

Original Research Article

Versatility of Buccinator Myomusosal Flap for VPI Correction: A Center Based Experience

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Abstract: *Objectives:* Wide range of surgical approaches, both conservative and surgical techniques for the correction of VPI have been described in the literature. Broadly classified into revision palatoplasty and pharyngoplasty, the surgical methodology changes as per needs. Buccinator myomucosal flap is one such flap that is chiefly used in cases that qualify for correction of VPI by palatal lengthening. By this case series and review, we present the treatment algorithm followed in our centre in deciding the suited treatment modality for the best patient outcomes. *Materials and Methods:* This article includes retrospective analysis of 12 patients who underwent palatal augmentation in our hospital. All the cases presented with VPI after primary palatoplasty. Based on specific patient selection criteria, the selected patients were operated for surgical lengthening of the soft palate using bilateral BMMF. The patient was then assessed and compared to the pre-operative state for betterment. *Results:* All the twelve patients who underwent VPI surgical correction with the bilateral Buccinator-based myomucosal flap reported improvement in standard of living and were satisfied with the results. *Conclusion:* Successful treatment outcomes validate the use of BMMF for VPI are reliable, reproducible, and leads to great outcomes in the management of VPI.

Keywords: surgical approaches, palatoplasty and pharyngoplasty, Buccinator myomucosal flap, VPI.

1. INTRODUCTION

Complex motor skills like swallowing and phonation depend upon the ability to obtain adequate closure of the velopharyngeal port. This is dictated by a diverse group of muscles along the upper aerodigestive tract. Inadequate closure of this port leads to nasal speech (hypernasality) and nasal regurgitation during swallowing eventuating to Velopharyngeal Insufficiency (VPI) [1].

VPI may precipitate due to Velo–palatal clefts, dehiscence, or scarring post palatoplasty [2-4] or after maxillary distraction for cleft orthognathic surgeries. Once VPI is diagnosed, a treatment plan, best suited, can be formulated [5, 6].

Literature depicts various approaches encompassing both conservative and surgical techniques for the correction of VPI. Surgical modalities to address this palate impairment can be broadly classified into revision palatoplasty and pharyngoplasty. Literature documents various flaps and modifications used for revision palatoplasty. Buccinator myomucosal flap is one such flap that is chiefly used in cases that qualify for correction of VPI by palatal lengthening.

The first documented use of the buccinator myomucosal flap for palatoplasty was by Ecker In 1975 who designated it as ‘buccal flap’ [7]. Maeda *et al.*, in 1987 developed a ‘T shaped sandwich flap’ [8] which utilised bilateral

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buccinator flap for separate closure of nasal and oral layers. But it was Bozola *et al.*, [9] in 1989, who first designated the title ‘buccinator muscle myomucosal flap’ or BMMF to the popular buccal flap, which later paved way for the extensive utilization of both unilateral and bilateral BMMF in palatoplasty and correction of VPI.

In this article, we present a case series where the utilization of the buccinator myomucosal flap was carried out for the surgical correction and reconstruction of velopharyngeal deficiency and come out with a Centre based protocol for correction of VPI.

2. MATERIALS AND METHODS

This article includes retrospective analysis of 12 patients who underwent palatal augmentation in our hospital, from January 2019 to December 2019. All the cases presented with VPI after primary palatoplasty. The patient selection criteria for the surgical correction of VPI are described in Table 1. Surgical lengthening of the soft palate using bilateral BMMF was done, and the data was recorded as per the assessment criteria depicted in Table 2. The patients were clinically evaluated for hypernasality and VPI defect size before surgery and 1, 6 months after surgery. The clinical evaluation was carried out by the chief surgeon and the speech progression was analyzed by a speech therapist. Donor site morbidity and patient satisfaction were also included in the analysis model.

Table 1: Inclusion and Exclusion Criteria

| Inclusion Criteria | Exclusion Criteria |
|-----------------------------------------------|-------------------------------------------|
| In adequate Velopharyngeal closure | All syndromic patients. |
| Hyper Nasality (Moderate, Severe) | Mild Hypernasality |
| Difficulty in speech | Patients who had undergone pharyngoplasty |
| Nasal Emission | |
| Nasal regurgitation | |
| Severe scar tissue after primary palatoplasty | |

Table 2: Assessment Criteria

| Assessment Criteria | | | |
|------------------------------|-------------|----------------------|----------------------|
| Patient’s age | | | |
| VPI in mm | Pre-Surgery | 6-month Post Surgery | |
| Hypernasality (..... scale): | Pre-Surgery | 1-month post-surgery | 6-month post-surgery |
| Donor site morbidity | Present | | Absent |
| Patient satisfaction | Poor | Good | Excellent |

3. SURGICAL ANATOMY

Buccinator muscle extends from pterygomandibular raphe posteriorly and inserts into the modiolus anteriorly. Super inferiorly, it extends from the maxillary vestibule till the mandibular vestibule and the external oblique ridge. The Stensen duct from the parotid gland travels anteriorly, pierces the muscle medially, slightly above its centre, and opens into the oral cavity adjacent to the upper second molar.

The buccinator muscle receives its arterial irrigation from 3 sources [10]. The buccal and posterosuperior branches of the internal maxillary artery and the facial artery. The venous drainage system is composed of anterior tributaries of the facial vein, posteriorly pterygoid venous plexus, and the internal maxillary vein.

The sensory innervation is from the Buccal branch of the mandibular nerve. The motor supply is by the long buccal branch from the facial nerve.

This complex and rich neurovascular buccinator muscle thus provides for a sensate flap, which can be utilised without compromising the vascular supply nor the nerve innervation [9, 11]. This is the surgical rationale for utilizing the flap to augment mild to moderate defects of the posterior palate for the betterment of VPI and hence hypernasality.

4. SURGICAL TECHNIQUE

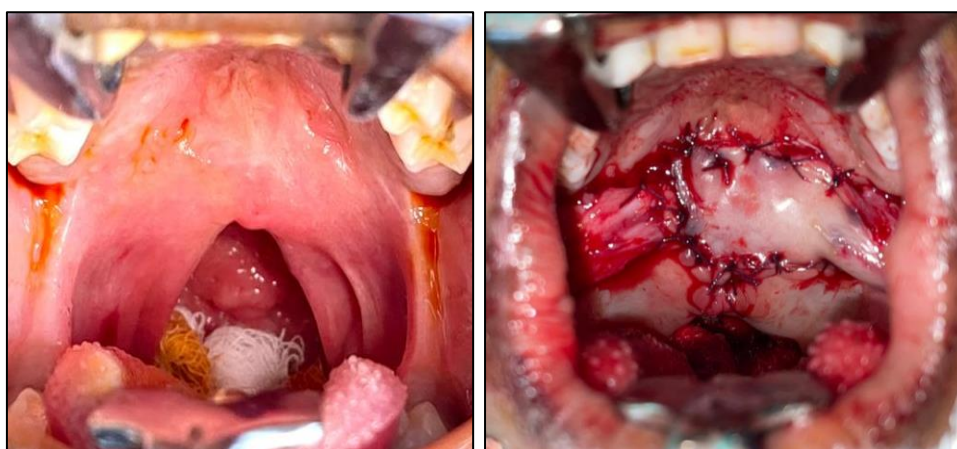
After securing adequate general anesthesia, the patient is Orotracheally intubated. The junction of the hard and soft palate is marked with methylene blue.

The buccal artery BMMF is then designed following a pre-determined protocol. It is generally harvested from the middle of the cheek. The posterior extend should be lateral to the junction of the soft and hard palate. Anteriorly it should be 2-3mm posterior to the commissure of the lip. Cranio caudal width was designed based partially on surgeons’ perspective and on the defect size to be augmented.

Local anesthesia was performed using a physiological 0.9% saline solution with lignocaine and 2% adrenaline is injected along the incision marking of the palate. The soft and hard palate junction is dissected in a layered fashion stripping the oral mucosa and the levator muscle from the posterior border of the hard palate. This creates a random pattern soft palate flap based at the anterior faucial pillars bilaterally which are then pushed posteriorly towards the pharyngeal wall, creating the defect for augmentation.

After infiltrating local anesthesia of 0.9% saline solution with lignocaine and 2% adrenaline, the BMMF is raised bilaterally. It is harvested in an anteroposterior fashion comprising the full thickness of the muscle. One side flap is raised and sutured into the defect with the mucosal layer projecting into the nasal side. The contralateral side flap is then raised and sutured into the defect with the mucosal surface directed towards the oral cavity thus completing the Sandwich technique. The donor sites on bilateral cheeks were sutured under primary closure. The cranio caudal width of the BMMF was thus used to augment the velopharyngeal defect antero-posteriorly.

The flaps were secured with 4-0 PDS and bilateral donor sites were sutured with 4-0 vicryl. Drain placement was not required. All patients were under antibiotic coverage. Diet was confined to liquids for seven days after the procedure and discharged once they were tolerating sufficient oral intake.



Pre-Operative VPI Palatal augmentation with Bilateral BMMF

5. RESULTS

Twelve patients underwent VPI surgical correction with the bilateral Buccinator-based myomucosal flap. The patients were evaluated based on the assessment criteria. A decrease in VPI was evidently noted during the 3 months post-surgery review. However, to verify the improvement in hypernasality, patients were followed up for 6 months which revealed significant improvement in all twelve cases. The data is depicted in Table 3. Donor site morbidity was absent in all the cases. The patient's standard of living had greatly improved, and all the patients were satisfied with the results.

Table 3

| Serial Number | CCI number | Patient's age in years | VPI in mm | | Hypernasality | | | Donor site morbidity | Patient satisfaction |
|---------------|------------|------------------------|-------------|----------------------|---------------|----------------------|----------------------|----------------------|----------------------|
| | | | Pre-Surgery | 6-month Post Surgery | Pre-Surgery | 1-month post-surgery | 6-month post-surgery | | |
| 1 | 1255 | 13 | 20 | 10 | ++ | + | + | Nil | Good |
| 2 | 1364 | 4 | 6.5 | 6 | ++ | + | + | Nil | Good |
| 3 | 1343 | 4.2 | 12 | 9 | ++ | + | 0 | Nil | Good |
| 4 | 1350 | 6 | 10 | 3 | ++ | + | + | Nil | Good |
| 5 | 1400 | 19 | 13 | 9 | ++ | + | 0 | Nil | Good |
| 6 | 1390 | 4 | 10 | 6 | +++ | + | 0 | Nil | Good |
| 7 | 1454 | 4 | 14 | 10 | ++ | + | 0 | Nil | Good |
| 8 | 1373 | 14 | 15 | 9 | +++ | + | 0 | Nil | Good |
| 9 | 1048 | 12 | 13 | 8 | +++ | + | 0 | Nil | Good |
| 10 | 1312 | 5 | 16 | 10 | ++ | + | + | Nil | Good |
| 11 | 1199 | 3.5 | 13 | 10 | ++ | + | 0 | Nil | Good |
| 12 | 1461 | 7 | 18 | 16 | ++ | + | + | Nil | Good |

6. DISCUSSION

Patients who presented with minimal VPI and hypernasality, the decision was to provide intense speech therapy and follow up which revealed immense refinement in phonation and quality of speech. Patients with moderate-severe VPI and hypernasality were selected as the ideal candidates for palate lengthening surgeries. All 12 patients underwent palatal augmentation with BMMF.

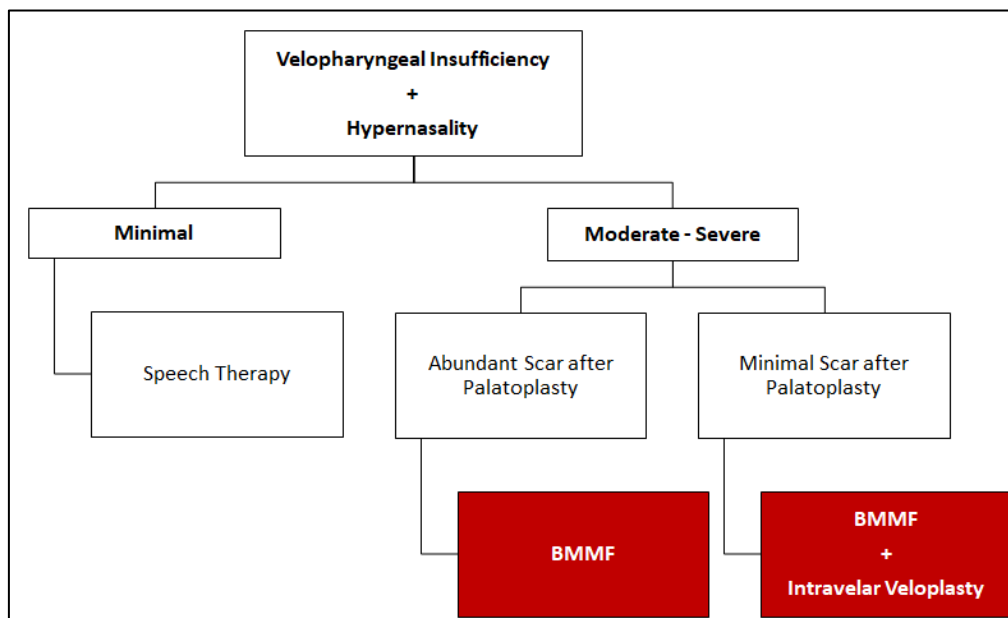
For patients with minimal scar tissue following their initial palatoplasty, intravelar veloplasty (IVV) was done as the muscles were easily identifiable and then the defect was reconstructed with BMMF for superior results. In cases with abundant scarring, IVV was avoided as radical muscle dissection was not possible due to loss of surgical planes. Such cases were treated only with BMMF reconstruction. However, as the results depict, all 12 patients reported improvement in their clinical condition.

Immediate post-surgical evaluation and outcomes based on 3 months follow-up showed significant improvement in velopharyngeal discrepancy. The palatal lengthening evaluated during the subsequent 3 and 6 months demonstrated results comparable to intraoperative measurements with less scar tissue formation. This data reveals the importance of thorough muscle dissection during the division of soft and hard palate for tension-free retro-positioning followed by reconstruction of the defect with a flap of adequate size.

On thorough evaluation by the speech consultant, enhanced phonation was noted in all twelve patients. An obvious reduction in hypernasality was observed during the 6-month follow-up. Patients underwent adjuvant speech therapy for improved results. All the patients expressed considerable betterment in speech and hence their psychosocial wellbeing.

Thus, BMMF proved to be an efficient reconstruction option in palatal lengthening surgeries for VPI. BMMF is a very versatile flap. Its anatomy is dependable, and the results are predictable owing to its rich vascularity. The complex neural structure makes it a sensate flap, similar in texture to the adjacent tissues. The benefits of easy harvest with adequate bulk while having minimal donor site morbidity makes it a surgeon's choice of interest when lengthening of palate for VPI is concerned. The donor site can be closed primarily and revealed excellent healing with good function during our follow-up.

Based on our clinical and surgical outcomes, we put forward a new centre-based treatment protocol for the management of patients presenting with VPI resulting in hypernasality.



Treatment protocol

7. CONCLUSION

Successful treatment allows the possibility of voice and speech improvements and consequently enhances communication skills, which is one of the most important factors associated with the psychosocial integration of an individual.

The treatment of velopharyngeal insufficiency in patients with cleft lip and palate is challenging. Even though this retrospective study may have benefited from longer follow-up, the outcomes based on our centre-based treatment protocol and subsequent follow-up evaluation indicate that buccinator flaps are reliable, reproducible, and leads to great outcomes in the management of VPI.

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