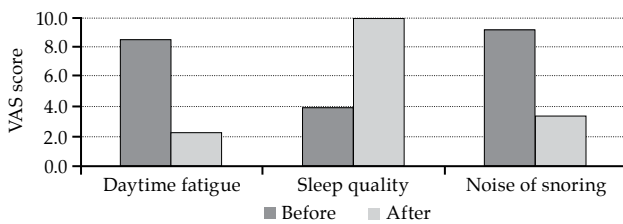
Complaint	Sex	Minimal age	Maximum age	Average age	SaO <sub>2</sub> before intervention (%)	SaO <sub>2</sub> after intervention (%)
Social bothersome snoring (n=27)						
Male	16	21	59	40.5	92	94
Female	11					
Mild sleep apnea (n=9)						
Male	6	40	60	50.2	90	95
Female	3					

emphasized common positive factors affecting long-term surgical outcome such as younger age (<50y), low body mass index (<27), low OSA severity (mild to moderate (RDI<25), unilevel obstruction area (oropharyngeal obstruction area with normal size of tongue) and small neck circumference (<17"). Surgical procedures including uvulopalatopexy, pillar palatal implant, soft palate radiofrequency, cautery-assisted palatal stiffening operation, injection snoreplasty, laser assisted uvuloplasty, uvulopalatal flap, uvulopalatoplasty (UPP) and UPPP have been described for the treatment of primary palatal snoring.<sup>[3-6]</sup> Failure in one or more procedures results in less than optimal structural and ultimately clinical outcomes.<sup>[7]</sup> The treatment of OSA is highly patient-specific and depends on a combination of hereditary and acquired anatomic and lifestyle factors. The success of surgical treatment depends on proper patient selection as well as the choice of surgical procedure. The ultimate goal of any surgical procedure designed

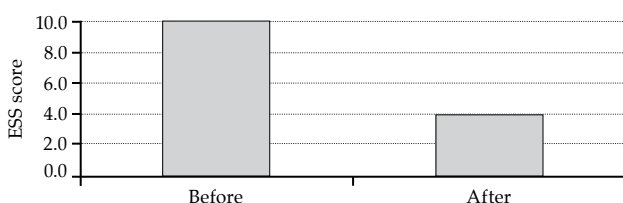
to treat OSA is soft tissue reduction or modification to open up the airway.<sup>[2]</sup>

Uvulopalatopharyngoplasty was the first described and most commonly used surgical procedure for OSA treatment.<sup>[5,7]</sup> This technique is defined as a reconstructive procedure of the upper pharyngeal airway segment which includes tonsillectomy, removal of redundant lateral pharyngeal wall mucosa, removal of redundant palatal mucosa, and partial removal of the uvula with a primary plastic closure of the anterior and posterior tonsil pillars, pharynx, palate, and uvula. Modifications of this technique have been described including UPP and laser-assisted uvuloplasty (LAUP) which reduce palatal volume and increase palatal stiffness through postoperative scarring.<sup>[1,7]</sup> However, the complications of these procedures, including mucosal breakdown, palatal swelling and velopharyngeal insufficiency have been well documented,<sup>[8,9]</sup> resulting in more targeted procedures to stiffen the palate and minimize surgical trauma. Such procedures include radiofrequency and sclerotherapy, but often require more than one treatment for optimal palatal stiffening. These stiffening methods are also difficult to perform in the thinned posterior pillars and palatal muscles of patients who have had a previous tonsillectomy.

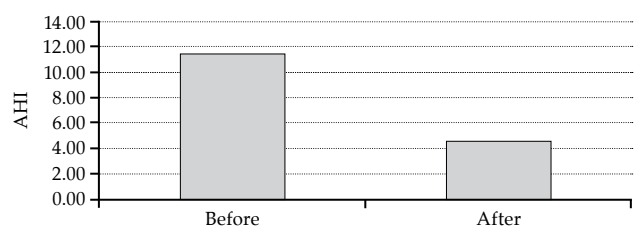
The technique of APUF can be used for previously tonsillectomized patients. This technique avoids complications of earlier procedures on the



**Figure 4.** Visual analog pain scale-conditions of daytime fatigue, sleep quality, snoring according to the patient's partner before and one year after the APUF, registered on a 0 to 10 visual analogue scale scale.



**Figure 5.** Pre- and postoperative Epworth sleepiness scale (ESS) scores.



**Figure 6.** Pre- and postoperative apnea hypopnea index (AHI).



**Figure 7.** Final appearance after arco-palato-uvular flap. Fuller fattened free edge of soft palate arch repositioned superior-laterally with wider oropharyngeal air space; note adequate velopharyngeal closure on palatal elevation.

velopharyngeal ring because the uvula, palatal arches and free palate edge are not totally resected but incorporated in the flap design, resulting in a fuller, fattened, functioning free palatal edge. This effectively stabilizes and repositions the soft palate and uvular muscles superolaterally and widens the retropalatal space to decrease airway resistance, while minimizing the risk of over-resection that results in velopharyngeal insufficiency. Should velopharyngeal insufficiency appear, early revision can theoretically be accomplished by loosening the flap to a lower level. In case of APUF failure, CPAP therapy can be initiated, because there is less tendency for the nasopharyngeal stenosis associated with UPPP.<sup>[10-12]</sup> Uvulopalatopharyngoplasty is still generally the standard procedure for patients with moderate OSA, while multilevel surgery is reserved for secondary treatment after CPAP failure.<sup>[13]</sup>

In conclusion, this new surgical procedure may treat palatal snoring and mild obstructive sleep apnea in previously tonsillectomized patients by widening the oropharyngeal airway, stabilizing the uvulopalatal segment and improving

functional results. Further studies are needed to understand the long-term success rates of the technique and to modify selection and exclusion criteria for patients.

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