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SYSTEMATIC-REVIEW

Role of Buccinator Myomucosal Flap in Primary Repair of Cleft Palate: Systematic Review

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Abstract

Background: Existing palatal tissue is used in traditional cleft palate repair techniques to achieve closure. Insufficient palate length, improper positioning of the velar musculature, and scarring and development limitation are possible outcomes of these surgeries. Buccinator myomucosal flap (BMMF) provide extra tissue and limits these drawbacks.

Objective: The aim of this study is to clarify the indication, limitation, drawbacks of clinical application of BMMF in primary repair of cleft palate with systematic review in English written papers since 2016.

Patients and methods: Systematic review was accomplished utilising the PRISMA statement, or preferred reporting items for systemic review and meta-analysis. The study obtained information about articles that were published between 2010 and 2022. The analysis covered all published publications examining the role of the BMMF in the primary repair of cleft palate.

Results: The included number of patients in this review study was 540 cases. The average defect reported in all studies was 1.25 cm and the main age was 12.5 months, the palatal lengthening outcome after myomucosal flap increased by 8.4 mm in average. The incidence of fistula reduced from 6.5% to 5%. 90% of the cases with normal speech and only 6.6% of the patients needed secondary speech surgery.

Conclusion: Regarding speech result, velopharyngeal insufficiency (VPI), and fistula occurrence, primary palate repair with the BMMF has been a successful procedure. It permits nasal layer lengthening, excellent levator muscle sling restoration and retro placement, tension-free palate closure, and the lack of raw areas that could hinder facial growth. Further comparative studies with other techniques with large sample size and long follow-up may be beneficial to find out the best procedure in terms of outcome and complication.

Keywords: Buccinator, Cleft palate, Myomucosal flap, Primary repair, Systematic review

1. Introduction

An optimum and effective palatal repair requires tension-free soft palate myomucosal closure. In order to enable an effective velopharyngeal valving motion during speech and create the right conditions for optimal velopharyngeal closure, it should extend the palate and reconstruct the muscle sling.¹

Basically, all of these requirements are met by the modified palatoplasty with the buccal myomucosal flap (BMMF).¹

BMMF had been developed and described in literature since 1984 to treat wide cleft palate.²

The BMMF, which has an axial pattern and contains buccinators and orbicularis oris muscle fibres in part, is covered by the buccal mucosa. It is a skeletonized version of the inferiorly pedicled facial artery and vein musculomucosal flap (FAMM) with a vascular island.³

According to Zhao et al., a pedicled flap or an axial flap based on the buccal or face artery can be harvested from the BMMF and can be positioned anteriorly, posteriorly, inferiorly, or superiorly.⁴

There are many advantages gives the BMMF the upper hand over other flaps such as simplicity, provision of tissue of similar anatomy and

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physiology, excess tissue to overcome the shortage in mucoperiosteal flap.⁵

However, no definite conclusion in literature regards indications and limitations of buccinator flap in primary repair of cleft palate.

This work aimed to clarify the role of buccinator flap in primary repair of cleft palate in a systematic review.

2. Patients and methods

Systematic review was accomplished utilising the PRISMA statement, or preferred reporting items for systemic review and meta-analysis. PubMed, PLOS, and the Cochrane library were searched for relevant literature.

To download the articles from the Scopus and Clarivate databases, many search engines was used, including the Egyptian Knowledge Bank (EKB) platform. The study obtained information about articles that were published between 2010 and 2022.

The analysis covered all published articles examining the role of the BMMF in the initial healing of cleft palate. The search phrases, their equivalents, and closely associated terms that utilised in this analysis include (cleft palate, buccinators, myomucosal flap, primary repair, complications). and abstract were the primary criteria for including or excluding studies. Researcher used Endnote by Clarivate to address the references. Data extraction was carried out methodically by two independent surgeons while following the PRISMA recommendation. The effectiveness of the BMMF in the primary repair of cleft palate, as well as its drawbacks, functional and aesthetic results, and patient and surgeon satisfaction, were examined in the study.

2.1. Inclusion criteria

As there is no randomized study, all observational studies, that included cohort studies and retro-analyses. All articles included are describing all of the following; the architecture of the BMMF and surgical methods, applications, limitations, donor site morbidity, functional and aesthetic outcomes in primary repair of cleft palate included in this study.

Characteristics that analyzed in the included studies are authors, country origin of the article, year the article published, study design, number of patients in each study, average age and SD, number of flaps, average follow-up-SD, up reported outcome, Level of evidence, and description of the study bias by ROBINS-1.

2.2. Exclusion criteria

All studies including experimental review or animal study will be excluded.

2.3. Surgical technique

When treating primary cleft palates or velopharyngeal insufficiency, the defects made at the meeting point of the hard and soft palates are repaired. That depends on the actual soft palate condition (i.e., the amount of scar tissue and/or the availability of soft tissue), other surgical techniques were used to enable retro-positioning of the soft palate without tension.⁶

Prior to primary cleft palate repair or the management of velopharyngeal insufficiency, the flaps were formed with a 'V' shape a few millimetres below the oral commissures. Posteriorly, cranial flap marking is related to the defect created at the soft palate. The middle of the cheeks, below, were planned for posteriorly based pedicled BMMFs following the formation of the palatal defects.

The flap's width is determined by the palatal defect that remains after complete dissection.⁷ Different flap designs may be utilised, depending on the defect's position, size, and rotational arc. Once the flap edges have been cut, the flap is lifted in an anteroposterior direction to cover the complete thickness of the buccinator muscle. Do not pry open or otherwise agitate the fascia covering the buccal fat pad. The flaps are then inserted into the flaw; ideally, palatal flaws should be corrected whenever possible with a two-layer, tension-free closure. The tissue around the fistula (such as marginal fistula hinge flaps) is employed in the nasal layer repair depending on the availability of healthy tissue.⁶

This got people to thinking of using the buccinator flap in cleft palate primary repair to lengthen the palate and reduce the incidence of velopharyngeal insufficiency (VPI). With a systematic analysis of English-language publications published since 2010, the purpose of this study was to elucidate the indication, restriction, and disadvantages of therapeutic application of the BMMF in primary repair of cleft palate (Figs. 1–6).

3. Results

Since the creation of the databases, a digital search of PubMed, Embase, Scopus, and Web of Science has been carried out. Primary repair, BMMF, Furlow, double opposing z-plasty, VPI, hypernasality, and nasal air emission were some of the search phrases used. Only articles in the English language were included in the search. 780 distinct

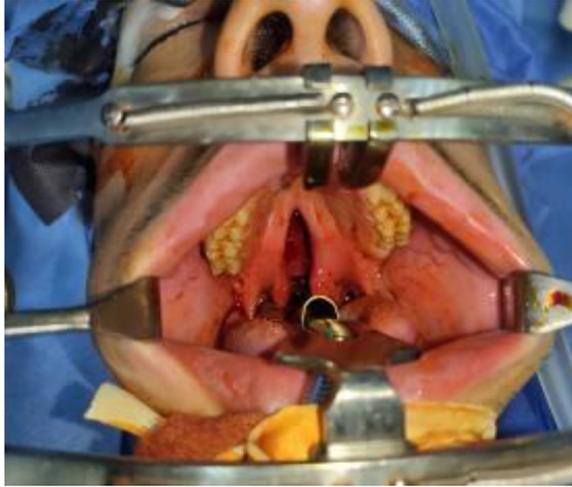


Fig. 1. Male pt 20 presented late by wide cleft secondary palate.

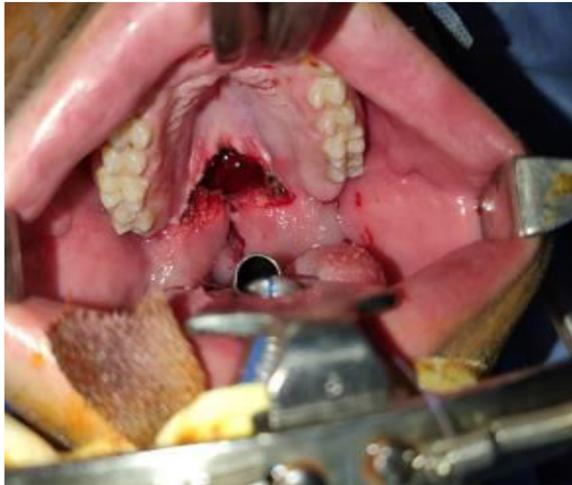


Fig. 2. Defect between hard and soft palate.



Fig. 3. Marking of the buccinator myomucosal flap 0.5 cm behind oral commissure posteriorly based.

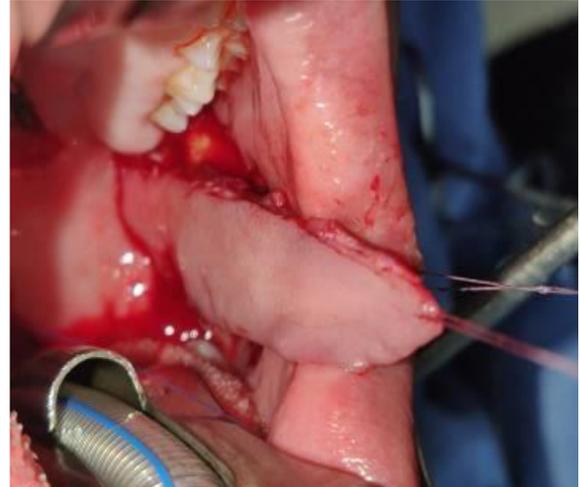


Fig. 4. Elevated BMMF

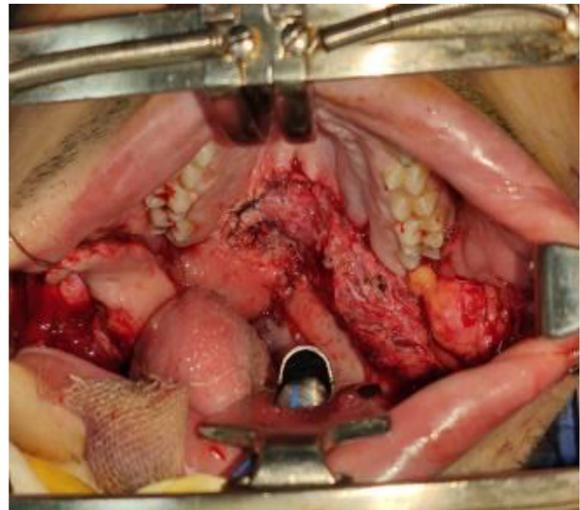


Fig. 5. Setting of unilateral one as anasal lining layer.

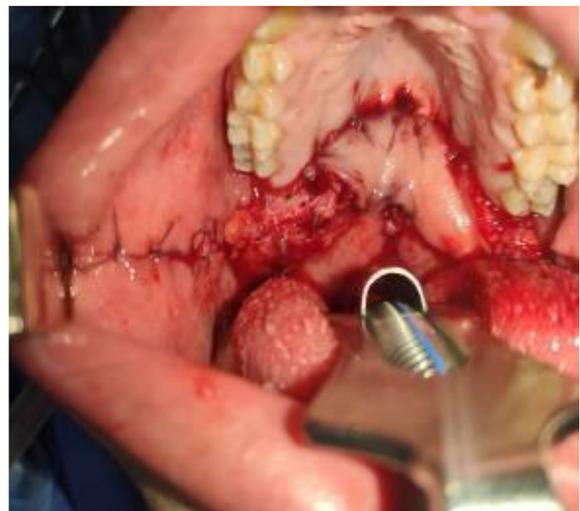


Fig. 6. Setting of the second flap as an oral layer opposing the first nasal lining one and closure of the doner site primarily.

citations were found using the search method. 104 possibly relevant publications were found after titles and abstracts were screened.

Seven papers that met the inclusion criteria for the article regarding the buccal flap's role in the primary repair of cleft palate since 2010 were found after a full text analysis of these articles.

Results details are in [Tables \(1–8\)](#).

A total of 540 cases were included with mean age was 12.4 months.

Total number of flaps were 827, mean width of the flap in mm was 11.2 and mean follow-up was 10.9 months.

Mean palatal length was 21.5 preoperative which increased to 29.6 postoperative, and the average change was 8.4 mm.

A total of 46 complications were founded, mostly were dehiscence complications in 7 cases, infection in 1 case, mouth opening limitations In 3 cases, hematoma in 2 cases, necrosis in 6 cases and fistula in 33 cases as shown in [Table 5](#).

3.1. The main results of the study revealed that

The included number of patients in this review study was 540 cases. The average defect reported in all studies was 1.25 cm and the main age was 12,5 months, the palatal lengthening outcome after myomucosal flap increased by 8.4 mm. The incidence of fistula reduced from 6.5% to 5%. 90% of the cases with normal speech and only 6.6% of the patients needed secondary speech surgery.

Table 1. Patient's characteristics.

Author	number	Age/m	m/f
Khodir et al. ⁸	40	11.5	25/15
Qamar F et al. ⁹	43	10.8	
Aboulhassan MA et al. ¹⁰	73	11.4	44/29
Denadai R et al. ⁶			
Mann RJ et al. ¹¹	319	10	
Bhayani B. ¹²	50	12.5	
Yang et al. ¹³	15	12	

Table 2. Type of cleft palate.

Author	Pathology and indications
Khodir et al. ⁸	28 patients had complete unilateral cleft (22 in the left side and 6 in the right one), 9 with incomplete cleft while 3 with bilateral cleft lip and palate.
Qamar F et al. ⁹	43 ULCP BCLP, submucous cleft palate
Aboulhassan MA et al. ¹⁰	73 patients, 20 patients had incomplete cleft palate, whereas 53 patients had complete cleft palate. 38 patients had left-sided complete cleft palate, whereas 14 patients only had right-sided complete cleft palate.
Denadai R et al. ⁶	Late presentation beyond (12–18 months), wide palate > 1.5 cm gap, not wide but there is a tension in repair 319 patients (UCLP, BCLP)
Mann RJ et al. ¹¹	Wide palate > 1.5 cm
Bhayani B. ¹²	50 patients of wide (UCLP, BCLP)
Yang et al. ¹³	11 patients with unilateral cleft palates and 4 patients with bilateral cleft palates

Table 3. Flap characteristics and follow-up.

Author	number of flaps	width of the flap/mm	follow-up/mn
Khodir et al. ⁸	40	12	
Qamar F et al. ⁹	11	1.75	10.86
Aboulhassan MA et al. ¹⁰	73	12	
Denadai R et al. ⁶		15.5	12
Mann RJ et al. ¹¹	638	12	93,12
Bhayani B. ¹²	50	1.75	36
Yang et al. ¹³	15	20	10

4. Discussion

Speech quality, midfacial development, and fistula rate are three crucial indicators of palatoplasty success. Techniques that maintain palatal length, reduce the scar burden on the hard palate created by relaxing incision, and create as minimal strain across the cleft repair as possible must be used if success in these areas is to be attained Mann and colleagues.¹¹

Despite their continued popularity, traditional palatoplasty treatments mostly rely on muscle and mucosal flaps that are lifted from the major and secondary palates themselves and do not add any new tissue to the repair. These procedures frequently fail to provide the palatal length and tension-free closure that are the characteristics of a successful palatoplasty because of this inherent tissue insufficiency Mann and colleagues.¹¹ However, no definite conclusion in literature regards

Table 4. Palatal length changes.

Author	Palatal length pre	Palatal length post
Khodir et al. ⁸	21.65 ± 4.25	29.65 ± 4.72
Qamar F et al. ⁹		
Aboulhassan MA et al. ¹⁰	21.36 ± 3.529	29.64 ± 4.171
Denadai R et al. ⁶		
Mann RJ et al. ¹¹		
Bhayani B. ¹²		

Table 5. Complications incidence.

Author	complication	Infection	dehiscence	mouth opening limitations	hematoma	necrosis	fistula
Khodir et al. ⁸	0						
Qamar F et al. ⁹	1						1
Aboulhassan MA et al. ¹⁰	7	1	4			1	1
Denadai R et al. ⁶							
Mann RJ et al. ¹¹	32		2			2	28
Bhayani B. ¹²	3					1	2
Yang et al. ¹³	0						

Table 6. Postoperative Speech outcomes; in 2 studies as shown in Table 6.

Author	Results	age
Mann RJ et al. ¹¹	Normal speech in 90% (272/303) Normal nasal resonance in 93,4% Nasal resonance score 1,38% in average	5 y
Bhayani B. ¹²	Normal speech in 90% without speech therapy 10%required post op speech therapy. Speech assessment after 6 months follow-up; Normal 36 72% Mild compromise 2 2% Moderate compromise 6 12% Severe compromise 6 12% The Bzoch Screening Test* Articulation Degree of Resonance Normal Developmental errors Hyper nasal Sibilant distortions Mild Consonant errors Moderate Nasal air emission during pressure consonants Severe hypo nasal Speech intelligibility Good: .85% of correct consonant production in a short conversational sample Mild: 65–84% of consonants are correct Moderate: 50–64% of consonants are correct Severe: ,50% of consonant production are correct	3 y

* 2* Source: Quoted from open access article of Bzoch, 1977. Nasal emission and hypernasality test were standardized on a set of 10 two-syllable words.¹²

Table 7. Speech quality assessment based on the Bzoch test and intelligibility grading system*.

1. In line with age and sex
2. Mild intelligibility impairment; repetition not necessary; mild difficulty understanding
3. Moderately challenging; rare repetition required; moderately impaired intelligibility
4. Extremely tough; usually requires repeating; severely impairs comprehension or, after repeated readings, becomes incoherent

3 Source¹².

Table 8. Secondary speech surgery for velopharyngeal insufficiency.

Author	Yes	Type
Mann RJ et al. ¹¹	Performed in 20 of 303 (6.6%)	Sphincteroplasty Pharyngeal flap

indications and limitations of buccinator flap in primary repair of cleft palate.

This has led toward the thinking of the use of the BMMFs to lengthen the palate. It was described in 1989 for the wide cleft palatal repair by Bozola recording a great improvement in nasality.

The preferred reporting items for systemic review (PRISMA) statement was used in this study to conduct a systemic review. All published publications examining the role of the BMMF in primary repair of cleft palate between 2010 and 2022 were considered for the study. In the current systematic review 7 studies meeting inclusion criteria Denadai and colleagues, Khodir and colleagues, Mann and colleagues and Yang and colleagues.^{6,8–11,13} Patients with cleft palate with or without cleft lip (CP + CL) were included in all investigations. In each study, the patient cohort was operated on by up to 4 surgeons at a single facility.

Out of the 7 studies there were 3 were retrospective studies Qamar and colleagues,⁹ Bhayani,¹³ Mann and colleagues,¹¹ and 4 were prospective studies Khodir and colleagues,⁸ Aboulhassan and colleagues,¹⁰ Denadai and colleagues,⁶ Yang and colleagues.¹³

Regarding the Patient's characteristics in the enrolled studies, This study, that the total number of 540 cases were included with maximum number of cases (73 patients) were assessed by Aboulhassan and colleagues.¹⁰ The mean age 9.8 years with minimum 0.9 years in the study by Qamar and colleagues,⁹ and maximum mean age of 20 years in the study by Denadai and colleagues,⁶ and the total male to female ratio was 107/70. Sex not stated in the study by Bhayani,¹² Qamar and colleagues,⁹ and Yang and colleagues.¹³

Regarding the total number of flaps used there were 827 flaps was used with mean width of 10.7 mm, and mean follow-up period is 32.5 months.

Regarding Palatal length changes, the current review mean palatal length pre was 21.5 which increased to 29.6 post. Change of palatal length was mentioned by 2 studies Khodir and colleagues,⁸ Aboulhassan and colleagues,¹⁰ with almost similar values.

The study by Khodir and colleagues,⁸ reported that the palatal lengthening was of a postoperative mean 29.65 (4.72) compared with preoperative mean of 21.65 (4.25) among 40 patients with an age range of 9–14 months.

The pre and postoperative data were significantly different ($P = 0.001$) using a paired t -test.

Whereas, Aboulhassan and colleagues,¹⁰ reported that the mean palate length after surgery was 29.64 4.171 mm, compared with the mean palatal length before surgery of 21.36 3.529 mm. Palatal length changed on average by 8.29 2.514 mm ($P = 0.000$). Regarding the Complications, there were a total of 46 complications was founded mostly was dehiscence in 7 cases, infection in 1 case, mouth opening limitations. In 3 cases, hematoma in 2 cases, necrosis in 6 cases and fistula in 33 cases (5%).

The studies by Khodir and colleagues,⁸ and Yang and colleagues,¹³ have not reported any complications in their studies.

However, the study by Qamar and colleagues,⁹ reported that one fistula returned, though it was smaller than it had been before surgery. There were no further fistulas.

The study by Aboulhassan and colleagues,¹⁰ reported that out of 73 treated cases there were cases had dehiscence, 1 case got infection, 1 case developed necrosis and 1 case had fistulas.

Mann and colleagues,¹¹ indicated the flap when the cleft gap more than 1.5 cm, however Denadai R and colleagues,⁶ added late presentation beyond the age of (12–18 months) or tension on repair whatever the gap.

The overall results of this study in terms of palatal lengthening, low fistula rate, improved speech outcome, make the role of BMMF in primary repair of cleft palate effective and beneficial. That could recommend BMMF in complex syndromic cases with short and wide palate.

Further comparative studies to other techniques with large sample size and long follow-up may be beneficial to find out the best procedure in terms of outcome and complication.

5. Conclusion

The BMMF has been used successfully for primary palate repair.

It permits nasal layer lengthening, excellent levator muscle sling restoration and retro placement, tension-free palate closure, and the lack of raw areas that could hinder facial growth.

Interestingly, BMMF could be indicated mainly in wide cleft more than 1.5 cm, as well as in a short palate, and in cases lately presented.

Disclosure

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Authorship

All authors have a substantial contribution to the article.

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Conflicts of interest

There are no conflicts of interest.

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