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Lateral pharyngoplasty versus uvulopalatopharyngoplasty: a comparative study in the treatment of obstructive sleep apnea hypopnea syndrome

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Objectives

The aim of this study is to explore the efficiency of lateral pharyngoplasty as a new treatment for obstructive sleep apnea hypopnea syndrome (OSAHS) versus uvulopalatopharyngoplasty (UPPP).

Study design

Prospective randomized study.

Patients and methods

This study was submitted on 30 patients diagnosed to have OSAHS with retropalatal obstruction classified randomly into two groups: in one group, we performed the lateral pharyngoplasty (15 cases) with blunt palatal tunneling, and in the other, we did the UPPP (15 cases). We compared the efficiency of surgeries subjectively through the Epworth Sleepiness Scale and objectively through clinical and polysomnographic findings.

Results

In the lateral pharyngoplasty, the mean apnea–hypopnea index (AHI) improved from 40.95 ± 28.50 to 8.92 ± 7.9 ($P < 0.01$) and in the UPPP, the mean AHI improved from 33.87 ± 20.92 to 15.66 ± 8.7 ($P < 0.01$). Comparing the postoperative mean AHI in both groups (8.9 ± 7.9 and 15.66 ± 8.7 correspondingly) there was a statistically significant difference. In contrast with UPPP, the group of lateral pharyngoplasty shows improvement in the average PsO_2 from 91.93 ± 4.67 to $94.27 \pm 3.53\%$ ($P < 0.05$) and in the lowest PsO_2 from 71.8 ± 10.56 to 81.27 ± 8.92 ($P < 0.01$). In the lateral pharyngoplasty group, the median Epworth Sleepiness Scale changed from 11 to 7 and the persistent nasal regurgitation was not recorded (0.0%), but in UPPP group the persistent nasal regurgitation was recorded in four patients out of 15 (26.7%) ($P < 0.05$).

Conclusion

The lateral pharyngoplasty may offer benefits over UPPP in treatment of OSAHS patients with retropalatal obstruction. We observed improvements after the two surgeries, but the lateral pharyngoplasty gave better polysomnographic findings with less complications.

Keywords:

lateral pharyngoplasty, obstructive sleep apnea, uvulopalatopharyngoplasty

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Introduction

Obstructive sleep apnea syndrome (OSAS) is a very frequent major health problem [1]. It is associated with many medical conditions, including pulmonary hypertension, right-sided heart failure, nocturnal hypoxemia, cerebrovascular disease, cardioarrhythmia, and systemic hypertension [2]. The vibration of the soft structures in the oral cavity causes snoring [3]. The lateral pharyngeal muscular walls have a key role in the pathophysiology of 'OSAS' [4].

Uvulopalatopharyngoplasty (UPPP) is the most common specialized procedure that directly enlarges the upper airway used for treating OSAS. The rationale for UPPP, as for most of the operations already proposed for treating OSAS, is widening of pharyngeal airway [5]. However, it does not reverse the underlying

structural or neuromuscular tendency of pharyngeal narrowing in OSAS patients [6].

The surgical treatment for OSAS should not be focused on changing pharyngeal space but, rather, should be focused on dealing with the pharyngeal muscular wall properties [4]. The lateral pharyngoplasty was first described by Cahali [7]. Pang and Woodson [8] presented an innovative technique in creating this tension in the lateral pharyngeal walls, preventing its collapse namely the expansion sphincter pharyngoplasty or lateral pharyngoplasty.

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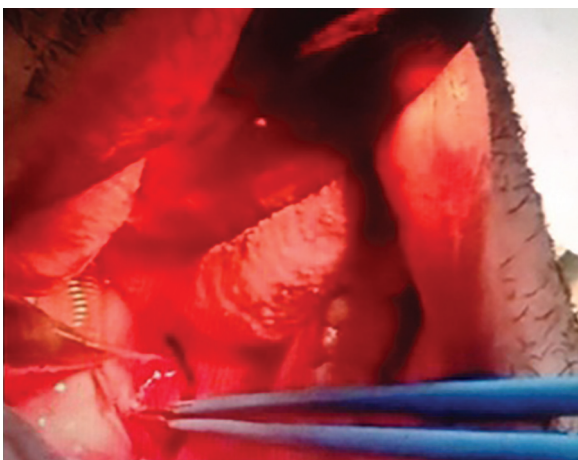
Patients and methods

The study was approved by the ethics committee of Benha faculty of medicine. The study was submitted prospectively on 30 patients during the period from March 2013 till August 2015. All patients had been selected from the outpatient clinics of Benha University Hospital. Patients included in this study were over 18 years of age, presented with habitual snoring and diagnosed with obstructive sleep apnea hypopnea syndrome (OSAHS) with Fujita type I and failed to accommodate or refused therapy with continuous positive airway pressure treatment.

We excluded from this study patients with central or mixed sleep apnea, patients with a multilevel obstruction, or patients with history of previous velopharyngeal or lingual surgeries. We also excluded from this study patients with gross mandible deformities or genetic disorders, patients with BMI greater than 40 kg/m², or patients with contraindication of surgery.

All patients in this study underwent a thorough clinical assessment including; complete history taking and administering a questionnaire [Epworth Sleepiness Scale (ESS)] according to Johns [9] and general examination including BMI and neck circumference. Full otorhinolaryngologic (ORL) examination was done including head and neck examination and rigid endoscopic nasal examination. All patients in this study were subjected to fiberoptic nasopharyngoscopy with Mueller's maneuver in supine position, nocturnal polysomnography and routine preoperative investigations. All patients had been subjected to a one-night polysomnographic study at a sleep lab with a test time of 6–8 h. The apnea–hypopnea index (AHI) was recorded denoting the total numbers of apneic plus hypopneic events divided by total sleep time in hours. The average pulse rate, average O₂ saturation, and lowest O₂ saturation were also recorded.

Figure 1



Dissection of the mucosa covering the right palatopharyngeus muscle.

Surgical techniques

We had randomly selected our patients to undergo the lateral pharyngoplasty or the UPPP operations by subjecting patients with odd sheet numbers for the lateral pharyngoplasty surgery group A and subjecting patients with even sheet numbers for the UPPP surgery group B. All the procedures were performed by the same surgeon, under general anesthesia and in the tonsillectomy position using the Boyle–Davis mouth gag with transnasal endotracheal intubation.

In group A, the lateral pharyngoplasty was performed according to Pang and Woodson [8] with the minimal modification of Vicini *et al.* [10] starting with bilateral tonsillectomy. The palatopharyngeus muscle was identified and dissected from the covering mucosa medially (Fig. 1).

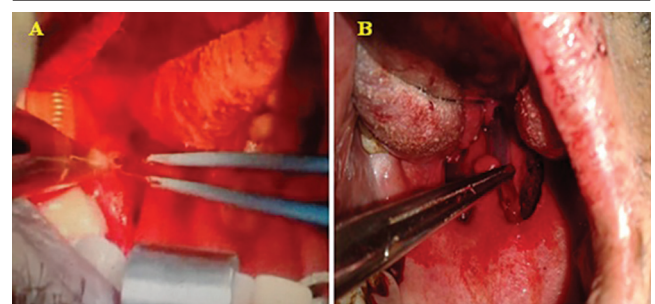
The palatopharyngeus muscle inferior end was transected horizontally using the bipolar diathermy and a superiorly based flap was dissected with a width of about 5 mm then rotated superolaterally (Fig. 2).

The modification of Vicini *et al.* [10] was in the form of blunt palatal tunneling without mucosal incisions. A superolateral soft palate tunnel was made on the anterior pillar arch bilaterally using blunt dissection with the curved tonsillar clamp. The palatopharyngeus muscle flap was then inserted through the tunnel of the soft palate using pull up vicryl suture 3/0 passed through the oral surface of the palate near the pterygoid hamulus to the tunnel and back again (Fig. 3).

Tonsillar pillars were then opposed with vicryl suture 3/0. The same steps were repeated on the opposite side. A partial uvulectomy was then performed (Fig. 4).

In group B the UPPP was performed according to Fujita *et al.* [5]. Tonsillectomy had been performed; then the anterior and posterior tonsillar pillars were trimmed using the knife. Then the anterior and posterior tonsillar pillars were reoriented using the

Figure 2



(a) The transection of the palatopharyngeus muscle using bipolar diathermy and (b) the superiorly based flap after the dissection.

interrupted vicryl sutures of 3/0, and the uvula had been excised to create a more retropalatal space.

Postoperative follow-up

One day hospital admission in semisitting position with observation of the vital signs, bleeding, feeding, breathing, and pulse oxymetry had been used. All the patients had been evaluated 10 days postoperatively for wound healing. Then they had regular visits weekly for a month, and monthly for 6 months asking about feeding, dysphagia, globus, and nasal regurge. The 6 months' postoperative evaluation had been done subjectively by history taking and administering the same questionnaire used preoperatively, the ESS according to Johns [9]. The postoperative objective evaluation, using complete clinical evaluation, ORL examination, and polysomnography was done. The postoperative polysomnography for all patients had been done at the same sleep lab 6 months after the surgery and analyzed by sleep lab physicians unaware of the type of surgery performed for each patient.

Results

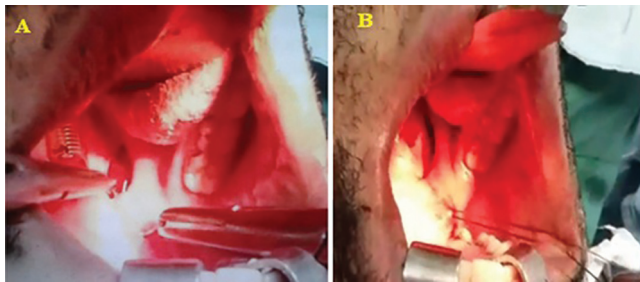
Group A consisted of 15 patients; nine male patients and six female patients, aged 18–51 years (age mean = 38.5 ± 10.1 years) while group B consisted of

15 patients; 10 male patients and five female patients, aged 19–54 years (age mean = 38.7 ± 9.2 years). There was no statistically significant difference between groups as regards age and sex distribution. There was no statistically significant difference between group A and group B as regards preoperative clinical and polysomnography data (BMI, neck circumference, average pulse, average PsO_2 , lowest PsO_2 , and AHI) (Table 1).

The comparison between preoperative and postoperative clinical and polysomnography data in group A shows that there was no statistically significant difference between preoperative and postoperative BMI, neck circumference, and average pulse. The average PsO_2 improved from 91.93% preoperatively to 94.27% postoperatively ($P < 0.05$). The lowest PsO_2 improved from 71.8% to 81.27% postoperatively ($P < 0.01$) (Fig. 5).

The comparison between preoperative and postoperative clinical and polysomnography data in group B shows that there was no statistically significant difference between preoperative and postoperative BMI, neck

Figure 3



(a) The passage of the needle through the oral surface of the palate and (b) the pull up suture near the pterygoid hamulus.

Figure 4



The view after completion of the lateral pharyngoplasty.

Table 1 Comparison between two study groups as regards preoperative data

| Preoperative | Group A (n = 15) | | Group B (n = 15) | | Test of significance | P-value |
|------------------------|------------------|-------|------------------|-------|----------------------|---------|
| | Mean | SD | Mean | SD | | |
| Preoperative | | | | | | |
| Height | 171 | 6.46 | 171.87 | 6.05 | 0.4 | >0.05 |
| Weight | 96.33 | 8.63 | 98.67 | 5.23 | 0.9 | >0.05 |
| BMI | 33.08 | 3.99 | 33.45 | 2.18 | 0.3 | >0.05 |
| Neck circumference | 16.69 | 0.45 | 16.67 | 0.49 | 0.1 | >0.05 |
| Average pulse | 81.53 | 8.68 | 80.13 | 11.49 | 0.4 | >0.05 |
| Average PsO_2 | 91.93 | 4.67 | 92.33 | 5.50 | 0.2 | >0.05 |
| Lowest PsO_2 | 71.80 | 10.56 | 77.33 | 10.55 | 1.4 | >0.05 |
| AHI | 40.95 | 28.50 | 33.87 | 20.92 | 0.5 | >0.05 |

AHI, apnea–hypopnea index.

circumference, average pulse, average PsO₂, and lowest PsO₂ ($P > 0.05$) (Fig. 6).

There was no statistically significant difference between group A and group B as regards postoperative clinical data (BMI and neck circumference); group A and group B patients' mean BMI was 33.24 and 33.62 kg/m², respectively and mean of neck circumference was 16.70 and 16.75 inches, respectively. There was no statistically significant difference between group A and group B as regards postoperative (average pulse, average PsO₂, and lowest PsO₂), group A and group B patients' mean of average pulse was 83.27 and 76.87 bpm, respectively, mean of average PsO₂ 94.27 and 93.20%, respectively, and mean of lowest PsO₂ 81.27 and 81.67%, respectively. In contrast, the comparison between group A and group B as regards postoperative AHI showed that there was a statistically significant difference (8.92 and 15.66, respectively) ($P < 0.05$) (Table 2).

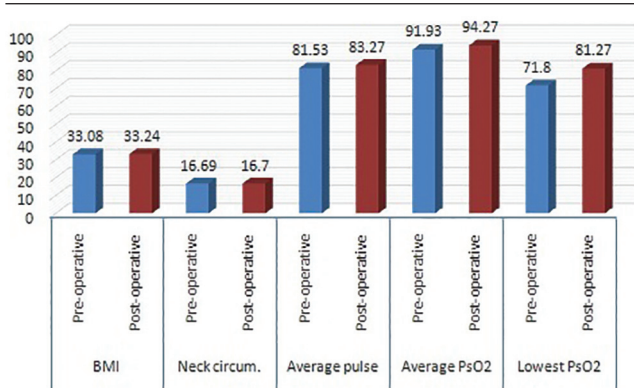
The comparison between preoperative and postoperative ESS in both groups shows that in group A, the median ESS improved from 11 (4 IQR) to 7 (4 IQR) with a statistically highly significant difference ($P < 0.01$). In group B, the median ESS improved from 12 (9 IQR) to 9 (9 IQR) ($P < 0.05$) with a statistically significant

difference ($P < 0.05$). There was no statistically significant difference between group A and group B as regards preoperative and postoperative ESS.

The comparison between preoperative and postoperative AHI in both groups shows that in group A, the mean AHI was 40.95 preoperatively and improved to 8.92 postoperatively ($P < 0.01$) with 78.21% of change. In group B, the mean AHI improved from 33.87 preoperatively to 15.66 postoperatively ($P < 0.01$) with 53.76% of change. There was no statistically significant difference between group A and group B as regards preoperative AHI, but the comparison showed that the AHI was better postoperatively in group A than in group B (8.92 and 15.66, respectively); there was a statistically significant difference ($P < 0.05$) (Table 3).

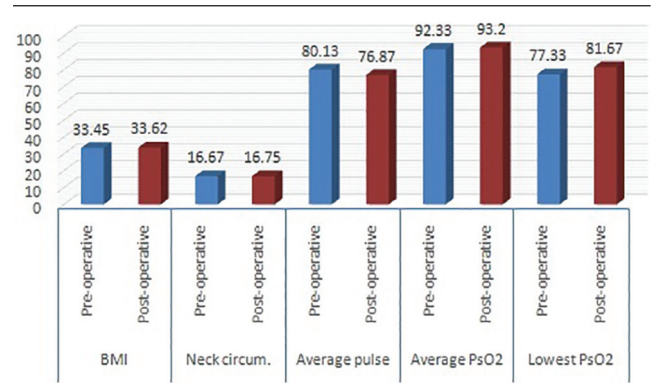
Successful surgery is determined by selecting a threshold of a 50% reduction in AHI and AHI less than 20 events/h [8,11]. The comparison between two study groups as regards successful surgeries shows that in group A, 12 patients out of 15 (80%) had successful surgeries and in group B, 10 patients out of 15 (66.7%) had successful surgeries. There was no statistically significant difference between group A and group B as regards successful surgeries. Postoperative

Figure 5



Comparison between preoperative and postoperative data in group A.

Figure 6



Comparison between preoperative and postoperative data in group B.

Table 2 Comparison between two study groups as regards postoperative data

| Postoperative | Group A (n = 15) | | Group B (n = 15) | | Test of significance | P-value |
|--------------------------|------------------|------|------------------|-------|----------------------|---------|
| | Mean | SD | Mean | SD | | |
| Postoperative | | | | | | |
| Weight | 96.87 | 8.01 | 99.20 | 7.38 | 0.8 | >0.05 |
| BMI | 33.24 | 3.62 | 33.62 | 2.82 | 0.3 | >0.05 |
| Neck circumference | 16.70 | 0.46 | 16.75 | 0.45 | 0.3 | >0.05 |
| Average pulse | 83.27 | 7.15 | 76.87 | 18.49 | 1.3 | >0.05 |
| Average PsO ₂ | 94.27 | 3.53 | 93.20 | 4.99 | 0.7 | >0.05 |
| Lowest PsO ₂ | 81.27 | 8.92 | 81.67 | 11.14 | 0.1 | >0.05 |
| AHI | 8.92 | 7.9 | 15.66 | 8.7 | 1.9 | <0.05 |

AHI, apnea-hypopnea index.

bleeding was not observed in any patient of both groups either reactionary or secondary bleeding. The comparison between the two groups as regards globus and persistent nasal regurge (for 6 months) shows that in patients of group A the globus sensation happened in two patients out of 15 (13.3%) and in patients of group B it happened in four patients out of 15 (26.7%) ($P > 0.05$), but there was a statistically significant difference between the two groups as regards the persistent nasal regurge, as the persistent nasal regurge was not recorded (0.0%) in group A but in patients of group B it was recorded in four patients out of 15 (26.7%) (Table 4).

The comparison between the two groups as regards the average of postoperative dysphagia shows that in patients of group A the average of postoperative dysphagia was 3.2 weeks and persisted more in patients of group B with the average of 3.6 weeks, but with no statistically significant difference between the two groups ($P > 0.05$).

Discussion

Since 2003, several studies concerned with the lateral pharyngeal wall collapsible properties and different surgical techniques were developed aiming for splinting the lateral pharyngeal wall. We chose the UPPP to be compared with the lateral pharyngoplasty as the UPPP is the most common specialized procedure that directly enlarges the upper airway used for treating OSAHS.

As regards preoperative clinical data (BMI and neck circumference), in our study there was no statistically significant difference between group A and group B. Also there was no statistically significant difference

between group A and group B as regards preoperative polysomnographic data (average pulse, average PsO_2 , lowest PsO_2 , and AHI). In our study, the preoperative mean of AHI for the entire patients of both groups was 37.41 ± 24.71 and this goes with Cahali [7] in which the mean was 45.8 ± 15.2 and with Pang and Woodson [8] in which it was 42.3 ± 17.1 .

In our study, the lateral pharyngoplasty had been performed in group A. The technique we used did not include the superolateral incision of Pang and Woodson [8], which was made on the anterior pillar arch bilaterally for identifying the arching fibers of the palatoglossus muscles; instead of that blunt palatal tunneling was done simply without mucosal incisions.

In our study, the postoperative follow-up at 6 months shows that in group A, the median ESS improved from 11 (4 IQR) to 7 (4 IQR) ($P < 0.01$). In group B, the median ESS improved from 12 (9 IQR) to 9 (9 IQR) ($P < 0.05$). This matches with Cahali *et al.* [4] who reported the same results as regards ESS; in the lateral pharyngoplasty group, the median ESS significantly improved from 14 (12 IQR) to 4 (4 IQR) ($P = 0.001$) and in the UPPP group, they found statistical improvement in the ESS value (median decreased from 14 to 5, $P = 0.005$).

It is well known that weight reduction has a substantial ameliorative effect on obstructive sleep apnea [12]. In our study, patients did not show any significant reduction in BMI or neck circumference 6 months postoperatively and this avoids the bias in our results as regards the improvement.

In our study in group A there was a statistically significant difference between preoperative and

Table 3 Comparison between preoperative and postoperative apnea–hypopnea index in both groups

| AHI | Group A (n = 15) | | Group B (n = 15) | | Mann–Whitney test | P-value |
|----------------------------|------------------|------|------------------|------|-------------------|---------|
| | Mean | SD | Mean | SD | | |
| Preoperative | 40.95 | 28.5 | 33.87 | 20.9 | 0.5 | >0.05 |
| Postoperative | 8.92 | 7.9 | 15.66 | 8.7 | 2.2 | <0.05 |
| Wilcoxon signed ranks test | 3.4 | | 3.4 | | | |
| P-value | <0.01 | | <0.01 | | | |
| % of change | 78.21% | | 53.76% | | | |

AHI, apnea hypopnea index.

Table 4 Comparison between the two groups as regards globus and persistent nasal regurge

| Postoperative complications | Group A (n = 15) [n (%)] | Group B (n = 15) [n (%)] | Total [n (%)] | χ^2 | P-value |
|-----------------------------|--------------------------|--------------------------|---------------|----------|---------|
| Globus | | | | | |
| No | 13 (86.7) | 11 (73.3) | 24 (80.0) | 0.2 | >0.05 |
| Yes | 2 (13.3) | 4 (26.7) | 6 (20.0) | | |
| Persistent regurge | | | | | |
| No | 15 (100) | 11 (73.3) | 26 (86.7) | 4.6 | <0.05 |
| Yes | 0 (0) | 4 (26.7) | 4 (13.3) | | |

postoperative average PsO_2 (91.93 ± 4.67 and $94.27 \pm 3.53\%$, respectively) ($P < 0.05$). There was a statistically highly significant difference between preoperative and postoperative lowest PsO_2 (71.8 ± 10.56 and $81.27 \pm 8.92\%$, respectively) ($P < 0.01$). This differs from Cahali [7] in which the group showed no statistically significant changes in the lowest PsO_2 , mean of 73.3% preoperatively and 77.8% postoperatively ($P = 0.359$); this difference may be due to smaller number in his group study. This small number of cases may also cause the difference between our results and the results of Li and Lee [13] as regards the lowest PsO_2 which improved only from 79.6 to 82.7% ($P = 0.102$). But in our results as regards the lowest PsO_2 match with Pang and Woodson [8], they reported improvement of the lowest oxygen saturation in the group of lateral pharyngoplasty from 78.4 ± 8.52 to $85.2 \pm 5.1\%$ ($P = 0.003$).

In our study, the comparison between preoperative and postoperative AHI in both groups shows that in group A, the mean AHI improved from 40.95 ± 28.50 to 8.92 ± 7.9 with P -value less than 0.01 and in group B, the mean AHI improved from 33.87 ± 20.92 to 15.66 ± 8.7 with P -value less than 0.01.

The postoperative intergroup comparisons showed that there was a statistically significant difference between group A and group B as regards postoperative mean AHI (8.9 ± 7.9 and 15.66 ± 8.7 , respectively). Our results were in agreement with Cahali *et al.* [4] as regards a statistically significant improvement in the AHI in the lateral pharyngoplasty group from 41.6 to 15.5. Our results match with Pang and Woodson [8] as they stated that the AHI improved from 44.2 ± 10.2 to 12.0 ± 6.6 ($P = 0.005$) following lateral pharyngoplasty and from 38.1 ± 6.46 to 19.6 ± 7.9 in the UPPP group ($P = 0.005$). This matching as regards improving in AHI denotes that the modification of Vicini *et al.* [10] which we used in the form of less traumatizing blunt palatal tunneling without mucosal incisions did not affect the results.

As regards the postoperative period, in our study there was no statistically significant difference between the two groups as regards globus sensation and the average of postoperative dysphagia. In patients of group A, the persistent nasal regurge was not recorded (0.0%), but in patients of group B it was recorded in 4 patients out of 15 (26.7%) ($P < 0.05$).

Conclusion

The data from this prospective randomized study of 30 patients suggest that the lateral pharyngoplasty

performed with blunt palatal tunneling may offer benefits over traditional method of UPPP in treatment of OSAHS patients with retropalatal obstruction (Fujita type I). We observed improvements after the two surgeries, but there was a statistically significant difference between group A and group B as regards postoperative mean AHI (8.9 ± 7.9 and 15.66 ± 8.7 , respectively). In contrast with the group of UPPP, the group of lateral pharyngoplasty shows a significant improvement in the average PsO_2 (from 91.93 ± 4.67 to $94.27 \pm 3.53\%$) ($P < 0.05$) and a highly significant improvement in the lowest PsO_2 (from 71.8 ± 10.56 to $81.27 \pm 8.92\%$) ($P < 0.01$).

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

- 1 Flemons WW. Clinical practice. Obstructive sleep apnea. *N Engl J Med* 2002; **347**:498–504.
- 2 Berry RB, Harding SM. Sleep and medical disorders. *Med Clin North Am* 2004; **88**:679–703.
- 3 Pang KP. Lateral pharyngoplasty in the treatment of obstructive sleep apnea. *Operative Techniques in Otolaryngology, Head and Neck Surgery* 2006; **17**:226–229.
- 4 Cahali MB, Formigoni GG, Gebirim EM, Miziara ID. Lateral pharyngoplasty versus uvulopalatopharyngoplasty: a clinical, polysomnographic and computed tomography measurement comparison. *Sleep* 2004; **27**: 942–950.
- 5 Fujita S, Conway WA, Zorick FJ, Roth T. Surgical correction of anatomic abnormalities in obstructive sleep apnea syndrome: uvulopalatopharyngoplasty. *Otolaryngol Head Neck Surg* 1981; **89**: 923–934.
- 6 Schwartz AR, Schubert N, Rothman W, Godley F, Marsh B, Eisele D, *et al.* Effect of uvulopalatopharyngoplasty on upper airway collapsibility in obstructive sleep apnea. *Am Rev Respir Dis* 1992; **145**:527–532.
- 7 Cahali MB. Lateral pharyngoplasty: a new treatment for obstructive sleep apnea hypopnea syndrome. *Laryngoscope* 2003; **113**:1961–1968.
- 8 Pang KP, Woodson BT. Expansion sphincter pharyngoplasty: a new technique for the treatment of obstructive sleep apnea. *Otolaryngol Head Neck Surg* 2007; **137**:110–114.
- 9 Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep* 1991; **14**:540–545.
- 10 Vicini C, Montevecchi F, Pang K, Bahgat A, Dallan I, Frassinetti S, Campanini A. Combined transoral robotic tongue base surgery and palate surgery in obstructive sleep apnea-hypopnea syndrome: expansion sphincter pharyngoplasty versus uvulopalatopharyngoplasty. *Head Neck* 2014; **36**:77–83.
- 11 Sher AE, Schechtman KB, Piccirillo JF. The efficacy of surgical modifications of the upper airway in adults with obstructive sleep apnea syndrome. *Sleep* 1996; **19**:156–177.
- 12 Schwartz AR, Gold AR, Schubert N, Stryzak A, Wise RA, Permutt S, Smith PL. Effect of weight loss on upper airway collapsibility in obstructive sleep apnea. *Am Rev Respir Dis* 1991; **144**(Pt 1):494–498.
- 13 Li HY, Lee LA. Relocation pharyngoplasty for obstructive sleep apnea. *Laryngoscope* 2009; **119**:2472–2477.