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Original Research Article

Comparison of Bolster Versus Quilting Techniques on Outcome of Graft Take for Free Fibula Donor Site

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Abstract: *Donor site management following free fibula flap harvest is crucial to optimize healing and minimize morbidity. While bolstering and quilting are both commonly employed to enhance graft adherence, their relative efficacy in donor site graft take and complication rates remains uncertain, particularly in head and neck oncologic reconstruction.* ***Objective:*** *This study aims to directly compare the outcomes of quilt and bolster when applied specifically to the free fibula flap donor site, in regard to graft take.* ***Methods:*** *After the ethical approval from the institutional review board, this Single center, parallel, open labelled, randomized control trial was conducted at Plastic Surgery Department at Aga Khan University Hospital from 01/July/2024 to 31/dec/2024. Through non-probability consecutive sampling, 48 patients aged 18-70 years, both gender, who underwent free fibula flap for reconstruction of head and neck tumors at were included in this study. Patients with prior history of limb trauma, peripheral vascular disease, underwent free fibula for other illnesses, such as osteoradionecrosis or trauma or extremity tumors were excluded from the present study.* ***Results:*** *The average flap donor site defect size was 93.5 ± 27.7 cm² in the bolster group and 90.4 ± 23.8 cm² in the quilting group (p = 0.649). The majority of split-thickness skin grafts (STSGs) in both groups were harvested from the contralateral leg—92% in the bolster group and 100% in the quilting group—while only 8% of STSGs in the bolster group were taken from the same leg (p = 0.162). The mean percentage of graft take was 86.2% ± 5.9 in the bolster group and 85.8% ± 7.5 in the quilting group, showing no significant difference (p = 0.812). Donor site complications were observed in 13% of patients in each group (p = 0.98), indicating comparable complication rates between the two techniques.* ***Conclusion:*** *Both bolstering and quilting techniques yield comparable outcomes in terms of graft take and complication rates at the free fibula donor site.*

Keywords: Graft, Graft take, Bolster, Quilting

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Introduction

Freshly harvested and local free fibula flaps are considered the gold standard for osseous and osteocutaneous reconstruction, especially for mandibular and long bone defects (1). However, still, the morbidity associated with the donor site remains significant including skin graft failure complication (2). Issues related to wound dehiscence, infection, prolonged healing and hospital stay would be avoided if a successful skin graft of the fibula donor site is implemented (3). The graft outcome is also influenced by the techniques used to secure the graft, the most commonly used being the traditional bolster dressing or the quilting suture method (4).

Pressure dressings are used as the bolster technique to ensure graft adherence to the wound bed and minimize shearing, which is secured by tie over sutures. Though simpler, the uses of this technique have been attributed to increased incidences of seroma and hematoma formation that can jeopardize graft survival (5, 6). On the other hand, quilting technique constructs the graft by means of multiple suture fixation sutures directly into the wound bed in order to minimize dead space, minimise fluid accumulation, and enhance graft contact (7).

Various studies have compared quilted bolster methods as compared to traditional bolster methods. As an example, quilting had shown a significant reduction in seroma formation (8% vs 24%) and better graft take (94 vs 82) as described by Zeelst et al. (2023) (8). Meena et al (2024) also showed that quilting sutures decreased partial graft loss by 60% relative to bolstering in lower leg grafts. The idea of quilting is also applicable at other donor sites, such as the anterolateral thigh and radial forearm, and their findings are consistent with the advantages of quilting (9). Although quilting is little used despite the evidence, it is partly due to increases in operative time and technical expertise. Despite this, the technique may warrant further evaluation, given the potential for improved outcome, in particular, in high tension, mobile areas including the fibula donor site (10).

This study aims to directly compare the outcomes of quilt and bolster when applied specifically to the free fibula flap donor site, in regards to graft take. This research will hypothesize statistically significant differences in these parameters in order to inform best donor site management practices for the best patient outcomes.

Methodology

After the ethical approval from the institutional review board, this Single center, parallel, open labelled, randomized control trial was conducted at Plastic Surgery Department at Aga Khan University Hospital from 01/july/2024 to 31/dec/2024. Through non-probability consecutive sampling, 48 patients aged 18-70 years, both gender, who underwent free fibula flap for reconstruction of head and neck tumors at were included in this study. Patients with prior history of limb trauma, peripheral vascular disease, underwent free fibula for other illnesses, such as osteoradionecrosis or trauma or extremity tumors were excluded from the present study. Data collection began after approval from CPSC and ERC. The patients were enrolled in this study after their admission at the ENT ward of Aga Khan Hospital. Both the methods of graft fixation will be explained to patients and informed consents were obtained. They were assigned Group A with bolster (the control group) and Group B quilting (the intervention group) with by lottery method. The osteocutaneous fibular free flap were harvested in a standard fashion and the length and width of skin paddle were noted. After achieving adequate hemostasis, a redivac drain were placed within the cavity and the donor site was closed primarily, tension-free, as far as possible. The remaining defect was closed using a meshed split-thickness skin graft from either the same leg or opposite anterio-medial thigh. Split thickness grafts was harvested

using a dermatome at 0.3mm thickness and meshed at a ratio of 1:1.5. For both groups postoperative splint was provided with a below knee back-slab applied on the plantar foot and posterior leg, immobilizing the ankle joint. Non-weight bearing ambulation was resumed on second postoperative day. Dressings was changed on fourth postoperative day and on alternate days thereafter, with paraffin based gauze and back-slab. The final assessment was done two weeks later on clinic follow-up and pictures will be taken. The main outcome measured is the graft uptake rate in each category. Pictures taken at the time of dressing change in their clinic visit (usually tenth to fourteenth post-operative day) were uploaded on ImageJ (National Institutes of health); an open source image processing software program. The total grafted area as well the graft loss area was highlighted on the image and their corresponding area noted. Objectively, the graft loss area outlined by the primary investigator is the area that stands out to be paler and crusted compared to rest of the graft. This was reviewed by a Plastic Surgery consultant. Graft uptake rate was calculated by the following formula: ((total grafted area) -(graft loss area))/ ((total grafted area)x1OO)). Data was analyzed on SPSS version 26. Normality of data was assessed by Shapiro-Wilk test. All qualitative variables such as gender, smoking, co-morbids like diabetes and hypertension, donor STSG source and complications, if any, was presented as frequency and percentages. All quantitative variables such as age, body mass index, flap donor site defect size was presented as mean and standard deviation. The mean value of percentage graft uptake in each group will be compared using the t-test. A p value of less than 0.05 was considered as statistically significantly.

Results

The study included two groups of patients undergoing free fibula flap procedures, with either bolster or quilting techniques used to secure the skin graft at the donor site. The average age of patients in the bolstering group was 51.3 ± 11.6 years, while the quilting group had a mean age of 49.3 ± 11.5 years, showing no statistically significant difference (p = 0.357). Gender distribution was comparable between the two groups, with males constituting 75% in the bolster group and 71% in the quilting group (p = 0.765). The prevalence of smoking was also similar, seen in 46% of the bolster group and 54% of the quilting group (p = 0.56). The mean body mass index (BMI) was 25.5 ± 5.4 kg/m² in the bolster group and 24.2 ± 4.4 kg/m² in the quilting group, with no significant difference (p = 0.376).

In terms of comorbidities, diabetes was present in 21% of patients in the bolster group and 13% in the quilting group. Hypertension was reported in 46% and 42%, coronary artery disease in 17% and 13%, and asthma in 4% and 0%, respectively. Hyperthyroidism was noted only in one patient (4%) in the quilting group. Notably, 25% of patients in the bolster group had no comorbidities, compared to 46% in the quilting group, though this difference did not reach statistical significance (p = 0.17).

Regarding clinical outcomes, the average flap donor site defect size was 93.5 ± 27.7 cm² in the bolster group and 90.4 ± 23.8 cm² in the quilting group (p = 0.649). The majority of split-thickness skin grafts (STSGs) in both groups were harvested from the contralateral leg—92% in the bolster group and 100% in the quilting group—while only 8% of STSGs in the bolster group were taken from the same leg (p = 0.162). The mean percentage of graft take was 86.2% ± 5.9 in the bolster group and 85.8% ± 7.5 in the quilting group, showing no significant difference (p = 0.812). Donor site complications were observed in 13% of patients in each group (p = 0.98), indicating comparable complication rates between the two techniques.

Table 1: Demographic and clinical variables

Variables	Bolstering	Quilting	P value
Age (years)	51.311.6	49.3±11.5	0.357
Gender			0.765
Male	18 (75%)	17 (71%)	
Female	6 (25%)	7 (29%)	
Smoking	11 (46%)	13 (54%)	0.56
BMI (kg/m2)	25.565.4	24.26±4.4	0.376
Comorbidity			0.17
Diabetes	5 (21%)	3 (13%)	
Hypertension	11 (46%)	10 (42%)	
Coronary Artery disease	4 (17%)	3 (13%)	
Asthma	1 (4%)	0	
Hyperthyroidism	0	1 (4%)	
None	6 (25%)	11 (46%)	

Table 2: Clinical outcomes

Variables	Bolstering	Quilting	P value
Flap donor site defect size (cm)	93.5±27.7	90.4±23.8	0.649
Donor STSG source			0.162
Contralateral leg	22 (92%)	24 (100%)	
Same leg	2 (8%)	0	
Percentage of graft take	86.2±5.9	85.8±7.5	0.812
Complications at donor site	3 (13%)	3 (13%)	0.98

Discussion

This study presents the demographic and clinical data of the conventional bolstering and quilting techniques in free fibula flap donor site management with useful insights into comparative performance of these two techniques. Balanced comparison and validity of outcome analysis is supported by lack of statistically significant differences in age, gender, BMI and smoking status between the two groups. Thus, these are important variables, which have been identified as potential risks factors for impaired wound healing and graft failure: smoking and elevated BMI (11). But neither factor seemed to have a statistically significant influence on outcomes, perhaps because the smoking rates and BMI values in both groups are relatively mild.

Comorbidities such as diabetes and hypertension, common in reconstructive surgery patients, were also well spread between the two groups. It is known that diabetes contributes to poor graft take and delayed

wound healing (12) but the rates observed here (21% in bolster group, 13% in quilting) did not seem to be influencing graft take. This agrees with the findings of Bellon et al. (2023) who found careful perioperative glycaemic control will buffer poor outcomes of diabetes in reconstruction of the lower limb (13).

The clinical outcomes, especially the surgical outcomes, are of special interest from the point of view of the surgeon. There was no difference in the size of the mean donor site defect size between groups, and both groups most frequently used STSGs from the contralateral leg. This preference is consistent with previous literature which recommends donor site at contralateral leg to minimize tension and complication due to movement (14). It is somewhat unexpected that the mean graft take is nearly identical (86.2% for the bolster group vs. 85.8% in quilting), and that donor site complication rates are also nearly the same (13%), given that previous studies have raised the possibility that quilting would decrease seroma or hematoma from occurring or might contribute to an increased graft adherence (15).

There are a couple of possibilities, one could be the meticulous surgical technique and post-operative care in both cohorts would have minimized the performance gap between the methods. In addition, quilting sutures have been purported to minimize dead space and provide better graft immobilization (16), but without improvement in the complication rate or graft take in this data, bolstering may have equally good results in controlled settings. In comparison to earlier literature, the complication rates observed here are slightly lower than those reported for the donor site complications that have varied from 20% to 35% (17), suggesting a higher operative and postoperative management standard.

Conclusion

In brief, although the data at hand do not demonstrate a statistically better graft take or rate of complications with quilting compared to bolstering, in summary these findings further confirm an increasing body of evidence suggesting that both techniques can work well if used judiciously. Prospective, randomized studies with more homogenous samples and standardized postoperative protocol may be required to detect subtler differences and to best describe the optimum graft fixation strategy at free fibula donor sites.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-MMS-033-24)

Consent for publication
Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

NS (Resident - FCPS**)**
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Conception of Study, Development of Research Methodology Design,
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Study Design, manuscript review, critical input.
All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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