



EFFICACY OF BILATERAL BUCCAL MUCOSAL FLAPS IN MODERATE AND SEVERE VELOPHARYNGEAL INCOMPETENCE

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ABSTRACT **Background:** The goal of cleft surgery is to close the gap the palate with a technique and timing that produce optimal speech and minimize facial growth disturbances. Success is not the domain of any single method or protocol, but the results of the experienced surgeon working with a team of cleft specialists and following solid principle. But even in the best hands, 5 to 38 % of the patients develop velopharyngeal incompetence following primary palatal surgery¹. Velopharyngeal incompetence is a multifactorial problem caused by a deep nasopharynx, poor lateral wall mobility, and structural insufficiency of the soft palate or lateral posterior pharyngeal walls^{2,17}. Restoration of normal anatomy is one of the fundamental aims of plastic surgery and the buccal myomucosal flap offers a more anatomical correction of short palates than traditional repairs. It is also technically easier, than a pharyngeal flap, tailoring the flap to the degree of preoperative velopharyngeal incompetence is often difficult. This study was contemplated to evaluate to efficacy of bilateral buccal mucosal flaps in the correction of moderate and severe VPI (>5 mm VP gap on phonation).

AIMS AND OBJECTIVES: Efficacy of bilateral buccal myomucosal flaps in surgical correction of moderate and severe VPI (velopharyngeal gap >5 mm). Degree of palatal length achieved post operatively.

MATERIALS AND METHODS: It is a prospective study comprising 12 Patients who underwent secondary palatoplasty between 2006 to 2014 June in which bilateral buccal myomucosal flap was used were reviewed retrospectively. Inclusion criterion: All patients who underwent VPI correction by bilateral buccal mucosal flap with a preoperative VPI gap More than 5 mm and cases operated by a single surgeon were included in the study.

METHODS:

1. All the data of patients who had undergone VPI correction by bilateral myomucosal flap were retrieved.
2. Patients selected were those who had crossed a minimum of six months after the primary palatoplasty.
3. At follow up patients were subjected to speech evaluation, and video fluoroscopy (the palate length and velopharyngeal gap were measured).

RESULTS: In our study, done in patients with moderate and severe VPI with VP gap (>5 mm) a significant improvement in the VPI in 92% (11/12) patients was observed. Complete closure of VPI could be successfully achieved in 59% (7/12). In 33% (4/12) the persistent velopharyngeal gap was less than 5 mm.

CONCLUSION: The buccal myomucosal flap is an effective technique that can be used in secondary palatal repairs as a single procedure or in conjunction with other techniques. It is effective in treating short soft palates, fistula in the palate, for poor speech. The buccal myomucosal flap allows both closure and lengthening of the soft palate without tension. Accurate reconstruction and repositioning of the muscle sling improves velopharyngeal incompetence and consequently speech and hyper resonance. The buccal mucosa should be harvested with the buccinator muscle for increased survival and the dissection should be meticulous at the pterygomandibular raphe, where the vessels enter the flap.

KEYWORDS :

BACKGROUND:

The goal of cleft surgery is to close the gap the palate with a technique and timing that produce optimal speech and minimize facial growth disturbances. Success is not the domain of any single method or protocol, but the results of the experienced surgeon working with a team of cleft specialists and following solid principle. But even in the best hands, 5 to 38 % of the patients develop velopharyngeal incompetence following primary palatal surgery¹. Severe velopharyngeal incompetence is distressing for the patient, the parents and challenging for the surgeons.

Velopharyngeal incompetence is a multifactorial problem caused by a deep nasopharynx, poor lateral wall mobility, and structural insufficiency of the soft palate or lateral posterior pharyngeal walls^{2,17}. Surgical options for velopharyngeal incompetence corrections include sphincter pharyngoplasty, pharyngeal flaps, Furlow's double opposing Z-plasty, Sommerlad's palatoplasty and palatal re-repair incorporating the buccal myomucosal flap.

The concept of palatal lengthening by Furlow's opposing Z-plasty is theoretically appealing and may have appropriate clinical applications. This procedure should be limited however to situations in which the velopharyngeal gap is relatively small (<5mm). The same holds good to the Sommerlad's palatoplasty.

Restoration of normal anatomy is one of the fundamental aims of

plastic surgery and the buccal myomucosal flap offers a more anatomical correction of short palates than traditional repairs. It is also technically easier, than a pharyngeal flap, tailoring the flap to the degree of preoperative velopharyngeal incompetence is often difficult.

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Inclusion criterion: All patients who underwent VPI correction by bilateral buccal mucosal flap with a preoperative VPI gap More than 5 mm and cases operated by a single surgeon were included in the study.

Exclusion criterion: Patients who have not undergone preoperative video fluoroscopy evaluation (other than cases in which the repaired soft palate had dehisced post operatively).

Methods:

1. All the data of patients who had undergone VPI correction by bilateral myomucosal flap were retrieved.
2. Patients selected were those who had crossed a minimum of six months after the primary palatoplasty.
3. At follow up patients were subjected to speech evaluation, and video fluoroscopy(the palate length and velopharyngeal gap were measured).
4. All data were compiled and assessment of the efficacy of buccal mucosal flap in the secondary palate surgery was evaluated.

History: The use of buccal mucosal flaps was initially advocated by the Filiberti in 1965 and he credited Saurez for the original description³.

Murarimohan Mukherji in 1969 initially described this flap for secondary palate repair in India,the buccal mucosal flap based on the buccinators vessels was later repoted in the western literature⁴. Ganguli in 1971 reported the use of submucous pedicled cheek flap to lengthen the short palate⁵.

Jackson in 1972 utilized local random buccal flaps for closure of secondary palatal fistulas⁶.Kaplan in 1975 described the technique in primary palatal repair as a unilateral buccal mucosal flap to be turned in for lining after the nasal mucosal division and the push back.Maeda et al in 1987 modified the initial buccal mucosal flap to a buccal myo mucosal flap,by including thin layer of buccinators muscle,in an attempt to improve the blood supply,they also used bilateral buccal flaps to lengthen the nasal layer and to cover the oral surface of the palate, as Nakikita et al 1991 also reported^{8,9}.

Freedlander and Jackson in 1989 studied the reliability of the buccal flap over time. They showed by endoscopic examination that the buccal flap remained viable and kept its initial dimensions, lengthening the nasal layer¹⁰. They hypothesized of the that the flap would prevent reattachment the reconstructed velar sling between the hard palate and the velar muscles.

The first radiographic observations of the velopharyngeal structure was repotd as early as 1909 by Schier.The use of motion pictures to study the movements of the velopharyngeal valve was first reported in 1930,initially as a method of assessing swallowing by Barclay¹¹. This procedure was next applied to speech during the next decade by Harrington.This study used one view video fluoroscopy(lateral view),as an objective assessment of VPI specifically noting VP gap antero posteriorly.

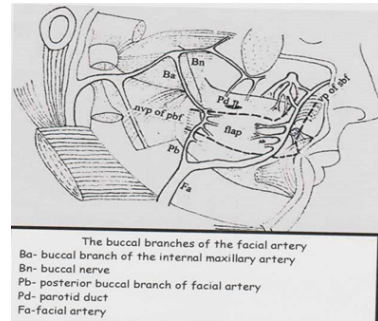
Anatomy: The buccinator muscle forms the deepest lamina of the peri oral muscles and is considered part of sphincteric muscular system.It is covered by submucosa and mucosa medially,and masseter,mandible,, fat pad, facial artery and vein and bucco pharyngeal fascia laterally.

The principal blood supply to the buccinators is not buccal artery as claimed by Bozola et al. Instead the facial artery seems to be major source¹². The facial artery,a branch of external carotid artery,enters face by hooking around lower border of the mandible at the anterior edge of the masseter muscle.It gives off a branch to the posterior half of buccinators,the posterior buccal branch.The inferior and anterior buccal branches of facial artery also supplies buccinators muscles.

The buccal branch of of the internal maxillary artery runs forwards and downwards under the pterygoideus lateralis muscle and reaches the posterior half of the buccinators where it communicates with the buccal branch of the facial artery.

The venous drainage of buccinators is very rich.Several veins originate from the lateral aspect of the muscle converge to form the buccal venous plexus and drain into the facial vein from 2 to 4

tributaries or into the pterygoid plexus of veins and internal maxillary vein by the buccal veins as comitantes to the buccal artery.

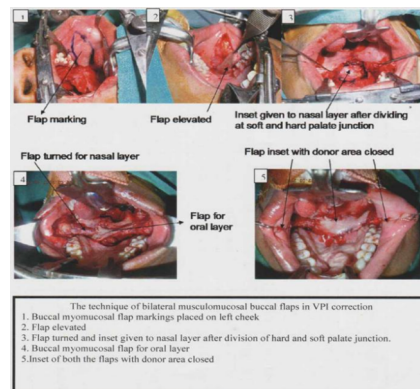
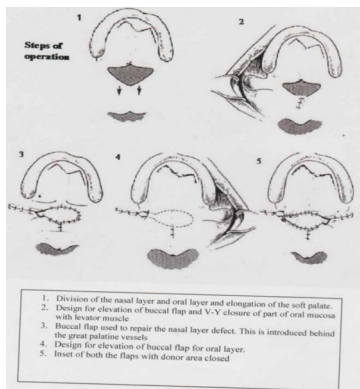


After removal of the skin,subcutaneous tissue,buccal fat pad,the posterior buccal branch (Pb),inferior buccal branches(Ib),and anterior buccal branches(Ab) of the facial artery(Fa), are found on the buccinator muscle.The diameter of buccal artery is larger than that of posterior buccal branch of facial artery,both anastomose to each other and ramify over the buccinators. The anastmotic network(An) between all these branches to the buccinators is located below the parotid duct(Pd).The long buccal nerve runs parallel and posterior to the buccal branch(Ba) of the internal maxillary artery;it reaches the posterior half of the buccinators and arborizes extensively on the buccal mucosa.The buccal artery does not reach the buccinator; it is compensated for by a branch of inferior alveolar artery through the anterior margin of the mandibular ramus. The posterior buccal branch becomes larger in caliber.

Surgical description:

The technique used in this series is a fusion of two techniques.First the sandwich pushback technique was described by Moore and Chong (1967),in which they utilized the Millrad type (1963) muco periosteal island flaps¹³,the drawback with regard to denuded hardpalate and resultant impact on facial growth has been overcome in our technique by the use of sandwich of buccinators muco periosteal flaps (Ganguli,1971) instead of muco periosteal flaps.The anatomy and clinical potential of the buccinators musculo mucosal flap was highlighted by Bozola et al.(1989).

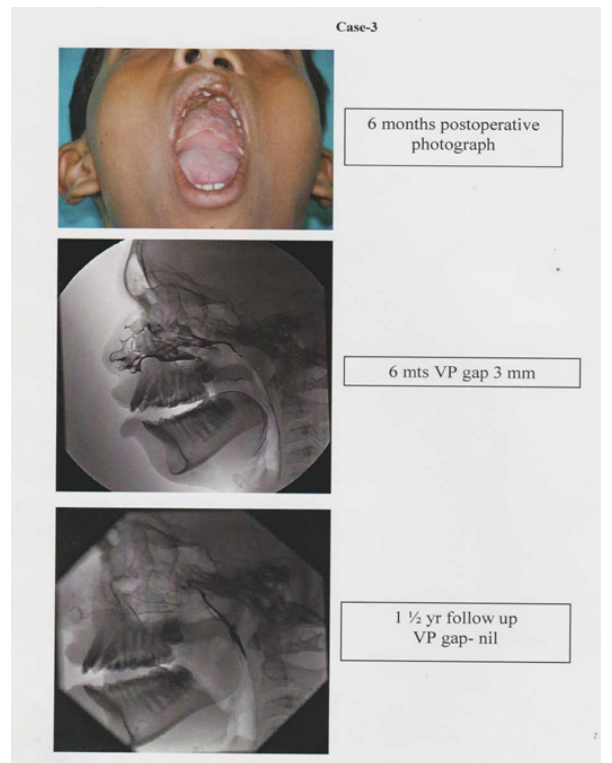
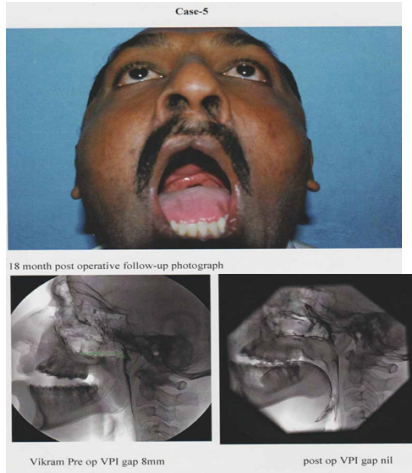
The junction of soft and hard palate is first marked and divided,detaching soft palate and allowing it to move towards posterior pharyngeal wall,creating the defect that will be reconstructed using bilateral buccinators flaps. The levator muscle along with the oral mucosa is sutured in V-Y advancement. The buccal myo mucosal flap is planned in the mid part of the cheek,below the parotid papilla and the oral mucosa area is retracted with s silk suture at the angle of the mouth for better exposure.The flap 1.5 to 2 cm in width is raised following incision of its margins in the antero posterior direction,including full thickness of the buccinator muscle¹⁵.sharp dissection is avoided just before reaching the pterygomandibular raphe. The first flap raised is sutured with its mucosal surface facing into the nasal layer of the defect. The opposite mucosal flap is then raised and sutured mucosal surface facing into the oral layer of the defect. The donor sites on either cheek are closed directly with attention being paid to repair of the defect in the remaining buccinators muscle. There are no specific postoperative requirements,and all patients are discharged when comfortable and able to manage adequate oral intake. At follow up the flap is visible as an island of mucosa at the hard-soft palate junction.



SL NO	PT Name	A/S	IPNO	DOS	Pre Op Fistula	VPI GAP		Palate Length		Palate Thickness		Surgery	Complications	Secondary Procedure
						Pre Op	Post Op	Pre Op	Post Op	Pre Op	Post Op			
1	JAYANTHI	25/F	704834	3/2/2007	NIL	1.2 CMS	2MM	2.62 cms	3.23 cms	0.81 cms	1.48 cm	BIL MMF		V-y Advancement
2	S.k. Allaudin	20/M	705485	3/8/2007	MPF	7MM	nil	2.06 cms	2.76 cms	0.89 cms	1.18 cms	BIL MMF		
3	Umapathi	13/M	705494	3/8/2007	NIL	8mm	3MM	1.96 cms	3.11 cms	0.94 cms	1.33 cms	BIL MMF		
4	Ranganayakulamma	17/M	707391	30/30/2007	PAF, APF	8MM	nil	1.9 cms	2.39c ms	0.8 cms	0.97	BIL MMF		
5	Vikram	28/M	707383	3/21/2007	APF	8MM	NIL	1.91 cms	3.30 cms	0.94 cms	1.52 cms	BIL MMF	Flap Pedicle Compression	Pedicle Division
6	Vanitha	11/F	716609	7/10/2007	APF	12MM	5MM	1.97 cms	2.83 cms	0.68 cms	1.33 cms	BIL MMF		
7	T. Shanthi	15/F	721534	9/6/2007	NIL	6MM	nil	2.03 cms	2.8 cms	0.93 cms	1.3 cms	BIL MMF		
8	B. Shanthi	18/F	721824	9/12/2007	NIL	14mm	12mm	2.41 cms	1.96c ms	0.96 cms	1.05 cms	BIL MMF	Flaps Necrosed	Redo Bil Mmf
9	Ameer Fathima	12/F	726231	10/31/2007	NIL	8MM	nil	2.01 cms	3.1 cms	0.89 cms	1.58 cms	BIL MMF		
10	Renuka	21/F	80499	2/27/2008	APF	NOT DONE	nil	NOT DONE	2.98c ms	-	1.04 cms	BIL MMF	Flap Necrosed Compression	Flap Pedicle Division
11	Ravi Kumar	18/M	811563	5/14/2008	APF	NOT DONE	nil	NOT DONE	2.77 cms	-	1.27 cms	BIL MMF		
12	Achutha	15/M	815629	6/25/2008	NIL	7MM	5MM	2.04 cms	3.01 cms	1.13 cms	1.25 cms	BIL MMF		

For pre op gap: Mean value-9.32,Median value-8,IQR value is-4.75

For post op gap: Mean value is-5,Median value is 3.5,IQR value is-9



RESULTS:

15 cases were operated between 2006 june -2014 june; out of which 12 cases had come for follow up.They were all subjected for speech evaluation and videofluoroscopy.In video fluoroscopy the velopharyngeal gap on phonation,and soft palatal length were recorded.

Duration of follow up

Duration : <1 year:---- 3 cases, >1 year--- 9 cases
Maximum duration of follow up was 1 years 10 months., Minimum duration of follow up was 07 months.

Age/Sex

Minimum age at operation was 11 years
Maximum age at operation was 28 years
Mean age was 17.75 years
Sex : Females-07 cases, Males-05 cases.

Velopharyngeal gap on phonation:

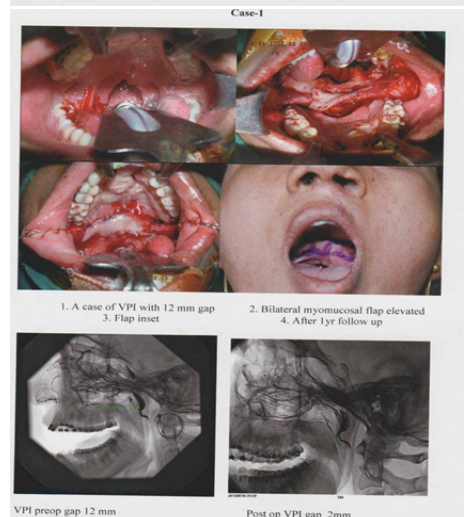
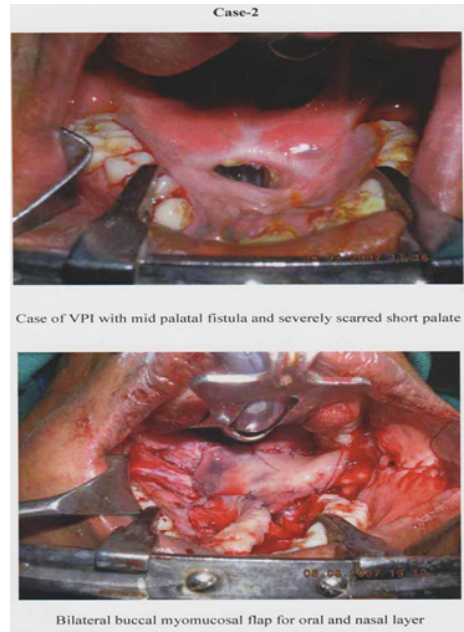
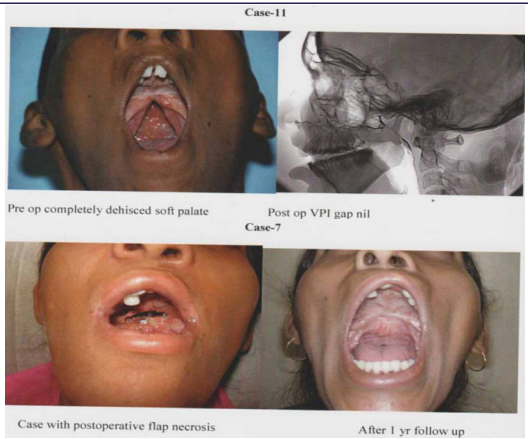
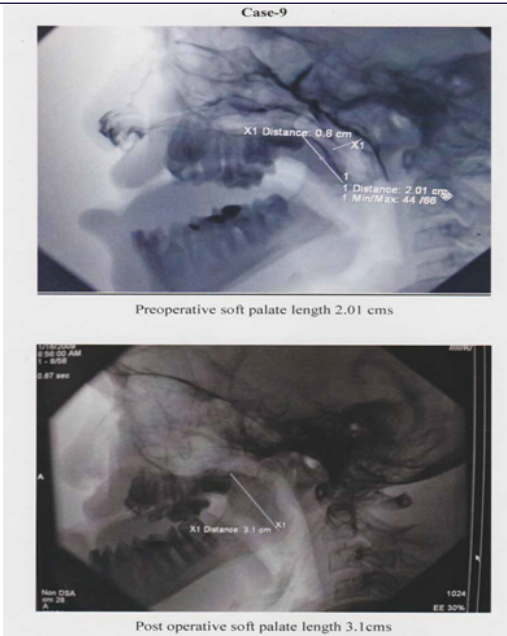
Case.No	Pre op gap	Post op gap
1	12mm	2mm
2	7mm	1mm
3	8mm	Nil
4	8mm	Nil
5	8mm	Ni
6	12mm	5mm
7	14mm	12mm
8	6mm	Nil

07 of 12 patients had complete closure of the velum on lateral view videofluoroscopy examination.

Average closure of velopharyngeal gap by the procedure was 7mm.

In two(02) cases reduction of VP gap was only 2mm;out of these two cases one had flap necrosis in both flaps and the other had only 7 months follow up.

In one case VP gap reduced to 3mm from 8mm in six months post operatively,and attained complete closure after 18 months follow up.In two cases soft palate was dehisced completely and was short and scared.They were not subjected to video fluoroscopy pre operatively but at postoperatively subjected to video fluoroscopy and the VP gap found nil.Maximum reduction of VP gap was 10 mm.



Soft Palate length:

Case No	Pre op length	Post op length
1	2.62cms	3.23
2	2.06cms	2.76cms
3	1.96cms	3.11cms
4	1.9cms	2.39cms
5	1.91cms	3.30cms
6	1.97cms	2.83cms
7	2.03cms	2.8cms
8	2.41cms	1.96cms
9	2.01cms	3.1cms
10	Not done	2.98cms
11	Not done	2.77 cms
12	2.04cms	3.01cms

For pre op length: Mean value is 2.09, Median value is-2.02, IQR value is-0.2,

For post op length: Mean value is-2.95, Median value is-2.97, IQR value is-0.3

Average gain in length of the palate was-0.74 cm, Maximum gain in length was 1.39 cm, Minimum gain in length was 0.41 cm, The mean palate length was increased by 35%.

Complications:

In 1 of 12 cases the buccal myomucosal flaps necrosed. In 2 cases an ulcer developed due to interposition of pedicle of the flap between the molars; this was devided under local anesthesia on out patient basis uneventfully. In the early post operative period, 4 cases in the series expressed a subjective tightness of their cheek mucosa; this was for a brief time and resolved completely in all 4 cases.

Secondary procedure

Case .No	Pre op gap	Post op gap	Followup Duration	Remarks
1	12mm	2mm	19months	V-Y advancement done
2	7mm	1mm	22months	V-Y advancement was planned
6	12mm	5mm	18months	Posterior wall augmentation planne
7	14mm	12mm	14 months	Redo bilateral myomucosal Flap cover was done
12	7mm	5mm	7months	Definitive plan after Following up for 1 yr

In case no 1 the post operative VP gap was 2 mm; this case was underwent V-Y advancement of oral layer of soft palate and tightening of levator muscle.

In case no 2 redo bilateral buccal myomucosal flap was done after 1 year follow up.

DISCUSSION

Many surgical and non surgical options have been proposed for correction of velopharyngeal incompetence as a primary and secondary procedure. These include speech therapy, prosthesis, posterior pharyngeal augmentation by injection or implantation, palatal rapair, Furlow's double opposing Z-plasty, posterior pharyngeal flap, and sphincter pharyngoplasty (yules, 1970). The existence of the large number of alternatives reflects the multifactorial nature of velopharyngeal incompetence but also implies the failure of some of the techniques to deliver consistent results with few

complications(witt et al.,1998).

Perkin JA et al observed that Furlow's palatoplasty helps in VP gap closure in only 40% moderate to severe VPI patients¹⁸. Most of the studies recommend use of Furlow's palatoplasty for VP gap less than 5 mm. In previous study in our institute the average gain in soft palate length was noted to be 3.86 mm.

Restoration of normal anatomy is one of the fundamental tenets of plastic surgery and the buccal myomucosal flap offers a more anatomical correction of short palates than traditional repairs. Where the palate appears short in relation to the gap, the anatomical defect is addressed directly. Mukherji was the first person to realize that this flap lengthens the soft palate and releases tension mainly antero posteriorly and to some extent transversely, adding up to 1.5-2.0 cm to the nasal layer and enabling closure of wide clefts. In our study the average gain in the length was noted to be 7.4 mm (35% gain).

In our study, done in patients with moderate and severe VPI with VP gap (>5 mm) a significant improvement in the VPI in 92% (11/12) patients was observed. Complete closure of VPI could be successfully achieved in 59% (7/12). In 33% (4/12) the persistent velopharyngeal gap was less than 5 mm.

Jackson IT et al combined palatal repair with single buccal myomucosal flap occasionally in conjunction with other techniques in their study². Out of 6 cases with moderate and severe VPI, 3 cases had mild velopharyngeal incompetence post surgically. Due to the relatively small number of the patients studied it makes analysis of these results difficult to draw conclusions.

In other study by Hill et al, 16 patients with VPI underwent palatal lengthening using sandwich bilateral buccinator myomucosal flaps. 93% (15/16) were reported to have significant improvement in velopharyngeal insufficiency¹⁵. However no distribution was between mild, moderate and severe VPI.

No major problems have been observed in the donor site of the buccal flap. The buccal mucosa available in adequate amount, and there is no significant danger of airway obstruction or haemorrhage. None of the complications described in the literature, such as swelling of face, infection, or stenosis of the parotid duct encountered. In our experience, the secondary palatoplasty with the buccal myomucosal flap has been an extremely safe and easy performed surgical procedure.

Conclusion

The buccal myomucosal flap is an effective technique that can be used in secondary palatal repairs as a single procedure or in conjunction with other techniques. It is effective in treating short soft palates, fistulas in the palates, for poor speech.

The buccal myomucosal flap allows both closure and lengthening of the soft palate without tension. Accurate reconstruction and repositioning of the muscle sling improves velopharyngeal incompetence and consequently speech and hyperresonance.

The buccal mucosa should be harvested with the buccinator muscle for increased survival and the dissection should be meticulous at the pterygomandibular raphe, where the vessels enter the flap.

REFERENCES:

1. Dufresne CR, Oronasal and nasolabial fistulas. In Bardach J, Morris HL.
2. Hill, C., Hayden C., and Leonard, A. G. Buccinator sandwich pushback: A new technique for the treatment of secondary velopharyngeal incompetence. *Cleft palate Craniofac. J.* 41:230, 2004.
3. Filiberti, A. T. Plastic closure of a septal perforation. *Ann. Chir. Otorhinolaryngol.* 96: 1, 1965.
4. Mukherji, M. M. Cheek flap for short palates. *Cleft palate J.* 6: 415, 1969.
5. Ganguli AC. Lengthening of short palate by submucous pedicle cheek flap. Presented at the 5th annual meeting of the International plastic and reconstructive surgeons; Melbourne, Australia 1971.
6. Jackson I. T., Moreira-Gonzalez, A. A., Rogers, A. and Beal, B. J. The buccal flap: A useful technique in cleft palate repair? *Cleft palate craniofacial. J.* 41: 144, 2004.
7. Kaplan, E. N. Soft palate repair by levator muscle reconstruction and a buccal mucosal flap. *Plast. Reconstr. Surg.* 56: 129, 1975.
8. Maeda, K., Ojimi, H., Utsugi, T., and Ando, S. A T-shaped musculo mucosal buccal flap method for cleft palate surgery. *Plast. Reconstr. Surg.* 79: 888, 1987.
9. Nakakita, M. D., Karo maeda, M. D., Hiroyukiojimmii. The modified buccal mucosal flap for cleft palate surgery. *Plast. Reconstr. Surg.* 79: 421-426, 1987.
10. Freedlander, E. and Jackson I. T. Fate of buccal mucosal flaps in primary cleft palate repair. *Cleft palate J.* 26: 110, 1989.
11. Skolnick, M. L., and Cohn, E. R. Videofluoroscopic study of speech in patients with cleft palate. New York: Springer-verlag, 1989.
12. Zhenmin Zhao, Senkai Li Yipping Yan, Buccinator myomucosal island flap- An anatomical study and clinical application. *Plast. Reconstr. Surg.* 104: 55, 1999.

13. Moore F T, Chong J K. The sandwich technique to lengthen the soft palate. *Bri. J Oral surg.* 4: 183-188, 1967.
14. Bozola AR, Gasques JAL, Carriquiry CE. The buccinator musculomucosal flap: Anatomic study and application. *Plast. Reconstr. Surg.* 84(2): 250-257, 1989.