

Effectiveness of the Superiorly Based Pharyngeal Flap in Treating Velopharyngeal Insufficiency

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Background: Velopharyngeal insufficiency (VPI) is a condition characterized by failure of the posterior part of the soft palate to reach the pharyngeal wall and separate the nasopharynx from the oropharynx during speech and swallowing. VPI may persist following cleft palate repair. This study aimed to determine the outcomes of the superiorly based pharyngeal flap to treat VPI post cleft palate repair.

Methods: A retrospective cohort study included patients with VPI post cleft palate repair who underwent secondary speech surgery. The criteria were based on clinical symptoms, physical examination, nasometry, and videofluoroscopy/nasoendoscopy findings. Data were analyzed by using SPSS program, version 22.0. A *P* value less than 0.05 was considered significant.

Results: Thirty-five patients were identified. VPI was reduced to 14.3% postoperatively. Before the surgery 25.7% of the patients had severe hypernasality, 68.6% had moderate hypernasality, and 5.7% had mild hypernasality. After the surgery, only 8.6% of the patients still had severe hypernasality, 22.9% had moderate hypernasality, 57.1% had mild hypernasality, and hypernasality became absent in 11.4%. Articulation disorders were present in 91.4% of patients before surgery, and decreased to 71.4% postoperatively. Speech intelligibility improved postoperatively in comparison with preoperative findings.

Conclusion: The present study concluded that the superiorly based pharyngeal flap was successful in treating VPI that persisted post cleft palate repair. (*Plast Reconstr Surg Glob Open* 2022;10:e4696; doi: [10.1097/GOX.0000000000004696](https://doi.org/10.1097/GOX.0000000000004696); Published online 13 December 2022.)

INTRODUCTION

Velopharyngeal insufficiency (VPI) is a condition characterized by failure of the posterior part of the soft palate to reach the pharyngeal wall and separate the nasopharynx from the oropharynx during swallowing and speech. This creates problems such as air escaping from the nose, which causes hypernasality in speech, and food leaking into the nasal cavity.^{1,2} This can have a negative impact on social interactions and poor self-esteem, especially at a young age.^{3,4}

Palatoplasties have witnessed great technical changes, with greater attention given to the importance of closure of the anatomical and functional structure, allowing for a more optimal success rate of cleft palate treatment.⁵ Some studies mentioned that VPI may persist after palatal repair

at a rate between 20% and 30%, requiring treatment and, in some cases, surgical intervention.^{6,7}

In reference to the American Cleft Palate Craniofacial Association recommendations, instrumental assessment of velopharyngeal function is required for all patients with resonance disorders. These include instruments such as videofluoroscopy, nasopharyngoscopy, aerodynamic measures, and nasometric studies.⁸ Nasality can be assessed using a computer based nasometer to provide data about the relative amount of nasal resonance in speech. Nasalance scores usually follow a scoring system that identifies 20% or less as no hypernasality, 20% to 30% as mild, 40% to 59% as moderate, and 60% and above as severe hypernasality.⁹

Several surgical techniques are used to treat VPI. The most commonly used are pharyngeal flap reconstruction, sphincter pharyngoplasty, and augmentation of the posterior pharyngeal wall.¹⁰ For most orofacial surgeons, the superiorly based pharyngeal flap continues to be the more favorable option.¹¹ The aim of the procedure is to improve the communication between nasal and oral cavity during swallowing and speech.

Possible complications include fistula formation, VPI persistence, airway obstruction, obstructive sleep apnea, speech abnormalities, and dehiscence at the flap site.¹² To our knowledge, there have been few studies investigating

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the outcome of pharyngeal flap as secondary speech surgery for treating velopharyngeal insufficiency from Saudi Arabia and Middle East region. Our study aimed to evaluate the effectiveness of the superiorly based pharyngeal flap to treat persistent VPI post cleft palate repair.

MATERIALS AND METHODS

A retrospective cohort study was carried out among patients who had persistent VPI after cleft palate repair and underwent secondary speech surgery. The study was conducted at King Faisal Specialist Hospital & Research Centre, Riyadh, Saudi Arabia. After approval of the institutional review board, data were collected from medical records of patients who visited the cleft clinic at King Faisal Specialist Hospital & Research Centre between June 1999 and June 2018. Patients diagnosed with cognitive disabilities or syndromes, or who had incomplete medical records of pre- or postoperative evaluations were excluded.

Demographic data (including gender and age) were obtained. The criteria we used to diagnose patients with VPI were based on clinical symptoms, physical examination with perceptual evaluation, and instrumental assessments. Videofluoroscopy and/or nasoendoscopy were used before and after secondary speech surgery to determine the presence or absence of VPI. Patients’ nasality was assessed using a nasometer. Nasality was classified as no hypernasality and mild, moderate, and severe hypernasality. Articulation disorder was identified as present if the patient had omission, substitution, and/or distortion of speech sounds at word or spontaneous speech levels. Speech intelligibility was subjectively judged by a speech and language pathologist at spontaneous speech levels.

OPERATIVE TECHNIQUE

The technique used for treatment of VPI in all patients was the superiorly based pharyngeal flap. A midline incision is made to divide the soft palate to the posterior nasal spine. On the nasal surface, book flap incisions are made bilaterally, allowing for the lateral ports to be lined with mucous membranes. The superiorly based pharyngeal flap is designed as wide as possible and raised to the prevertebral fascia. The free edge of the pharyngeal flap is fixed to the posterior edge of the soft palate. Closure is followed down between the edge of the flap and the nasal edges of the soft palate. The flap donor site is closed primarily. The two flaps from the soft palate are then used to cover the raw surface of the pharyngeal flap. Finally, the oral side of the soft palate is closed.

The data were analyzed by using SPSS program, version 22.0, using descriptive statistics. For the quantitative data, continuous variables in mean ± SD were presented. For the qualitative data, number and percentages were presented in tables. A P value less than 0.05 was considered significant.

RESULTS

Of the files reviewed, 35 patients met the inclusion criteria. The male-to-female ratio was similar, as 18 (51.4%) of the patients were women (Table 1). Age of patients at

Takeaways

Question: Is the superiorly based pharyngeal flap able to treat velopharyngeal insufficiency post cleft palate repair?

Findings: The superiorly based pharyngeal flap is an effective technique to reduce hypernasality from severe to mild and lessening articulation disorders rate.

Meaning: The superiorly based pharyngeal flap is effective in treating velopharyngeal insufficiency that persists after cleft palate repair.

Table 1. Demographic Data, Diagnosis, and Type of Surgery

	No. Sample Size (n = 35)
Gender	
Men	17 (48.6)
Women	18 (51.4)
Age at the time of surgery	
Range	5–56
Mean ± SD	15.1±9.1
Diagnosis	
VPI	35 patients
Type of surgery	
Pharyngeal flap (superiorly based flap)	35 patients

the time of surgery ranged from 5 to 56 years, with a mean ± SD of 15.1±9.1. The superiorly based pharyngeal flap was the technique used in all subjects. No operative complications were noted in any subjects.

Videofluoroscopy/nasoendoscopy showed VPI in all patients preoperatively (100%) (Figs. 1, 2). After surgery, videofluoroscopy/nasoendoscopy showed a significant decrease in VPI and was seen in only 14.3% of patients (Fig. 3). Articulation disorders were present in 91.4% of patients. After surgery, articulation disorders were decreased and seen in 71.4% of patients only (Fig. 4). Before surgery, 25.7% of the patients had severe hypernasality, 68.6% had moderate hypernasality, and 5.7% had mild hypernasality. After surgery, only 8.6% of the patients had severe hypernasality, 22.9% had moderate hypernasality, 57.1% had mild hypernasality, and hypernasality became absent in 11.4% (Fig. 5). Speech intelligibility ranged from 20 to 100 with

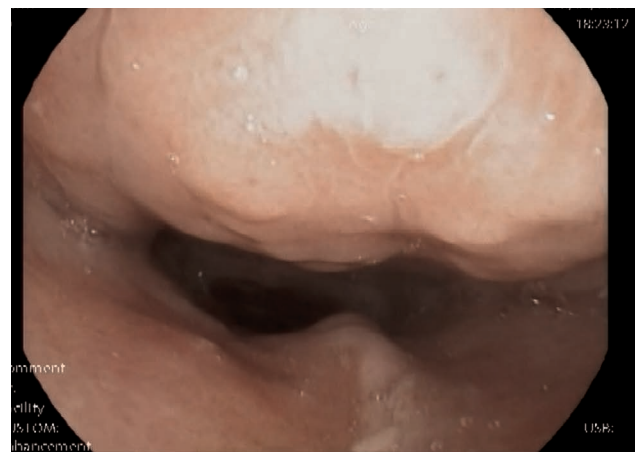


Fig. 1. Preoperative VP port opening.

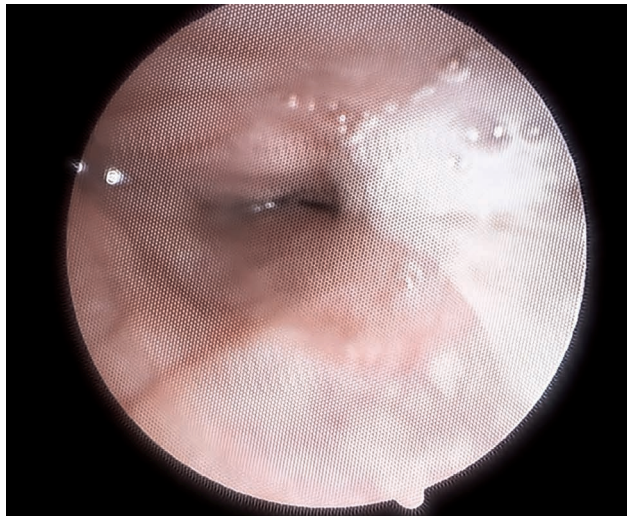


Fig. 2. Preoperative VP port closure.

a mean \pm SD (64.3 ± 17.4) before secondary speech surgery. This improved to a range from 30 to 100, with a mean \pm SD (80.4 ± 17.3) after surgery (Table 2).

DISCUSSION

VPI is an anatomical defect that can cause many complications, including nasal resonance, hypernasality, unclear or distorted articulation production, escape of air through the nose during speech, and aberrant facial movements.¹³

VPI procedures are divided into palatoplasties (which aim to increase the length of the palate), pharyngoplasties (which reduce the velopharyngeal space), and palatopharyngoplasties (a combination of the two previously mentioned procedures).¹⁴

Dailey et al showed that the pharyngeal flap was effective in reducing hypernasality ratings in patients with VPI post cleft lip/palate repair.¹⁵ Sullivan et al confirmed that the tailored superiorly based pharyngeal flap is highly effective in treating hypernasality post cleft palate repair in nonsyndromic patients. Their postoperative results showed higher rates of normal resonance (76%) and hyponasality (11%), with no severe hypernasality reported.¹⁶ Similarly, our study results confirm significant improvement in hypernasality ratings. Postoperatively, moderate hypernasality rate was 22.9% and mild hypernasality rate was 57.1%, with normal resonance seen in 11.4% of patients.

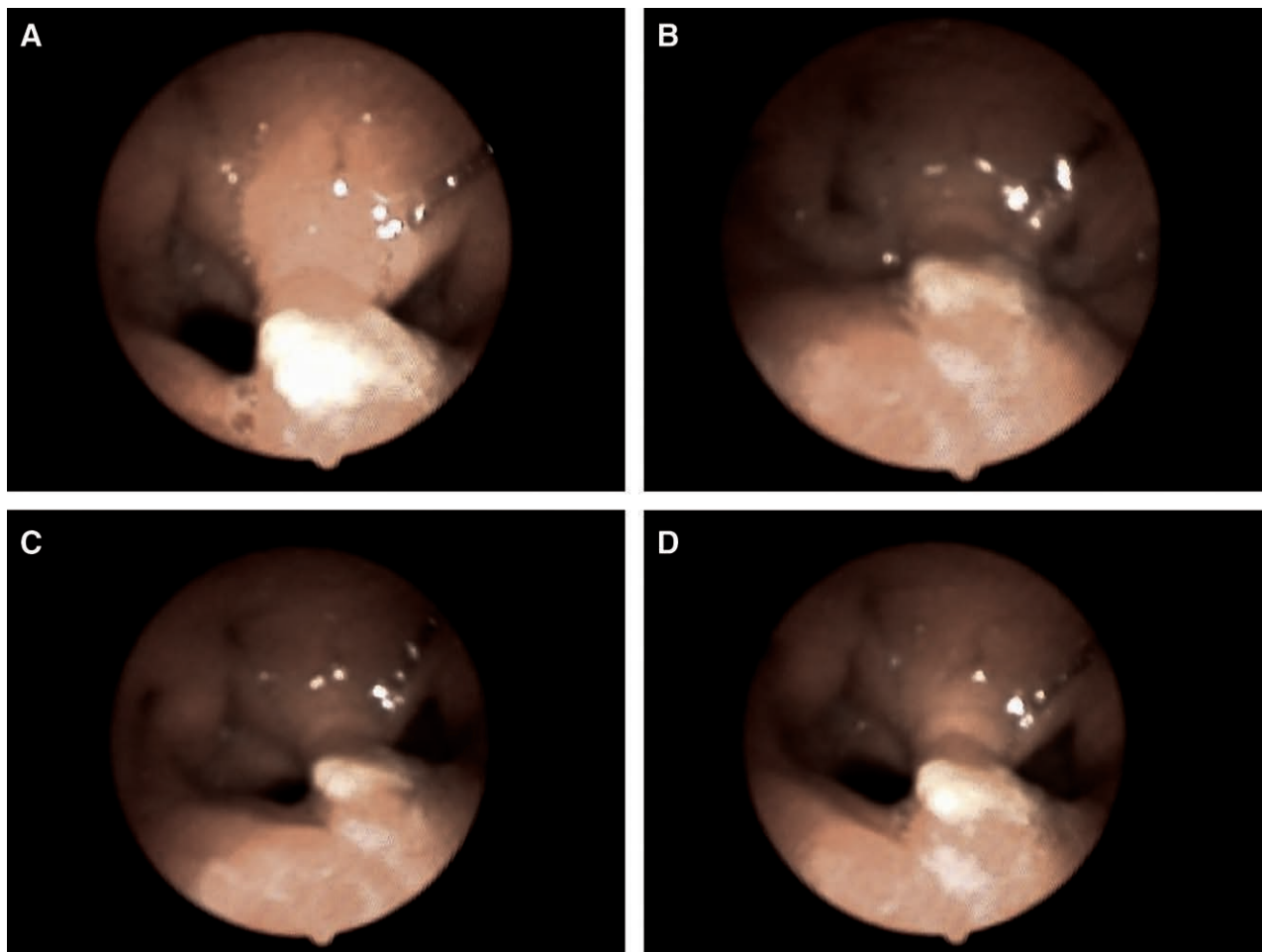


Fig. 3. Postoperative pharyngeal flap: (A) during rest, (B) during swallowing, (C) during /a/i/u/ pronunciation, (D) during /sh/ pronunciation.

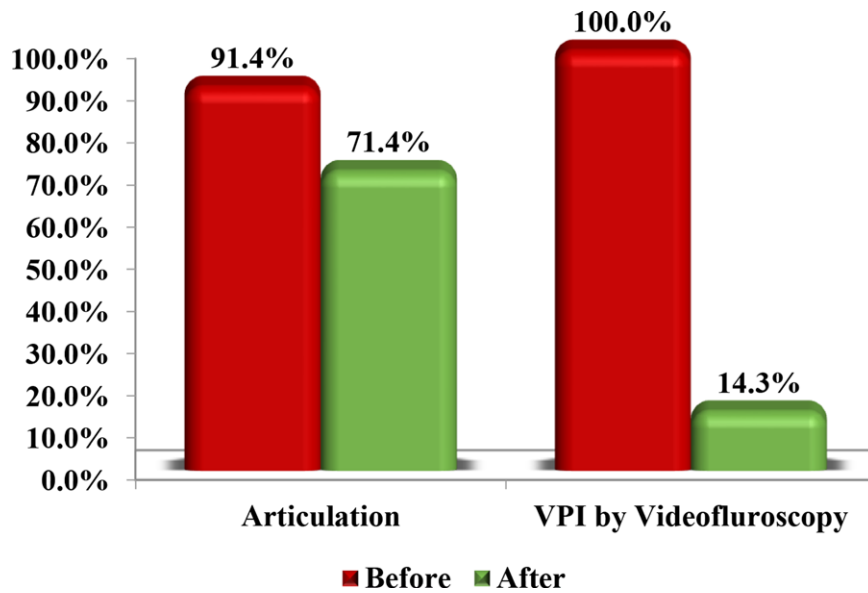


Fig. 4. Percentage of articulation disorders and VPI seen in videofluoroscopy/ nasoendoscopy before and after surgery.

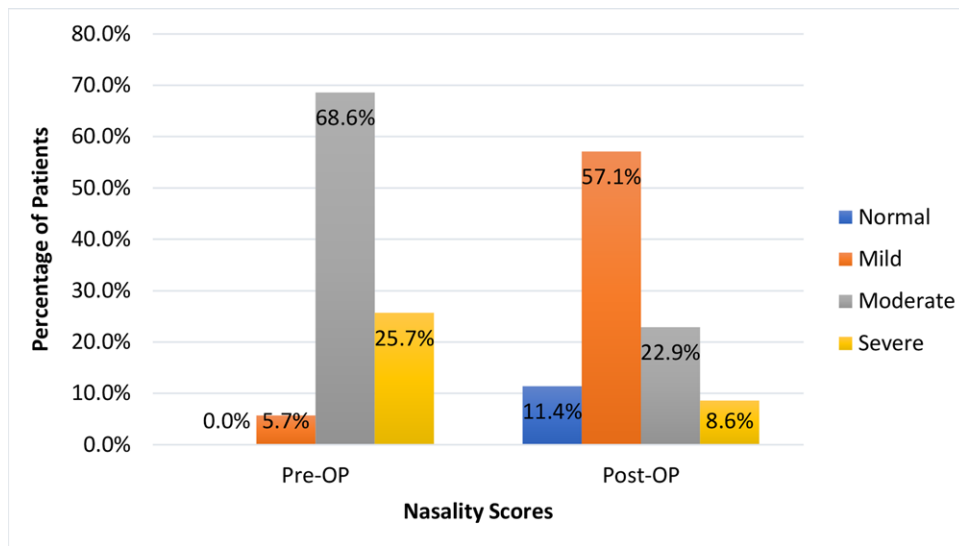


Fig. 5. Nasality scores before and after surgery.

Table 2. Percentage of Articulation Disorders among Patients, Nasality and Intelligibility Scores, and Videofluoroscopy/ Nasoendoscopy Findings Pre and Postoperatively

	Pre	Post	P
Articulation disorders			
Present	32 (91.4%)	25 (71.4%)	0.016
Absent	3 (8.6%)	10 (28.6%)	
Nasality scores			
Normal resonance	0 (0%)	4 (11.4%)	0.000
Mild hypernasality	2 (5.7%)	20 (57.1%)	
Moderate hypernasality	24 (68.6%)	8 (22.9%)	
Severe hypernasality	9 (25.7%)	3 (8.6%)	
Videofluoroscopy/nasoendoscopy (VPI/no VPI)			
VPI	35 (100%)	5 (14.3%)	0.0001
No VPI	0 (0%)	30 (85.7%)	
Intelligibility			
Range	20–100	30–100	
Mean ± SD	64.3 ± 17.4	80.4 ± 17.3	0.000

Samoy, et al evaluated the effectiveness of pharyngoplasty in treating VPI and articulation disorders. Twelve months after the surgery, VPI was resolved in 25 patients (42.4%).¹⁷

Ysunza et al examined the velopharyngeal (VP) sphincter in patients with VPI by using nasoendoscopy and multi-view videofluoroscopy. After pharyngeal flap surgery, results showed complete closure of VP sphincter and resolution of VPI in 22 patients (88%).¹⁸ Our study showed similar resolution of VPI in 35 patients after the surgery (85.7%).

Sullivan et al evaluated articulation disorder rates in VPI patients before and after pharyngeal flap surgery. Fifty-eight patients (61%) had articulation disorders before surgery, which were reduced to only 14 patients (18%) postoperatively.¹⁶ Samoy et al also found a drop in articulation disorders from 77.4% to 51% after surgery.¹⁷ Our study also demonstrated a drop in the rate of articulation disorders from 91.4% preoperatively, to 71.4% postoperatively.

Fukushiro and Trindade evaluated the effectiveness of the pharyngeal flap in treating residual VPI post cleft lip/palate repair. The preoperative mean nasalance score was 42%, which decreased to 27% postoperatively. After surgery, normal nasalance score and complete VP closure were seen in 55% and 50% of patients, respectively. Patients who underwent speech therapy had the highest improvement rate.¹⁹ In our study, nasalance scores and speech therapy effectiveness were not measured.

Several limitations were faced during the course of this study. Many participants were excluded due to incomplete medical records. We did not assess the effectiveness of the surgery among syndromic patients or patients with other medical comorbidities. The long-term outcomes of the surgery and the effectiveness of speech therapy sessions could not be assessed due to loss of follow-up. We could not compare different surgical techniques to the superiorly based pharyngeal flap as all our patients had pharyngeal flap surgery.

Future research about the long-term outcomes of different surgical techniques are needed. The impact of speech therapy sessions including number, timing, type, and quality of sessions provided by the speech and language pathologist needs to be studied thoroughly, as this might have a positive impact on surgery outcomes.

CONCLUSIONS

This study concluded that the superiorly based pharyngeal flap was effective in treating velopharyngeal incompetency that persisted after cleft palate repair by reducing hypernasality from severe to mild and lessening articulation disorders.

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