Does the dimple point represent the margin of soft palate musculature?

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Objective: To evaluate and compare the length of the soft palate from the posterior nasal spine (PNS) to the dimple point and, to the posterior margin of soft palate musculature.

Material and methods: A prospective descriptive study was made. Two hundred-seven patients, who underwent uvulopalatal flap for sleep-disordered breathing between Jan 2003 and Dec 2006, were recruited for the study. The length from PNS to the dimple point of the soft palate (PNS-Dimple) was measured. After the mucosa on the outlined soft palate were removed, measurement of the length from PSN to the posterior border of the soft palate musculature (PNS-Muscle) was recorded.

Results: Lengths of PNS-Dimple and PNS-Muscle were 24.3 ± 3.2 and 24.5 ± 3.5 mm (mean ± SD), respectively. There were no statistically significant differences between the lengths (p=0.40; r=0.7). Mean lengths of PNS-Dimple and PNS-Muscle in OSA patients were significantly longer than those in primary snoring patients.

Conclusion: When undertaking soft palate surgery for sleep-disordered breathing, removal of the soft palate should not exceed the dimple point which represents the posterior border of the soft palate musculature in order to prevent postoperative velopharyngeal insufficiency.

Keywords: Palate, uvulopalatal flap (UPF), velopharyngeal insufficiency (VPI).

Frequent and loud snoring is only a disturbing social problem, but snoring combined with nocturnal apnea and excessive daytime sleepiness is a symptom of obstructive sleep apnea (OSA) [1, 2]. Excessive daytime sleepiness, unrefreshed feeling on awakening, poor cognitive function, sleep fragmentation and personality changes are usually found in OSA patients. Risks of hypertension, cerebrovascular disease, ischemic heart disease and automobile accidents are significantly increased in severe cases. Awareness of this disease through TV, radio, magazine articles and other media is increasing rapidly among the public.

Management begins with history taking, examination of the upper airway, fiberoptic endoscopy, and lateral cephalography X-ray. A sleep test (polysomnography) is recommended for selected cases. All these aim to find the sites of the obstruction and to assess the severity. Treatment consists of weight reduction, body positioning during sleep, dental appliances [3], medical and, surgical treatment. The most widely used and effective treatment of OSA is continuous positive airway pressure (CPAP) therapy. although CPAP is the gold standard of treatment, patients’ compliance in use of this equipment is poor due to many factors [4, 5]. Site-specific surgery is an alternative and highly effective treatment [6-9]. Surgical treatment of the soft palate with uvulopalatopharyngoplasty (UPPP) was initiated in 1981, and has been further developed over the years [8, 10-12]. Laser-assisted uvulopalatoplasty (LAUP) is a surgical procedure that has been used as a treatment for snoring and obstructive sleep apnea (OSA). LAUP can be performed almost anywhere, using only local anesthesia and a carbon dioxide (CO₂) laser to reduce and reshape the uvula and soft palate. The technique was developed by Kamami [13].

Common complications of UPPP and LAUP are velopharyngeal insufficiency (VPI), dry throat, foreign body sensation of the throat, speech/phonation alteration and swallowing abnormality [14-16]. VPI is the result of an impaired velopharyngeal sphincter...
during swallowing or speaking. The cause is the removal of too much soft tissue from the soft palate, especially the palatopharyngeus and levator veli palatini muscles. The low incidence of VPI may also be the result of an inherently narrowed pharyngeal airway, i.e. the increased tendency toward the collapse of pharyngeal tissues and soft palate that is usually found in patients with OSA [17, 18]. The anatomic and physiological characteristics that predispose these patients to OSA development may provide some “protective effect” on VPI development. It has been demonstrated that UPPP stiffens the pharynx as a result of tissue reduction and tissue fibrosis. Thus, it reduces the tendency pharyngeal collapse, to reducing airway obstruction [19. 20]. The gradual softening of the soft palate may increase the movement of the soft palate to achieve velopharyngeal closure; thus it possibly explains why all of the patients exhibiting VPI symptoms later had a resolution of their symptoms.

A fresh cadaver study of normal adults analyzed velopharyngeal function of the levator veli palatini, palatopharyngeus and superior constrictor muscles [21]. The levator veli palatini (LVP) occupied the central 50 percent of the soft palate in transverse dimension. It is the major component of velopharyngeal closure. The palatopharyngeus and superior constrictor muscles help LVP to get the full function of velopharyngeal closure. A reversible uvulopalatal flap (UPF), introduced by Powell et al, achieved the same results as the UPPP, and with less risk of developing VPI [8]. The current study focuses on surgical treatment for primary snoring and OSA at King Chulalongkorn Memorial Hospital using the uvulopalatal flap (UPF) technique. The study investigates whether or not the dimple point represents the margin of soft palate muscles.

Materials and methods

The research proposal was approved by the Ethics Committee, Faculty of Medicine, Chulalongkorn University. Consecutive adult patients were evaluated at King Chulalongkorn Memorial Hospital between the period Jan 2003 and Dec 2006. A complete history taking, physical examination, fiberoptic nasopharyngoscopy and lateral cephalogram were performed for each patient. Polysomnography was performed if the patient, or their bed partners, reported any doubtful signs or symptoms of daytime sleepiness, restless sleep, or observed apnea in the sleep laboratory with full monitoring that included an electroencephalogram, electro-oculogram, chin and leg electromyograms, electrocardiogram (modified V2 lead), airflow, thoracic and abdominal efforts, pulse oximetry, and snoring sound (Cadwell system; Cadwell laboratories, Inc. Kennewick, USA).

The polysomnogram was analyzed according to the standards of the American Academy of Sleep Medicine. Inclusion criteria were sleep-disordered breathing patients who failed or refused CPAP treatment, had obstruction at the level of the retropalatal region, and were planned for UPF. Excluded were children (age <15), elderly patients (age >70), pregnant women, and patients with bleeding disorders or high cardiopulmonary risks. Two hundred-seven patients were programmed for UPF under general anesthesia. Written informed consent was given by every patient before their recruitment.

After general anesthesia was performed, the patient was positioned with extension of head and neck as the standard position for tonsillectomy procedure. Mc Ivor’s mouth gag was applied to keep the mouth opened wide enough for the surgeon to have a good exposure view. The position of the posterior nasal spine was palpated in the mouth and marked with a sterile marking pen. The uvula was grasped with toothed forceps and reflected back toward the soft-hard palate junction. The dimple was identified and marked on the soft palate mucosa. Measurement of length was done from the posterior nasal spine to the dimple using a caliper.

UPF was performed as described originally by Powell et al. [8]. The soft palate was injected with 5 to 10 milliliters of 1% lidocaine with epinephrine solution. The mucosa, submucosa with glands, and fat on the lingual surface of the uvula and soft palate were removed with a scalpel. Bleeding was controlled with bipolar electrocoagulation. Measurement of length was done from the posterior nasal spine to the dimple using a caliper.

Postoperative medications included antibiotic suspension for 7 days and acetaminophen as needed for pain relief.

Statistical analysis

Sample size calculation was not used and no sampling method was done. All eligible patients were enrolled consecutively. Data exploration and a data
cleansing process were done before data analysis. Demographic data was analyzed by descriptive analysis. Both lengths were analyzed for means, standard deviation, 95% confidence interval, paired t-test, and correlation. Comparison between primary snoring and OSA patients was done by using SPSS version 15 software.

Results

207 patients who underwent UPF were enrolled. They consisted of 177 males and 30 females. The average age was 44 years, with a range from 22 to 69 years. Standard full-night polysomnography was performed on most patients (n=179, 86.5%). Most patients were diagnosed as OSA (87%). The remainder was diagnosed as primary snoring (13%). Means of length from PNS to the dimple (PNS-Dimple) and from PNS to the posterior border of the soft palate musculature (PNS-Muscle) were 24.3 mm (SD=3.2; 95%CI=23.9-24.8) and 24.5 mm (SD=3.5; 95%CI=24.0-25.0), respectively. There was no statistically significant difference between the lengths (p=0.40). The mean difference between the lengths was 0.1 mm (SD=2.5; 95%CI=0.2 to 0.5). Correlation (R) between both lengths was 0.7 (p<0.01).

Table 1 shows that mean of the lengths (PNS-Dimple and PNS-Muscle) in OSA patients (24.7, 24.7) was longer than of primary snoring patients (23.2, 23.4), as the difference being statistically significant (p<0.01 and p<0.01, respectively) (Tables 2 and 3). Postoperatively, no VPI was found in any patients during one-year follow-up.

Table 1. Lengths measured from PNS to dimple (PNS-Dimple) and from PNS to posterior border of soft palate musculature (PNS-Muscle).

<table>
<thead>
<tr>
<th>Length (mm)</th>
<th>95% CI of Difference</th>
<th>Difference Mean±SD</th>
<th>95% CI of Difference</th>
<th>p-value</th>
<th>Correlation R (Pearson Correlation)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNS-Dimple</td>
<td>24.3±3.2</td>
<td>23.9 - 24.8</td>
<td>0.1±2.5</td>
<td>0.40</td>
<td>0.7</td>
<td>&lt;0.01</td>
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<tr>
<td>PNS-Muscle</td>
<td>24.5±3.5</td>
<td>24.0 - 25.0</td>
<td>-0.2 - 0.5</td>
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</table>

Table 2. The mean length of PNS-Dimple as compared between primary snoring and OSA.

<table>
<thead>
<tr>
<th>PNS-Dimple (mm)</th>
<th>P-value</th>
<th>Mean Difference (mm)</th>
<th>95% CI of Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary snoring</td>
<td>&lt;0.01</td>
<td>1.4</td>
<td>0.5 - 2.3</td>
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<td>OSA</td>
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Table 3. The mean length of PNS-Muscle as compared between primary snoring and OSA.

<table>
<thead>
<tr>
<th>PNS-Muscle (mm)</th>
<th>P-value</th>
<th>Mean Difference (mm)</th>
<th>95% CI of Difference</th>
</tr>
</thead>
<tbody>
<tr>
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Discussion

Comparing the mean lengths of PNS-Dimple and PNS-Muscle in Tables 2 and 3, we determined whether the dimple point can represent the posterior margin of soft palate muscles. Sample population was sleep-disordered breathing Thai patients, programmed for UPF who were within the eligible criteria. Most patients were males (n=177, 86%), OSA (n=156, 75%), and underwent PSG (n=179, 86%). Polysomnography was not performed in some patients (n=28, 14%) as there were no doubtful symptoms, signs of daytime sleepiness, or observed apnea reported by the patients or their bed partners. The mean lengths of PNS-Dimple and PNS-Muscle were approximately 23-25 mm. There was no statistically significant difference between them (p=0.40; R=0.71 p<0.01). Mean lengths of PNS-Dimple and PNS-Muscle in OSA patients were longer than in primary snoring, patients showing a statistically significant difference (p<0.01 and p<0.01, respectively).

The optimal length for soft palate removal in sleep-disordered breathing surgery should not exceed the dimple point which represents the margin of soft palate musculature. Resection of the soft palate muscles, especially Levator veli palatine and Palatopharyngeus, may compromise the function of the velopharyngeal sphincter. In the UPF technique, the anatomy of soft palate muscles can be identified and preserved after the outlined mucosa is removed, but these muscles cannot be seen in the standard UPPP or LAUP techniques, and excessive soft palate removal may result in VPI.

Conclusion

The dimple point on soft palate represents the posterior border of soft palate musculature. When undertaking UPPP or LAUP for sleep-disordered breathing, removal of the soft palate tissue should not exceed the dimple point to prevent postoperative VPI.

The author has no conflict of interest to declare.

References