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RECONSTRUCTION OF INTRA ORAL SOFT TISSUE DEFECTS USING RADIAL FOREARM MICRO VASCULAR SUB DERMAL FLAP-A RETROSPECTIVE STUDY

Oncology

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ABSTRACT

BACKGROUND: Radial forearm free flap is the most commonly used flap for reconstructing any kind of defects in the Oro-facial region. Eliminate the secondary donor site morbidity and elicit the cosmetic outcomes of donor site.

METHODS: A total number of 10 patients (8 male and 2 females) age group ranging from 25-55 were prospectively subjected to the study and underwent ablative surgery. Intra oral defects in 8 patients with oral squamous cell carcinoma and 2 patients with oral sub-mucous fibrosis were reconstructed using RFFF.The donor site was assessed by the Patient and Observer scar Assessment Scale modified NHS scale.

RESULTS: Among 10 patient who underwent reconstruction, all the 10 flaps were successful. At the donor site the scar healing was good in 8 patient and satisfactory in 2 patients by the observer scar assessment scale. 5% (α=0.05) is fixed as a level of significance.

CONCLUSIONS: Functional outcome of the forearm region has shown remarkable healing during the early post operative period irrespective of intra operative injury to the paratenon layer.Despite the few setbacks in the sub-dermal radial forearm flap, the ease of harvest and the post operative outcomes clearly indicate the need for such modification in order to impart good result in the reconstructive surgery.

KEYWORDS

Sub dermal flap, radial forearm, split thickness graft, reconstruction

INTRODUCTION

Radial forearm free flap is the most commonly used flap for reconstructing any kind of defects in the Oro-facial region.[1] This flap is in use with different components including the osseous portion. Since the time of inception of micro-vascular surgery, the use of radial forearm is considered as the most versatile flap. The vascular component of the flap is its greatest advantage for this flap, as the length and caliber width are more than the adequate for a comfortable cooptation. Harvesting of RFFF in supra-facial layer flap transfer results in minimal tread of tendon exposure.[2]

However, the post operative morbidity associated with this flap is debilitating in some cases as the second donor site is exposed and the resultant wound contracture in the forearm tendons may result in functional alteration of the hand. Moreover, preservation of paratenon layer is the major vascular source for the uptake of the split thickness skin graft (STSG). While harvesting the flap, when the paratenon layer is injured and the tendons are exposed, the uptake of split thickness skin graft (STSG) will be compromised. In order to overcome such complications, the modification of the conventional radial forearm flap has been made.

Especially in the case of intra oral reconstruction, epidermal layer of the forearm is not required as the mucosalization takes place when the flap takes up well. Hence the epidermal layer is spared in the donor site while the sub-dermal layers with the vascular components are harvested. Thus obtained flap has thin layer of tissue which is ideal for isolated soft tissue deficiencies. Secondly, as the epidermis spared in the forearm, the donor site shall be covered with the pedicled keratinized epidermis. Exploring the second donor site for harvesting the Split Thickness Skin Graft (STSG) is alleviated by employing this method of flap harvesting.

Infection rate of RFFF is comparatively very less as compared to other flaps like FFF, PPMF, ALTFF, and PLDF.[3] This is also one of the primary reasons for choosing RFFF in case of reconstruction of head and neck surgery.

We hypothesis that the soft tissue flaps used for addressing the intraoral defects are harvested along the epidermis. Such harvested donor sites require second donor site for obtaining the STSG. Whereas, in our study, the need for obtaining STSG has been alleviated as the overlying epidermal layer itself preserved for closure. This method shall be applied for any kind of soft tissue flaps used for intraoral defects.

MATERIALS AND METHODS

This prospective study on reconstruction of the intraoral defects using Radial forearm micro-vascular sub dermal flap, was conducted in the Department of Oral and Maxillofacial Surgery, SRM Dental College & Hospital, Ramapuram, Chennai, in the year 2016-2018. The study has been conducted after obtaining the Ethical clearance from Institutional Review Board.A total number of 10 patients were subjected for this study in which, 8 male and 2 females with the age group ranging from 25-55 (mean: 40 years). In our study, the intra oral defects in 8 patients with oral squamous cell carcinoma and 2 patients with oral sub-mucous fibrosis were reconstructed using RFFF.

Informed consents were obtained from all the patients after explaining the foreseen possible complications during the surgery and also in the post operative period. Surgical ablation was performed with adequate marginal clearance and neck dissection was done as per the treatment protocol.[18]

Patients diagnosed as a case of Squamous cell carcinoma (SCC) and Oral sub mucous fibrosis (OSMF) was included in the study. Medically compromised patients and patients with Peripheral vascular disease (PVR) were excluded from the study.

All the patients were examined systemically and co morbidities were ruled out in order to fulfill the inclusion criteria. Clinically, Allen's test was performed for all the patients and was found normal. Preoperative angiography was taken to ensure the normal vascular architecture in the forearm and the skin perforators were marked in the ideal position of the flap.

In all the patients, the flap harvesting was initiated after the ablative surgery, ensuring clear margins (especially in patients with carcinoma) and the flap was designed as per the defect dimensions. The donor site was assessed by the Patient and Observer scar Assessment Scale modified NHS scale (Table 1 & 2).

After assessing the defect size, the flap outline was marked in the forearm region (Figure 1), denoting the outer layer and inner layer of epidermal flap and the sub-dermal flap respectively. Tourniquet was applied with inflation pressure of 300mm Hg and maintained for 90 minutes.

Using the manual skin graft device Watson modified Humby's knife,(Figure 2) the epidermal layer of the skin was raised and the distal end was kept intact in the donor site (Figure 3).The subdermal flap was raised in a usual fashion and the pedicle on the distal and proximal ends were ligated. While harvesting the flap, all precautions were taken to spare the paratenon layer in the donor site however; in two patients the vascular layer of the paratenon was injured. The proximal dissection was done meticulously and maximum pedicle length was ensured prior the flap division. The tourniquet was deflated and the perfusion to the distal end of the flap was ensured. After preparing the recipient bed and the vessels of the recipient site, the flap was divided from the donor site. While the harvested flap was inset, the donor site was closed in layers with drain secured in the medial compartment.(Figure 4)

Thus obtained sub-dermal flap was tailored as per the defect dimensions. The flap was then placed in the recipient site (Figure 5) and the anastomosis of vessels was performed using 8-0, 9-0 ethilon suturing material for artery and vein respectively. After completion of arterial and venous anastomosis, Acland vascular clamps were released and the flap perfusion was checked intra-operatively followed by post operative period at various intervals.(Figure 6 and 7)

RESULTS

Among 10 patient who underwent reconstruction, all the 10 flaps were successful. At the donor site the scar healing was good in 8 patient and satisfactory in 2 patients by the observer scar assessment scale.The flap vitality was checked after releasing the clamps followed by every one hour for the first 48 hours, then every 4 hours for 5 days, 1st month and 3rd month .

While assessing the flap viability (Table 3), all the 10 patients had successful outcome with uneventful recovery. On the other hand, evaluation of the donor site has shown uneventful healing with inconspicuous scar. The functional outcome of the forearm region has shown remarkable healing during the early post operative period irrespective of intra operative injury to the paratenon layer.

As the need for STSG has completely been alleviated, the resultant scar in the donor site is inconspicuous. It has eliminated the need for STSG from other site for closure and donor site morbidity. Cosmetic outcome was also pleasing in surgical donor site. All the patients were subjected to active physiotherapy and mouth opening exercise to gain backs their normal mouth opening, for their functional rehabilitation.

In this study, the following descriptive statistics are calculated. For Patient scale characteristics Mean, Standard Deviation, Median, 1st Quartile, 3rd Quartile, Minimum and Maximum values are measured. For all other variables, as they are qualitative in nature, simple frequency (n) and its percentage is calculated. To analyse the data SPSS (IBM SPSS Statistics for Windows, Version 23.0, Armonk, NY: IBM Corp. Released 2015) is used. 5% (α=0.05) is fixed as a level of significance.

DISCUSSION

Reconstruction of oro-facial defects has progressed from simple loco-regional flaps to advanced micro-vascular free flaps since five decades. The role of distinctive teams for performing resection and reconstruction is imperative and such two team approach is mandatory for ablative surgeries for hassle free treatment[7].Fang QG et al[16] stated that soft tissue defects are reconstructed using many flaps, radial forearm flap is the mainstay, as the pliability is compatible with the oral texture. Despite the various complications associated with radial forearm donor site, the ease and anatomical consistency gain popularity among the surgeons. RFFF anatomically it has superficial and deep vein which gives good venous drainage and also helps in dual anastomosis for the better flap outcome.[17] However, second site for closure of donor site is integrated part of the procedure. Calhoun KH [10] and Oranges CM et al [25], by obtaining the spilt thickness skin graft, multiple sites are exposed to minimal degree of complications and it has highest range of success rate as compared to PMFC ALT. In our study, 10 patients who underwent reconstruction, all the 10 flaps were successful. At the donor site the scar healing was good in 8 patient and satisfactory in 2 patients.

Riecke B et al[19] in his study experienced that on sub dermal radial forearm flap dissection was able to overcome such complications to a greater extent.Moreno-Sánchez M et al [20], the mucosalization of the skin over the flap is much faster in the case of sub dermal radial forearm flap than the conventional flap. Apart from the alleviation of second donor site, preservation of the epidermal layer in the donor site spares the functions of the ligaments by preventing the wound contracture. STSG is superior than FTSG and more reliable for esthetics outcome too.[9,21] Alternate of STSG is tissue expanding technique, FTSG of volar of Radial forearm, STSG with acellular dermal matrix can also be used.[15,16,19]

Bonaparte JP et al [5] and Martin IC et al [8] stated, the role of split thickness skin graft used for the closure of primary donor site may require constant dressing and monitoring to prevent secondary infection. On the other hand, the rejection of split thickness skin graft is also not to be overlooked due compromised local host site.

Maan ZN et al[17] and Pabst AM et al [23]explained despite the overall advantages of the sub-dermal radial forearm flap, the setbacks in this flap cannot be overlooked. In which , the tethering of the epidermal layer while harvesting the flap is sometimes unavoidable. In such cases, if the puckered epidermis is wide, the covering over the tendons becomes a challenge and thus resulting in STS Grafting as per the conventional method.When such puckered epidermal layer is used to cover the defect, the resultant wound dehiscence over the tendon remains unhealed and leads to permanent functional disability of the exposed tendon.[15,19] Though the patients subjected for this study had uneventful healing of the surgical site, the chances for such complications have been reported in various literatures. However, reconciliation in the wound healing is acceptable by addressing with STSG.

The role of skin graft is prevented in this study has clearly shown this procedure is versatile to harvest flawless sub-dermal flap. The dissection of this flap is performed in different planes in order to incorporate the cephalic vein and the radial vessels are the major challenges associated with this technique.

Maan ZN et al[17] reported that when the radial vessels are dissected deeply and the cephalic vein is dissected superficially, the sub-dermal surface will become fragile in thin individuals.Ray E et al[24] illustrated , the advantage of this flap , even in the deeper plane of dissection involving the paratenon will have satisfactory healing of the epidermal layer over the tendons followed by traditional dressing.The thickness of this flap is considerably reduced due to the involvement of the sub dermal layer; intraoral reconstruction becomes easy as the pliability is better than the conventional radial forearm flap, where secondary debulking may be required.[13,14]

This prospective study on sub-dermal radial forearm free flap surgery has been revealing the following facts;

1. The primary donor site doesn't require STSG from another site as the epidermis is preserved prior harvesting the flap. Hence the need for preserving the paratenon is not mandatory.
2. Early mucosalisation of the oral wounds takes place as the epidermal layer is not included in the flap
3. Scar in the donor site is minimally conspicuous unlike the conventional radial forearm flap method, where the donor site is covered with STSG.
4. The thickness of the flap jeopardizes the strength of the flap in thin individuals which becomes fragile eventually.

CONCLUSION

Despite the few setbacks in the sub-dermal radial forearm flap, the ease of harvest and the post operative outcomes clearly indicate the need for such modification in order to impart good result in the reconstructive surgery.This surgical technique aids in reducing the STSG. Future studies should aim at applying the same technique for harvesting of other flaps and assess efficacy of the same in healing of the donor site defects.

ABBREVIATIONS:

RFFF- Radial forearm free flap
STSG- split thickness skin graft
FTSG- Full thickness skin graft
PVD- with Peripheral vascular disease
SCC- Squamous cell carcinoma
OSMF- Oral submucous fibrosis
EJV- External jugular vein
IJV - Internal jugular vein
ALT- Anterolateral thigh flap
NPWT- Negative pressure wound therapy
SSI - surgical site infections
AFTFF- free fasciocutaneous anterolateral thigh flap
PPMF- pedicled myocutaneous pectoralis major flap
FFF -free osteocutaneous fibula flap
PLDF- Pedicled myocutaneous latissimus dorsiflap

Table 1: POSAS PATIENT SCALE

	Has the scar been painful in the past few weeks?	Has the scar been itching the past few weeks?	Is the scar color different from the color of your normal skin at present?
N	10	10	10
Mean	1.70	1.80	2.00
Std. Dev	0.82	0.79	0.67
Median	1.5	2.0	2.0
1st Quartile	1.0	1.0	2.0
3rd Quartile	2.0	2.0	2.0
Minimum	1.0	1.0	1.0
Maximum	3.0	3.0	3.0

Table 2: POSAS OBSERVER SCALE

	Is the stiffness of the scar different from your normal skin at present?	Is the thickness of the scar different from your normal skin at present?	Is the scar more irregular than your normal skin at present?
N	10	10	10
Mean	4.10	2.50	2.70
Std. Dev	0.88	0.53	0.82
Median	4.0	2.5	2.5
1st Quartile	4.0	2.0	2.0
3rd Quartile	5.0	3.0	3.0
Minimum	2.0	2.0	2.0
Maximum	5.0	3.0	4.0

Table 3: FLAP MONITORING CHART

		Number	Percentage
Vascularity	Pink	10	100.0%
	Total	10	100.0%
Pigmentation	Hyper	8	80.0%
	Mix	2	20.0%
	Total	10	100.0%
Thickness	Thinner	10	100.0%
	Total	10	100.0%
Relief	More	10	100.0%
	Total	10	100.0%
Pliability	Mix	10	100.0%
	Total	10	100.0%
Surface area	Mix	10	100.0%
	Total	10	100.0%

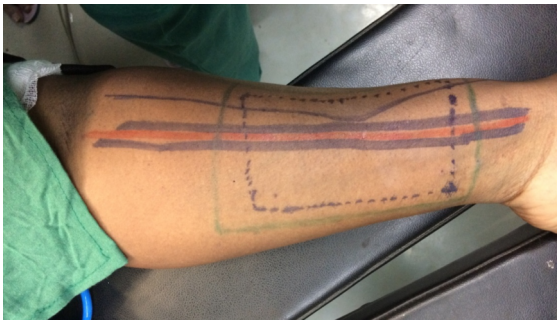

Figure 1: FLAP OUTLINE

Figure 2: WATSON MODIFIED HUMPY'S KNIFE

Figure 3: PEDICLED EPIDERMAL FLAP HARVESTED

Figure 4: DONOR SITE CLOSURE WITH DRAIN

Figure 5: RECIPIENT SITE CLOSURE

Figure 6: POST OPERATIVE HEALING OF DONOR SITE

Figure 7: POST OPERATIVE HEALING OF RECIPIENT SITE

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