

## Original Research Article

# A comparative study of graft uptake in split skin grafting between the first postoperative dressing done on day 3 versus day 5

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### ABSTRACT

**Background:** Skin grafting offers a method of regaining skin continuity. The common causes of skin graft failure are hematoma, seroma, infection. These affect the graft uptake maximally in the initial postoperative period by impairing graft adherence and subsequent revascularization. Aim of study was to compare graft uptake, rejection, seroma and infection among first postoperative dressing on day 3 versus day 5.

**Methods:** A comparative, prospective study conducted at our institute from November 2015 to April 2021, with 100 patients who underwent SSG (split skin grafting) who were distributed into two groups. Group A underwent the first postoperative dressing on day 3 and group B on day 5. The second postoperative dressing was done 2 days following the first. The grafted site was then assessed on for the percentage of graft uptake, rejection, seroma, infection clinically and through culture and sensitivity.

**Results:** The mean graft uptake in group A was 88.48% whereas in group B was 82.62% in the first dressing and in the second dressing, group A was 88.14% whereas group B was 78.02%, with statistically significant data and thus showing less rejection and infection rate in group A. Seroma was present in 82% of cases in group A and 74% in group B on 1st postoperative dressing which reduced to 6% and 12% respectively with the 2nd dressing.

**Conclusions:** Thus, the first postoperative dressing done on Day 3 following skin grafting, significantly increased the final uptake of the graft, reduced seroma, infection and rejection rate.

**Keywords:** SSG, Early postoperative dressing, Graft uptake, Graft rejection

### INTRODUCTION

The skin is the largest organ of the body by virtue of its surface area. It is in direct communication with the outside environment and its biological and mechanical properties serve to protect and maintain the delicate homeostasis of the human body.<sup>1</sup>

In dealing with the problems in wound healing, skin grafting offers the surgeon a method of regaining skin continuity. With the advantages of reduced healing time and length of hospital stay along with minimal donor site

morbidity, it is an effective method of managing large ulcers of varied etiology. Hence, skin grafting is one of the most commonly done operative procedures under surgical care. Split thickness skin grafts are harvested by taking all the epidermis together with dermis leaving the remaining dermis behind to heal the donor site.<sup>2</sup>

Following skin grafting, the graft will survive based on a defined sequence of events that culminates in vascular independence. These events are serum imbibition, in first 24 to 48 hours; inosculation, in the next 24 to 72 hours; and angiogenesis, that starts after 72 hours.

Factors that interrupt this process such as fluid collection under the graft or mechanical shear forces will compromise the graft uptake.<sup>3</sup>

Surgical dressing is used to cover the grafted site or the recipient site in the postoperative period to enhance the healing process and improve the uptake. Dressings encourage epithelisation from graft into the wound and granulation of the wound itself.<sup>4</sup>

Several studies have been performed investigating the factors involved in the uptake of split-thickness skin graft. The most common causes of skin graft failure were hematoma, seroma, infections, movements (shear) at recipient area.

These factors affected the graft uptake maximally in the initial postoperative period by impairing the graft adherence to the wound bed and subsequent revascularization. Dressing stabilized the graft against shear forces, provided moist, sterile environment and prevented the accumulation of fluid under the graft.

The success of a graft depended primarily on the extent and speed at which vascular perfusion was restored to between the donor and recipient tissue. Therefore, surgical dressing was a very important postoperative component for ensuring successful graft take.<sup>5</sup>

The postoperative dressing was typically left in place for 5 to 7 days before removal, at which time the graft was inspected and re-dressed. Hematoma, seroma and clots under the graft in the immediate postoperative period of 1-3 days, impaired the graft adherence and prevented revascularization and take of the graft.

Hence, inspection and first postoperative dressing done during this period will help in evacuating the hematoma, seroma, clots and graft can be reapplied in case it has been disrupted, thereby improving revascularization and graft survival rate. The risk of infection as well, can be monitored and appropriate treatment started, if the graft was inspected early.<sup>6</sup>

Studies concerning this issue, especially the impact of first postoperative dressing on the graft uptake and survival are lacking; with very few studies done which suggested the timing of the first postoperative dressing.

Hence, our study was to determine the relevance of the first postoperative dressing which was done on 3rd day and 5th day after surgery and its effect on graft uptake, early and late complications associated with grafting in patients undergoing split thickness skin grafting.

### ***Aims and objectives***

The aims and objectives were to evaluate the following with respect to split thickness skin grafting between first postoperative dressing done on day 3 versus day 5. They

were the percentage of graft uptake; seroma formation; infection; and graft rejection.

### **METHODS**

This was a prospective, comparative study conducted in the department of general surgery at our institute, from November 2015 to April 2021, after passing ethical board certification. The study included 100 patients undergoing split thickness skin grafting for various etiological factors, meeting the inclusion and exclusion criteria.

#### ***Inclusion criteria***

Patients of either sex aged >18 years and <60 years; patients undergoing split thickness skin grafting for the treatment of ulcers/raw areas; and patients with preoperative wound culture sensitivity showing no growth were include in the study.

#### ***Exclusion criteria***

Patients undergoing grafts for the second time/re-grafting; patients with active infection, exposed tendons, bones, multiple ulcers, multiple sites were excluded from the study.

They underwent a detailed history taking, physical examination, assessment and treatment of co morbidities and preoperative investigations.

The specific preoperative investigations carried out were blood investigations, serum albumin, wound culture swab on first postoperative dressing.

After evaluation, the patients underwent preoperative standard wound care till healthy granulation and negative culture swab and underwent SSG. STROBE guidelines were followed for reporting.<sup>7</sup>

#### ***Procedure***

Under strict aseptic precautions, after appropriate anaesthesia, the recipient bed was prepared.

The split-thickness graft, harvested from the thigh using Humby's knife (Watson modification), tailored, meshed and fashioned onto the freshly prepared ulcer bed. The graft was secured with skin staplers.

After the graft had been fixed in position, care was taken to express any collection of blood or serum.

The grafted area was covered with sterile antibiotic-impregnated tulle and upon which sterile dressing and pressure bandage was applied. The limb was immobilized with the POP slab when grafted near the joints. Donor site was covered

with antibiotic-impregnated tulle and pressure bandage applied. Standard postoperative management carried out.

**Postoperative management**

The patients were distributed into two groups as group A and group B, by allotting alternatively for doing the first postoperative dressing (POD 1) on day 3 and day 5 respectively. The grafted site was then assessed for the percentage of graft uptake by measuring the surface area of graft, observing the colour, presence of seroma, slough, graft adherence and rejection. The percentage of graft uptake was calculated by using the following formula,

$$\text{Percentage of graft uptake} = \frac{\text{area of graft uptake}}{\text{total area of graft}} \times 100.$$

The area of graft uptake and rejection was calculated from the dimension of the stable appearing graft as a percentage of total grafted area, by marking the outline in a graph paper.<sup>8</sup>

The seroma was evacuated and slough when present was removed, under sterile conditions and samples were sent for culture and sensitivity test. The grafted area was then covered with sterile antibiotic-impregnated tulle dressing. The second POD 2 was done on day 5 for group A and day 7 for group B and findings noted.

The area of graft uptake and rejection was calculated both in first and second post operative dressing in both the groups. The patients were discharged and followed up.

**Data entry and analysis**

Data entry was done in Microsoft excel and analyzed by SPSS software (v 20).

Continuous and categorical were expressed in mean (SD) and count (%) respectively.

The categorical variables such as group (group A and group B), seroma formation, slough formation/infection, were reported as proportions.

The association between continuous variables and the groups (group A and group B) were assessed using unpaired T test or Mann Whitney U test based on the normality of the distribution of continuous variables. Association between the categorical variables was assessed using Chi square test or Fisher's exact test based the cell values.

The p<0.05 was considered for statistical significance.

**Sample size**

The minimum sample size was calculated be 50 patients. The 50 patients were required to have a 80% chance of detecting as significant level 5% (relative precision) in study group with power of the study 80% and 95% of confidence interval.

Our sample size was taken to be 100.

**RESULTS**

Our study population comprised of 26% (n=13) of the patients were female and 74% (n=37) were male in group A and 14% (n=7) of the patients were female and 86% (n=43) were male in group B with mean age in group A being 43.6 years and in group B 42.9 years. The most common cause of raw area was trauma 57% and 22% of the patients were diabetic. The demographic data of our study is represented in Table 1.

**Table 1: Demographic data of our study population.**

Factors	Group A	Group B	Total
	N (%)	N (%)	N (%)
<b>Sex</b>			
Male	37 (74)	43 (86)	80 (80)
Female	13 (26)	7 (14)	20 (20)
<b>Cause of ulcer</b>			
Traumatic	33 (66)	24 (48)	57 (57)
Post infective/debridement raw area	8 (16)	15 (30)	23 (23)
Other	9 (18)	11 (22)	20 (20)
<b>Co-morbidities</b>			
Absent	36 (72)	37 (74)	73 (73)
Diabetes alone	11 (22)	11 (22)	22 (22)
Other (hypertension, venous disease, arterial disease)	3 (6)	2 (4)	5 (5)
<b>Recipient sites</b>			
Upper limb	8 (16)	6 (12)	14 (14)
Lower limb	34 (68)	33 (66)	67 (67)
Other	8 (16)	11 (22)	19 (19)

**Table 2: First dressing day graft uptake values of the participants in group A and group B.**

Variables	Day 3 group A	Day 5 group B	P value
<b>POD 1 percentage of graft uptake</b>	88.48 ( $\pm$ 11.17)	82.62 ( $\pm$ 13.36)	0.02

**Table 3: Second dressing day graft uptake values of the participants in group A and group B.**

Variables	Day 3	Day 5	P value
<b>POD 2 percentage of graft uptake</b>	88.14 ( $\pm$ 16.61)	78.02 ( $\pm$ 14.04)	0.00

**Table 4: Seroma formation on the first dressing day among the participants in group A and group B.**

POD 1 seroma	Group A	Group B	Total	P value
	Day 3 N (%)	Day 5 N (%)		
<b>Absent</b>	9 (18)	13 (26)	22 (22)	0.334
<b>Present</b>	41 (82)	37 (74)	78 (78)	
<b>Total</b>	50 (100)	50 (100)	100 (100)	

**Table 5: Seroma formation on the second dressing day among the participants in group A and group B.**

POD2 seroma	Group A	Group B	Total	P value
	Day 3 N (%)	Day 5 N (%)		
<b>Absent</b>	47 (94)	44 (88)	91 (91)	0.295
<b>Present</b>	3 (6)	6 (12)	9 (9)	
<b>Total</b>	50 (100)	50 (100)	100 (100)	

**Table 6: Comparing infection rate in group A and group B postoperatively, through positive culture/sensitivity of the graft site.**

Groups	Postoperative infection rate; according to culture/sensitivity	Clinical evidence of infection (slough)
	N (%)	N (%)
<b>A</b>	23 (45)	8 (15)
<b>B</b>	25 (50)	10 (20)

**Table 7: Graft rejection values in group A and group B on first postoperative dressing.**

Variables	Day 3 group A (%)	Day 5 group B (%)	P value independent t test
<b>POD 1 percentage of graft rejection</b>	5.86	11.24	0.02

**Table 8: Graft rejection values in group A and group B following 2nd postoperative dressing.**

Variables	Day 3 (%)	Day 5 (%)	P value independent t test
<b>POD 2 percentage of graft rejection</b>	11.86	21.98	0.00

**Table 9: Graft uptake in relation to first and second postoperative dressing done on 3rd and 5th day, comparing data from different studies.**

Name of the study	First POD done following skin grafting	Mean graft uptake (%)
<b>Tauro et al<sup>9</sup></b>	5th POD	60.45
<b>Younes et al<sup>10</sup></b>	3rd POD	95.62
<b>Maher<sup>11</sup></b>	3rd POD	84.34
<b>Rituraj et al<sup>12</sup></b>	5th POD	85.9
<b>Our study</b>	3rd POD/5th POD	88.14/78.02

**Table 10: Role of postoperative dressing on graft uptake in relation to local factors.**

Groups	POD	Local factors		Final % of graft uptake
		Seroma	Infection	
		N (%)	N (%)	
<b>A</b>	First	41 (82)	23 (45)	88.14
<b>B</b>	First	37 (74)	25 (50)	78.02



**Figure 1: Graft uptake in a group A patient.**



**Figure 2: Graft uptake in a group B patient.**

The mean graft uptake value of first dressing done POD 1 for group A was 88.48% whereas in group B was 82.62%. There was significant association ( $p < 0.05$ ) between first dressing day and graft uptake between the 2 groups, as shown in Table 2. The mean graft uptake value of second dressing day POD 2 in group A was 88.14% whereas in group B, it was 78.02%. There was significant association ( $p < 0.01$ ) between the groups and final graft uptake, as shown in Table 3.

Among group A, 82% of participants had seroma and 74% in group B had seroma on the first postoperative

dressing. There was no statistical significance (Table 4). And only 5% of patients in group A had seroma while 7% had seroma in group B in POD 2. There was no statistical significance (Table 5).

When comparing the infection rate in group A and group B postoperatively via clinical evidence of infection and positive culture/sensitivity of the graft site, it was noted that, in group A, 45% of the cases showed positive wound culture reports, with most common organism being *E. coli*, while only 15% of these had clinical evidence of infection. And, in group B, 50% of the cases

showed positive wound culture reports, with most common organism being *Staphylococcus aureus*, while only 20% of these had clinical evidence of infection (Table 6).

The mean graft rejection value of first dressing done for group A was 5.86% whereas in group B was 11.24%. There was a significant association ( $p < 0.05$ ) between first dressing day and graft uptake (Table 7). The mean graft rejection value of second dressing done for group A was 11.86 whereas in group B was 21.98%. There was significant association ( $p < 0.01$ ) between second dressing day and graft uptake (Table 8).

## DISCUSSION

The postoperative care was as important as the technique of application of the graft for the successful vascularization of graft. Several factors adversely influenced the uptake of the skin graft. The most common causes of graft failure were seroma, infections and shearing movements.

The postoperative dressing was typically left in place for 5 to 7 days before removal. However, early inspection and first dressing done during immediate postoperative period will help in evacuating seroma, hematoma and also the graft can be reapplied in case it had been disrupted, thereby it improved revascularization and graft survival rate.

According to Converse et al the nourishment of a free skin graft was provided by the underlying serum for the first two days and was then followed by in-growing revascularization. Therefore, seromas, hematomas or clots under the graft should be immediately evacuated. If this was done within the first 24 hours, the graft can be salvaged and a 100% take of graft was assured. It was advisable to carry this out following a day or within 2 days depending on the condition of the graft at the initial dressing inspection.<sup>14</sup>

Studies regarding the role of first postoperative dressing on graft uptake were lacking.

Our study analysed 100 patients who underwent split thickness skin grafting for the treatment of ulcers of varied etiology, to gain perspective on graft uptake and its association with postoperative dressings.

### **Graft uptake**

The graft uptake observed on the first postoperative dressing day in group A, ranged from 70 to 98% with mean of 88.48% and in group B it ranged from 50 to 95% with mean of 82.2%. The mean graft uptake was more in group A compared to group B and it was statistically significant with p value of 0.02.

The graft uptake observed on the second POD day in Group A, ranged from 80 to 100% with mean of 88.14% and in group B it ranged from 3 to 94% with mean of 78.02%, which was statistically significant with value of  $< 0.001$ .

Thus, concluding that, the graft uptake was significantly better in patients who underwent early postoperative dressing.

Various studies were compared showing the graft uptake in relation to first and second postoperative dressing done on 3rd and 5th day (Table 9).

In a study conducted by Tauro et al from September 2003 to October 2005 following split thickness skin grafting, wounds were reassessed at the end of 5th POD. The mean graft uptake was  $60.45 \pm 19.34$  in the group which underwent conventional moist wound dressings.<sup>9</sup>

In a study conducted by Younes et al published in 2006 at University of Jordan, first dressing change following split-thickness skin grafting was done on postoperative day 3. The graft take was declared as successful when the grafted skin attached completely and epithelization was apparent by inspection at the edges. The graft take was 100% in 12 of the 16 patients. 3 patients had 90% take and 1 patient had 60% take (mean graft uptake was 95.62%). Almost complete take (90% and above) was noticed in 90% of the cases after a period of preparation of 2-8 weeks.<sup>10</sup>

In our study, we found that 88.14% was the mean graft uptake in 3rd day group and 78.02% in 5th day group with statistically significance with the results comparable to the above mentioned studies.

### **Local factors and percentage of graft uptake**

In our study, it was noted that the seroma formation and infection rate was less in group A, compared to group B, owing to significantly better graft uptake in group A (Table 10).<sup>13</sup>

McGrath et al reported that the most common cause of skin graft failure was hematoma under the graft, where the blood clot was a barrier to contact of the graft and bed for revascularization. Shearing or movement of the graft on the bed will precluded revascularization and caused graft loss.<sup>3</sup>

In lieu of the above studies, it was evident that in our study, seroma were present in both the groups. And it was noted that the evacuation of seroma in group A improved the final uptake of the graft, reduced rate of rejection and had a better outcome comparatively, owing to earlier evacuation of seroma, nidus of infection if any and earlier addressing of the local factors with appropriate timely treatment.

The confounding factors in our study were noted to be the different patient profile such as various co morbidities that influenced the graft uptake such as diabetes, nutritional status and the different recipient sites and its vascularity.

## CONCLUSION

Thus, we conclude in our study that early postoperative dressing in SSG done on the third post-operative day, allowed the graft to be cleared of excess seroma formation, infection if any thus significantly increasing the final uptake of the graft. This indicated that the success of skin grafting depends on the extent and speed with which the vascular perfusion is restored to the recipient tissue. Seroma and infection, if present, on the account of being immediately evacuated early restores vascular perfusion, so that graft can be salvaged and graft uptake be increased.

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