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Original Research Article

Forehead flap: a reconstructive option in selected complex defects following resection of oral cancers staged T4

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ABSTRACT

Background: Head and neck squamous carcinoma constitutes 30% of malignancies in our region, oral carcinoma being most common among them. Most of these tumours involve lower gingivobuccal sulcus and buccal mucosa. 80% patients present with locally advanced disease. Following resection of these tumours, reconstruction of composite defects is challenging. Though microvascular free flaps are ideal in such cases, it is not always feasible due to malnutrition, peripheral vascular disease, sometimes non–availability of microvascular surgeon and financial constraints. Pectoralis major myocutaneous flap, the workhorse of reconstruction is bulky, non-pliable and cannot be advanced over intact mandible. Forehead flap in complex defects is pliable, versatile, has excellent vascularity and colour matching, easy to harvest and suitable in selected cases and as salvage flap when other flaps fail. The aim of the study was to document outcome of folded forehead flap reconstruction of complex defects following resection of T4 staged oral carcinoma.
Methods: This retrospective study in a tertiary rural hospital included 31 patients with oral carcinoma staged T4. The patients underwent folded forehead flap reconstruction for full thickness cheek defects with some extending into oral commissure and lower lip, along with segmental or alveolar resection of mandible or maxilla.
Results: 27 patients had uneventful healing, 2 had wound dehiscence and 2 had necrosis of distal part of flap. Patients with externally rotated flap had mild trismus and patients in whom forehead flap was used to reconstruct the oral commissure had oral incompetence.
Conclusions: Folded forehead flap is good reconstructive option in complex full thickness defects of cheek and as salvage reconstruction.

Keywords: Folded forehead flap, Salvage reconstruction, Full thickness resection of cheek, Complications, Oral commissure

INTRODUCTION

India has a high prevalence of head and neck cancers worldwide with oral cavity being the most common site.[1-3] Socio cultural habit of tobacco chewing in the rural population, particularly among females is the reason for this high prevalence of gingivobuccal and other lateralised oral cancers.[4] Due to the lack of health awareness, ignorance, low socio economic status, paucity of treatment facilities and logistic problems to avail these facilities, these cancers present at an advanced stage, with majority of them presenting in Stage III or Stage IV.[5,6] Surgery with adjuvant therapy remains the mainstay of management.[7] Therefore R_0 resections invariably require primary

reconstruction following complex defects involving full thickness cheek or involving the oral commissure and lip. An ideal reconstruction should be reliable, easy to execute, have suitable texture, volume, color matching of tissue and it should reconstitute anatomy, avoiding physiologic dysfunction and minimize donor deformity.[8]

Many of these cancers encroach upon the posterior buccal mucosa and extend to retromolar trigone (RMT) and oropharynx. Resection of such lesions creates complex multiplane defects in a relatively restricted access. Therefore, reconstruction requires non-bulky and pliable tissue. Pectoralis major myocutaneous (PMMC) flap, the workhorse of head and neck reconstruction has limitations - it is bulky, enhances the shoulder dysfunction, may require comprehensive neck dissection and segmental removal of normal mandible for mobilizing it through the neck.[9] Microvascular free tissue transfer may not always be feasible in rural hospitals due to poor patient nutrition, peripheral vascular disease and unavailability of reconstructive surgeon.[10] Therefore forehead flap is a good option both for selected cases requiring primary reconstruction of complex defects as well as a salvage option where conventional flap or microvascular flap has failed.

Forehead flap is well suited for reconstruction of posterior oral cavity and oropharynx as it preserves velopharyngeal competence. It is suitable for both inner and outer lining for full thickness reconstruction of cheek particularly when mandible is preserved. Its advantages in an economically backward and resource constrained region and short operating time and short hospital stay outweigh the donor site deformity involving this flap.

Objectives

The objectives of the study were to evaluate the outcome of forehead flap reconstruction for complex defects of the oral cavity like full thickness cheek defects and defects extending to lips or oral commissure following oral cancer resection and to evaluate the outcome of the forehead flap as salvage reconstruction for failure of other flaps following oral cancer surgeries.

METHODS

This retrospective analytical study was done on patients who were operated from January 2010 to December 2020 at the Department of ENT, Head and Neck Surgery at R. L. Jalappa Hospital and Research Centre, a rural tertiary care hospital.

Patients who underwent forehead flap reconstruction for complex defects involving full thickness cheek or oral commissure and lip were included in the study.

Oral cancers staged T1, T2 and T3 and those requiring bony reconstruction were excluded from the study. Patients having inoperable or unresectable lesions with orocutaneous fistula were also excluded from the study.

The study included 31 patients aged between 35 years to 75 years of whom 5 were males and 26 were females.

19 patients had lesions in the buccal mucosa, 2 were involving the lower gingivobuccal sulcus (GBS) in addition to the buccal mucosa. In the other 10 patients, the lesion in the buccal mucosa was extending to the oral commissure and lower lip in 4 patients, to the lower lip and RMT in 1 patient, to the oral commissure in 3 patient, to the oral commissure, upper and lower GBS in 2 patient (Table 1).

Forehead flap was used for primary reconstruction in 23 patients, to supplement another axial flap in 1 patient and for secondary reconstruction in 7 patients when primary reconstruction with another axial flap had failed.

6 of the 31 patients had T4b disease which was extending to the infratemporal fossa.

Out of 31 patients in whom forehead flap was used for reconstruction, 21 patients had full thickness cheek defects. Among them, folded forehead flap was used in 13 patients to reconstruct both the mucosal and skin defect whereas in 8 patients the forehead flap was rotated externally to reconstruct the external defect and inner aspect of the forehead flap was lined by split thickness skin graft for the mucosal defect. The other 10 patients had buccal mucosal defect along with oral commissure-lip complex, the mucosal defect in 1 extending beyond the RMT. A forehead flap which was distally folded was used for reconstruction of mucosal and skin defect.

In 20 patients who underwent reconstruction of composite defects using forehead flap, 16 underwent hemimandibulectomy and 4 underwent partial maxillectomy along with hemimandibulectomy. In 3 patients where the disease was not reaching the last 2 molars, marginal mandibulectomy was done. In 1 of these 3 patients where tumor was adjacent to the last 2 molars the entire alveolus along with the anterior half of ramus and coronoid process of mandible was removed. In 3 patients where the mandible was preserved and coronoid process was bulky, coronoidectomy was done to avoid pressure on the flap. In 2 patients only partial maxillectomy was done along with soft tissue resection. In 3 patients where the tumor was in soft tissues and not reaching the alveoli only soft tissue resection was done.

The flap was externally rotated in 10 patients and tunneled medial to the zygomatic arch in 21 patients, to reach the recipient site.

Forehead flap was used as a salvage flap in 7 patients. Among them, previous bipaddle PMMC had failed in 4 patients and a deltopectoral (DP) flap had failed in 3 patients. All 7 patients had full thickness defects of the buccal mucosa.

Flap division was carried out 4 weeks after surgery before the patients were subjected to adjuvant treatment in the form of radiotherapy (21) or concurrent chemoradiotherapy (10) in patients who had close margins or tumor extension into pterygoid muscles in the infratemporal fossa.

The patients were followed up for a minimum of 2 years during which time surgical complications like flap necrosis, wound dehiscence, orocutaneous fistula and functional outcome in terms of oral competence and trismus were documented.

Results were tabulated in SPSS excel sheet and descriptive statistics were used to analyse the results.

RESULTS

In this study forehead flap was used following resection of oral squamous cell carcinoma staged T4a (due to skin involvement) to reconstruct defects of the cheek along with the lower lip and commissure in some of the patients.

Table 1: Clinical characteristics of the patients.

	Site of primary tumor					
	Buccal mucosa	**Buccal mucosa and lower GBS**	**Buccal mucosa, oral commissure and lower lip**	**Buccal mucosa, lower lip and RMT**	**Buccal mucosa and oral commissure**	**Buccal mucosa, oral commissure and upper and lower GBS**
Number of patients (n=31)	19	2	4	1	3	2

Table 2: Outcome of folded forehead flap following resection of T4 oral cancer.

Defect	**Outcome**			
	Uneventful healing	**Wound dehiscence with residual orocutaneous fistula**	**Partial necrosis**	**Incompetence of oral commissure**
Full thickness cheek defect (n=21)	19	2	NIL	NIL
Cheek defect along with partial lower lip and oral commissure defect (n=9)	7	NIL	2	9
Cheek defect along with partial lower lip and mucosal defect extending beyond the retromolar trigone (n=1)	1	NIL	NIL	1

Table 3: Insetting and complications of folded forehead flap.

Method of insetting	**Complication**	
	Trismus	**Recurrent Infection at the proximal fold**
Externally rotated (n=10)	8(Grade I)	NIL
Tunnelled medial to zygomatic arch (n=21)	NIL	21

There was uneventful healing in 27 patients and they were all able to commence radiotherapy within six weeks of surgery. 2 patients had wound dehiscence which needed secondary suturing. These 2 patients had a residual orocutaneous fistula. There was necrosis of the distal part of the flap in 2 patients which was secondarily reconstructed using a nasolabial flap in one patient and Estlander flap in the other. All 10 patients in whom the forehead flap was used to reconstruct the oral commissure-lip complex did not have a satisfactory oral competence resulting in drooling on consumption of liquids (Table 2).

Patients in whom the flap was tunnelled medial to the zygomatic arch (21) did not have trismus. The rest of patients in whom the flap was externally rotated had Grade I trismus. Those patients who had a low hairline or in whom a wider flap was harvested had hair growth intra orally and needed repeated trimming. There were repeated episodes of infection at the proximal part of the flap when the flap was tunnelled medial to the zygomatic arch due to ingrowth of hair (Table 3).

Table 4: Outcome of forehead flap used as salvage reconstruction.

Defect	Primary reconstruction	Salvage flap used	Outcome
Full thickness cheek defect	Bipaddle PMMC (n=4) which had resulted in necrosis of both inner and outer paddles	Folded forehead flap for inner lining and outer cover (4)	Uneventful healing
Full thickness cheek defect	DP flap with PMMC of which DP (n=3) which was used for skin cover had failed	Forehead flap for outer skin cover (3)	Uneventful healing

There was uneventful healing in all the 7 patients where the forehead flap was used as a salvage flap (Table 4).

DISCUSSION

This study was done in a tertiary care medical college hospital in an economically backward rural area having high prevalence of oral cancer.[11] This study included oral squamous cell carcinoma (SCC) staged T4a and T4b. The treatment in these patients involved extensive composite resection, reconstruction and adjuvant treatment.

Figure 1: Recipient site of folded forehead flap.

Following resection some of the patients in this study had full thickness cheek defect and in some patients the cheek defect also involved oral commissure and lower lip. Majority of these patients also had bony resections like hemimandibulectomy, marginal mandibulectomy and partial maxillectomy.

The forehead flap in head and neck reconstruction was introduced by Mc Gregor and popularised by Conley and Jatin Shah.[12-14]

The advantages of forehead flap include its reliable vascularity through anterior branch of superficial temporal artery, pliability since it is a fasciocutaneous flap, provision for use of large flaps, colour matching with skin of the face, non-hair bearing area, the ease of harvesting the flap, proximity to recipient site, avoids physiologic dysfunction and absence of gravitational pull on the flap. These advantages have also been highlighted in series of forehead flap reconstructions performed in Pakistan and Nigeria and these studies also highlight the use of forehead flap in resource depleted regions and as salvage for earlier failed reconstructions.[15,16]

Figure 2: Donor site of forehead flap.

10 of our patients underwent folded forehead flap for defects which also involved the oral commissure and lower lip as popularised in different studies.[14,17] Jatin Shah introduced the use of folded forehead flap as a two stage reconstruction for full thickness cheek defects, in contrast all patients in our series underwent a single stage reconstruction using folded forehead flap as described in the literature.[14,18]

Like the series from Pakistan all our forehead flaps which were tunnelled into the oral defect were routed deep to the zygomatic arch, in our series 10 flaps were rotated externally into the defect and in 8 patients the externally rotated flaps were lined on the inner aspect with split skin graft. Unlike the series from Nigeria, all forehead flaps in our series were complete forehead flaps as a partial flap leaves an unacceptable and asymmetric defect at the donor site. Unlike the series from Pakistan and Nigeria none of our patients underwent reconstruction for trauma.[15,16]

In our series about 85% of patients had uneventful healing (Figure 1). Only 2 patients had wound dehiscence resulting in orocutaneous fistula. Only 2 patients had partial necrosis of the distal part of flap, requiring further reconstruction. Similarly high success rates of forehead flap reconstruction have been reported by various studies in USA, Europe and Pakistan. The small number of partial flap necrosis in our series can be explained by the fact that these were used for complex full thickness defects of cheek and involved folding at two points proximal for mucosal

cover and distal for skin cover. Analysing retrospectively, a controlled fistula at the distal fold along the inferior aspect of the defect and a two stage reconstruction as described by Jatin Shah would have been beneficial in these 2 patients instead of single stage reconstruction.[14]

The 10 patients in our series who underwent folded forehead flap reconstruction for defects involving oral commissure as described by Conley, had oral incompetence and drooling when consuming liquids.[13] This is a disadvantage of such flaps. A primary repair of the oral commissure with a microstomia and a folded forehead flap for the rest of the defect may have been beneficial in such defects. A complex microvascular free flap maybe more useful in such defects.[19]

In our series, 8 patients in whom the forehead flap was rotated externally developed grade I trismus 2-3 months after surgery. This can be explained by the fact that a fasciocutaneous flap can shrink marginally after adjuvant radiation. The split skin graft lining for the inner aspect of these flaps in our series may also have contributed to the trismus due to shrinkage.

Most of the patients where the forehead flap was tunnelled medial to the zygomatic arch had repeated infection due to ingrowth of hair at the proximal part of the flap. This can be avoided by dividing the proximal fold of the flap beyond the hairline at the time of flap division (4 weeks after the reconstruction). A few patients having a low hairline in our series had a tuft of hair growing intra orally which required trimming till adjuvant radiotherapy was started.

In 7 patients forehead flap was used for salvage reconstruction after failure of other axial flaps, the ideal reconstruction for these defects being microvascular free tissue transfer. The success in these 7 patients shows its versatility and utility in complex defects.

In our series the patients were reasonably satisfied with donor site defect on the forehead as they all had complete forehead flap which was carefully designed to lie between the hairline and the upper limit of eyebrows and the donor site was lined with an adequately thick split skin graft (Figure 2). Similar observations were made in their series by Jatin Shah and Adrian Frunza.[14,20]

The patients included in this study (31) are a selected small group undergoing composite resections in our institute which is a relatively high volume centre for oral cancer. PMMC is our workhorse of reconstruction, but in full thickness cheek defects a bipaddle PMMC especially in female patients may not be feasible. Similar views have been expressed by other authors who have used it only in selected cases as salvage for failure of other flaps. This has led to the forehead flap being termed as life boat flap or second workhorse for oral reconstruction in developed countries.

After a mean follow up of 2 years, 27 patients in our series were satisfied with the forehead flap reconstruction that they underwent.

CONCLUSION

Forehead flap in select cases with complex composite defects of oral cavity is a reliable option for reconstruction. Forehead flap can be used for primary reconstruction in full thickness cheek defects and in a salvage setting in the event of failure of an earlier axial flap. The flaps tunnelled deep to the zygoma into the oral cavity have a better outcome. However a folded forehead flap to replace the oral commissure leads to persistent drooling due to oral incompetence. Even in the era of microvascular free tissue transfer, forehead flap is a useful option in patients with malnutrition, severe comorbidities and in resource constrained hospitals with regard to availability of microvascular surgeon.

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