Journal of Institute of Medicine Nepal
Institute of Medicine, Kathmandu, Nepal

OPEN ACCESS

Original Article

JIOM Nepal. 2021 Aug;43(2):1-6.

Split Thickness Skin Grafting With and Without Surgical Removal of Granulation Tissue in Granulating Wounds: A Single Blinded, Randomized Controlled Trial

Samit Sharma[1], Biraj Pokhrel[2], Sangam Rayamajhi[1], Jayan M Shrestha[1], Ishwar Lohani[1]

Author(s) affiliation

[1]*Department of Plastic Surgery and Burns, Maharajgunj Medical Campus, Tribhuvan University Teaching Hospital, Institute of Medicine, Maharajgunj, Kathmandu, Nepal.*

[2]*Maharajgunj Medical Campus, Institute of Medicine, Tribhuvan University, Maharajgunj, Kathmandu, Nepal.*

Corresponding author

Samit Sharma, MS, MCh
samitsharma157f@gmail.com

Submitted
Jun 18, 2021

Accepted
Jul 21, 2021

ABSTRACT

Introduction

Split thickness skin graft (STSG) is a commonly carried out procedure in granulating wounds. The graft may be applied directly on the granulation tissue (without scrapping) or it may be applied after complete removal of the granulation tissue (after scrapping). Surgeons are divided on this issue.

Methods

A single blinded, randomized, controlled trial was carried out between November 2017 and December 2018 in the Department of Plastic Surgery and Burns, Tribhuvan University Teaching Hospital, Kathmandu, Nepal. The study consisted of 62 patients who were divided into two groups. Group A consisted of patients undergoing removal of granulation tissue and Group B included patients on whom the skin graft was directly applied on the granulation tissue. On the 10th post-operative day, assessment of the graft take was done.

Results

There was no statistically significant difference in graft take between group A and group B (p=0.59). The average drop in hemoglobin levels after the surgery was 1.6 gm% in group A and 0.4 gm% in group B and this difference was statistically significant. Also, the drop of serum protein after surgery was 8.6% gm/dl in group A and 1.0 gm/dl in group B and this difference was significant.

Conclusion

There was no significant difference in the take of skin graft with or without removal of granulation tissue in our study. However, with lesser blood loss, lesser protein loss and lesser operative time, this study favours skin grafting without the removal of granulation tissue.

Keywords
Graft take, granulation tissue, split thickness skin graft

INTRODUCTION

Skin grafting is the removal of a part of skin from any part of the body completely devascularized and replaced in different location.[1] Split thickness skin graft (STSG) includes the epidermis and various thickness of dermis.[2] It is used to cover the areas of skin loss due to various reasons such as burn, trauma, infection and malignancy. It is one of the most common procedures performed in plastic and reconstructive surgery. To optimize the take of the skin graft, the recipient site must be prepared and should have healthy granulation tissue.[3] In patients with granulating wounds, the graft may be applied directly on the granulation tissue (without scrapping) or it may be applied after complete removal of the granulation tissue (after scrapping). This depends upon the personal preference or the own experience of surgeons. Some surgeons prefer application of skin grafts after removal of granulation tissue from the recipient bed.[4] This is because they believe that wound is heavily contaminated with bacteria, graft take improves dramatically after scrapping and that, after healing, less scar tissue is produced. The others favour application of skin graft directly on skin the granulation tissue.[3,5] There are conflicting results comparing skin grafting by these two methods.

Carl Thiersch, a prominent German surgeon, described removing granulation tissue before applying skin graft.[6] However, Brown and McDowell in 1942 asserted that if granulations are new, flat, not edematous and otherwise bright red and healthy, graft may be placed right on them.[4] McGregor further stated that grafting should be done in healthy granulation tissue with good marginal healing without delay.[3] They believed that good marginal healing was presumptive evidence that granulation would accept a skin graft, and that clinical appearance was a better guide than bacterial flora in assessing suitability for grafting.

Split skin grafting is one of the most common plastic surgery procedures carried out in our center in patients with granulating wounds and the usual practice has been to remove granulations before applying the graft. This study will evaluate whether removing granulations is actually required for better graft uptake.

METHODS

A single blinded, parallel group, randomized controlled trial was conducted from November 2017 to December 2018 in the Department of Plastic Surgery and Burns, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal. Patients were included in in-patient basis. All patients ≥16 years of age undergoing skin grafting on granulating post-traumatic, post-burn or post-infective granulating wounds (raw areas); and in whom wound size was less than or equal to 20% of total body surface area (TBSA) were included in the study. Patients with known history of uncontrolled diabetes mellitus (DM), nephritis or chronic kidney disease (CKD), malignancy, history of steroid

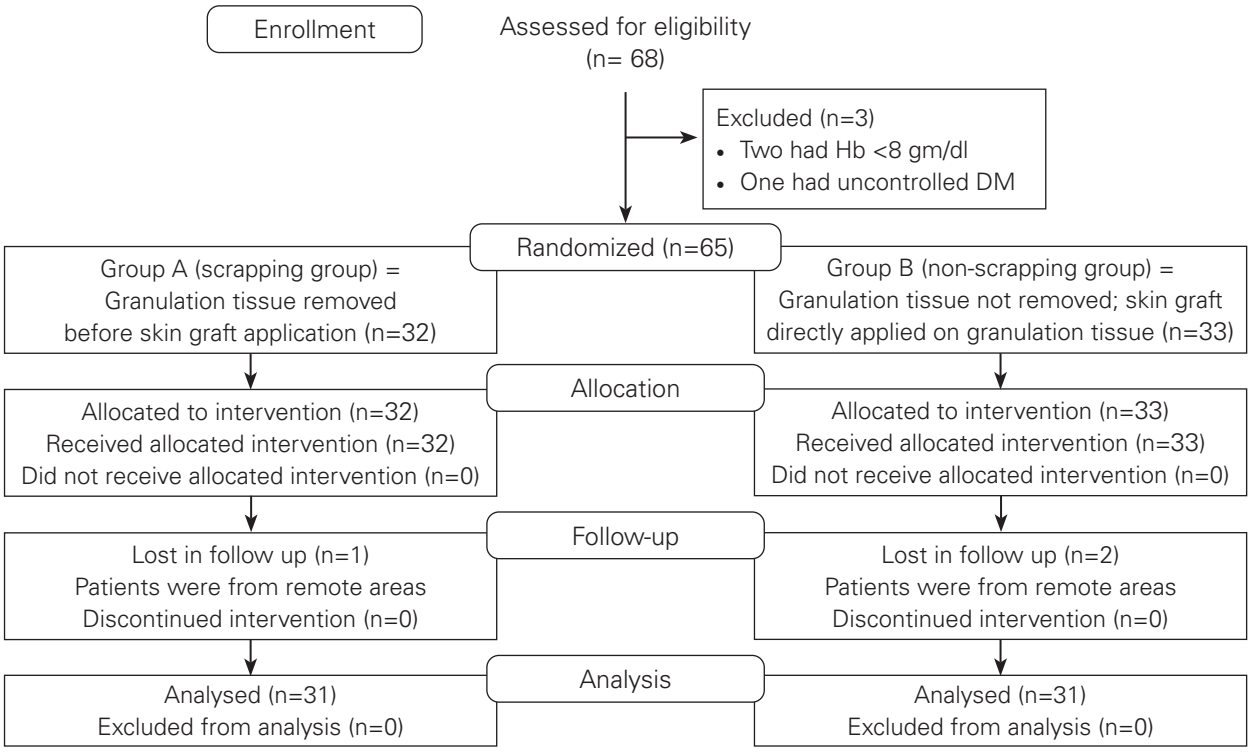

Fig 1. CONSORT flow diagram

intake, history of radiation, venous or arterial ulcer, patients on anticoagulants, patients with severe anemia (hemoglobin < 8 gm%) and patients with severe hypoalbuminemia (serum albumin < 2.5 mg/dl) were excluded.

Written informed consent was obtained from all participants. Approval to carry out our study was sought from the Institutional Review Board (IRB) of Institute of Medicine (Ref: 260(6-11-E)²/074/075).

Computer generated random numbers were used for randomization of the sample into two groups. Patients were blinded about the removal of the granulation tissue. In group A, granulation tissue was removed before skin graft application (scrapping group) while in group B, granulation tissue was not removed and skin graft was directly applied on the granulation tissue (non-scrapping group).

The primary outcome was to compare the skin graft take with and without surgical removal of granulation tissue in granulating wounds on the 10th postoperative day. Secondary outcomes were to study the demographic profile of the patients requiring split thickness skin graft (STSG), average graft application time, decline in hemoglobin and hematocrit levels, decline in serum protein levels and frequency of wound complications (hematoma, seroma, infection) between two groups.

All the patients included in the study were enrolled in the in-patient basis. Regular dressing was done preoperatively to prepare the wound for skin grafting. Thorough washing of the wounds was done using normal saline (NS) after painting with povidone iodine. Intermediate-thickness STSG was harvested using Humby's knife. Skin was harvested by standard procedure and applied to wounds immediately.

First dressing was done on third postoperative day (POD), second dressing on fifth POD and then every alternate day until the tenth POD when assessment of the skin graft take was done by graph paper method. The percentage of graft take was measured by using graphs and counting the large and small squares over the graft.

A sample size of 68 patients would have 90% power to detect a difference in the comparison of skin graft take with and without surgical removal of granulation tissue in granulating wounds.

Categorical variables were represented with number and percentage (%), whereas continuous variables were presented as mean. IBM SPSS Statistics version 24.0 was used for statistical analysis. Independent samples t-test was used to compare quantitative data between the groups and Chi-square test was used to compare the qualitative data. P value of less than 0.05 was taken as statistically significant. Where appropriate, we expressed statistical uncertainty with 95% CIs.

RESULTS

From November 2017 to December 2018, 68 patients were enrolled. Among 68 patients, three of them were lost to follow up, two had haemoglobin less than eight and one had uncontrolled diabetes mellitus.

Baseline characteristics showed that 33 (53.2%) were males and 29 (46.8%) were females. The age of the study population ranged from 16 to 76 years, and the mean age of the study population was 46.7 years. The mean age of the patients in group A was 45.7 years and that in group B was 47.6 years.

Infection was the most common cause of the wounds among the patients studied accounting for 46.8% of the cases, and post-infective raw areas (PIRA) were also the most common raw areas grafted in each of the sub-groups (Table 1). Though post traumatic raw areas (PTRA) were the second most common wounds grafted in group A and post burn raw areas (PBRA) in group B, the difference in the etiology of wound between the two study groups was not statistically significant.

The percentage body surface area of the wounds was divided into four categoric ranges. There was no statistically significant difference between the percentage body surface area of the raw areas in the two groups. Most of the wounds occurred in the lower limbs (Table 1).

The average time taken for the application of the graft in group A was 42.7 minutes whereas in group B it was 32.1 minutes and this difference in graft application time between the two groups was statistically significant (p-value 0.02).

Table 1. Distribution of the study population by etiology, location of the wounds in the body and percentage body surface area of the raw areas grafted

Parameters	Scrapping Group (n=31)	Non-scrapping Group (n=31)	Total
Location of wound			
Chest and trunk	0	6	6
Upper limb	8	2	10
Lower Limb	23	23	46
Diagnosis			
PTRA	8	6	14
PIRA	16	13	29
PBRA	7	10	17
Others	0	2	2
TBSA category			
0-5	16	13	29
6-10	8	9	17
11-15	5	7	12
16-20	2	2	4

Table 2. Distribution of skin graft take on the 10th post-operative day

Skin graft take %	Scrapping Group (n=31)	Non-scrapping Group (n=31)	Total
91 -100	12 (38.7%)	15 (48.4%)	27 (43.5%)
81-90	15 (48.4%)	14 (45.1)	29 (46.8%)
71-80	4 (12.9%)	2 (6.5%)	6 (9.7%)
<70	0 (0%)	0 (0%)	0 (0%)

Assessment of the skin graft take was done on the 10th POD. Patients were divided into four categories as per the skin graft take. None of the patients had take less than 70% (Table 2).

In group A, 12 patients had graft take between 91-100% and 15 patients between 81-90% whereas in group B, 15 patients had taken between 91-100% and 14 patients between 81-90%. Four patients in group A had taken in the range of 71-80% whereas only two patients in group B had the same take range. However, these differences between the groups in terms of the graft take were not statistically significant (p value = 0.59). Two of the four patients in group A who has graft take in the range 71-80% had developed hematoma underneath some parts of the grafts, one had seroma collection in different parts and one was partially infected.

The average drop in hemoglobin levels after the surgery was 1.6 gm % in group A and 0.4 gm % in group B and this difference was statistically significant (p value 0.002). Similarly, average drop in hematocrit was 5.1 % in group A and 1.0 % in group B (p value 0.001). Also, the drop of serum protein after surgery was 8.6 gm/dl in group A and 1.0 gm/dl in group B and this loss in protein was statistically significant (p value <.001) (Table 3).

Table 3 . Drop in blood hemoglobin, hematocrit and protein levels in the study groups

Skin graft take %	Scrapping Group (n=31)	Non-scrapping Group (n=31)	p-value
Hemoglobin (gm%)	1.6	0.4	0.002
Hematocrit (%)	5.1	1.0	0.001
Protein (g/dL)	8.6	1.0	<0.001

Table 4 . Comparison between two groups

Parameters	Scrapping Group (n=31)	Non-scrapping Group (n=31)
Graft uptake	Same	Same
Blood loss	More	Less
Protein loss	More	Less
Operative time	More	Less
Cost of surgery	More	Less

Further, comparative findings generalizing graft uptake, blood loss, protein loss, operative time and cost of surgery of the study are shown in Table 4.

DISCUSSION

Skin graft may be applied with or without the removal of granulation tissue. This is largely a controversial topic and surgeons have been divided on this issue depending upon their own practice, preference or experience. Moreover, there have been conflicting results comparing skin grafting by these two methods.

In the last century, there were some studies favouring excision of granulation tissues, and the others favouring direct application of grafts.[3,4,7-11] Recently there have been three major studies looking in this matter. The first study consisting of 51 patients was carried out by Dhar et al in India in 2006 which found no significant difference in the take between the study groups.[12] The second study consisting of 57 patients by Hasan et al came from Bangladesh in 2013 which favoured complete removal of granulation tissue before skin grating for better take.[13] The third study consisting of 30 patients and carried out by Krishna et al, again came from India in 2017 found similar graft take in both the groups.[14] Table 5 shows comparison of skin graft take among different studies.

In our study, the age distribution, etiology of wounds, percentage body surface area of the wounds and location of the wounds in both the study groups were similar and not statistically different.

Our study did not find any significant difference in the graft take between the groups (p value 0.59). The study by Dhar et al[12], and Krishna et al[14] also showed no significant difference in between the groups. However, the study by Hasan et al[13] revealed better take with removal of granulation tissue (Table 5). Our study also revealed a significant fall in blood haemoglobin, hematocrit and protein levels in between the groups.

Though scrapping could lessen bacterial and other inflammatory burden of the granulation tissue, it is to be balanced with the consequences associated with it such as continuous oozing of tissue fluids and blood from the wound bed, formation of small hematomas despite greatest care at meticulous hemostasis and loss of protein when granulations are removed. Though scrapping would help lessen the infection, it would also help lose blood and proteins which are important for wound healing and also predispose to formation of small hematomas and seromas underneath the graft reducing the graft take rates.

The study by Dhar et al have reported more blood loss, less secure hemostasis, and the need for blood transfusions for excision group and also

Table 5. Comparison of skin graft take among different studies

Study	Scrapping Group (n=31)	Non-scrapping Group (n=31)	p-value
Dhar et al.[12]			
91 -100	16 (42.1)	12 (31.6)	0.51
81-90	10 (26.3)	16 (42.1)	
71-80	5 (13.15)	5 (13.1)	
<70	7 (18.42)	5 (13.1)	
Hasan et al.[13]			
91 -100	49 (86)	30 (52.6)	0.0006
81-90	8 (14)	18 (31.6)	
71-80	0 (0)	7 (12.3)	
<70	0 (0)	2 (3.5)	
Krishna et al.[14]	87.21 ± 9.48	86.58 ± 11.18	0.69
Our study			
91 -100	12	15	0.59
81-90	15	14	
71-80	4	2	
<70	0	0	

serum albumin concentrations affecting the take rate, they have not quantified the blood loss.[12] The study by Krishna et al have reported the average blood loss of 54.5 ml/100 square centimeters of granulation tissue removed.[14] The study by Hasan et al have not looked at blood or protein loss in their study.[13]

The study by Dhar et al also looked at the cosmetic appearance of the grafts using modified scar assessment score at three months. Though Group A wounds had marginally better scars than Group B, the difference was not statistically significant.[12] However, scar quality assessment was not a part of the protocol in this study and other two studies. In this study, the cosmesis of the scar was not studied as most of the patients had hailed from remote and far away areas of the country and would be lost to follow up. There is a theoretical advantage of scrapped wounds having better scars due to the removal of excess granulation tissue and also sharp debridement leading to better scars, but further studies are required to quantify and confirm these.

The study by Krishna et al interestingly found delayed wound healing time in the non-scrapping group.[14] However they haven't given a specific explanation for their finding, they have speculated that presence of hyper granulation tissue in the same group could have led to the increased time for healing. However, they have not mentioned that this must be weighed against the blood, tissue fluid loss and protein loss that would not occur in the non-scrapping group and thus would lessen the wound healing time.

This study also looked at the graft application time. Two other studies have mentioned an advantage of time in non-scrapping group but have not quantified it.[12,14] The graft application time was defined as the time from the start of the debridement/removal of the granulation tissue to the completion of securing of skin graft over the raw area with skin staplers. It was found that the mean graft application time in group A was prolonged by an average of 10 minutes, and the difference in the time was statistically significant. This time was spent in excision/removal of granulation tissue and securing hemostasis at various stages and sometimes even removing the clot collected underneath the applied graft and sometimes flushing and mopping them. Thus, more graft application time implied increased operative time and which in turn implied greater cost of surgery in group A.

The comparative findings of this study are tabulated in the table. Thus, it can be deduced that not removing the granulation tissue before skin grafts has more advantages than removing it.

Also, it can be seen from Table 2 that infection was the most common etiology of the wounds. There were 16 patients with post infective raw areas in group A and only 13 patients in group B. Though scrapping the wound might have lessened the bacterial and inflammatory in those patients, the take rates were still similar in both groups. Infection is just one of the factors affecting wound healing and thus graft take. Protein and hemoglobin levels may be equally important. Also, securing meticulous hemostasis or avoiding continuous ooze of blood and body fluids after the application of the graft may be equally important to have similar take rates.

CONCLUSION

There is no significant difference in the take of skin graft with or without surgical removal of granulation tissue in granulating wounds. However, given the advantages of lesser blood loss, lesser protein loss, lesser effort required at securing hemostasis and thus less operative time, this study favours skin grafting without the removal of granulation tissue.

FINANCIAL SUPPORT

None.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. Thorne CH. Grabb and Smith's Plastic Surgery. 7th ed. Philaldelphia: Lippincott Williams and Wilkins; c2014. Chapter 1, Techniques and Principles in Plastic Surgery; p. 5-6.
2. Seyhan T. Split-Thickness Skin Grafts In: Spear M, editor. Skin grafts- indications, applications and current research. Rijeka: InTech; c2011. p. 3-17.
3. McGregor AD. Fundamental techniques of plastic surgery. 10th ed.

Churchill Livingstone: Harcourt Publishers Ltd., c2004. Chapter 3, Free skin grafts; p. 35-59.

4. Brown JB, McDowell F. Massive Repairs of Burns with Thick Split-Skin Grafts: Emergency "Dressings" with Homografts. Ann Surg. 1942;115(4):658-74.
5. Stone HH, Fabian TC, Turkleson ML, et al. Management of acute full-thickness losses of the abdominal wall. Ann Surg. 1981;193(5):612-8.
6. Paletta CE, Pokorny JJ, Rumbulo P. Skin grafts. In: Mathes SJ, Hentz VR, editors. Mathes plastic surgery. Vol. 1; Philadelphia: Saunders Elsevier Inc; c2006. p. 293-316.
7. Ackman D, Gerrie JW, Pritchard JE, et al. A Report on the Management of Burns: Using the Occlusive Compression Dressing, with Sulfathiazole Emulsion. Ann Surg. 1944;119(2):161-77.
8. Blair VP, Brown JB. The use and uses of large split skin grafts of intermediate thickness. Plast Reconstr Surg. 1968;42(1):65-75.
9. Brown JB, Byars Louis T, Blair VP. A study of ulcerations of lower extremity and their repair with thick split skin grafts. Surg Gynecol Obestretics 1936;63(3):331–40.
10. Pollock WJ, Parkes JC. Open skin grafting of war wounds. J Bone Joint Surg Am. 1969;51(5):926-34.
11. Rudolph R, Ballantyne DL. Skin grafts. In: McCarthy JG, editor. McCarthy Plastic surgery, Vol. 1. Philadephia: WB Saunders Company; c1990. p. 221–74.
12. Dhar S, Saraf R, Gupta AK, et al. Comparative study of skin grafting with and without surgical removal of granulation tissue in chronic burn wounds. Burns. 2007 Nov;33(7):872-8.
13. Hasan M, Khundkar S, Kabir ME, et al. A comparative study of split thickness skin graft take on chronic wounds with and without surgical removal of granulation tissue from the recipient bed. JAFMC [Internet]. 2015 Feb [cited 2019 Jan 3];9(2):49-3
14. Krishna D, Kumar S, Sharma U, et al. Impact of nonscraping of granulation tissue on outcomes after skin grafting. Indian J Burns 2017; 25(1):33-37