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Palatopharyngeal sling: A new technique in treatment of velopharyngeal insufficiency

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KEYWORDS

Palatopharyngeal sling;
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Pharyngeal flap;
Sphincter
pharyngoplasty

Summary

Objective: (a) Pharyngeal flap and sphincter pharyngoplasty are the procedures most frequently chosen by craniofacial surgeons for surgical management of velopharyngeal insufficiency. Both operations may be complicated by obstructive breathing and even sleep apnea. (b) The purpose of this study is to evaluate the efficacy of a palatopharyngeal sling in the treatment of velopharyngeal insufficiency in cases with weak palatal mobility and its effect on breathing.

Methods: Seventeen cases of post-palatoplasty velopharyngeal insufficiency were subjected to treatment by palatopharyngeal sling. This sling, created by elevation of bilateral myomucosal flaps formed of palatopharyngeus and superior constrictor muscles, passed through palatal split, sutured together and to a raw area on the oral surface of the soft palate. Pre- and post-operative evaluation was carried out by perceptual speech analysis and flexible nasopharyngoscopy. Polysomnography was used to assess the effect of the operation on breathing.

Results: Complete closure was achieved in 13 cases (76.5%) while 4 cases showed incomplete closure (2 of them showed improvement when compared with the pre-operative video). The overall improvement of speech and velopharyngeal closure was 88.2%. Polysomnography showed no obstructive breathing.

Conclusions: Palatopharyngeal sling is a useful technique for correction of velopharyngeal insufficiency in cases with little palatal motion and it carries no risk of obstructive sleep apnea.

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1. Introduction

Velopharyngeal insufficiency (VPI) is the inability to completely close the velopharyngeal port during speech. The resultant leakage of air into the nasal

cavity during speech can cause hypernasal vocal resonance and nasal emissions [1].

The effect of VPI on speech and resonance ranges from mild speech distortion to a catastrophic disruption of speech intelligibility, leading to breakdown of the ability to communicate verbally [2].

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The most common cause of VPI is the palatal cleft even after repair. The frequency of hypernasality after cleft palate repair that may need secondary surgery varies in different literatures between 15 and 45% [3].

Surgical techniques available to correct VPI are: palatal push back, posterior pharyngeal wall augmentation (obtained for example by Teflon injections which are not longer used), posterior pharyngeal flaps, or sphincter pharyngoplasty. The common goal of these surgical techniques is to create a permanent partial obstruction of the velopharyngeal space in order to correct hypernasal speech [4].

Posterior pharyngeal flap is created by suturing a superior, or more rarely an inferior posterior pharyngeal wall flap to the free side of the soft palate leaving a lateral port on either side for breathing [5]. This method is ideal for patients with sagittal or circular closure pattern with good lateral wall motion which is necessary for closure of the lateral ports [6].

Sphincter pharyngoplasty is created by elevation of bilateral myomucosal flaps from the lateral pharyngeal wall to be inserted into an incision on the posterior pharyngeal wall. This obturates the central and lateral portions of velopharynx and it is used in patients with coronal closure pattern and good palatal motion [7].

Pharyngeal flap and sphincter pharyngoplasty remain the procedures most frequently chosen by craniofacial surgeons for surgical management of VPI, whether associated with unsuccessful cleft palate repair or in other situations. Neither operation gives uniformly successful speech results, and both can have negative consequences. Obstructive sleep apnea seems to be more frequently, if not almost exclusively, associated with pharyngeal flap surgery. However, many consider pharyngeal flap to be a more effective procedure for correcting VPI, particularly in severe cases [1].

This study presented a new method for the treatment of VPI in cases with weak palatal mobility in which the medial part of palatopharyngeus together with the lateral part of superior constrictor muscles inserted into the levator palati muscles bilaterally and elevating the soft palate upwards like a sling.

The aim of this study is to assess the efficacy of this new method in the treatment of VPI.

2. Methods

This study was conducted on 17 patients who complained of hypernasal speech after cleft palate repair with failed speech therapy to correct the

problem. Eleven males and six females, their age ranged between 4.5 and 12 years with a mean age of 7 years and 2 months. All patients were collected from the ENT outpatient clinic of Children Hospital of Cairo University in the period from July 2003 to February 2006. All children had completely closed previous cleft with no gaps or fistulae. Informed consents were obtained from the parents of the patients and the principles outlined in the Declaration of Helsinki were followed.

All patients were subjected to the following:

2.1. Pre-operative assessment

- General examination to exclude any other congenital anomaly.
- Full ENT examination and history taking.
- Assessment of velopharyngeal function and speech:
 - *Perceptual speech resonance evaluation*: this was carried out by a phoniatrician. According to Sell and Grunwell, a four-point scale (normal, mild, moderate and severe) was used for hypernasality. This measure was chosen because it contains the parameters that had been used successfully in a national U.K. audit [8].
 - *Flexible nasopharyngoscopy*: to see the velopharynx, the size and site of gap and the mobility of different velopharyngeal walls. The patients were asked to repeat the word (key) during endoscopy. Cases with weak palatal mobility were selected to be participants in this study. The data for each individual patient were recorded on a videotape for post-operative review and comparison.

2.2. Operative technique

- Under general anesthesia with oral endotracheal intubation, a Dingman mouth gag is introduced. The posterior tonsillar pillar and the lateral part of the posterior pharyngeal wall are injected with saline in adrenaline (1:2,00,000). The soft palate is injected as well.
- The palate is retracted with a uvula retractor. Two parallel vertical incisions are made, one at the medial part of the posterior faucial pillar and the other at the lateral part of the posterior pharyngeal wall. Both incisions are connected with a transverse one at the level of the lower pole of the tonsil. The incisions are carried out bilaterally including muscles and their overlying mucosa.
- The two lateral flaps are superiorly based myomucosal flaps, 1–1.5 cm in width. They include the medial part of the palatopharyngeus and the lateral part of superior constrictor muscles (Fig. 1A).

- Two vertical incisions in the lateral part of the soft palate (midway between the posterior end of hard and the posterior end of soft palate), these incisions are deepened to include all layers of the soft palate (splitting the palate). Another transverse incision connecting both vertical incisions is made. The transverse incision includes oral mucosa only that is elevated anterior and posterior to create a raw surface (Fig. 1B).
- Each palatopharyngeal flap is delivered through the palatal split. They are placed in the raw area created previously in the oral surface of the soft palate. Both flaps are sutured together and to the edges of the mucosa anterior and posterior to them using vicryl 4-0 sutures (Figs. 1C and 2).
- The donor site and the palatal split are closed.
- Now we have a U-shaped sling passing from the posterior pharyngeal wall through the palatal tissue to the oral surface of the soft palate, and the muscles of the flap become in a direct contact with the levator muscle.

2.3. Post-operative evaluation

All patients were followed up for 6 months and they were sent 1 month post-operatively for speech therapy. The velopharyngeal function and speech were assessed again at the end of the follow up period by perceptual speech analysis and flexible nasopharyngoscopy. The post-operative data were collected and tabulated against the pre-operative findings. Sleep studies were done for all patients at the end of the follow up period using overnight polysomnography to detect any obstructive episode.

2.4. Statistical method

The data were coded and entered using statistical package SPSS version 12 for windows. Data were



Fig. 2 The flaps passed through palatal split created bilaterally and sutured together and to the recipient raw area on the oral surface of the soft palate.

summarized using frequency and percentage for qualitative variables. Comparison between the pre- and post-operative speech results was done using Pearson Chi-square correlation test with a level of significance of $p < 0.05$.

3. Results

This study was conducted on 17 patients who complained of post-palatoplasty velopharyngeal insufficiency. As regards the perceptual speech analysis, the pre- and post-operative data were compared (Table 1), 9 cases showed complete improvement of their speech (6 were mild and 3 were moderate), 5 cases showed mild hypernasal speech (4 were moderate and 1 was severe), 3 cases showed moderate hypernasal speech (1 of them was severe and the other 2 were moderate with no improvement after surgery). The overall improvement in speech was 88.2%. The comparison between the pre- and post-

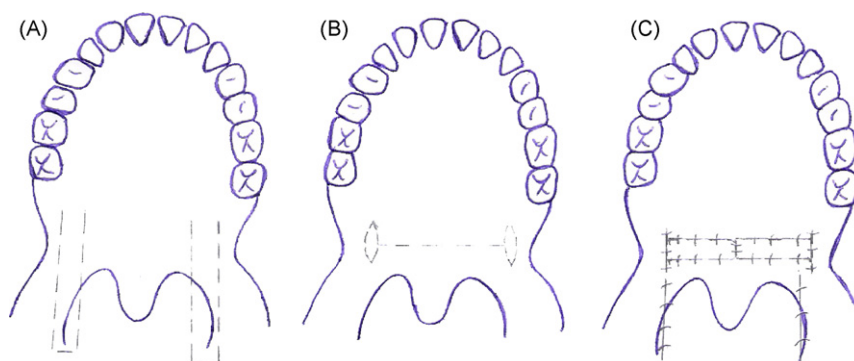


Fig. 1 Surgical technique for the palatopharyngeal sling. (A) Incisions marked to elevate bilateral palatopharyngeal muscle flaps (formed of palatopharyngeal muscle and part of superior constrictor muscle with their overlying mucosa). (B) Splitting the palate bilaterally and creation of a raw area on the oral surface of the soft palate. (C) Muscle flaps sutured together, end-to-end, and sutured into the recipient defect.

Table 1 Comparison between the pre and post-operative resonance (hypernasality)

	Pre-operative	Post-operative
Normal	0 (0)	9 (53)
Mild	6 (35)	5 (29)
Moderate	9 (53)	3 (18)
Severe	2 (12)	0 (0)

Values in parentheses are in %.

operative results was statistically significant ($p = 0.003$).

As regards the results of flexible nasopharyngoscopy (Fig. 3), complete closure was achieved in 13 cases (76.5%) while 4 cases showed incomplete closure (2 of them showed improvement when compared with the pre-operative video). The overall improvement of velopharyngeal closure was 88.2%.

No obstructive episodes were recorded in polysomnograms.

4. Discussion

Palatopharyngeal sling is a new surgical method designed to elevate the soft palate upwards. It is formed of two myomucosal flaps similar to the flaps of sphincter pharyngoplasty but they passed through palatal splits created bilaterally to meet each other on a raw area on the oral surface of the soft palate producing together a U-shaped sling. In the sphincter pharyngoplasty operation as mentioned by many authors, both flaps attached together and sutured in a raw area in the posterior pharyngeal wall in order to close the velopharynx against the palate [9,10]. Elevation of the soft palate by this new technique would facilitate velopharyngeal closure by decreasing the distance between it and the posterior pharyngeal wall.

Suturing of the flaps to the oral surface of the soft palate is more accessible and easier than suturing them to the posterior pharyngeal wall as in sphincter pharyngoplasty operation. This point adds to the advantages of this new technique.

In this technique, we included the palatopharyngeus muscle in the flap for two reasons: firstly, its antagonistic action to the levator palati as suggested by Georgantopoulou et al. dividing and transposing the palatopharyngeus muscles would then allow the levators to act unopposed, thus resulting in increased velar elevation [9]. Secondly, not to leave a lateral gutter between the sling and the lateral pharyngeal wall, if the flap was formed of superior constrictor muscle only, this gutter may be a site for mucus accumulation.

In this study the incidence of speech improvement and velopharyngeal closure was 88.2% which is matched with results obtained by many authors using pharyngeal flap and those using sphincter pharyngoplasty [2,7,10,11].

No obstructive episodes were recorded in patients subjected for this technique.

Sloan in his article about the pharyngeal flap and sphincter pharyngoplasty, concluded that obstructive sleep apnea seems to be more frequently, if not almost exclusively, associated with posterior pharyngeal flap surgery [1]. However, Witt et al. [12] demonstrated that airway dysfunction can follow sphincter pharyngoplasty. They retrospectively studied 58 patients who underwent sphincter pharyngoplasty. A total of eight patients (14%) had airway dysfunction. Of those eight patients, five had Pierre Robin sequence. Raymond et al. [4] and de Serres et al. [13] advised sphincter pharyngoplasty as it has lower risk of obstructive sleep apnea.

Finally, we conclude that palatopharyngeal sling is a useful technique for correction of VPI in cases with little palatal motion and it carries no risk of obstructive sleep apnea.

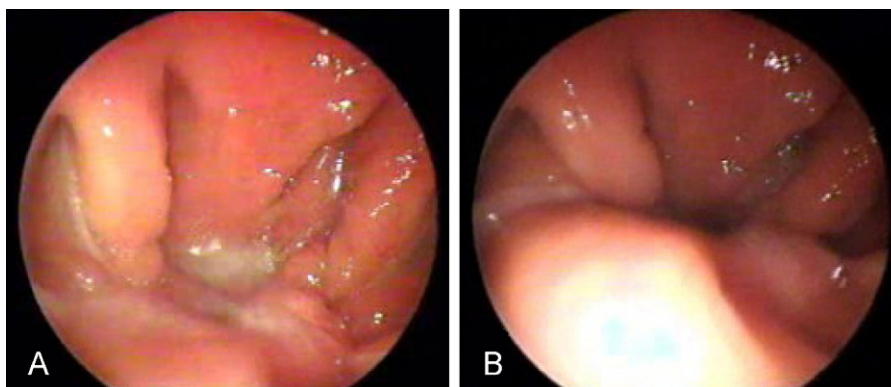


Fig. 3 The velopharynx seen by flexible nasopharyngoscopy. It shows the difference in palatal elevation between (A) pre-operative and (B) post-operative, as well as bubbles seen in the pre-operative endoscopy.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.ijporl.2007.10.004](https://doi.org/10.1016/j.ijporl.2007.10.004).

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