# Submental artery flap versus Facial artery mucosal flap in maxillary reconstruction: Pros and Disadvantages

**Original Article**

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## ABSTRACT

The current state-of-the-art in palatal tumours treatment is excision followed by immediate defect repair. Immediate defect restoration with tissues that are comparable in texture, thickness, and colour eliminates the disadvantages of secondary reconstruction. Immediate rebuilding avoids fibrosis and subsequent defect shrinking, resulting in the loss of true defect borders and dimensions. Only the local random and axial pattern flaps can provide excellent colour and texture for palatal tissue reconstruction. However, the axial pattern flaps provide vascularized tissues of greater size than the random pattern flaps. The submental artery flap (SAIF) and the facial artery myomucosal flap (FAMM) are both axial pattern flaps that are based on the facial artery. They give an abundance of soft tissues with a long arc of rotation capable of repairing multiple palatal defects at the same time. They were employed on 14 patients at the same time as tumour removal. The article explains the comprehensive surgical anatomy and harvesting process, as well as the versatility and reliability of the flaps. It also reviews the clinical findings and explains the benefits and drawbacks of each flap.

**Key Words:** Axial pattern flaps, SAIF, FAMM.

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## BACKGROUND

Post-excision medium-sized palatal defects do not allow tension-free primary closure and, at the same time, adversely affect swallowing and speech when reconstructed with bulky distant flaps. Furthermore, the texture and consistency of those flaps severely alter most normal functions. Local flaps, as opposed to distant flaps, take less time and provide appropriate flap thickness, surface texture, and colour. As a result, they are regarded as an excellent approach to palatal defect repair. Local flaps are defined as either random or axial pattern flaps based on their vascular supply.

Axial pattern flaps, on the other hand, are created with the flap aligned axially along a superficial vascular pedicle. Axial pattern flaps are directly supplied from the vascular pedicle, ensuring not only enough blood supply to the flap but also improved circulation at the site of reconstruction. Because these flaps are not confined to the 2: 1 ratio and the conventional arc of rotation, they have replaced inadequately vascularized and limited-sized random flaps in the restoration of major palatal defects.

The facial artery with its branches offers a strong circulatory supply to the face and cheek mucosa. Based on the facial artery, two axial flaps are now common. Martin et al created the SAIF in 1993[1]. It is thin, malleable, and has a long, dependable pedicle. In addition, a huge surface area may be harvested. It has uses comparable to the radial forearm flap but without the necessity for skilled microvascular skills. However, because free flaps have become the gold standard, there has been a lack of research employing the SIF for palate reconstruction in the last 10 years, and there have been no reports of its potential advantages compared to a free flap in resource-limited settings.

The facial artery myomucosal flap (FAMM) is another common cheek mucosal flap. It is an axial pattern flap based on the facial artery itself reported by Pribaz et al in 1992, with useful dimensions of 11 x 2 cm ideal for restoring moderate-size palatal defects. The FAMM flap includes the mucosa, the underlying facial artery, and a tiny cuff of the buccinator muscle[2 -4].

The FAMM flap can be pedicled either inferiorly (orthograde flow) or superiorly (retrograde flow) on the retromolar area[5]. The facial artery itself is anatomically located immediately under the mucosa but deep to the facial muscles (as risorious, zygomaticus major, levator anguli oris). The facial artery only provides a few continuous branches that enter the surrounding muscles, but the artery itself continues to flow deeper to the muscles just beneath the mucosa without penetrating them. The buccinator muscle is the only exception; the artery transversely crosses across it, diagonally crossing between it and the mucosa from its inferior to the superior border[6].

As a result, the flap can be raised as a completely

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mucosal flap, containing only the mucosa and a minimal cuff of the buccinator, precisely where the artery passes further into the muscle. When the flap is liberated from the underlying muscle, the associated muscle cuff protects the pedicle from kinking and prevents unwanted separation of the muscle from the artery.

In comparison to the submental artery flap, the FAMM has much lower donor site morbidity since it does not create an additional extraoral scar. Furthermore, it is exceedingly thin in thickness. The FAMM flap, on the other hand, has certain drawbacks, including its relatively modest breadth compared to the SAIF, which limits its application to large palatal defects. Furthermore, flap harvesting is technically challenging because the face artery follows a complex tortuous path that risks pedicle damage[7, 8]. Thus, binocular loupe magnification and time-consuming dissection are required for safe flap elevation.

## PATIENTS AND METHODS

A retrospective analysis was aimed to include instances of palatal benign and malignant tumours submitted to Shefa OMFS and Faculty of Dentistry Minia University between November 2023 and April 2024. Fourteen individuals were chosen, ranging in age from 20 to 60 years old and suffering from palatal tumours averaging 2-3 cm in diameter. All data were reviewed to determine the tumour type, size, flap dimensions, surgery duration, and a short and long-term follow-up period of up to 6 months. The treatment approach included comprehensive excision of the lesion with a reasonable safety margin, followed by immediate repair with the SAF and FAMM flaps.

Prior to surgery, the facial artery was detected by digital palpation and traced with methylene blue throughout its journey across the skin and mucosal surfaces. Using methylene blue and permanent skin markers, the flap region was then precisely centered over the facial artery path. Although Audible Doppler ultrasound validated the artery path, direct digital palpation may be used in most circumstances. The reconstruction procedure commenced using 4x magnification binocular loupes.

### *Surgical technique*

### *Facial artery myomucosal flap (FAMM)*

The flap width was set such that the maximal dimension could be harvested without harming the lip mucosa or the parotid duct. The flap length was increased by creating an arch with two linked arms above the artery. The first arm stretched diagonally down to the commissure from the alar base. Then, from the commissure, a second arm curled in the opposite manner towards the retromolar region. When the flap is raised, the arc is extended, increasing the length by one to two centimeters. By incising the lateral marked edge along the commissure with a # 15 blade down to the mucosa, the flap was lifted. The flap is then delicately elevated using Debakey forceps while a blunt scissor is used to deepen the dissection to the buccinator fibers. To find the pedicle around the lower vestibule, a blunt dissection with a curved mosquito is done. The superior labial branch bifurcation is also located, dissected, clamped, and severed. The pedicle is then released, and the scissor is gently used to cut along the lateral border extending the length of the arch. Because the artery is very prone to damage due to its tortuous path, dissection is conducted meticulously step by step, clearly identifying the pedicle prior to each cut.

A transverse incision is made at the upper lip to reach the desired upward level, and the pedicle is clamped and knotted. The flap may now be readily rotated medially and downward, revealing the pedicle where the medial side of the arch is incised under direct vision. The commissure is carefully dissected under the buccinator, and it is cut proximal and distal to the place where the artery runs under the muscle, including a very little muscular cuff. To designate the muscle ends and aid subsequent donor site closure, both muscle ends were sutured with 3/0 vicryl. The flap is now free from all sides except the base, where the facial artery connects it to its bed. As a result, the flap was turned inside out to cover the defect. To separate the nasal and oral mucosa, the recipient site edge is sliced with a blade and dissected using a curved periosteal elevator. Primary orienting sutures were used for flap insetting. The flap was then grasped all the way around to the defect borders with a series of untied 4/0 vicryl sutures.

The donor site was next addressed; the muscle was approached by tying the previously indicated muscle sutures and the margins were undermined to achieve direct closure. The viability of the flap was verified with a needle prick, and then normal surgical termination procedures were performed.

**Figure 1:** palatal mass with central ulcer

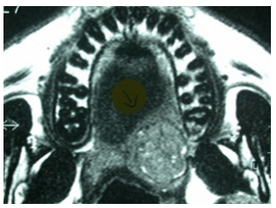
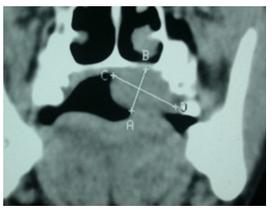



**Figure 2:** MRI well defined palatal mass
**Figure 3:** CT coronal showing extensions


**Figure 4:** Defect after tumor excision
**Figure 5:** Excised specimen

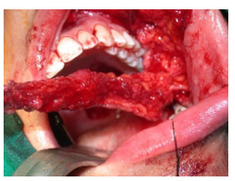



**Figure 6:** Mapping of the artery & flap
**Figure 7:** Flap raised on its pedicle


**Figure 8:** one week postop. **Figure 9:** 6-month postop.

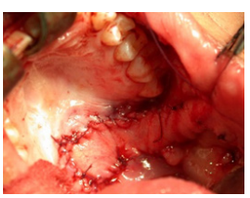



**Figure :10,11** Another case showing complete flap insetting and 1 year postop

***Submental artery flap***

***A) Flap design***

An elliptical or spindle-shaped skin paddle was drawn with the neck in the normo-position according to the dimensions of the primary defect. The amount of the skin harvested without affecting on the primary closure was customized according to the laxity of each patient.

The pinch test was done to estimate the maximum width depending on how floppy the neck skin was, in order to allow for primary closure of the donor incision. The superior boundary of the incision was positioned at least one centimeter below the mandibular border to preserve the marginal mandibular nerve and avoid lower lip eversion.

***B) Flap incision and dissection:***

After identifying and marking the facial vessels until their origin from the external carotid artery and the submental artery with its perforators using the hand Doppler ultrasound, the incision was started from the opposite side of the pedicle with the neck hyperextended along the inferior margin in a subplatysmal plane to the midline, followed by submandibular gland traction and/or excision.

In some cases, the antegrade approach was used starting from the pedicle. The submental vessels were seen near the medial edge of the digastric muscle's anterior belly. They entered deep into the muscle the majority of the time, but not always. Above the mandibular border, the facial arteries were tied off, and the upper half of the flap was incised (Special care has to be done to avoid injury of the marginal mandibular nerve).

Including the anterior belly of the digastric muscle to protect the vascular pedicle and taking a sleeve of the mylohyoid muscle, as well as slicing the posterior belly of the digastric muscle to liberate the facial artery. The dissection was continued until the distal boundary of the maxillary and/or midface defect was reached with sufficient length of the pedicle.

The flap was raised medially, dissecting the mylohyoid muscle tissues while leaving the mandibular bone and platysma attached to the flap. After tracing the facial artery as it traveled behind the submandibular gland, the submental artery may be retracted by pulling downward on the gland. The submental island flap encompassed the anterior belly of the digastric muscle, the mylohyoid muscle, and the skin paddle.

The submental vein connects the common facial vein with the submental vein, which drains into the same gland. The flap was transferred into the defect, and the mandibular bone had to be cut and twisted into the shape of the maxilla. The marginal mandibular nerve was routed beneath the elevated flap. The flap was able to advance their pedicles further and rotate in a larger arc as a result.

The skin paddle of the flap was given through a tunnel made either subcutaneous or submucosal, medially or laterally to the mandible, depending on the site of the defect. With or without a drain, a flap was insetted in the defect and sutured. To avoid lip eversion or injury to the marginal mandibular nerve, the donor site was closed by undermining the inferior neck flaps rather than the superior one.

**Figure 12**. Maxillary tumor

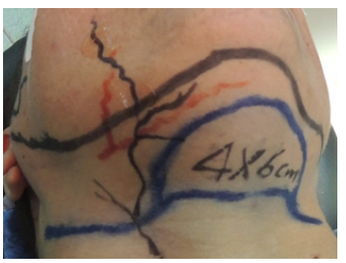



**Figure 13.** Marking the dimensions of the submental flap and tracing the facial artery and the submental artery using the handheld Doppler ultrasound.

**Figure 14**. The submental musculocutaneous flap.

**Figure 15.** Submental Island Flap Insetting.

All patients were held in the department for 8 hours to check post-operative recovery before being discharged the next day. Clinical assessment was used to check flap viability and the existence of uneventful healing at 3, 5, and 1-week intervals. After 21 days, the pedicle was cut with local anesthesia, and the extra tissue was carefully returned to the donor site. Long-term follow-up was performed on a monthly basis for the next six months.

## RESULTS

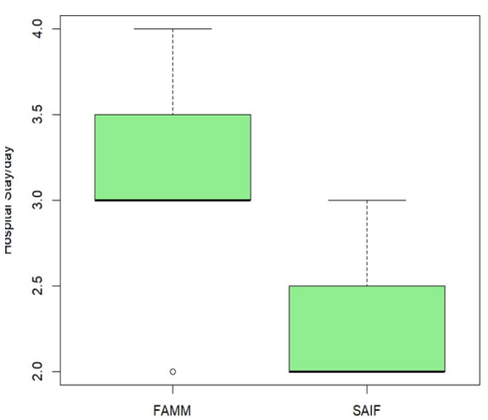
The study incorporated fourteen patients who went through reconstruction of maxillary defects utilizing both pedicled SAF and FAMM flaps.

### *Maxillary defects and patient features*

Fourteen patients were given 14 flaps from Shefa OMFS the faculty of Dentistry-Minia University, and Malawi Specialized Hospital. The age and gender distributions of patients in the FAMM flap and SAF groups were comparable. The majority of the time, primary resection and reconstruction were performed simultaneously in both groups. Fourteen individuals were chosen, ranging in age from 20 to 60 years old and suffering from palatal tumours averaging 2-3 cm in diameter. All data were reviewed to determine flap dimensions, surgery duration, hospital stay, complications, advantages, disadvantages, and a short and long-term follow-up period of up to 6 months.

### *Operative and postoperative results*

In terms of flap size, surgical time, and hospital stay, the FAMM and SAF groups were compared. The mean flap size in the SAIF group was much larger than that in the FAMM group. Patients undergoing FAMM flap repair had insignificantly shorter operating times but longer hospital stays as compared to the SAIF group. (Figure 16,17)



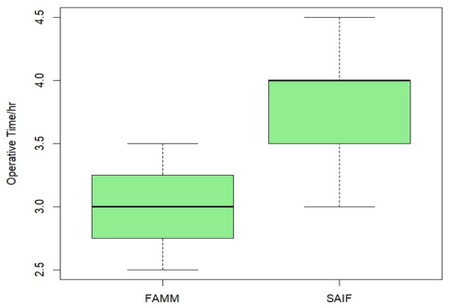



**Figure 16,17**. Show insignificant difference in operative time and hospital stay between FAMM flap and SAIF.

***Functional results***

Speech results were reported to be excellent in the majority of patients, independent of the reconstructive approach used. The vast majority of patients had normal swallowing function. However, the variations in speech and swallowing ability between the two groups were not statistically significant. Scales based on intelligibility. According to Paydarfer et al, the outcomes were stratified into three categories: excellent (80% intelligibility), good (50%-80%), and poor (50%) (Paydarfar and Patel, 2011). Swallowing function was likewise rated differently, with the most robust scale consisting of five categories: full diet, soft diet, liquid diet, combined oral and gastric tube, and exclusively gastric tube. (Table 1)

**Table 1**. Show the differences in speech and swallowing between the two groups.

| Items | FAMM (No of cases = ) | SAIF (No of cases = ) | P value |
|---|---|---|---|
| **Speech** | | | |
| Excellent | 4 | 3 | |
| Good | 2 | 3 | (NS = 0.99) |
| Poor | 1 | 1 | |
| **Swallowing** | | | |
| Oral only | 2 | 1 | |
| Soft | 1 | 2 | |
| Liquids | 1 | 1 | (NS = 0.99) |
| Gastric tube in addition to oral | 2 | 2 | |
| Gastric tube only | 1 | 1 | |

Abbreviations: FAMM, ; SAIF, Submental Artery Island Flap; NS, Not Significant.

***Complications***

Donor site complications were more prevalent during SAIF reconstruction. There have been cases of SAIF with donor site issues; most commonly, the anterior neck closure dehiscence, which was then healed by secondary intention. There were no cases of chronic marginal mandibular nerve paralysis in the SAIF group. When patients in the SAIF group were compared to those in the FAMM group, the FAMM flap group had more general recipient site complications.

In the FAMM flap group, only one flap was ripped from its recipient site on the fourth postoperative day; the flap was re-sutured in place, and the patient was cautioned not to open his mouth wide. Unfortunately, the patient returned two days later with a damaged flap; the patient declined further treatment, and the flap, while being critical, was returned to its donor site according to the patient's request. For the first 12 hours, there was mild postoperative congestion, which cleared spontaneously in virtually all flaps.

For the first 15 days, until the pedicle was severed, all patients had some cheek tightness. In contrast, all patients reported feeling better after pedicle severing and returning to the donor site. One flap had prolonged congestion, which was relieved by removing several sutures. Normal colour and texture were restored very instantly. Small and medium-sized palatal defects FAMM flap had less morbidity and better function. (Table 2)

**Table 2.** Show the most common complications between the two groups

| Variables | FAMM (No of cases = ) | SAIF (No of cases = ) | P value |
|---|---|---|---|
| **Flap complication** | | | |
| Failure of the flap | 0 | 0 | |
| Partial flap necrosis | 0 | 0 | 0.42 |
| Venous Congestion | 1 | 3 | |
| **Donor site complication** | | | |
| Dehiscence of the wound | 0 | 3 | (NS = 0.87) |
| Trismus | 2 | 0 | |
| **Recipient site complication** | | | N/A |
| The FLAP ripped off | 1 | 0 | |

Abbreviations: FAMM, ; SAIF, Submental Artery Island Flap; NS, Not Significant; N/A, Not Applicable.

## DISCUSSION

The SIPF has been used to restore defects in the face, neck, tongue, buccal mucosa, and palate since 1993(Sebastian, Thomas et al. 2008). Due to its flexibility and thin skin, the SAIF has similar benefits to the FAMM flap. In most cases of oral cavity reconstruction, the SIPF was raised as a pedicle flap and tunneled from the submandibular region into the oral cavity.

In our study, SAIF and FAMM flaps were selected to work upon for reconstruction and rehabilitation of maxillary and palatal defects. As a result, in the present study, fourteen patients suffering from maxillary defects were selected from the oral and maxillofacial surgery department, faculty of Dentistry-Minia University, Malawi Specialized Hospital-Ministry of Health, and Shefa OMFS clinic. The age of the patients ranged from 20 to 60 years old. The fourteen patients were divided into two groups; the first group was subjected to SAF while the 2nd group was treated with FAMM flap.

In this study, FAMM and SAF for maxillary and palatal defects were compared. Along with flap size, operating time, hospital stay, complications at the donor and recipient sites, speech and swallowing outcomes were all factors we looked. The FAMM flap is regarded as a safe and adaptable choice for primary palatal repair. With a lengthy pedicle and adjustable proportions to address most palate defects, the axial pattern flap provides improved perfusion to the recipient site. Our findings are comparable to those of Pribaz and others.

The submental island pedicled myocutaneous flap features a broad arc of rotation, a constant axial vessel, enough pedicle length, a big skin paddle, and a broad pivotal movement. This was in agreement with (Tan, Kiroglu, et al. 2006) who reported that the submental artery flap has a constant, safe pedicle, and wide pivotal movement.

Regarding the FAMM flap group, we had no flap loss as a result of pedicle thrombosis or kink. Furthermore, no partial flap necrosis occurred in our instances. One flap was purposefully detached from the recipient location twice because the patient had psychological issues. The use of audible Doppler ultrasonography can be replaced by digital palpation for tracing the pedicle, although this is not always possible; certain instances may have anatomical variations that necessitate Doppler tracing.

The superior labial artery in FAMM flap group was ligated to improve perfusion and flap circulation. Bite block was not commonly employed to prevent flap biting in completely dentate patients, as Pribaz stated. To protect the pedicle, we utilized extra sutures to rotate the flap edge in the form of a tube. The patients accepted the flap well; they complained of tightness for the first 72 hours, then became accustomed to it, and they did not report any inadvertent biting, even while sleeping.

Immediate postoperative congestion can be reduced by utilizing little pressure while suturing flaps. Except in one case, the axial vein was placed near the artery and was concurrently dissected and incorporated in the flap despite the fact that it tends to split from the flap, particularly at the commissure.

The inclusion of the vein significantly decreased the postoperative congestion and offered better circulation. Though we did not search for the vein specifically it seems that it can be included in the flap consequently, changing the flap type from arterialized to a fully axial pattern flap. More research is needed to determine the viability of extending the base to accommodate the vein.

Regarding the flap size, a bigger flap size has been contributed to the SAIF group compared to the FAMM flap group. As expected, the deployment of the FAMM flap led to noticeably reduced hospital stays and operating times, this was in accordance with study which concluded that employing the FAMM flap for oral reconstruction would lead to a shorter hospital stay and, quicker operation.

The speech and swallowing abilities of the two groups were nearly equivalent, but, there was a tendency for the SAIF group to do somewhat worse. This might be attributed to the larger flap size in the SAIF group which may potentially contribute to this result. These findings are compatible with previous studies that have sought a correlation between the flap size, and the postoperative functional results regarding speech and swallowing.

On the other hand, Complications were more frequent overall in the SAIF group. at the recipient and donor sites compared to the FAMM flap group, this might be attributed to the longer surgery, extra oral neck scar, possible affection of the marginal mandibular branch of the facial nerve, and presence of hair follicles in the submental flap in male patients.

In this study, the FAMM flap demonstrated a number of potential advantages. Because of its thinness, pliability, and adaptability in design, it is an excellent flap for soft-tissue palatal reconstruction, as is the SAIF flap. It also has a good color and texture match for the palatal region and is easily elevated. this was in accordance with clinical study which reported that the FAMM flap is an effective and reliable method for palatal reconstruction of small to medium-sized soft tissue defects of the oral cavity. Donor site morbidity is low and the remaining scar is inconspicuous. Despite that buccinator muscle is of less functional importance, it causes donor site morbidity and later cheek tension[9, 10].

Damage to the marginal mandibular nerve is a possible consequence of the SAIF. However, the supraplatysmal dissection considerably reduces the injury to the marginal mandibular nerve. Therefore (Taghinia, Movassaghi, et al. 2009) recommended that The use of nerve stimulators in conjunction with a precise dissection reduces the potential of nerve injury.

In the light of this study, we concluded that the SIPF and FAMM flap should be considered for reconstruction of palatal defects. When compared to the FAMM flap to SAIF, the FAMM flap may provide benefits such as reduced operative time, length of hospital stay, and morbidity while preserving appropriate speech and swallowing function.

## CONCLUSION:

The FAMM flap is a valuable addition to the standard armamentarium of reconstructive maxillofacial surgery. However, further research is needed to increase the flap's venous return.

## CONFLICT OF INTEREST

This clinical study was self-funded by the authors, with no conflict of interest.

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