

# Buccinator Myomucosal Flap and Levator Muscle Repositioning in Management of Velopharyngeal Insufficiency Secondary to Cleft Palate Repair

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## Abstract

**Background:** Buccinator myomucosal flap and levator muscle repositioning is an alternative technique in the management of velopharyngeal insufficiency secondary to cleft palate repair.

**Aim of Study:** The goal of this study is to assess the effectiveness of the buccinator myomucosal flap and levator muscle repositioning in the management of velopharyngeal insufficiency secondary to cleft palate.

**Patients and Methods:** A prospective study was done on thirty patients who have velopharyngeal insufficiency after cleft palate repair and recommended for surgery by the phoniatrician. The period of the study was between August 2017 and August 2019. All cases were evaluated for speech assessment and videofluoroscopy before the operation and 3 months after the operation. Successful speech outcome was defined as completely improved, improved, and not improved.

**Results:** Overall improvement of the speech was obtained in 25 cases (83%) Nine of them (30%) were completely improved, 16 of them (53%) were improved by at least one grade, 5 cases (17%) showed no improvement.

**Conclusion:** Buccinator myomucosal flap and levator muscle repositioning is a reliable efficient procedure for the management of VPI secondary to the cleft palate with minimal complications.

**Key Words:** *Buccinator myomucosal flap – Levator muscle repositioning – Velopharyngeal insufficiency – Cleft palate repair.*

## Introduction

**VELOPHARYNGEAL** insufficiency (VPI) occurs in about 20-30% of cases after primary cleft palate repair [1]. Velopharyngeal insufficiency results in hypernasality, nasal air emission, and poor quality of speech. The main causes of the VPI after palat-

oplasty are short palate and limited velar mobility. The most common VPI surgeries are pharyngeal flaps, sphincter pharyngoplasty, palatal muscle retro positioning, double opposing Z-plasty, and posterior pharyngeal wall augmentation [2]. This variety reflects the fact that there is no ideal technique. Moreover, each case needs a customized plan for management and a precise selection of the procedure. Obstructive sleep apnea, mouth breathing, hyponasality, nasal mucous flow, and/or disrupted facial growth are reported complications with those procedures [3].

Levator veli muscle repositioning and buccinator myomucosal flaps procedure goal is to restore the normal anatomy as far as we can, thus, improving the function. It also deals directly with the main causes of the VPI, it improves the movement of the velum and lengthens the short palate [4,5].

The aim of this study is to assess the speech outcome and rate of complications in the patients undergoing levator muscle repositioning and buccinator myomucosal flaps for management of velopharyngeal insufficiency and whom had a history of cleft palate repair.

## Patients and Methods

A prospective study was performed on 30 patients with a history of repaired cleft palate ± cleft lip who were operated upon by buccinator myomucosal flap and levator muscle repositioning for management of velopharyngeal insufficiency between August 2017 and August 2019. All cases were above 3 years with a short scard palate with manifesting VPI proved by APA and videofluoroscopy. We included the cases who had previous velopharyngeal insufficiency surgeries.

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We excluded syndromic cases, delayed language development cases, neurologically impaired cases, and cases with incomplete medical records.

Preoperative assessment by experienced phoniatricis team included screening with the auditory perceptual assessment of all repaired cleft palate cases using standardized perceptual speech protocol. Patients determined to have VPI is then evaluated using videofluoroscopy.

The operative technique included levator muscle repositioning using intravelar veloplasty or double opposing Z-plasty (Furlow) and posteriorly based buccinator myomucosal flaps for palatal lengthening (unilateral or bilateral) [6,7]. Briefly, one of two techniques were done for Levator muscle repositioning. The first one included transverse incision just posterior to the junction between hard

and soft palate (Fig. 1), the levator muscle is dissected completely from the abnormal attachment to the hard palate and repositioned in the transverse orientation leaving an anterior defect [4,5].

The other technique used was double opposing Z-plasty (Furlow). A Z-plasty of oral mucosa is performed (60-degree angle). The levator muscle is dissected from oral mucosa in right side and dissected from nasal mucosa on the other side. Another Z-plasty is made on the nasal mucosa. This allows the levator muscle to be repositioned posteriorly and a defect is made between the flaps.. The resulting defect in both techniques is reconstructed using posteriorly based buccinator myomucosal flap (Fig. 2) [8]. All patients received liquid oral intake by the operative day night. The pedicle is divided 1 month postoperative if needed.



Fig. (1): The transverse incision between the hard palate and soft palate.

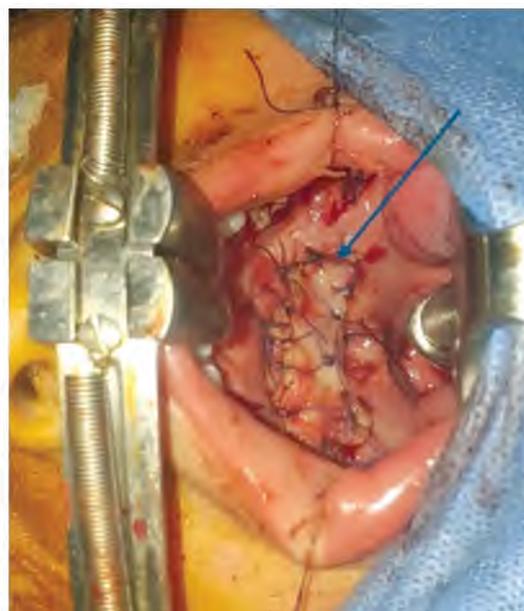


Fig. (2): Post-operative view after lengthening of the palate-Buccinator flap (Arrow).

The operative parameters elected were the operative time, bleeding, length and width of the flaps, prolapse of the buccal pad of fat, nerve injury, and recovery.

Early postoperative parameters were the establishment of feeding, hospital stay, flap's integrity, donor site complications, snoring, and obstructive sleep apnea.

Postoperative follow-up was made twice weekly. The speech therapy started 1 month after operation. Three months later the auditory perceptual

assessment and videofluoroscopy were made. All parameters elected preoperatively were assessed again by experienced phoniatrician. APA parameters are hyper-nasality, nasal air emission, imprecision of consonants, glottal articulation, pharyngealization of fricatives, and unintelligibility of speech. All parameters were rated on 5 points scale from 0 (no) to 4 (severe). The cases was categorized as (completely improved, improved, and not improved). Videofluoroscopy parameters were velar length, resting gap, and active gap.

**Results**

*Criteria of the patients:*

Thirty patients were included. The mean age at the operation was  $8y2m \pm 4y2m$ . Females were 17 and males are 13. The original pathology was incomplete cleft palate in 17 cases, bipartite cleft palate in 10 cases, and 3 cases were tripartite.

*Surgical techniques:*

The mean operative time was 1-hour  $\pm$  9 minutes. The mean blood loss was  $30 \pm 5.5$ ml. The mean length of the flap was  $68 \pm 7.4$ mm. The longest flap was 82mm without stretch, while the shortest one was 52mm. The mean width of the flap was  $16.8 \pm 3.7$ mm. The widest flap was 26mm, while the narrowest one was 12mm. Prolapse of the buccal pad of fat occurred in 5 cases and all of them returned and the space was sutured with no post-operative sequelae. No delayed recovery, there were No post-operative bleeding, No affection of normal breathing with any case.

All patients started feeding 4 hours postoperatively and tolerated semisolids by the same day night. All cases were discharged the next day morning. Evident cheek edema (donor site) occurred in 3 cases (10%) with no affection of feeding or breathing. One of them needed readmission for another two days just for monitoring with no sequelae and was discharged free.

*Early postoperative assessment:*

The early postoperative period showed No flap affection with any case. All flaps were intact and viable for the follow-up period (3 months). No ischemia, no dehiscence, and no fistulas occurred. No case developed snoring, sleep disturbance, and/or mouth breathing.

*Postoperative assessment:*

Preoperatively, patients with high-grade hypernasality (83.33%), high-grade nasal air emission (80%), high grade of unintelligibility of speech (70%), circular closure pattern (70%), large velopharyngeal gap (63.33%), limited velar mobility (73.33%), and short velum (60%).

Postoperatively, there was a progressive improvement of hypernasality, nasal air emission, intelligibility of speech, and overall velopharyngeal function (Table 1). There was a progressive reduction of the size of the gap, an increase in the velar mobility, an increase in the length of the palate, and an overall increase in the number of patients with complete velopharyngeal closure (Table 2). Three months after, there was an improvement of

speech in (83.33%) of all patients. It is related to the significant increase in palatal length and reduction of the velopharyngeal gap.

Table (1): Auditory perceptual assessment: Comparison between the number of cases with each grade before and after the operation.

Improvement	Hypernasality 84%		Nasal air emission 79.8%		Unintelligibility of speech 83.3%	
	Before	3m After	Before	3m After	Before	3m After
Grade 0	0	9	0	8	0	9
Grade 1	0	12	0	11	0	13
Grade 2	5	5	6	6	9	5
Grade 3	20	2	19	4	16	2
Grade 4	5	2	5	1	5	1
Mean $\pm$ SD	3 $\pm$ .58	1.37 $\pm$ 1.42	2.96 $\pm$ .61	1.1 $\pm$ 1.06	2.86 $\pm$ .68	1.16 $\pm$ .98

Table (2): Videofluoroscopy assessment.

	Pre-operative (Mean $\pm$ SD)	3 month postoperative (Mean $\pm$ SD)	The change occurred
Length of the velum	23.56 $\pm$ 4.42mm	31.57 $\pm$ 2.92mm	Increased by 7.92 $\pm$ 2.49mm
Resting gap	11.74 $\pm$ .41mm	5.04 $\pm$ 1.67mm	Decreased by 56.4%
Active gap	7.4 $\pm$ 3.2mm	1.83 $\pm$ 1.99mm	Decreased by 75.1%

**Discussion**

The success rate of the speech outcome was (83.3%) and the rate of minor complications (10%) which is comparable to the previous studies (48-96% and 8-31%) [4,5,8-15] respectively. Those studies have mixed groups of syndromic and non-syndromic cases. Moreover, many of them evaluated the BMMF for fistulas and VPI too. Our study had a strictly defined group of children with post palatoplasty VPI who will undergo the operation for the management of VPI.

Our results show significant improvement of speech (83.3%) which is comparable with other operations used for management of secondary VPI with less complication. Other studies showed an improvement up to 74% for Teflon injection, 85% for sphincter pharyngoplasty, 96% for pharyngeal flaps, 68% for fat grafting, and 82% for palatal rerepair [16-21]. Pharyngoplasties has its well-known complication like the risk of hemorrhage, breathing problems, hyponasality, inability for naso-endotracheal intubation, and obstructive sleep apnea (OSA) [4]. OSA develops in about 80% of patients with dynamic pharyngoplasty 1 year after the operation [22].

Lateral videofluoroscopy assessment, during rest, showed a significant increase in the palatal length with a mean 7.92mm that is comparable with the result elected by Hens et al., [5] Which showed an average increase by 7.5mm. Rao et al., [23] study on BMMF with intravelar veloplasty for VPI management study showed a 61.5% reduction of the resting gap and increased the length of the velum by 7.5mm. In our study, the resting velopharyngeal gap decreased by (57%) in size and the active gap decreased by 75%. The difference in the percentages of reduction between resting and active gap is almost related to the better positioning and contraction of the levator muscle. The limited reduction in resting gap protects the patient from obstructive symptoms (e.g. OSA) and the significant reduction occurs in the active gap ameliorate the speech.

Buccinator myomucosal flaps are applicable in a wide variety of VPI patients of various ages, causes, closure pattern, number of previous surgeries, amount of palatal scarring. The idea of the restoration of normal anatomy by repositioning of levator muscle and lengthening of the velum by buccinator flaps is beneficial in every situation. Moreover, it is in line with the plastic surgery goal of restoration of normal anatomy [4]. Interestingly, it is a well-vascularized flap, elastic, malleable, close to the target site, has a sufficient length, width, and thickness. The technique is easy, quick, teachable, doesn't leave denuded periosteum which affects facial growth, a good choice in patients with difficult access to the pharynx, gives enough length to reduce the gap but without causing hypo nasality and/or breathing problems.

One of the limitations of our study was the relatively short follow-up period, we predict a continuous improvement of the cases later on. Denadai et al., [24] made a serial evaluation 3, 6, and 12 months for 53 cases who underwent bilateral BMMF for VPI management. His evaluation after three months showed 4 patients only with no hypernasality (10.8%) this number became 22 (59.5%) patients with no nasality 12 months after the operation. Our evaluation after 3 months showed 9 (30%) patients with no hypernasality. Better wound healing and adaptation of the patient for the mechanism of closure could explain this continuous improvement with time. However, unfortunately, we have no follow-up after 12 months.

Another limitation was the absence of a controlled group, but the intention of the study was the assessment of indications and outcomes of the buccinator myomucosal flap and levator muscle

repositioning for management of VPI after palatal repair. Another larger series, with longer follow-up, and comparative groups is needed to reach a generalization of the technique.

#### *Conclusion:*

Buccinator myomucosal flaps and levator muscle repositioning is a reliable efficient procedure for the management of velopharyngeal insufficiency in non-syndromic cleft patients with minimal complications.

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## استخدام العضلة الخدية وتعديل وضع العضلة الرافعة لسقف الحلق في إصلاح القصور اللهاثي البلعومي الناتج عن جراحة إصلاح شق سقف الحلق

يعد القصور اللهاثي البلعومي من المشكلات الشائعة والتي تحدث بنسبة تتراوح بين والمرضى الذين يخضعون لإجراء جراحة إصلاح شق سقف الحلق.

الهدف من الدراسة: تستهدف هذه الدراسة تقييم استخدام العضلة الخدية وتعديل وضع العضلة الرافعة لسقف الحلق في إصلاح القصور اللهاثي البلعومي الناتج عن جراحة إصلاح شق سقف الحلق.

المرضى ومنهجية الدراسة: شملت هذه الدراسة ثلاثون مريضاً ممن أجريت لهم جراحة إصلاح شق سقف الحلق بمستشفى الأطفال الجامعي بالمنصورة أو في أي مكان آخر، عانى جميع هؤلاء المرضى من القصور اللهاثي البلعومي وزاروا عيادة جراحة الأطفال بجامعة المنصورة لطلب العلاج في الفترة ما بين أغسطس ٢٠١٧ و أغسطس ٢٠١٩.

الحالات المتضمنة: تضمنت هذه الدراسة الحالات التي تعاني من القصور اللهاثي البلعومي بعد عملية إصلاح شق سقف الحلق ممن بلغ عمرهم الثلاثة سنوات أو أكثر، مع ثبوت وجود القصور إكلينيكيًا وكذلك بإجراء المنظار الأنفي البلعومي والأشعة السينية بالصبغة، كما تضمنت الحالات التي قامت بإجراء جراحات أخرى لإصلاح القصور اللهاثي البلعومي لنفس السبب ولم تؤدى للشفاء.

الحالات المستبعدة: لم تتضمن هذه الدراسة الحالات التي لم تبلغ ثلاثة سنوات من العمر، وكذلك لم تتضمن الحالات التي تعاني من متلازمات مرضية أو قصور ذهني أو عصبي، كما لم تتضمن الدراسة تلك الحالات التي تعاني من القصور لأسباب أخرى غير جراحات شق سقف الحلق.

التدخل الجراحي: خضعت الحالات لتقييم جودة النطق بالاختبار الإدراكي السمعي، وتم تقييم حالة سقف الحلق بالمنظار الأنفي البلعومي والأشعة السينية بالصبغة. قبل إجراء الجراحة ثم إعادة التقييم بعد ثلاثة أشهر من الجراحة.

- أجريت جميع الجراحات تحت تأثير المخدر الكلي.

- تتضمن الجراحة تعديل وضع العضلة الرافعة لسقف الحلق لوضعها العرضي الطبيعي، مع إطالة سقف الحلق باستخدام سدلة من العضلة الخدية.

النتائج: طبقاً للاختبار الإدراكي السمعي فمن بين ٣٠ حالة أجرت الجراحة حدث تحسن واضح في النطق في ٢٥ حالة وبنسبة تصل لـ ٨٣٪. منها تسعة حالات تمتعت بتحسن كامل بنسبة ٣٠٪، و ١٦ حالة تمتعت بتحسن ملحوظ بنسبة ٥٣٪ من الحالات، وخمسة حالات ١٧٪ لم يلاحظ التحسن عليها.

- طبقاً للمنظار الأنفي البلعومي: لوحظ تحسن واضح في حركية سقف الحلق في سبعة وعشرين حالة (٩٠٪) وكذلك انخفاض في قياس الفجوة اللهاثية البلعومية في ثمان وعشرين حالة (٩٣٪).

- طبقاً للأشعة السينية التنظيرية بالصبغة: حدثت إطالة ملحوظة لسقف الحلق بمتوسط ٧.٩ ملم، وانخفاض في الفجوة اللهاثية البلعومية في وضع الراحة بنسبة ٥٦٪ وانخفاض في وضع الحركة بنسبة ٧٥٪.

الخلاصة والخاتمة: خلصت الدراسة إلى أن علاج القصور اللهاثي البلعومي باستخدام العضلة الخدية وتعديل وضع العضلة الرافعة لسقف الحلق هو علاج فعال وموثوق به بنسبة كبيرة وبنسبة منخفضة للغاية من المضاعفات، وذلك في الحالات الناتجة بعد عملية إصلاح شق سقف الحلق.