

A Comparison of Skin Graft Techniques with and without Plaster Back Slab Dressing in Reducing Donor Site Morbidity in Radial Forearm Free Flap Surgery - A Retrospective Study

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Abstract

Introduction: The radial forearm free flap (RFFF) is a commonly used free flap for the reconstruction of orofacial defects because of its versatility and reliability. The donor site is closed with either split or full-thickness skin graft, and one of the common donor site morbidities is skin graft failure. Various techniques to minimise skin graft failure were reported, and we compared the skin graft techniques with and without plaster back slab dressing in the radial forearm donor site. **Materials and Methods:** This is a retrospective study of 75 patients who had RFFF for reconstruction of oral cavity cancer at two different tertiary teaching hospitals in the United Kingdom between April 2015 and March 2020. Thirty-nine patients from Hospital one had volar back slab, bolster dressing and crepe bandage. In contrast, 36 patients from Hospital two had only pressure dressing without a back slab. **Results:** The mean age of the study population was 60.65 ($P = 0.274$). In both groups, two patients had donor site complications. However, there was no significant difference in the donor site skin graft complications with a $P = 0.662$. **Discussion:** There was no evidence in the literature to support an ideal bandage for skin graft at the RFFF donor site. Our comparison of two techniques of skin graft dressings with and without back slab did not show any difference in the skin graft take, and the volar back slab did not add any additional benefits. The simple use of foam as a bolster dressing without a back slab is ideal for the radial forearm free flap donor site.

Keywords: Head and neck cancers, radial forearm donor site morbidity, radial forearm free flap, skin graft, volar back slab

INTRODUCTION

First pioneered by Yang *et al.* in 1981, the fasciocutaneous radial forearm free flap (RFFF) has become a workhorse flap in head and neck reconstructive surgeries.^[1] Its popularity can be attributed to its ability to provide a thin, pliable, relatively hairless skin paddle and the reliability of its long and large-diameter pedicle to reconstruct three-dimensional defects.^[2] However, despite its versatility and reliability, the main drawback of RFFF is a relatively high rate of donor site complications, including partial necrosis of skin graft, tendon exposure, loss of skin graft, wound dehiscence, haematoma, seroma and wound infection.^[3]

The most common donor site complication is skin graft failure.^[4] The incidence of skin graft failure with exposure to flexor tendons and delayed healing has been reported as high as 33%–50% in many series.^[5] The significant risk factors for early graft failure are the shear forces exerted at the graft

site and haematoma formation. Ideally, the forearm is held in dorsiflexion to prevent this complication, ensuring minimal contracture of the underlying tendon with firm pressure overlying the graft site and held rigidly to reduce wrist movement.^[6] Various dressing strategies have been advocated to improve skin graft take, like negative pressure dressing, volar slab constructed from plaster of Paris, ‘off the shelf’ orthopaedic volar splint and simple pressure dressing with

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gauze and crepe bandaging. We compared different techniques of skin graft dressing between two hospitals in a retrospective review of 75 patients. In one hospital, pressure dressing with the bolster and crepe bandage and the volar back slab was used, whereas the other hospital did not use the back slab. The difference in bandaging techniques gave us an excellent opportunity to investigate whether applying a plaster volar back slab shows an advantage in reducing donor site complications in patients undergoing RFFF.

MATERIALS AND METHODS

We retrospectively reviewed 75 patients who had RFFF to reconstruct oral cavity cancer resection defects at two tertiary teaching hospitals in the United Kingdom between April 2015 and March 2020. The maxillofacial department operated on all of these patients, and the donor site was closed with a full-thickness skin graft.

The study was submitted to the hospital audit department and formally obtained approval. As the local audit department already approved this study, as per the hospital policy, there was no need for ethical approval, and there was no need to obtain consent for the collection, analysis and publication of the retrospectively obtained and anonymised data for this study. All procedures performed in the study were conducted in accordance with the ethics standards given in the 1964 Declaration of Helsinki, as revised in 2013. All the patients had given written consent for the proposed surgery.

Among 75 patients, 39 patients from hospital one had a volar back slab in addition to bolster dressing and crepe bandage [Figure 1]. In contrast, the remaining 36 patients from hospital two had only pressure dressing without a back slab [Figure 2]. In both hospitals, the donor site was closed mainly with a V-Y full-thickness skin graft, and only two patients had a skin graft from the abdomen. The skin graft technique was selected based on the defect size; when the forearm flap width was half of the wrist circumference or larger, a skin graft from a second donor site was taken.



Figure 1: Arm dressing with backslab

The harvested full-thickness skin graft was sutured to donor site defect in both groups. Following this, a single layer of gelonnet dressing was applied over the skin graft. Polyurethane foam was cut according to the donor site, which was then lightly soaked in betadine (povidone-iodine) antiseptic solution, placed over the graft and secured with staples. Multiple gauze layers were used as a bolster and put on top of the foam to offer static pressure and at the same time immobilise the skin graft. After that, hospital one used a volar back slab, whereas the other hospital did not use the back slab. Both used a crepe bandage to cover the surgical site below the elbow including the hand. In both techniques, care is taken to keep the hand in dorsiflexion with slight ulnar deviation, and the final bandage dressings prevented full wrist flexion from avoiding shearing forces on the graft. The bandages were removed on day 10, and the percentage of skin graft take was estimated by visual inspection and evaluated for any other donor site morbidity. For statistical analysis, continuous data were tested for distribution. Non-normally distributed data were tested using the Mann–Whitney *U*-test. The Chi-square and Fisher's exact tests were used for categorical data. Skin graft complications were noted in both groups of patients, and a comparison of skin graft complications was performed using Chi-square analysis. The $P < 0.05$ was considered significant.

RESULTS

The mean age of the study population was 60.65 ($P = 0.274$). The patient characteristics and graft complications for each group are listed in Table 1.

In the first group, 2/39 patients had donor site skin graft complications. One patient had wound dehiscence and haematoma, followed by the development of partial necrosis of the graft. The other patient had a wound infection which led to partial graft loss. In the second group, we noticed donor site complications in two patients; one had partial graft loss, and the other had an infection in the skin graft. The infection manifested as tiny pustules, which became more prominent, and there was more than 50% of graft loss. A specialist wound care nurse regularly dressed the donor site, which eventually granulated. There was no significant difference in the donor site skin graft complications with a $P = 0.662$, as shown in Table 1.

DISCUSSION

The RFFF is commonly used to reconstruct orofacial defects in head and neck surgery due to its versatility and reliability.



Figure 2: Arm dressing without a backslab

Table 1: Patient characteristics and graft complications

Patient characteristics	Hospital 1	Hospital 2	P
Mean age	61.82	59.38	0.274*
Gender (%)			
Male	21 (53.8)	23 (63.9)	0.482**
Female	18 (46.2)	13 (36.1)	
Skin graft complications (%)			
Yes	2 (5.1)	2 (5.6)	0.662***
No	37 (94.9)	34 (94.4)	

*Mann-Whitney test, **Chi-square test, ***Fisher's exact tests

The radial forearm flap, sometimes called 'the Chinese flap', is ideal for most soft tissue intraoral defects because of its constant vascular pedicle and the thin, pliable, predominantly hairless skin of the forearm.^[7,8] However, the published reports of donor site morbidity are a significant problem for the patient and surgeon in the early post-operative period. Timmons *et al.* were among the early authors who reported donor site complications after RFFF and reported delayed healing of the donor site because of the skin graft failure in eight out of 15 patients (53%).^[9] Bardsley *et al.* noticed 28% of delayed healing and graft loss when they reviewed 100 radial artery free-flap donor sites.^[10] Out of 35 patients treated with the RFFF, Swanson *et al.* noticed a partial loss of skin graft with the flexor carpi radialis tendon exposure in 10 patients (33%).^[11] Richardson *et al.* reported a 16% partial skin graft loss incidence in 100 patients who underwent RFFF for reconstruction in the head and neck.^[12]

Several techniques were tried to avoid skin graft failure at the radial forearm donor site by securing the skin graft and immobilising it at the radial donor site. Soutar *et al.*, who popularised the RFFF for intraoral reconstruction, advised avoiding more distal graft beds where the flexor muscles become tendinous and preserving paratenon to improve the graft take.^[7] McGregor applied a skin graft with the wrist extended, and he carefully packed the gutter between the flexor carpi radialis and brachioradialis to ensure good contact with tendons and muscles.^[13] The rest of the wound was dressed, and circumferential plaster was applied to immobilise the entire hand and forearm for 10 days, resulting in a good skin graft take.^[13] Fenton and Roberts sutured the muscles of flexor pollicis longus to flexor digitorum superficialis, burying the tendon of flexor carpi radialis and covering the skin graft with a foam tie-over dressing with plaster of Paris back-slab for 2 weeks.^[14] Volar slab avoids the potential complication of ischaemia or compartment syndrome with the circumferential cast in case of substantial swelling. Complications of volar slab include alteration to circulation or to local nerves if the slab is too tight.^[15] If the bony prominences are not adequately padded and protected, skin ulcers might develop and that warrants careful inspection for distal swelling and adequate perfusion and active movements and repeat a neuromuscular examination.^[15] Hughes *et al.* used an 'off the shelf' orthopaedic volar splint instead of time-consuming

conventional plaster with the significant advantage of Velcro fastening, which allowed differential pressure according to the underlying graft.^[6] The negative pressure dressing has been observed to improve graft take compared to the static pressure dressing; however, the high cost of negative pressure dressing prevents them from being used routinely.^[5,16] Integra dermal regeneration template has shown an aesthetic and functional successful defect coverage of RFFF donor site but the disadvantage of having additional split-thickness graft as a secondary procedure.^[17,18] Allogenic grafts such as Alloderm have shown promising results for coverage of the donor site defect of RFFF, and the main advantage is that no additional graft is needed and, therefore, no secondary defect is produced.^[19] We mainly used direct defect closure of donor site with triangular shaped local full-thickness skin graft and Pirlich *et al.* noticed no statistically significant results when comparing direct (V-Y closure) and indirect closure (full-thickness skin graft harvested by distant site).^[20]

In spite of the various techniques described above, there was no evidence to support an ideal pressure bandage for closure of the RFFF donor site,^[21] and the donor site morbidity, although objectively important, has a small impact on the long-term living of head and neck cancer patients.^[22] In this study, we compared for the first time the bolster pressure dressing with and without plaster of Paris back slab for full-thickness skin grafts in the radial forearm donor site. Traditionally, the tie-over-bolster technique is used to secure the skin grafts but has the disadvantage of long surgical time and the possibility of creating uneven pressure across the graft bed and excess tension on the edges where the sutures are placed.^[23] To avoid these complications, the simple use of foam as a bolster with staples to immobilise the skin graft has been advocated.^[24] Furthermore, using a simple polyurethane sponge as a bolster or using foam from the surgical scrub has been shown to be more effective than the traditional tie-over-bolster method.^[23] All our cases had foam as a bolster dressing that was stapled and secured with layers of blue gauze. A crepe bandage was applied from below the elbow to the hand if the back slab was not used.

Our study did not find any difference in the skin graft take between the two groups, and the volar back slab did not add any additional benefits. Therefore, we recommend the simple use of foam as a bolster with staples to immobilise the skin graft for the RFFF donor site without a back slab. We also advise that the surgeon evaluate each case individually and decide the method of dressing based on operative time and patient factors, including predictors of poor wound healing, whether the patient requires early hand mobilisation, or whether there is a need for close monitoring of hand perfusion.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients

understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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