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VERSATILITY OF RECTUS ABDOMINIS FREE VASCULARISED FLAP IN THE RECONSTRUCTION OF ORO FACIAL DEFECTS

Dental Science

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ABSTRACT

Successful reconstruction of extensive soft tissue defects in the head and neck region usually require voluminous tissues for restoring the reasonable form and basic functions. Rectus abdominis flap is more versatile and voluminous tissue flap to obtain water seal wound closure and facial harmony. Its efficacy and outcome of reconstruction of oro facial defect using rectus abdominis free vascularized flap are discussed in this study. 10 patients were taken in the study, 7 male and 3 female who underwent composite resection with reconstruction using rectus abdominis free flap. Age of patient varied from 55 to 73 years and mean was 64 years. Overall flap outcome was good in nine patients and one flap was failed. Survival rate of the flap remains high when compared to other soft tissue flaps.

KEYWORDS

Antro Lateral Thigh Flap, Reconstruction, Rectus abdominis flap, Squamous Cell Carcinoma

INTRODUCTION

Successful reconstruction of extensive soft tissue defects in the head and neck region usually require voluminous tissues for restoring the reasonable form and basic functions. Most of the defects in the oro facial region result from the ablative surgeries and high velocity impacts due to which, the need for flaps with more of tissue components becomes inevitable. While aiming at total rehabilitation, osteocutaneous flap becomes the ideal choice for reconstruction due to its bony component to facilitate dental implants. However, most of the ablative surgeries are indicated in oral cancer where the patient is sent for radiation immediately after the surgery. In such conditions, the feasibility for osteocutaneous flap is questionable due to the radiation exposure of the bone flap. Hence attempts to address the defect with osseous flap are prevented by compromising the dental rehabilitation using implants. Whereas, wound closure for obtaining tissue seal is achieved with soft tissue flaps and removable prosthesis shall be considered for dental rehabilitation.

Despite various reconstructive options among the soft tissue flaps, Rectus abdominis free myocutaneous flap offers the maximum tissue volume in restoring such defects with optimal outcome(1). Rectus abdominis flap has undergone various modifications in the technique of harvesting as well as in the content with respect to the type of the defects to be restored[(2)].

Rectus abdominis flap is more suitable in the defects that occur in the regions like Maxilla, Tongue, floor of the mouth and cheek require voluminous tissue to obtain water seal wound closure and facial harmony. Over the other soft tissue free flaps like radial forearm and anterolateral thigh flap, the rectus abdominis flap has many advantages from various surgical points of view. This includes the flexibility of the donor site to achieve primary closure after harvesting the flap, minimal transient donor site morbidity and early functional recovery. For reconstructive purpose in those clinical situations where the wound closure is the primary criteria and the rehabilitation is secondary, rectus abdominis flap offers a large amount of skin and subcutaneous tissue when compared to other flaps like radial forearm and anterolateral thigh flap[(3)].

The major advantage of rectus abdominis flap has an adequate pedicle length of approximately 10cm to 15 cm and the pedicle caliber is about 3-4 mm, hence the venous drainage of the flap does not show any venous congestion. Due to this, the survival rate of the flap remains high when compared to other soft tissue flaps. Reconstruction of composite oro-facial defects can be achieved by several variations in the rectus abdominis flap such as the bi-lobed technique and sandwich technique. On comparing the radial forearm free flap and antero-lateral thigh flap, the rectus abdominis flap has the following advantages: (4)

i. Concealed donor site
ii. Primary closure of the donor site
iii. Modifications like TRAM flap and VRAM can be done.
iv. Secondary de-bulking is not required[(12)].

Although the rectus abdominis flap removal is associated with frequent donor site morbidity particularly weakness of the abdominal wall and herniation, certain modifications had been put forth by various surgeons to reduce the morbidity rate. The application of rectus abdominis flap is widespread in other fields like breast reconstruction but the use of the flap in the head and neck reconstruction still remains limited[(10)].

This study explores the versatility of the rectus abdominis flap in reconstructing different types of oro-facial defects, which can be a viable substitute to other popular soft tissue flaps.

MATERIALS AND METHODS

The prospective study on primary or secondary reconstruction of composite facial defects that follow resection of tumour in any region in the oral cavity treated using rectus abdominis free vascularized flap. This study was done and ethical clearance was obtained from the Institutional Review Board. A total number of 10 patients were included in the study with their informed consent in which, 7 were males and the 3 were females with the age ranging from 55 to 73 years (mean: 64 years).

The study included the following patients who require primary or secondary reconstruction of composite facial defects that follow resection of tumours in any region in the oral cavity, patients with burn scar, and patients with animal bite. However the exclusion criteria were patients with history of previous abdominal surgery, patients with peripheral vascular diseases, patients who are systematically compromised due to diabetes, patients with anatomical anomalies

METHODS:

Preoperative biopsy was performed in all the patients who reported to the department outpatient ward and histopathology report was used to confirm the diagnosis of the lesion and the grading was done. All patients were meticulously examined for rectus abdominis free vascularized flap for feasibility of harvesting the flap

SURGICAL PROCEDURE:
Under general anaesthesia, naso/endotracheal intubation done in all the patients.

Recipient site: Incision done in the head and neck region, neck dissection was done based on the grading of tumour. Tumour site was exposed and ablation of the tumour done. The resected site was assessed for the defect size.

Donor site: Rectus abdominis incision marking was done surrounding the umbilical and para-umbilical region. Dissection carried out through skin, sub cutaneous tissue, anterior rectus sheath, rectus abdominis muscle followed by deep inferior epigastric artery and vein. The rectus abdominis flap was harvested. Abdominal wall mesh was placed in the harvested site and secured. Rectus sheath was approximated and sutured. Layer wise closure was done and drain was placed.

The harvested rectus abdominis flap was placed in the recipient site and anastomosis done. The arterial anastomosis done with superior thyroid artery in 4 patients, facial artery in 6 patients whereas venous anastomosis was done with internal jugular vein in 6 patients and external jugular vein in 4 patients.

FOLLOW UP:
The flap was monitored after the patient recovered from anaesthesia. The flap was checked for every one hour for first 48 hours and 4th hourly for next 120 hours, followed by one month review. The donor site was reviewed on third month for healing.

All the surgery was performed by the single surgeon. (Fig 1)

RESULTS
The current study was a prospective case series evaluating the efficacy of the rectus abdominis free flap for the reconstruction of the oro facial defects. In this series ten patients were included, of which male and female were seven and three respectively. The mean age of these patients were 64 years, ranging from 55 years to 73 years. All the patients underwent resection or excision of malignant tumor.

INTRAOPERATIVE PARAMETERS:
Under general anesthesia, all the patients underwent resection or excision of the malignant tumor, followed by reconstruction with the rectus abdominis free flap. The mean overall operating time was 9hrs 57mins, ranging from 9hrs to 10hrs 45mins. The mean time taken for flap harvesting was 1hr 10mins, ranging from 1hr to 1hr 40mins. The mean time taken to inset the flap was 53mins, ranging from 40mins to 65mins. These details have been summarized in (Table 1).

The donor site artery and vein was constant for all cases. The deep inferior epigastric vein was used, which was anastomosed with external jugular vein in four patients and internal jugular vein in six patients while the deep inferior epigastric artery was used, which was anastomosed with facial artery in six patients and superior thyroid artery in four patients. Donor site was closed using primary closure for all cases.

POSTOPERATIVE PARAMETERS:
The donor site was evaluated using the Vancouver scar scale at three months. Out of ten patients, eight patients had a normal vascularity, normal pigmentation, firm texture, yielding pliability, and the scar was less than 2mm in height. Two patients had a satisfactory wound healing with height of 2-5mm (Table 2).

The recipient site was assessed using the Modified NHS scale. This evaluation was performed daily for the first one week, then monthly for three months. Findings were consistent throughout. Out of ten patients, In nine patients, the flap had healthy pink color, was firm, warm to touch, and capillary refill was less than 3sec. On needle prick, bright red blood was elicited. In one patient flap was purple, was spongy, cold to touch, and capillary refill was greater than 3sec. On needle prick, dark red blood was elicited. These finding were indicated of venous congestion. This flap failed on the third postoperative day. Flap revision was attempted but was not successful. The defect was then closed primarily for this patient. Overall flap outcome was good in nine patients and one flap failed. These findings were summarized in (Table 3). Evaluation of patient compliance was summarized in (Table4). The rectus abdominis flap is an adaptable flap that has a good outcome for reconstruction of complex composite defects in the head and neck region.

DISCUSSION
The prospective study on the versatility of the rectus abdominis free vascularized flap for oro facial defects reconstruction has been done in Chennai, between 2016 and 2019.

Intra oral isolated soft tissue defects are easy to reconstruct and seldom faces challenges that too when the irradiated tissue bed needs reconstruction. In such conditions free vascularized flaps are the only choice for restoring the basic functions. Among the various reconstructive options in free flaps, radial forearm is the workhorse for resurfacing the intra oral defects. However, the resultant donor site morbidity associated with radial forearm is significantly high. Whereas, the other soft tissue flaps such as ALT, Upper lateral arm flaps are having limitations either in the pedicle length width ratio or in the limited anatomical base[27].

While considering all these facts, the ideal alternate donor source is rectus abdominis free vascularized flap which is fulfilling all kind of deformities occurring in the maxillofacial region.The reliable anatomical location of the skin perforators[5] in the para umbilical area enhance the ease of harvesting the flap, through which, the main pedicle shall be dissected along the flap. Besides its Anatomical consistency of the flap, the vascular pedicle, the deep inferior epigastric artery and vein (DIEAV) is adequate in length (maximum 15 cms) and its caliber width (7mm) for a patent anastomosis[7] with the recipient artery and vein. In this study, anastomosis of DIEA was done with facial artery in 6 cases and in 4 cases superior thyroid artery was used for cooptation. Whereas, the venous anastomosis of DIEV was done with internal jugular vein in 6 cases and external jugular vein was used in 4 cases. In arterial anastomosis, none of the patients encountered vessel mismatch and hence end to end anastomosis was done without tension. On the other hand, deep inferior epigastric vein (DIEV) was anastomosed with external jugular vein in 4 patients using end to end anastomosis as the diameter of both the vessels are almost equal (7mm)[14]. The remaining 6 patients undergone end to side anastomosis with internal jugular vein.

The major advantage of rectus abdominis flap is the adequate volume which covers even the composite or large defects occurring in the maxillofacial region. Usage of TRAM flap is considered in such conditions, in which the flap covers the mucosa and the skin for fullness over the cheek. Despite the advantages of this flap, the draw backs of this flap are also undeniable. The fullness of the flap sometimes requires de-bulking in order to overcome the difficulty in mastication and swallowing[28].

When the primary de-bulking is planned, the time consumed for harvesting the flap is more than the conventional faciomyocutaneous flap as it needs dissection of through the rectus abdominis muscle, as well as the fat over the anterior abdominal wall[23].

Similarly, in this study, polypropylene mesh has been used to prevent the herniation. However, in rest of the nine cases, primary closure was achieved. When such condition arises, the post-operative abdominal weakness associated with the rectus abdominis flap becomes inevitable. The uneventful recovery after surgery has been noted in all the cases involved in this study.

The significant features observed in the study were, none of the patients had post-operative infections and also all the patients did not report any donor site complications. Meanwhile, one of the cases had ischemic necrosis of the flap on the fourth post-operative day.

In this study, mobilization of all the patients was encouraged on the 24th hour, inclusive of one patient who underwent closure with polypropylene mesh.

Intra-operatively, the vascular anatomy of Deep Inferior Epigastric Vessels (DIEAV) was consistently correlating the preoperative acoustic Doppler aided markings and the harvesting of the flap was found easy. However, in two cases, due to facial layer thickness of the anterior abdominal wall, the pedicle of the flaps was found deep. But the skin perforators were showing adequate signals in the preoperative assessment using acoustic Doppler[29].

In this study, deliberation of primary de-bulking of the flap during the dissection was not tried in any cases due to the requirement of the voluminous reconstruction. Moreover, despite the placement of such voluminous flap, all the patients had reasonably good contour after the reconstruction. In two cases, wound dehiscence was noticed but the wound healed eventually.

According to this study, rectus abdominis free flap has shown several advantages over very few setbacks from the surgeon as well as the patient point of view. However, the advantages of this flap constantly supersede the few draw backs observed in the flap.

CONCLUSION:

Ten cases have been subjected to this study and the following facts have been brought into the light.

1. Anatomically consistent vascular anatomy of the flap makes the surgical procedure simple and the preoperative assessment to locate the skin perforators enhances the process even easier.
2. The volume of the flap promises overall outcome in restoring any kind of defects demanding only fullness to camouflage, which means the restoration of even composite defects of the Oral and Maxillofacial region can be addressed just to mask the defects.
3. Though primary de-bulking of the flap was not done in this study, the feasibility of such surgical step is unquestionable as per the discussion.
4. Vascular Anastomosis of the DIEAV with the orofacial vessels and the outcomes were uneventful without any secondary exploration on the post-operative days.
5. Usage of polypropylene mesh is not mandatory for all cases but was used in one patient for achieving the closure of the donor site.
6. In all the patients the average flap harvesting time was uniform and not exceeded 90 minutes.

Besides very few disadvantages with rectus abdominis free flap, remarkable features of this flap shall be considered as first choice for reconstructing any kind of defects in the Oral and Maxillofacial region.

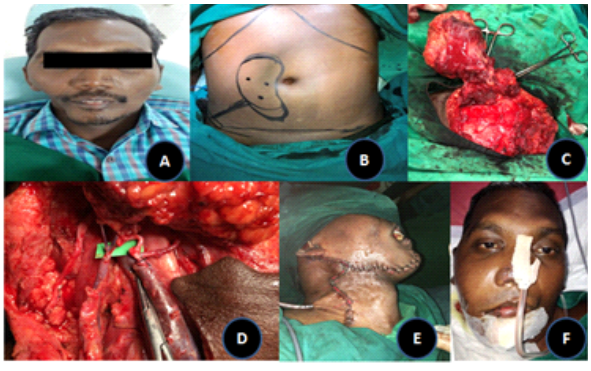


Fig 1: Shows preoperative to post operative images. A: Preoperative image; B: Flap design; C: Flap harvesting; D: Anastomosis ; E: Flap closure; F: Post operative image.

Figure 1:

TABLE 1: INTRA OPERATIVE TIMINGS

Case	Flap Harvest Time	Insert Time	Overall Operative Time
1	80mins	55mins	640mins
2	90mins	40mins	600hrs
3	60mins	45mins	570mins
4	100mins	60mins	620mins
5	85mins	65mins	555mins
6	80mins	50mins	645mins
7	65mins	55mins	585mins
8	60mins	40mins	540mins
9	70mins	60mins	615mins
10	75mins	60mins	600mins

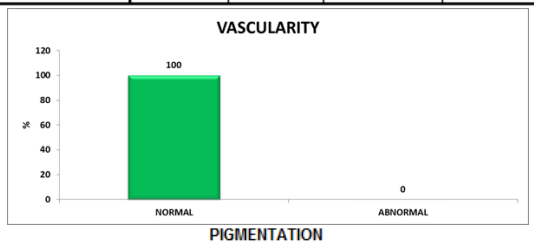
TABLE 2: EVALUATION OF DONOR SITE

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
FLAP HARVEST TIME	10	60	100	76.50	13.134
INSERT TIME	10	40	65	53.00	8.882
OVERALL OPERATIVE TIME	10	540	645	597.00	34.817
Valid N (listwise)	10				

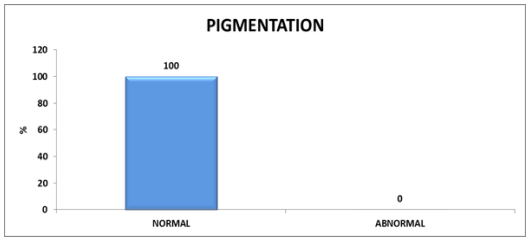
VASCULARITY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NORMAL	10	100.0	100.0	100.0



PIGMENTATION

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NORMAL	10	100.0	100.0	100.0



PIABILITY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FIRM	8	80.0	80.0	80.0
	YIELDING	2	20.0	20.0	100.0
	Total	10	100.0	100.0	

HEIGHT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 2 mm	8	80.0	80.0	80.0
	2 - 5 mm	2	20.0	20.0	100.0
	Total	10	100.0	100.0	

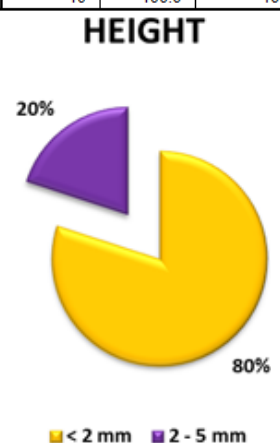


TABLE 3: FLAP OUTCOME

FLAP OUTCOME

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	GOOD	9	90.0	90.0	90.0
	FAILURE	1	10.0	10.0	100.0
	Total	10	100.0	100.0	

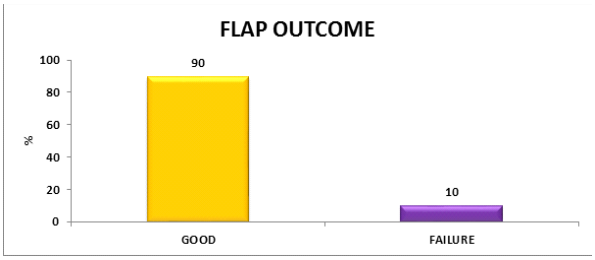


TABLE 4: PATIENT COMPLIANCE

COMPLIANCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WELL	5	50.0	50.0	50.0
	MODERATE	3	30.0	30.0	80.0
	POOR	2	20.0	20.0	100.0
	Total	10	100.0	100.0	

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