

Good results in patients with defects after intraoral tumour excision using facial artery musculo-mucosal flap

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ABSTRACT

INTRODUCTION: The purpose of this article was to assess our experience with the facial artery musculo-mucosal (FAMM) flap technique for reconstruction of the oral cavity after tumour ablation. We also introduce new surgical developments for this technique.

MATERIAL AND METHODS: We retrospectively examined 22 cases involving FAMM flap surgery during the period from July 2007 to December 2009, focusing on postoperative complications and flap survival. We describe a new method for closing the donor defect using the buccal fat pad, as well as a method for harvesting a broader flap than is traditionally described.

RESULTS: Among the 22 cases studies, seven (32%) experienced postoperative complications. However, 57% of these cases had undergone preoperative radiotherapy. The complications we observed included problems relating to integration, partial necrosis and bleeding. There were no reported complications relating to the donor site.

CONCLUSION: The FAMM flap is a suitable technique for reconstruction following tumour ablation. Our study also suggests that while preoperative radiotherapy is a contraindication for this treatment, neck dissection surgery is not.

The reconstruction of an oral cavity defect resulting from tumour ablation can be achieved using several different surgical techniques. Regional flaps, local flaps as well as free flaps can be taken into consideration depending on the profile of the defect. Size, localisation and involvement of the tongue or the mandibular region can all play an important role when deciding which technique should be used.

For small to moderately large defects, the facial artery musculo-mucosal (FAMM) flap has gained ground as an important method of treatment in recent years. Several authors have described the advantages of this technique [1, 2]. The advantages include the use of local tissue for reconstruction, a large coverage area, good blood penetration supporting survival of the flap, uncomplicated donor-site healing as well as cosmetic benefits.

This study aims to review the outcome of patients treated using the FAMM flap technique at the Depart-

ment of Otolaryngology, Head and Neck Surgery at The University Hospital of Aarhus, Denmark. Focus is on the survival of the flap in terms of tissue necrosis, the necessity of postoperative flap readjustment, length of hospitalization after surgery as well as functionality with respect to the commencement of food intake. We also explore new developments in the surgical technique that may broaden the application of this procedure. Finally we address previously stated contraindications given for the technique.

MATERIAL AND METHODS

During the period from July 2007 to December 2009, 23 patients underwent FAMM flap procedures due to defects in the oral cavity at the Department of Otolaryngology, Head and Neck Surgery at The University Hospital of Aarhus, Denmark. Twenty-two of these were due to tumour ablation, while the remaining case was due to an oro-antral fistula and was therefore omitted from this study.

The follow-up data for this study were collected from patient charts. Data spanned from the time of diagnosis to the time the patient was discharged, transferred to a regional hospital, or to the time of final contact with the patient.

All postoperative care was performed at the aforementioned department. Six of the 22 patients were treated/monitored at the Intensive Care Unit before being transferred to the Department of Otolaryngology, Head and Neck Surgery.

Follow-up data included age and sex of the patients as well as size, location and type of tumour. Information was also collected regarding pre- and postoperative radiotherapy, the type of FAMM flap used, relevant postoperative complications involving the flap, postoperative nourishing methods as well as the duration of hospital stay. The criteria for complications were partial or total necrosis, loss of flap, integration problems, trismus and postoperative bleeding.

Surgical technique

The facial artery musculo-mucosal flap, which was first

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described by Pribaz et al [3] in 1992, consists of the mucosa, the submucosa, part of the buccinator muscle and the facial artery and venous plexus, hence its name.

The flap can be superiorly or inferiorly based depending on the location of the defect to be repaired. A superiorly based flap with retrograde blood flow is suitable for defects in the palate, the alveolar maxillary process, areas around the palatoglossal arch and in the nasal cavity or in the orbita. An inferiorly based flap with antegrade blood flow can be used for defects in the floor of the mouth, the mandibular vestibule, the lower gingival area as well as the lower lip.

The length of the flap can vary according to the size of the defect to a maximum of 9 cm. It has been described how the width of the flap is limited by the presence of Stensen's duct [4]. However, in four cases this limitation was overcome by relocating the duct as described below. The flap can be shaped to suit the needs determined by the shape and size of the defect to be repaired as long as it is centred over the facial artery.

The path of this artery is identified using Doppler ultrasound and it is then outlined. The FAMM flap, with its oblique orientation, stretches from the retromolare trigonum to the upper gingivolabialis sulcus corresponding to the ala nasi and it traditionally lies anterior to Stensen's duct. The first incision is made on the distal

end of the outlined flap and both the mucosa and the buccinator muscle are dissected. The facial artery is then identified, ligated and cut after which the flap can be elevated. The elevated flap can then be rotated either superiorly or inferiorly, with the point of rotation lying between the retromolar trigonum and the gingivolabialis sulcus as needed.

In the case of a defect that requires a wider flap, the opening of Stensen's duct may be rotated. In such a case, the desired flap can be marked out inside the cheek, allowing the parotid papilla to be part of the flap (**Figure 1**). While cutting out the flap, care should be taken not to cut through the duct. During the elevation of the flap, the duct is then cut so that a new duct opening can easily be located on the inside of the donor site. This new opening is sutured to the mucosa before closing.

It has been described how the donor site can be closed in two layers. However, to reduce tension on the mucosa in the inner cheek, we have found it beneficial to mobilise the buccal fat pad into the donor site where it is sutured around the edge of the defect. After a couple of weeks, this is covered with epithelia to create a satisfactory result (**Figure 2**).

RESULTS

This study of 22 patients included 17 men and five women who had a median age of 55.5 years (range 35-85 years). Fifty percent of the patients were 50-65 years old, while 18% were over 80 years old.

Eighteen patients had squamous cell carcinoma, while the remainder included adenomatous carcinomas, malignant melanomas and one muco-epidermoid carcinoma.

In the majority of cases (73%), the defect was located in the floor of the mouth. Four patients had tumours removed from the palate, one from the retromolar trigonum and another from the palatoglossal arch. This resulted in a total of 16 antegrade FAMM flaps and six retrograde flaps.

Twelve patients underwent either ipsilateral or bilateral neck dissection at the same time as the FAMM flap operation, while two patients had previously undergone that procedure.

Four patients received preoperative radiotherapy. The median length of the follow-up period was 19.5 weeks, it ranged from one to 105 weeks. Fifteen patients were discharged from hospital 11 days or less after their operation and the longest stay was 17 days. Among the 22 patients, eight cases had serious underlying illnesses including hypertension, diabetes mellitus II, renal insufficiency, apoplexy and psychiatric illness. Five patients had a weekly alcohol intake above 30 units, while another four were recovering alcoholics.

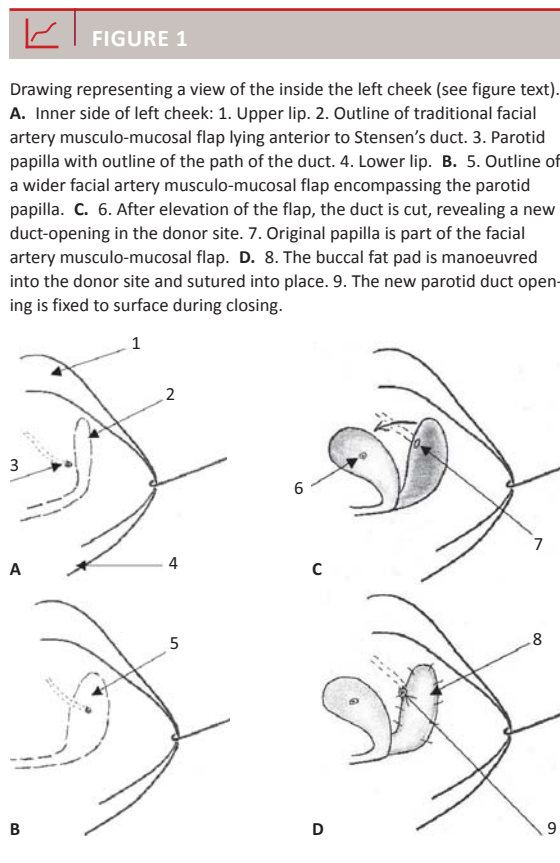
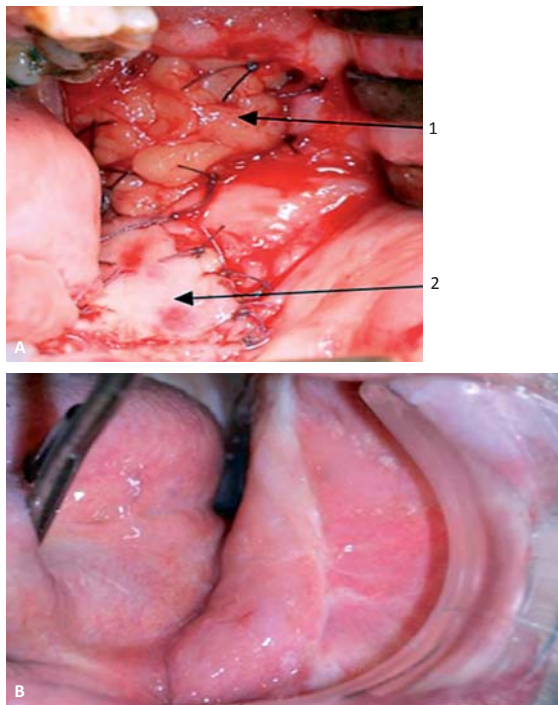



FIGURE 2

Results of facial artery musculo-mucosal flap surgery. **A.** Left hand side of oral cavity immediately after surgery. Note the buccal fat pad in the donor site (arrow 1) and the facial artery musculo-mucosal flap in the floor of mouth (arrow 2). **B.** Result of facial artery musculo-mucosal flap surgery two months after operation.



Complications

A degree of partial necrosis of the flap was reported in three cases. In two of these, it was deemed necessary to remove the necrotic tissue and in one of these, a palatal swing flap was required to repair the subsequent defect.

There was one issue of integration failure with a flap. This was seen in a patient who had undergone pre-operative radiotherapy. Despite good vitality, the flap was relocated to the cheek and replaced with a temporal flap. All of the three other patients who had received radiotherapy treatment before FAMM flap surgery experienced complications (**Table 1**).

There was one case of serious bleeding due to the patient's repetitive manipulation of the flap. The bleeding started several days after the operation. It was deemed necessary to ligate the central segment of the facial artery to stop the bleeding. The parts of the flap that had healed into the defect survived.

There were no reported complications regarding the donor site after the initial swelling and pain immediately after the operation subsided.

The median length of time from surgery to the commencement of intake of semisolids was eight days,

(range: 5-16 days). Five patients experienced initial problems with this, while one of these also reported initial problems drinking water.

DISCUSSION

The reconstruction of the oral cavity after tumour ablation presents the surgeon with several difficulties. Factors such as suitability of tissue type, mobility of the tongue, complete healing and not least cosmetic factors need to be taken into account. For the closure of small to moderately large defects in the oral cavity, the use of the FAMM flap plays an important role alongside other techniques such as the nasolabial flap and the free microvascular transplant.

In this study, we analyzed 22 patients who underwent treatment using the FAMM flap. We omitted one other patient from the study who received a FAMM flap due to reasons other than cancer ablation.

In recent years, several authors have described the use of this technique. **Table 2** compares our findings to those of Bianchi et al [5], Ayad et al [6], Ashtiani et al [7] and Joshi et al [8]. Out of the 127 flaps analyzed in these four studies, there were two total flap losses and a post-operative complication rate of 24%. Our percentage of complications seems to be considerably higher than this; however we believe that, unlike the aforementioned studies, the inclusion in our study of patients who previously underwent radiotherapy contributes significantly to this difference.

As stated above, four of the patients included in our study had previously received radiotherapy. Postoperative complications were seen in all four of these cases. These complications included integration problems, partial necrosis and patient non-compliance. In one case it was necessary to relocate the otherwise vital flap to the donor site. It is worth noting that both the donor site and the recipient site are affected during radiotherapy, which reduces the integration potential while increasing the risk of necrosis of the newly harvested flap. Among the three cases where partial necrosis was reported, two


TABLE 1

Description of complications.

Patient ID	Radio-therapy	Complication
1	No	Partial necrosis
4	Yes	Trismus
10	Yes	Bleeding due to manipulation of flap by patient
13	Yes	Integration problem
14	No	Partial necrosis
16	Yes	Problems related to osteoradionecrosis
20	No	Partial necrosis



TABLE 2

A comparison of facial artery musculo-mucosal flap studies.

Reference	Patients, n	Flaps, n	Total complications reported, n (%)	Partial necrosis, n (%)	Surgical revision required, n (%)	Total loss of flap, n
Bianchi et al, 2009 [5]	27	27	2 (7)	1 (4)	–	1
Ayad et al, 2008 [6]	57	61	22 (36)	15 (5)	6 (10)	0
Ashtiani et al, 2005 [7]	21	22	3 (13)	2 (9)	–	1
Joshi et al, 2005 [8]	16	17	3 (18)	1 (6)	2 (12)	0
Present study	22	22	7 (32)	3 (14)	4 (18)	0

needed minor revision, while the remainder was treated conservatively.

The fact that the width of the flap is restricted by Stensen's duct is stated in the majority of the literature as a disadvantage. However, in four cases we saw that this can be overcome by relocating the opening of the duct whereby the versatility of the flap is augmented. This increases the potential range of uses for this technique.

We also observed that by mobilizing the buccal fat pad into the donor site, we reduced tension on the mucosa and distortion, while maintaining a cosmetically satisfying outcome (Figure 2).

It has been described by Bernardo Bianchi et al [5] that neck dissection is a contraindication for the use of the FAMM flap. We have found this not to be the case. Out of the 22 cases studied here, 14 had undergone neck dissection surgery at the same time as the FAMM flap procedure or at an earlier date. As long as care is taken during this procedure to avoid damaging the facial artery, there is no reason why a FAMM flap procedure cannot be carried out either simultaneously or subsequently.

It can be difficult to determine the boundaries of a residual tumour in cases where radiotherapy treatment has previously been attempted. Therefore, it is necessary to find an alternative method of treatment in such cases.

It is well known that patients with malignant tumours in the head and neck area have an increased tendency to develop secondary cancer in the mucosa localised in the upper respiratory tract and the upper gastrointestinal regions (so-called field cancerization). While this does not contraindicate the use of a FAMM-flap, one should avoid using this method of treatment in cases displaying diffuse dysplasia in the oral cavity.

The conclusion of this study is that the FAMM flap is an advantageous and suitable method for repairing oral cavity defects resulting from tumour ablation. Good vitality and minimal necrosis has been observed. We did

not find this procedure to be contraindicated by neck dissection surgery. However, one may conclude from our findings that the use of FAMM flap surgery is not suitable for patients who have previously undergone radiotherapy. The flap is versatile and with the added method of moving Stensen's duct if required, this procedure is suitable for oral defects of a large variety of sizes.

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CONFLICTS OF INTEREST: none

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