



8-31-2024

Section: Plastic surgery

Speech Outcomes of Velopharyngeal Insufficiency after correction by Sphincter Pharyngoplasty versus Palatal Lengthening: A Comparative Study

Tarek Mahmoud Elbanoby

Department of Plastic Surgery and Burn, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Tarek El Bastawesy Zayed

Department of Plastic Surgery and Burn, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Ahmad Masoud Awad

Department of Plastic Surgery and Burn, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt,
aamasoud9@gmail.com

Follow this and additional works at: <https://aimj.researchcommons.org/journal>



Part of the [Medical Sciences Commons](#), [Obstetrics and Gynecology Commons](#), and the [Surgery Commons](#)

How to Cite This Article

Elbanoby, Tarek Mahmoud; Zayed, Tarek El Bastawesy; and Awad, Ahmad Masoud (2024) "Speech Outcomes of Velopharyngeal Insufficiency after correction by Sphincter Pharyngoplasty versus Palatal Lengthening: A Comparative Study," *Al-Azhar International Medical Journal*: Vol. 5: Iss. 8, Article 3.
DOI: <https://doi.org/10.58675/2682-339X.2579>

This Original Article is brought to you for free and open access by Al-Azhar International Medical Journal. It has been accepted for inclusion in Al-Azhar International Medical Journal by an authorized editor of Al-Azhar International Medical Journal. For more information, please contact dryasserhelmy@gmail.com.

Speech Outcomes of Velopharyngeal Insufficiency after correction by Sphincter Pharyngoplasty versus Palatal Lengthening: A Comparative Study

Tarek M. Elbanoby, Tarek E. Zayed, Ahmad M. Awad *

Department of Plastic Surgery and Burn, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: Velopharyngeal Insufficiency is a medical condition characterized by incomplete closure of the velopharyngeal port, which is crucial for successful sphincter pharyngoplasty. The procedure involves raising and lifting bilateral palatopharyngeus myomucosal flaps off the posterior tonsillar pillar.

Aim: To compare speech outcomes of velopharyngeal Insufficiency after correction by sphincter pharyngoplasty versus palatal lengthening by double buccal flap.

Patients and methods: This randomized control prospective research was performed on 16 cases with post-cleft palate at AL-Azhar University hospital. There were two groups of patients, which were as follows: Group A: 8 cases with palatal lengthening (PL) by double buccal flap and Group B: 8 cases with sphincter pharyngoplasty (SP).

Results: Revision rate was less frequent in PL group compared SP group but without statistically significant variance. According to the findings of our investigation, there was no discernible distinction between the groups regarding hypernasality, pharyngealization of fricatives, or oral and nasal sentences. Moreover, hypernasality, pharyngealization of fricatives, and oral and nasal sentences significantly decreased in each of the collections postoperatively. Also, our results demonstrated that there was no significant variance amongst the groups concerning velopharyngeal (VP) closure grade. While there was a significant increase in grade in both groups postoperatively.

Conclusion: Regarding our results, sphincter pharyngoplasty versus palatal lengthening by double buccal flap have similar results of speech outcomes of velopharyngeal Insufficiency after correction by surgery on the pharynx's sphincter.

Keywords: Sphincter pharyngoplasty, Velopharyngeal insufficiency, Palatal lengthening

1. Introduction

Velopharyngeal Insufficiency is diagnosed when the velopharyngeal port, which connects the oro- & nasopharynx, is not completely closed. While the palate pharyngeal muscle & superior constrictor muscle approach the pharyngeal wall in a midline trajectory, the levator veli palatine muscle raises the velum in an upward & retrograde direction during phonation. If, for various reasons, air flows partially throughout the nostrils instead of passing entirely via the oral cavity throughout phonation, this can disrupt the normal articulation & resonance of speech.¹

The operative procedure of treatment of velopharyngeal Insufficiency is Furlow palatoplasty (double opposing Z-plasty), Overlapping traveler pharyngoplasty with oral Z-plasty, Pharyngeal flap, Sphincter

pharyngoplasty, Palatal Lengthening with buccal flap.²

Sphincter pharyngoplasty was performed by elevating my mucosal flaps from the posterior aspect of the posterior tonsillar pillar that was positioned superiorly on both sides. A transverse incision was performed at the level of the first cervical vertebra via the posterior aspect of the superior constrictor. Following this, the membranes were affixed to the transverse incision in a subjective manner, with the extent of overlap being assessed. The degree of overlap between the two openings was indicative of the tightness of the sphincter. Preoperatively, vigorous movement of the palate would allow for the utilization of a narrow membrane with reduced overlap. In the absence of significant palatal motion, a broader flap was utilized to harvest, thereby optimizing the overlap.³

Accepted 21 August 2024.

Available online 31 August 2024

* Corresponding author at: Plastic Surgery and Burn, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: aamasoud9@gmail.com (A. M. Awad).

<https://doi.org/10.58675/2682-339X.2579>

2682-339X/© 2024 The author. Published by Al-Azhar University, Faculty of Medicine. This is an open access article under the CC BY-SA 4.0 license (<https://creativecommons.org/licenses/by-sa/4.0/>).

The buccinator Myo mucosal flap, which has an axial pattern and contains buccinators and orbicularis oris muscle fiber in part, is covered by buccal mucosa. It is a skeletonized version of the inferiorly pedicled facial artery and vein. A posterior displacement of the entire soft palate was performed, encompassing the nasal layer, muscle complex, & oral mucosa in the direction of the posterior pharyngeal wall. By doing so, an elliptical defect between the hard & soft palate was formed. Following this, an incision was made across the buccal mucosa in order to reflect the flap; the flap's apex was directed toward the commissure, & its base was positioned at the retromolar trigone. Upon reaching the commissure, the flap underwent an anterior narrowing and was situated a minimum of two millimeters posterior to the opening of Stensen's duct.⁴

The aim of this work was to compare speech outcomes of velopharyngeal Insufficiency after correction by sphincter pharyngoplasty versus palatal lengthening by a double buccal flap.

2. Patients and methods

This randomized control prospective research was performed on 16 cases of post-cleft palate patients at the AL-Azhar University Hospital. The individuals were separated into two groups: Group A cases with Palatal Lengthening by double buccal flap and Group B: 8 cases with Sphincter pharyngoplasty.

Inclusion criteria: Age: 3.5 - 14 years, sex: male and female cases and post cleft palate repair

Exclusions criteria: Revision and recurrent cases, Fistula, adenoid, tonsil, syndromic, and old age

Ethical Consideration: The protocol for the research was presented to the Institutional Review Board, which is located within the Department of Plastic and Reconstructive Surgery at AL-Azhar University, for approval. Informed written and the participants who were sharing in the research were all required to give their consent verbally, including the hazards of surgery, Donor site morbidity, and flap failure. Confidentiality & personal privacy were upheld throughout the investigation at all levels.

Methods

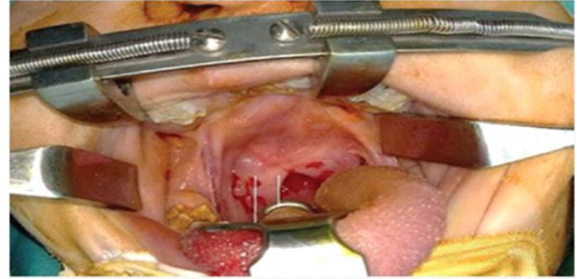
Preoperative: History taking, examination, investigations (nasendoscopy and nanometer), and speech analysis

Operative techniques:

Sphincter pharyngoplasty:

A sphincter pharyngoplasty was conducted by raising bilateral palatopharyngeus myomucosal flaps to construct a functional velopharyngeal sphincter. The flaps were raised and inserted into a mucosal incision made along Passavant's ridge, as high as possible, in the back of the throat next

to the adenoid pad. The central port was created by bringing the flaps together along the midline, with the flexible soft palate edge & mucosal surfaces of the bilateral posterior tonsillar pillars forming its borders.



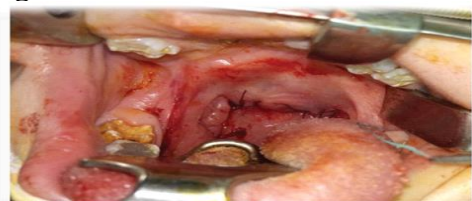
(A) An intraoperative view showing the sphincter pharyngoplasty flap design with a lateral and medial limb incision was performed over the mucosa of the rear tonsillar pillar. Subsequently, the contralateral flap was generated following a comparable design.



(B): my mucosal flaps are elevated from the posterior tonsillar pillar



(C): Transverse incision on the posterior pharyngeal wall.

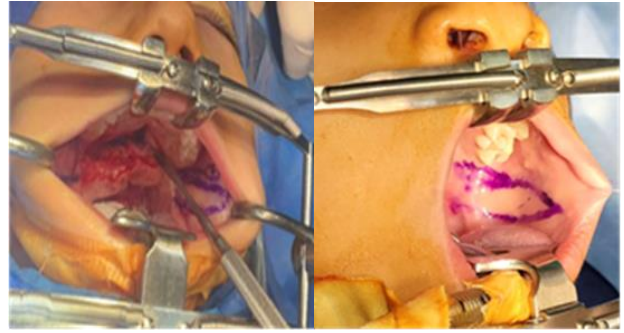


(D): An intraoperative view showing the superiorly based flaps (1) were transposed 90 over the demoralized recipient bed and sutured with vicryl sutures to the inferior limb of the transverse incision. The other side flap (2) was transposed superiorly to the other flap and sutured at its apex, followed by suturing of the two flaps (1 and 2) together, creating a transverse muscular bulge.

Figure 1. Sphincter pharyngoplasty

The Double-Opposing Buccal Flap Procedure for Palatal Lengthening:

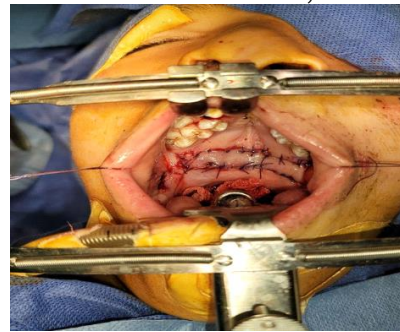
The individuals were placed in the conventional palatoplasty position. Utilizing a Dingman mouth mask facilitated surgical exposure. Lidocaine 0.25 percent was used to infiltrate the buccal mucosa, while epinephrine 1:400,000 was administered topically. The primary incision was made in a transverse direction across the soft palate, precisely 2.5 mm posterior to the junction of the hard palate and soft palate. Subsequently, the atypical attachments of muscles were liberated from their connection to the posterior hard mandible. Furthermore, every anomalous scar tissue originating from the posterior hard palate was eliminated. After being fully expelled from the hard palate, the soft palate proceeds in a posterior direction. The base of buccal flaps was subsequently delineated at the retromolar trigone. The buccal flaps had a basal width ranging from seventeen to eighteen mm. The flap design becomes more pronounced in the anterior direction as it nears the commissure. When designing flaps, particular care should be taken to position the pedicle within the retromolar trigone in order to prevent possible gnawing on the pedicle. Subsequently, the membrane was raised from the commissure to the retromolar trigone. A thickness of approximately ninety percent of the buccinator muscle was incorporated, thereby preserving the integrity of the anterior ten percent of the muscle & facial artery. In contrast to the facial artery musculomucosal flap with an axial pattern, this flap was arbitrarily devised. To close the nasal side, one membrane was subsequently interposed in the space among hard & soft palates. A similar procedure was followed to intersect the second flap, & the nasal flap's underside was adhered to it, effectively sealing the oral side. As an additional benefit to reducing inactive space, tacking sutures hinder flap tubing. The average degree of soft-palate lengthening was illustrated. Subsequently, the donor site was systematically closed in multiple layers using absorbable sutures, except for the pedicled portion of the flap at its base, which is adjacent to the retromolar trigone and measures seventeen to eighteen mm in width. At a later time, the buccal flap pedicles were subsequently separated. Furthermore, during splitting, the minor palatal fistula that was formed at the base of the membrane was sealed.



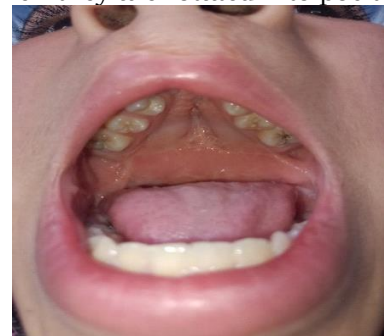
(A): (left) The incision posterior to the hard-palate/soft-palate junction is required. A 17-mm base is incorporated into the design of the buccal membrane at the retromolar trigone. (right) By making an incision, the soft palate is permitted to migrate posteriorly.



(B): The buccal membrane, which includes a segment of the buccinator muscle, is elevated.



(C): One side of the flaps forms the oral closure, while the other constitutes the nasal closure when they are rotated into position.



(D): 6-month postoperative

Figure 2. Double-Opposing Buccal Flap Procedure for Palatal Lengthening

Postoperative: follow-up on 1st day, oral care, soft diet, and analgesia

Evaluation: Speech after one month, three months, six months, and nine months, sleep disorder breathing, persistent velopharyngeal Insufficiency, operative time, and snoring

Data Management and Statistical Analysis

Using Microsoft Excel, data gathered over time, including fundamental clinical examination, laboratory investigation, & outcome measure data, were entered, coded, & analyzed. The information was subsequently transferred into version twenty of Statistical Package for the Social Sciences software in order to conduct the analysis. In order to determine the significance of the variances between qualitative & quantitative groups (represented by number & percentage, respectively, and mean \pm standard deviation, respectively), the following tests were applied: Pearson's correlation or Spearman's correlation. The p-value thresholds for significant and highly significant results were set at 0.05 and 0.001, respectively.

3. Results

Table 1 showed that was noted no statistically significant variance amongst two collections as regard sex & age.

Table 1. Demographic characteristics of the two studied collections.

	PL (N=8)	SP (N=8)	T / X ²	P
AGE (MONTHS) MEAN \pm SD	7.63 \pm 3.5	7.88 \pm 2.99	.478	.632
SEX				
Male	4 (50%)	5 (62.5%)	.254	.614
Female	4 (50%)	3 (37.5%)		

Table 2 demonstrated that was noted no significant variance amongst the collections concerning Velopharyngeal (VP) closure grade. Moreover, there was a significant increase in grade in both groups postoperatively.

Table (2): Velopharyngeal Closure grades distribution between the two groups.

	PL (N=8)			SP (N=8)			P
	Pre	Post 3	Post 6	Pre	Post 3	Post 6	
1	1 (12.5%)	0	0	1 (12.5%)	0	0	P1=.809 P2=.522 P3=.302
2	6 (75%)	0	0	5 (62.5%)	0	0	
3	1 (12.5%)	1 (12.5%)	0	2 (25%)	2 (25%)	1 (12.5%)	
4	0	7 (87.5%)	8 (100%)	0	6 (75%)	7 (87.5%)	
P	<0.001			<0.001			

P1: comparing preoperative between the two studied groups, P2: comparing 3 months postoperative between the two studied groups, P3: comparing 6 months postoperative between the two studied groups.

Table 3 demonstrated that was noted no significant variance amongst the collections

concerning hypernasality. Moreover, hypernasality significantly decreased in severity in both groups postoperatively.

Table 3. Hypernasality distribution between the two groups.

	PL (N=8)			SP (N=8)			P
	Pre	Post 3	Post 6	Pre	Post 3	Post 6	
NORMAL	0	6 (75%)	7 (87.5%)	0	5 (62.5%)	6 (75%)	P1=.59 P2=.58 P3=.522
MILD	0	2 (25%)	1 (12.5%)	0	2 (25%)	2 (25%)	
MODERATE	5 (62.5%)	0	0	6 (75%)	1 (12.5%)	0	
SEVERE	3 (37.5%)	0	0	2 (25%)	0	0	
P	<0.001			<0.001			

P1: comparing preoperative between the two studied groups, P2: comparing 3 months postoperative between the two studied groups, P3: comparing 6 months postoperative amongst the two studied collections.

Table 4 showed that there was no significant variance amongst the collections regarding pharyngealization of fricatives. Moreover, pharyngealization of fricatives presence significantly decreased in both groups postoperatively.

Table 4. Pharyngealization of fricatives distribution between the two groups.

	PL (N=8)			SP (N=8)			P
	Pre	Post 3	Post 6	Pre	Post 3	Post 6	
PRESENT	5 (62.5%)	1 (12.5%)	0	6 (75%)	2 (25%)	1 (12.5%)	P1=.95 P2=.522 P3=.302
ABSENT	3 (37.5%)	7 (87.5%)	8 (100%)	2 (25%)	6 (75%)	7 (87.5%)	
P	<0.001			<0.001			

P1: comparing preoperative between the two studied groups, P2: comparing 3 months postoperative between the two studied groups, P3: comparing 6 months postoperative amongst the two studied collections.

Table 5 showed that there was no significant variance amongst the collections regarding oral and nasal sentences. Moreover, oral and nasal sentences significantly decreased in both groups postoperatively.

Table (5): Nasometric evaluation of the two studied collections.

	PL (N=8)	SP (N=8)	T	P
ORAL SENTENCE				
PREOPERATIVE	21.5 \pm 4.99	22.75 \pm 3.58	.576	.574
POSTOPERATIVE	14.13 \pm 3.18	15.63 \pm 3.42	.908	.379
NASAL SENTENCE				
PREOPERATIVE	71.38 \pm 3.85	72.25 \pm 4.27	.430	.673
POSTOPERATIVE	53.38 \pm 3.78	55.25 \pm 3.85	.984	.342

Table 6 demonstrated that was noted no significant variance amongst the collections concerning OSA & snoring. Revision rate was less frequent in PL group compared SP group but without statistically significant difference.

Table 6. OSA and snoring distribution and revision rate between the two groups.

	PL (N=8)		SP (N=8)		X ²	P
	N	%	N	%		
OSA	0	--	1	12.5%	1.1	.302
SNORING	1	12.5%	2	25%	.410	.522
REVISION RATE	0	--	2	25%	2.29	.131

4. Discussion

Our findings showed that the two groups were comparable in sex and age without statistically significant variance.

In their study on the care of PVI, Bohm et al.⁵ attempted to examine the surgical results of sphincter pharyngoplasty, pharyngeal flap, & combined Furlow palatoplasty & sphincter pharyngoplasty. Our findings were in agreement with their findings. There were ninety-six individuals who participated in their trial. These individuals were separated into three groups: sphincter pharyngoplasty (n = 20), pharyngeal flap (n = 38), and combined furlow and sphincter (n = 38). According to the findings of the scientists, there was no significant difference amongst the C that were analyzed in terms of age or gender.

Additionally, Carlisle et al.⁶ wanted to discuss our experience in the treatment of individuals who were treated for velopharyngeal Insufficiency with sphincter pharyngoplasty with or without the addition of palatal lengthening to be performed by furlowpalatoplasty. A retrospective investigation was performed on forty-six children who were diagnosed with VPI and were treated with sphincter pharyngoplasty. The majority of these children developed palatal clefts. According to the findings of the scientists, there was no significant difference among the collections that were analyzed in terms of age or gender.

We found that there was no discernible variance among the collections concerning Velopharyngeal Closure grades during the study. Moreover, there was a significant increase in grade in both groups postoperatively.

Our results were consistent with, Losken et al.⁷ who reported that was observed no significance amongst the studied collections concerning Velopharyngeal Closure grades. While, there was a significant increase in grade in the studied collections.

As well, Carlisle et al.,⁶ who demonstrated that was noted no significant variance amongst the collections concerning regarding Velopharyngeal Closure grades. While, there was a significant increase in grade in the studied collections.

The present research demonstrated that was noted no significant variance amongst the

collections concerning hypernasality & pharyngealization of fricatives. Moreover, hypernasality and pharyngealization of fricatives significantly decreased in severity in both groups postoperatively.

Our results were consistent with Fuller et al.,⁸ who reported that was observed no significance amongst the studied collections concerning pharyngealization of fricatives, & hypernasality after operation.

Our findings indicated that no statistically significant distinction existed among the categories. concerning oral & nasal sentences. Moreover, oral and nasal sentences significantly decreased in both groups postoperatively.

Additionally, our findings revealed no statistically significant distinction among the categories concerning OSA & snoring.

Saman & Tatum⁹ sought to examine recent developments in pharyngeal modification techniques utilized to treat velopharyngeal Insufficiency in patients with cleft palate subsequent to primary repair. Our findings corroborated their research. Furthermore, they deliberated on the safety & effectiveness of the numerous pharyngoplasty procedures, in addition to their benefits & drawbacks. In instances of severe VPI, pharyngoplasty, pharyngeal flap, or combination techniques were shown to be the most effective.

As well, Fuller et al.,⁸ who demonstrated that there was no significant variance amongst the studied collections concerning OSA & snoring.

Our outcomes were consistent with Bohm et al.⁵ who demonstrated that was observed no significant difference amongst their studied collections concerning OSA & snoring.

The revision rate was less frequent in the PL group than in the SP group but without a statistically significant difference.

Cheng et al.¹⁰ reported on the successful outcomes of a modified sphincter pharyngoplasty involving 56 individuals. The procedure utilized a Furlow double-opposing Z-plasty with repositioning of the levator velopalatini for the velar portion of the soft palate & a tunneled palatopharyngeus my mucosal flap for the mobile circular portion of the pharynx. In their study, Vadodaria et al.¹¹ documented the implementation of a transnasal endoscopic-assisted approach for sphincter pharyngoplasty, claiming that it offers enhanced access & visibility. A technique known as "keratoplasty," as described by Sader et al.¹² involves transforming the longus capitis muscle into a novel muscular loop. The purpose of this procedure is to strengthen the posterior pharyngeal wall & extend the velum posteriorly. Ragab¹³ described a cerclage sphincter pharyngoplasty utilizing polypropylene sutures, which resulted in

hypernasality of speech and a significant improvement in VPI. Furthermore, numerous surgeons employ a multitude of combinations of diverse procedures in addition to these novel approaches.

Hens et al.¹⁴ whose objective was to evaluate the effects of mucosal buccinator flaps-induced palate lengthening on velopharyngeal Insufficiency, examined the alterations in palate length as well as speech outcomes. A retrospective analysis was conducted on thirty-two consecutive individuals who underwent the buccinator flap technique. Palate length & the existence or absence of a velopharyngeal gap were evaluated utilizing a calibrated image analysis system on preoperative & postoperative video fluoroscopic recordings. They reached the conclusion that the buccinator flap technique is straightforward & relatively risk-free. It is a viable surgical option for individuals with VP, for which a short palate length is the predominant factor.

4. Conclusion

Regarding our results, Sphincter pharyngoplasty versus Palatal Lengthening by double buccal flap have similar results in speech outcomes of velopharyngeal Insufficiency after correction by Sphincter pharyngoplasty. Further studies are needed with larger scales for confirming our results.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

References

1. Bishop A, Hong P, Bezuhly M. Autologous fat grafting for the treatment of velopharyngeal insufficiency: state of the art. *J Plast Reconstr Aesthet Surg*. 2014;67(1):1-8.
2. Nam SM. Surgical treatment of velopharyngeal insufficiency. *Arch Craniofac Surg*. 2018;19(3):163-167.
3. Mohamed NM, Zayed AM, Amer AM, El-Sabbagh AH, Shouman OO. A multidisciplinary approach to sphincter pharyngoplasty for correction of velopharyngeal dysfunction following repair of cleft palate. *Chinese Journal of Plastic and Reconstructive Surgery*. 2022 ;4(3):105-9.
4. Chauhan JS, Sharma S, Jain D, Junval J. Palatal lengthening by double opposing buccal flaps for surgical correction of velopharyngeal insufficiency in cleft patients. *J Craniomaxillofac Surg*. 2020;48(10):977-984.
5. Bohm LA, Padgett N, Tibesar RJ, Lander TA, Sidman JD. Outcomes of combined Furlow palatoplasty and sphincter pharyngoplasty for velopharyngeal insufficiency. *Otolaryngol Head Neck Surg*. 2014;150(2):216-221.
6. Carlisle MP, Sykes KJ, Singhal VK. Outcomes of sphincter pharyngoplasty and palatal lengthening for velopharyngeal insufficiency: a 10-year experience. *Arch Otolaryngol Head Neck Surg*. 2011;137(8):763-766.
7. Losken A, Williams JK, Burstein FD, Malick D, Riski JE. An outcome evaluation of sphincter pharyngoplasty for the management of velopharyngeal insufficiency. *Plast Reconstr Surg*. 2003;112(7):1755-1761.
8. Fuller C, Brown K, Speed O, et al. Impact of Surgery for Velopharyngeal Insufficiency on Eustachian Tube Function in Children: Pharyngeal Flap Versus Sphincter Pharyngoplasty. *Cleft Palate Craniofac J*. 2021;58(12):1473-1481.
9. Saman M, Tatum SA 3rd. Recent advances in surgical pharyngeal modification procedures for the treatment of velopharyngeal insufficiency in patients with cleft palate. *Arch Facial Plast Surg*. 2012;14(2):85-88.
10. Cheng N, Zhao M, Qi K, Deng H, Fang Z, Song R. A modified procedure for velopharyngeal sphincteroplasty in primary cleft palate repair and secondary velopharyngeal incompetence treatment and its preliminary results. *J Plast Reconstr Aesthet Surg*. 2006;59(8):817-825.
11. Vadodaria S, Mowatt D, Ramakrishnan V, Jacob S, Freedlander E. Trans-nasal endo-assisted pharyngoplasty: a cadaver study. *Br J Plast Surg*. 2004;57(5):418-422.
12. Sader R, Zeilhofer HF, Dietz M, et al. Levatorplasty, a new technique to treat hypernasality: anatomical investigations and preliminary clinical results. *J Maxillofac Surg*. 2001;29(3):143-149.
13. Ragab A. Cerclage sphincter pharyngoplasty: a new technique for velopharyngeal insufficiency. *Int J Pediatr Otorhinolaryngol*. 2007;71(5):793-800.
14. Hens G, Sell D, Pinkstone M, et al. Palate lengthening by buccinator myomucosal flaps for velopharyngeal insufficiency. *Cleft Palate Craniofac J*. 2013;50(5):e84-e91.