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Original Article

Comparative Study of Split-Thickness Skin Grafting in Cases of Granulating Wounds with and without Scraping

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Abstract

Background: In the 21st century, prompt recovery and good functional outcome for patients with raw area depend largely on proper management of wound. The standard treatment of these wound is split-thickness skin grafting when wound becomes granulating. Some surgeons favor application of skin graft after scraping of granulation tissue, whereas others favor application of skin graft directly on the granulating wound which of the two methods offer a better take, better healing time and chances of regrafting was the objective of our study carried out in BJ Medical College and Civil Hospital, Ahmedabad.

Materials and Methods: This prospective comparative study was carried out on patients of the Department of Burns and Plastic Surgery, Civil Hospital and B. J. Medical College, Ahmedabad, Gujarat, India, from December 2017 to December 2019. A total of 30 adult subjects (both males and females) of age group (2–60 years) who were willing to participate were included in the study. The data were collected with a pro forma regarding patient, defect, and treatment-related parameters. All the details of the patients that were relevant to the study were collected during the pre-operative, surgical, and post-operative periods and during follow-up which was later analyzed.

Results: There were 18 (60.00%) males and 12 (40.00%) females included in the study and the mean age was 27.77 years. Male:female ratio was 1.5:1. Out of 30 patients, 23 (76.67%) having granulating wound due to burns injury, 2 (6.66%) patients having post-trauma granulating wound, and 5 (16.67%) patients having post-cellulitis granulating wound. Median area of wounds grafted in Group A was 163.40 ± 45.66 cm^2 (Mean ± SD) and in Group B was 161.80 ± 45.50 cm^2 (Mean ± SD) with $P = 0.45$. Mean graft uptake % in Group A was 87.00 ± 9.12 (Mean ± SD) and in Group B was 85.00 ± 10.14 (Mean ± SD). These differences were not statistically significant ($P = 0.25$). No statistically significant difference in graft uptake between two groups was noted when chronicity of the wounds was considered. About 60.00% of wound healed completely within 14 days in Group A against 46.67% in Group B. The mean duration of complete wound healing in Group A was 14.00 ± 3.06 (mean ± SD) and in Group B was 15.00 ± 3.56 (mean ± SD) which showed significant difference ($P = 0.0021$).

Conclusion: In scraped group, complete wound healing is faster than non-scraped group. The wounds with scraping had less discharge, required lesser number of dressings, and thus healed earlier with respect to control wounds. Scraping of granulation tissue was also associated with increased blood loss, more physiological insult to patient, increased operative time, and more requirement for blood transfusions. Because of increased loss of blood with scraping of the granulation tissue, perioperative risks to the patient due to blood loss after scraping of large granulating wound outweigh the advantage of marginally faster healing and comparable success rate of skin grafting. Therefore, it is not recommended to scrape the healthy granulation tissue before skin grafting.

Key words: Blood loss, Graft uptake, Non-scraping, Scraping, Split-thickness graft

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INTRODUCTION

Wound healing which is the stated goal of any wound management protocol has been described throughout recorded history, however, our understanding of its basic mechanisms has grown more in the past two decades than in the preceding two millennia. Nevertheless, poor wound

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healing remains a critical problem in our daily practice of surgery exerting a heavy toll on our patients as well as on the health-care system.[1] In the 21st century, prompt recovery and good functional outcome for such patients depend largely on proper management of wound. Perhaps, the greatest advances in burn care to date have been the institution of early surgical excision of the burn wound with immediate or delayed wound closure strategy to each patient.[2] Chronic wound for the purpose of this study meant a wound with skin loss which failed to heal or epithelialize on its own within 3 weeks from the date of injury. The standard treatment of these wound is split-thickness skin grafting when wound becomes granulating. The problem which arises now is how to apply skin graft on these granulating wounds. Opinion is divided on this issue, some surgeons favor application of skin graft after scraping of granulation tissue whereas others favor application of skin graft directly on the granulating wound. Despite its widespread use, there is little or no objective information about the outcomes of skin grafted wounds without knowing the exact time period. The actual length of time it takes for complete wound healing of skin grafted wounds has been reported by only few in the literature. There is very limited literature describing the impact of scraping of post-burn/trauma/cellulitis granulating wounds on take of split-thickness skin grafting and the length of time it takes to achieve complete wound healing in such cases which of the two methods offer a better take of skin grafts was the objective of our study.

MATERIALS AND METHODS

This prospective comparative study was carried out on patients of the Department of Burns and Plastic Surgery, Civil Hospital and B. J. Medical College, Ahmedabad, Gujarat, India, from December 2017 to December 2019. A total of 30 adult subjects (both males and females) of age group (2–60 years) who were willing to participate were included in the study.

Study Design

This was a prospective observational study.

Study Location

This was a tertiary care teaching hospital-based study done in the Department of Burns and Plastic Surgery, Civil Hospital and B. J. Medical College, Ahmedabad, Gujarat, India.

Study Duration

This study was from December 2017 to December 2019.

Sample Size

Thirty patients.

Inclusion Criteria

The following criteria were included in the study:

1. Age: 2–60 years
2. Post-burn or post-traumatic/cellulitis healthy granulation tissue
3. Raw area ≥200 cm^2 in dimension
4. Wounds of more than 3-week duration.

Exclusion Criteria

The following criteria were excluded from the study:

1. Age: >60 years or <2 years
2. Wounds of <3-week and >10-week duration
3. Patients with other medical illness (diabetes, hypertension, anemia [Hb <10 g%], malnutrition, bleeding disorder, and on anticoagulant, corticosteroid, and chemotherapy)
4. Wound swab culture positive for β-hemolytic streptococcal infection.

Procedure Methodology

Collection of data

The data were collected with a pro forma regarding patient, defect, and treatment-related parameters. All the details of the patients that were relevant to the study were collected during the pre-operative, surgical, and post-operative periods and during follow-up which was later analyzed.

Procedure

Both informed and written consents were taken about the procedure and the study on a preformed format. For each patient, specific data were collected on duration of wound, area of wound (measured with graph paper), and basic and specific investigation (e.g., wound swab culture and sensitivity, bleeding time, and clotting time). Area of wound was measured by cutting the sterile mackintosh sheet into shape of the wound then putting it over graph paper and outlining its border [Figure 1a]. The outlined area was then measured by counting the large and small squares of graph paper, and thus, raw area was calculated [Figure 1b]. The study was done by dividing the wound into two groups, Group A and Group B. In patients with single wound, Group A included approximate half area of wound in which granulation tissue was removed before skin grafting by scraping. Group B included remaining area of same wound where no scraping was done [Figure 1b]. In patients with multiple wounds, over different parts of body two wounds were selected as a Group A and Group B. Total wound area was cleaned with 5% povidone-iodine followed by saline wash. Complete scraping of granulation tissue was done by back of dissecting forceps/bard parker knife handle/scoop in Group A and hemostasis was achieved by adrenaline soaked gauzes, compression bandage, and electrocautery or ligation if required. Split skin grafts were meshed, applied, and secured by staples/sutures (same technique in both groups) and splint was given to provide best immobilization. Ratio of meshing was 1:2 or manual by pie crusting with surgical

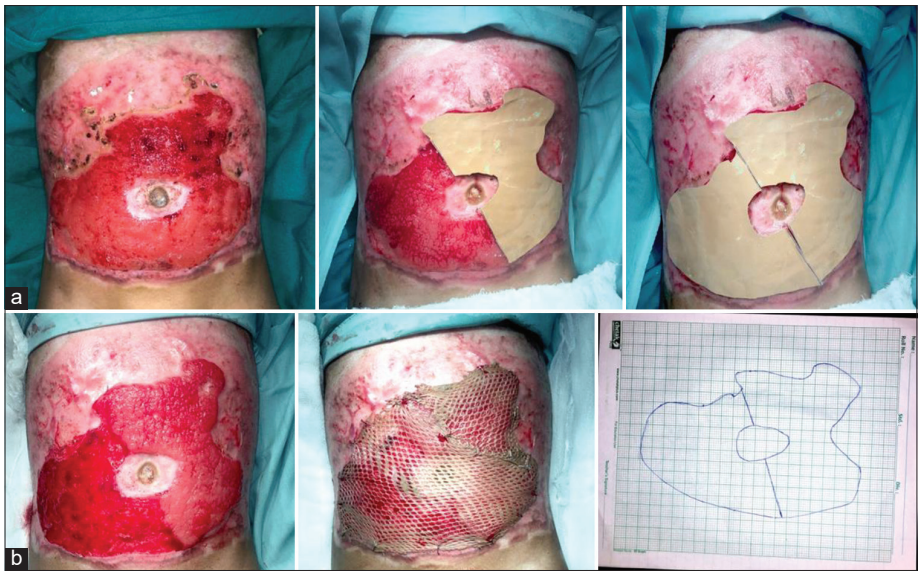

Figure 1: (a) Area of wound measured by cutting the sterile mackintosh sheet to shape of the wound. (b) Approximately half area of wound was scraped and rest served as control. It was grafted. Outlined area was measured by counting the large and small squares of graph paper

knife but same in test and control groups. Dressings were done after the 3rd, 5th, 7th, and 10th post-operative days and thereafter as required. Graft take was monitored on the 3rd, 7th, and 10th post-operative days. Percentage of graft take was measured using graph paper and calculated by subtracting the area of graft loss from estimated pre-operative raw area in both groups. Final outcome was decided by graft take as observed on the 10th day. Intraoperative blood loss was determined as the weight difference between the wet gauzes used in cleaning and achieving active hemostasis pre- and postoperatively. Pre-operative weight of gauzes used in this procedure was determined by weight difference between total wet gauzes taken preoperatively and remaining wet gauzes postoperatively in a bowl. All these weight measurements were done on same standard weighing machine. Time required for patient to be free from dressing and complete wound healing was calculated in both groups. Requirement of regrafting was also noted in both groups. The study was designed such as to enable us to achieve two important objectives. One was to eliminate the variables such as age, gender, duration of wounds, and nutrition that may affect graft uptake, by doing both the types of grafting on the same patient. The other was to remove any selection bias of patients by taking consecutive patients in the study.

Follow-up Procedure

The patient was followed up and dressings were done after the 3rd, 5th, 7th, and 10th post-operative days and thereafter as required. Graft take was monitored on the 3rd, 7th, and 10th post-operative days.

Assessment of Outcome

Percentage of graft take, percentage of intraoperative blood loss, time required for healing, and requirement for regrafting were noted and assessed statistically.

Table 1: Comparative distribution of area of wounds grafted

Area in cm²	Group A *n*=30 (%)	Group B *n*=30 (%)
100–150	14 (46.66)	15 (50.00)
150–200	10 (30.00)	10 (30.00)
>200	6 (20.00)	5 (16.00)

RESULTS

Thirty consecutive patients were studied. In these 30 patients, 13 had single wound which was divided into two parts (Group A and Group B) and 17 patients had wounds over different parts of body, presenting a milieu for an ideal comparative study.

There were 18 (60.00%) males and 12 (40.00%) females included in the study and the mean age was 27.77 years. Male:female ratio was 1.5:1. Out of 30 patients, 23 (76.67%) having granulating wound due to burns injury, 2 (6.66%) patients having post-trauma granulating wound, and 5 (16.67%) patients having post-cellulitis granulating wound. There was no statistically significant difference in the area of wounds grafted in two groups.

Table 1: Median area of wounds grafted in Group A was 163.40 ± 45.66 cm2 (Mean ± SD) and in Group B was 161.80 ± 45.50 cm2 (Mean ± SD) with P = 0.45.

Figure 2: Mean graft uptake % in Group A was 87.00 ± 9.12 (Mean ± SD) and in Group B was 85.00 ±10.14 (Mean

± SD). These differences were not statistically significant ($P = 0.25$).

The average blood loss in Group A was 52.53 ml/100 cm^2 area of wounds, and in Group B, it was negligible. No grafts were lost due to seroma in both groups. No patient required regrafting in both groups.

Table 2: No statistically significant difference in graft uptake between two groups was noted when chronicity of the wounds was considered. About 60.00% of wound healed completely within 14 days in Group A against 46.67% in Group B.

Figure 3: The mean duration of complete wound healing in Group A was 14.00 ± 3.06 (mean ± SD) and in Group B was 15.00 ± 3.56 (mean ± SD) which showed significant difference (*P* value = 0.0021).

Patient photos: Post-burn wound abdomen:

a. Pre-operative right abdominal part scrapped, left abdominal part non-scrapped
b. Graft uptake on the 3rd post-operative day
c. Graft uptake on the 7th post-operative day
d. Graft uptake on the 14th day.

DISCUSSION

Any wounds with granulation tissue are managed by applying split skin graft. For improving skin grafting success rate, some surgeon prefers to scrape the granulation tissue but some surgeons consider it to be unnecessary. According to Brown and Mcdowell, if granulations are fresh, they can be grafted on directly, but if granulations are long standing and fibrous, they should be removed before applying graft.[3] This study was done to objectively evaluate the effect of scraping of granulation tissue on improvement of skin grafting success rate as compared to control where graft was applied directly without grafting. One prospective comparative study of skin grafting of chronic burn wounds with and without surgical removal of granulation tissue by Dhar *et al.* shows no significant difference in the comparative bacteriology, graft uptake, and cosmetic appearance of the grafts (mean graft uptake % in Group A was 83.74 ± 16.74 and in Group B was

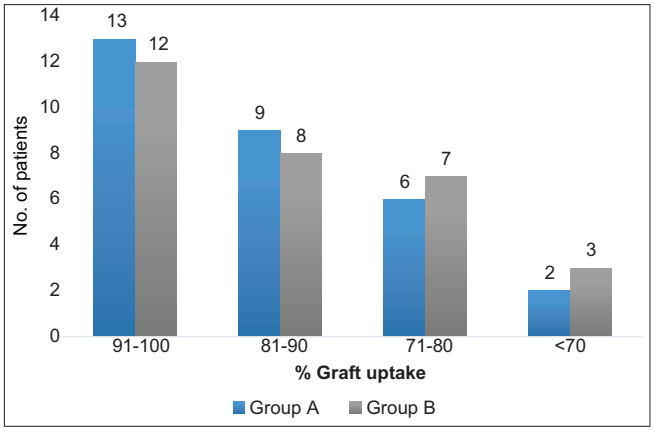

Figure 2: Comparative uptake of graft on the 10th post-operative day

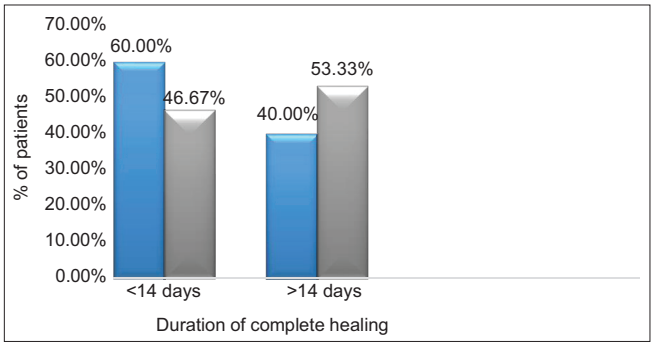

Figure 3: Comparative study of duration of complete healing

Table 2: Comparative distribution of graft uptake in relation to the chronicity of wounds

Chronicity (weeks)	% graft uptake	Group A	Group B	*P* value
3–6 weeks	81–100	16 (69.57%)	15 (65.22%)	*P*=0.63
(***n***=23)	<81	7 (30.43%)	8 (34.78%)	Non-significant
>6–10 weeks	81–100	5 (71.43%)	5 (71.43%)	*P*=0.51
(*n*=7)	<81	2 (28.57%)	2 (28.57%)	Non-significant

84.23 ± 18.90).[4] Our study was done by dividing the wound in two groups, Group A and Group B. Group A included approximate half area of wound in which granulation tissue was removed before skin grafting by scraping. Group B included remaining area of same wound where no scraping was done. The sample size was of 30 patients between the age group of 2 and 60 years. Mean graft uptake percentage in Group A was 87.00 ± 9.12 (Mean ± SD) and in Group B was 85.00 ± 10.14 (Mean ± SD). These differences were not statistically significant ($P = 0.25$). According to Lee *et al.*, estimation of blood loss using a gravimetric method is accurate and applicable in the clinical setting and provides surgeons with a simple and objective tool to evaluate intraoperative blood loss.[5] According to Bundy *et al.*, the mean blood loss for 1% of burn excised or split skin donor site harvested was 117 ml in adult cases and blood loss can also be expressed as a mean percentage of the patient's calculated total blood volume for each 1% burn excised or autograft harvested, giving figures of 2.6% for adults and 3.4% for children.[6] In our study, intraoperative blood loss was determined as the weight difference between the wet gauzes used in cleaning and achieving active hemostasis pre- and postoperatively. The average blood loss in Group A was 52.53 ml/100 cm^2 area of wounds and in Group B was minimal. Surgical removal of granulation tissue results in significant blood loss and adds to physiological and operative insult to already compromised and catabolic patient. There is also more oozing of tissue fluids after surgical removal (Group A) which also leads to protein loss.[7] Proteins in such patient are needed for building up body reserves in the form of hemoglobin and tissue proteins in addition to skin graft uptake. When the granulation tissue is not removed (Group B), there are minimal blood loss and minimal physiological insult and more secure hemostasis and proteins are thus conserved for graft uptake only as shown by Dhar *et al.*[4] According to Jewell *et al.*, most burn wounds after primary excision and skin grafting healed within 2 weeks and factors such as total body surface area burned, sex, age, graft type, and infection did not significantly influence time to complete wound healing.[8] Healthy granulation tissue fit for surgery is characterized by pink to red in color, finely granular in appearance, moist, epithelized margins, and minimal discharge, does not bleed easily on touch and free from β-hemolytic streptococci organisms.[9] It has an excellent blood supply but also contains debris, bacteria in the form of biofilm on their surface. Removal of granulation tissue decreases the load of bacteria resulting in improved graft uptake, less chances of infection, and early wound healing. In our study, 60.00% of wound healed completely within 14 days in Group A against 46.67 % in Group B. The mean duration of complete wound healing in Group A was 14.00 ± 3.06 (mean ± SD) and in Group B was 15.00 ± 3.56 (mean ± SD) which showed significant difference ($P = 0.0021$). These results are comparable to other studies in literature.

CONCLUSION

In this study, results show that success rate of skin graft uptake was comparable in both groups without significant difference. In scraped group, complete wound healing is faster than non-scraped group. The wounds with scraping had less discharge, required lesser number of dressings, and thus healed earlier with respect to control wounds. Scraping of granulation tissue was also associated with increased blood loss, more physiological insult to patient, increased operative time, and more requirement for blood transfusions. Because of increased loss of blood, scraping of the granulation tissue requires alertness on the part of attending doctors to detect hypotension which usually occurs suddenly. This causes more physiological instability in an already chronically ill patient if replacement by fluids and blood is not swift and adequate. Achieving hemostasis after scraping also requires time and efforts. Blood requirements for surgery and thus time and efforts required to arrange it can virtually be dispensed with if scraping is not done. Thus, perioperative risks to the patient due to blood loss after scraping of large granulating wound outweigh the advantage of marginally faster healing and comparable success rate of skin grafting. Therefore, it is not recommended to scrape the healthy granulation tissue before skin grafting.

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