

A Prospective Comparative Study of Two Methods of Dressing (Open versus Bolster Dressing) in Split Thickness Skin Grafting

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Abstract

Background and Aim: The management of wounds with loss of the dermo - epidermic layer where primary closure is impossible has been a challenge to surgeons since historical times. Success in skin grafting is dependent on adequate contact of graft with a vascular supply and control of infection. A prospective randomized study of 60 patients with wounds related to pre - existing clinical condition like ulcer, wounds and burns which required STSG was conducted in the Department of Surgery, Medical College and hospital.

Material and Methods: A total of 60 patients admitted in surgical units in General Hospital and Medical College, having wounds with skin loss which hindered primary closure were incorporated to this study. Wounds with soakage mild to moderate in amount were included in study. Wounds with positive bacterial culture were included in the study. After preparing the recipient site patient was randomized into two groups to receive one of the two techniques of dressing in STSG: cotton bolster group and open group. We recorded patient - related factors like gender, age, haemoglobin, nutritional status, obesity, diabetes mellitus, steroid therapy, jaundice, smoking status, chronic alcoholism, Operation related factor that was recorded was type of anaesthesia.

Results: The mean age of the patients in the study population was 43.33 years. 6 patients from open group and 7 patients from bolster group were found to be having associated co - morbidities. Out of 60 patient evaluated majority had ulcer following cellulites (n = 43), other had trauma (n=11) and burns (n=6) as the cause of ulcer. Mean duration of ulcer in open dressing group was 28.83 days as compared to 25.73 days in bolster dressing group. In both the groups the characteristics of the wound including cause, site, duration of ulcer number of wounds having moderate discharge and positive bacterial culture was not significantly mismatched. pre-operative positive bacterial culture didn't influence graft uptake in open group but it had significant influence on graft uptake in bolster group.

Conclusion: open dressing of STSG can be effectively utilized in management of wound, even for that having persistently more amount of exudates and is inoculated with bacteria. It increases the graft uptake in such wounds and also decreases the operative time. Thus it gives better results of skin grafting in such situations and is eminently acceptable by the patient.

Keywords: Dermo - Epidermic Layer, Dressing, Split - Thickness Skin Graft, Wound

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Background

The management of wounds with loss of the dermo - epidermic layer where primary closure is impossible has been a challenge to surgeons since historical times. During a great part of the history of medicine, the management of injuries has been based on the use of dressings and substances for external use that has resulted in discreet effectiveness and produced unsatisfactory results [1,2].

One of the principal tools that the modern surgeon counts on is the split - thickness skin graft (STSG), a relatively simple versatile technique that can guarantee cutaneous covering for practically any defect [1,3].

Success in skin grafting is dependent on adequate contact of graft with a vascular supply and control of infection. Conventional method of achieving these two important goals incorporates the principle of grafting only surfaces which are free of infection with techniques of fixation of graft by sutures and retentive dressing, plus immobilization of graft and its bed by inlay moulds and external splints². This conventional method is termed as Bolster Dressing [4,5].

Though not much has been written regarding Open Dressing in STSG its concept was first mentioned 80 years ago in text book of plastic surgery by Davis and has come to the reckoning of plastic surgeon more after Second World War.

Bolster dressing was found to have limited efficacy in STSG in areas with complex contour and in presence of infection in some studies. Open dressing in STSG was found to be more effective in such areas [6]. But surgeons still do not have a unanimous opinion regarding this. This has led us to study the efficacy of bolster dressing and open dressing in STSG. A prospective randomized study of 60 patients with wounds related to pre - existing clinical condition like ulcer, wounds and burns which required STSG was conducted in the Department of Surgery, Medical College and hospital.

Materials and Methods

A total of 60 patients admitted in surgical units in General Hospital and Medical College, having wounds with skin loss which hindered primary closure (chronic non healing ulcer, post traumatic ulcers, ulcers following debridement of cellulites and burns) were incorporated to this study. We excluded patients with ≥ 20 % of total body surface burns, wounds of inguinal groin and perineal regions, wounds with exposed bone/tendon/nerve/artery, wound with slough, polytraumatized, surgical contraindications, and age less than 18 years, patents with mental disorder. Wounds with soakage mild to moderate in amount were included in study. Wounds with positive bacterial culture were included in the study. However wounds with culture showing isolation of "Group A B Haemolytic Streptococci" were excluded as

its infection is an absolute contraindication for STSG.

Upon arrival of patient unhealthy patch was mechanically debrided and dressed with povidone - iodine. Every day the wound was mechanically cleaned and EUSOL solution used for slough removal and was considered for STSG once the wound showed red granulation, migration of epithelium from periphery of defect and lack of high amount of exudates from surface of the wound. Amount of exudates was quantified as under

Mild: When single layer of gauze applied over the wound was soaked.

Moderate: When single layer of pad applied over the wound was soaked.

High: When more than 1 layer of pad applied over the wound was soaked.

From 2 days prior to skin grafting normal saline was used to dress the wound and exudates from wound was taken and culture and sensitivity done and antibiotics were started accordingly and continued till 5th post-operative day . In case if no organisms were isolated before grafting then a single shot of cefotaxime was given 1 hour before grafting and was continued post operatively for 5 days.

Before bringing patient to operative room donor site was scrubbed using povidone - iodine scrub and covered using pad and bandage. After bringing patient on operative table donor site was again scrubbed using povidone - iodine scrub then povidone - iodine solution was applied and then spirit was applied. Layer of paraffin was used on donor site for smooth harvesting of skin.

Skin was harvested with manual dermatome (thickness of 0.012 0.016 inches). After harvesting skin donor site was dressed with single layer of pre - sterilized paraffin impregnated gauze and covered with pad

and bandage. Multiple small nicks were kept over the harvested skin.

Recipient site was prepared using povidone - iodine scrub followed by povidone - iodine solution and skin surrounding ulcer was cleaned with spirit and light mechanical scrapping of wound was done. In chronic wound a thin bluish rim of epithelium at the margin was trimmed away. A gauze piece soaked in saline having 1: 100000 adrenaline solutions were applied over the ulcer bed and compression used so as to have complete haemostasis.

After preparing the recipient site patient was randomized into two groups to receive one of the two techniques of dressing in STSG. Patients Randomization was done by simple randomization were kept in both groups alternately i.e. patients 1, 3, 5, etc. was allotted to open group.

In cotton bolster group

STSG was placed over the recipient site and secured by non-absorbable sutures circumferentially and covered with single layer of pre - sterilized paraffin impregnated gauze and then the entire site was bolstered with bulky cotton gauze dressing and wrapped with a cotton gauze bandage. A splint made from Plaster of Paris was applied over this if grafting was done on extremities for immobilization. Patient was then shifted to ward.

In open group

Once the recipient site was prepared it was dressed with saline soaked gauze and cotton pads and cotton gauze bandage was applied over it and patient was shifted to ward. The meshed skin graft was covered on both sides by saline impregnated gauze piece was rolled in cigars and placed in saline bottle. This bottle was then kept in refrigerator.

Graft was applied over the recipient area in not more than one hour from shifting of

patient to ward. Patient was then moved to his bed and was advised to assume a comfortable position with proper exposure of the recipient site, he was also counselled regarding his immobilization in that position for at least 2 days. Recipient area was then exposed and skin grafts were placed over it taking all aseptic precautions.

Grafts were tailored to fit as accurately as possible on recipient surface taking care not to overlap the margin. If more than one graft was required, subsequent pieces were fitted as closely as possible to the grafts already in position. All the grafts were then smoothed out using curved surface of handle of scissors so as to remove all the bubbles trapped beneath the graft. Surrounding skin was cleaned with spirit and the grafted area was covered with single layer of pre-sterilized paraffin impregnated gauze. A sterile moistened gauze piece was then kept over it. Bed cradle was used to keep the overlying bed sheets off the recipient area. Restraints were used as required

In bolster group

First dressing of the recipient site was done on 5th post op day. Dressing was done under complete aseptic precaution. On opening the dressing wound was dapped with pads soaked in saline and povidone - iodine and the sutures were removed and sloughed off graft was removed using scissors. Crust if formed was removed and serum filled blebs were drained using No. 11 Bard - Parker scalpel blade and gently expressing any fluid from around the margins. Exudates if present was taken for culture sensitivity and antibiotics were administered accordingly. Then again dapping was done with povidone - iodine impregnated pads and surrounding skin was cleaned with spirit.

Then the grafted area was covered with single layer of pre sterilized paraffin impregnated gauze. Bolster dressing and POP slab was applied again.

The procedure was repeated on 7th, 10th, and 14th post op days.

In open group

After first 24 hours the recipient area was dapped with pads soaked in saline and povidone - iodine without lifting up of paraffin impregnated gauze from the grafted area. Dapping was repeated depending upon the amount of exudates from the grafted area. After 48 hours after dapping the graft the paraffin impregnated gauze were carefully lifted from the graft taking care not to dislodge the graft. Graft was inspected and sloughed off graft was removed using scissors. Crust if formed was removed and serum filled blebs were drained using No. 11 Bard - Parker scalpel blade and gently expressing any fluid from around the margins. Surrounding skin was then cleaned with spirit and the grafted area was again covered with single layer of pre-sterilized paraffin impregnated gauze. A sterile moistened gauze piece was again kept over it.

Exudates if present were taken for culture sensitivity on 5th, 7th, 10th and 14th post op day and antibiotics were administered accordingly.

Post-operative care of donor site

The donor site dressing was not opened until it comes off spontaneously by the 14th post-operative day or there were signs of infection or inflammation like pain, foul smelling discharge from it. After opening up of donor site dressing patient was explained regarding local hygiene and application of coconut oil or oil based creams.

Statistical analysis of data was carried out using EPI INFO (ver. 6.04) and Microsoft Excel software. To examine the statistical significance of differences between two sets of qualitative data the "Chi square test" was used, while for quantitative data "f - test" was utilized. Levels of significance were

expressed as probability value (p - value); $p < 0.05$ was considered statistically significant. Continuous variables were expressed as mean.

Results

A Randomized study of 60 patients of STSG was carried out in the Department of General Surgery, Medical College during a period of 8 months from April 2008 to November 2008. We recorded patient - related factors that could have contributed to decreased graft uptake and graft failure like gender, age, haemoglobin, nutritional status (clinical examination, albumin $< 2.5\text{g / dl}$), obesity (body mass index $> 30\text{kg / m}^2$), diabetes mellitus, steroid therapy, jaundice, smoking status, chronic alcoholism, concomitant cardiovascular diseases, malignancy, immunocompromised status, size of skin graft in square centimetres, site of grafting and causal factors of wound. Operation related factor that was recorded was type of anaesthesia.

The patients in the study belonged to the range of 42.22 years 15.24years (1 SD). The mean age of the patients in the study population was 43.33 years, the youngest being 18years and the eldest being 70 years. The maximum number of patients belonged

to the age group 31-60 years 58.3 %. Patients in the control group were in the age range of 41.07years ± 14.21 years (1 SD), the mean age being 41.07 years. While, the patients in the open group were in the age range of 43.33 years ± 16.42 years (1 SD), the mean age being 43.33 years.

In our study 71.7% of the patients were males and the remaining 17% being females. The Male Female ratio was 2.5:1 approximately. The Male Female ratio in open and bolster group was 2:1 and 3:1 respectively.

Co - Morbidities

Out of 60 patients 13 patients were having co - morbidities in form of either of followings Diabetes mellitus, Malnutrition, S. Albumin levels $< 2.5\text{g / dl}$, Steroid use, Jaundice, CVS Disease & Respiratory Disease, Pre - op Immunocompromised state (AIDS), Severe Anaemia , Malignancy. 6 patients from open group and 7 patients from bolster group were found to be having associated co-morbidities.

Patients in both the groups were well matched in terms of age, gender, and co morbidities (Table -1). The proportion of the male patients to females was high overall and in both the groups.

Table 1: Characteristics of 60 patients who were evaluated in the study

Patient characteristics	Open dressing (n = 30)	Bolster dressing (n = 30)	p value
Mean age (yrs)	43.33	41.07	0.57
Sex ratio (M : F)	20:10	23:7	0.39
Presence of co morbidity	5(20%)	7(23.3%)	0.75

Cause of ulcer

STSG was done in patients as their wound had skin loss which hindered primary closure. Out of 60 patient evaluated majority

had ulcer following cellulites (n = 43), other had trauma (n = 11) and burns (n = 6) as the cause of ulcer.

Table 2:

Diagnosis	No. of patients	Percentage
Ulcer following cellulites	43	71.7
Trauma	1	18.3
Burns	6	10

The sites of grafting in both the group and included lower limb (n = 45), upper limb (n = 11) and abdomen (n = 4).

Table 3: Duration of ulcer

Duration of ulcer	No. of patients		Percentage	
	Open	Bolster	Open	Bolster
Lower limb	14	21	46.7	70
Upper limb	14	7	46.7	23.3
Abdomen	2	2	6.7	6.7

Duration of ulcer in both the groups was recorded as it is also one of the factors responsible for outcome of STSG. Mean duration of ulcer in open dressing group was 28.83 days (n = 30, range 12-55 days) as compared to 25.73 days (n = 30, range 6-68) in bolster dressing group.

Wounds with mild and moderate discharge were taken in the study. A total of 10 patients had moderate discharge from wound in Open group and 11 in Bolster group. A total of 7 patients had positive bacterial culture from wound in open group and 8 in bolster group. No wound with positive bacterial culture was found to have streptococci as isolated organism as it was an excluding criteria.

Table 4:

Type of STSG	Positive moderate	Culture discharge
Open	10	7
Bolster	11	8
Total	21	15

Area of ulcer in both the group were also compared and it was found that the in open group the area of ulcer ranges from 4 cm² to 288 cm² with mean of 79.17 cm² and in bolster group it was found to be ranging from 9 cm² to 210 cm² with mean of 56.6 cm².

Thus it was found that in both the groups the characteristics of the wound including cause, site, duration of ulcer number of wounds having moderate discharge and positive bacterial culture was not significantly mismatched. There was also no significant difference in the mean ulcer size between the groups, although the open group had slightly larger ulcers overall.

Table 5: Characteristics of ulcers 60 patients who were evaluated in the study

Ulcer characteristics	Open dressing (n = 30)	Bolster dressing (n = 30)	P value
Mean duration of ulcer (days)	28.83	25.73	0.364304
Mean area grafted (cm ²)	79.17	56.6	0.229480

Table 6: Location of ulcer

Lower limb	22	23	0.765594
Upper limb	6	5	0.738649
Abdomen	2	2	0.604733

Table 7: Cause of ulcer

Cellulites	24	19	0.152008
Trauma	4	7	0.316862
Burns	2	4	0.666955
Amount of exudates from wound (mild: moderate)	20:10	19:11	0.786648
Pre grafting culture positive	6	7	0.765594

In the open group the mean percentage of graft uptake was found to be significantly higher 91.83% (n = 30) when compared to bolster group 77.33% (n = 30) (p = 0.000001, f - test).

And on comparing the graft uptake in ulcers with moderate discharge the efficacy of open group (84 % , n = 10) was also found to be higher than the bolster group (67.27%, n = 11), though the difference was clinically not significant but it approached significance (p = 0.081052). Similarly on comparing the result of wounds having positive bacterial culture pre operatively it was found that in open group (n = 6 / 30) the mean graft uptake was 80.71 % which was higher than the bolster group (68.75%, n = 7 / 30) again not significant statistically as the sample size was too small. (p = 0.205648).

On analyzing the influence of moderate soakage on graft uptake we observed that graft uptake in wounds with mild discharge doesn't differ significantly with graft uptake in wounds with moderate discharge, in open group, whereas in bolster group graft uptake was significantly decreased in wounds with moderate discharge as compared to wounds with mild discharge. Similarly pre operative positive bacterial culture didn't influence graft uptake in open group but it had significant influence on graft uptake in bolster group.

On analyzing the influence of the area grafted and graft loss, it was observed that the graft uptake decreases as the area grafted increases in bolster group whereas in open group uptake remains almost same with increase in grafted area.

Discussion

The split thickness skin grafting has the greatest range of usefulness in repair of skin loss of all methods of skin transplantation. Goal of all surgeons doing STSG is to achieve 100% graft uptake in 100% cases. Failure in achieving this may be due to error in judgement, error in technique, poor postoperative care, and poor patient cooperation in immobilization or presence of significant co morbidity [7,8].

Hence there are numerous patient, wound, environment, surgical technique and treatment related factors which contribute to the graft uptake. Of these an important factor on which a successful skin grafting is dependent is adequate contact of graft with vascular supply and control of infection. Thus an ideal STSG dressing should have three main components: elimination of fluid collection, immobilization of the graft, and stabilization of the graft on an irregular surface.

Secondarily, protecting the graft from desiccation is essential, as well as providing an environment that limits infection risks. Conventional method of achieving above

criteria incorporate the principle of grafting only surfaces which are free of infection with technique of fixation of graft by sutures and cotton bolster dressing, plus immobilization of graft and its bed by inlay molds and external splints [9,10].

With bolster dressing some limitation of grafting were discovered like grafting could not be done on granulating wound in presence of infection and exudates. Also it was found by clinical investigative work that maintaining normal skin temperature and avoiding moist environment was essential for good uptake of graft which was not fulfilled in bolster dressing as graft was packed beneath many layers of dressing and remain covered with serum moistened dressing .

Open method of skin grafting 1st referred in textbook of plastic surgery by Davis in 1920 but came into attention of plastic surgeons during 2nd world war after 1943 when Sano, described a coagulum contact method of skin grafting, and Young¹ reported a year later on 22 grafts managed without pressure dressing or sutures but utilization of method of plasma - thrombin fixation. Since then the use of open method of STSG has increased [11].

As the initial results of grafting by exposure method were promising its use was extended to the areas where conventional bolster dressing was applied and was found to give better results.

Various studies like William J. Pollock [12] and James C. Parkes in their study of Open Skin Grafting of War Wounds concluded that exposure technique gives greater , more consistent graft uptake with decreased tendency to lose graft due to confined infection and accumulation of pus underneath the graft, simplicity of the technique, decrease in operating time, continuous monitoring of progress of wound healing .

Bradford Cannon [13] in the study of Open Grafting of Raw Surfaces of the Hand concluded that exposure grafting help in keeping the graft dry and at normal skin temperature thus increasing its uptake.

James K. Masson [14], Rochester , Minn in their study of Exposure in free split thickness skin grafts⁴ concluded open method is having number of advantages over methods in which grafts are covered with protective pressure dressing .

Herbert D. Gullick, Syracuse in their study of Exposure and natural fixation of split thickness skin grafts concluded that pressure dressings are not essential for successful grafting of split thickness skin. But till now not a single study has demonstrated significance in difference of graft uptake on using bolster or open dressing.

Our study is first of its kind to compare the efficacy of both types of dressing, open and bolster, in prospective manner. The concept of open dressing is based on sound physiological principles. There are normally present on surfaces of graft and well prepared wound all the substances necessary for adhesion of graft to the granulating surface.

There are evidences that adhesion between a skin graft and clean granulating surface occurs almost the moment the graft is applied. The graft is always under direct observation and any collection of serum or blebs may be detected and easily removed. Less heat and moisture are present over the graft, and, therefore, less infection occurs. The studies of skin biologist attest the effect of cooling on survival of skin graft. The reports of Calnan and Innes⁸ corroborates in every details the management and observation of healing which has been our experience.

There are different techniques of exposure dressing of STSG like some studies have

preferred not to mesh the skin graft and lay them as single sheets as they believe that perforations of mesh gets sealed off by serum and lose its importance in drainage while some used multiple stamp size grafts. Also in post operative periods some studies have used foam - rubber protector and some have devised a protective screen to protect the graft bed clothes and sheets. But of utmost importance is the extreme vigilance necessary in the first 24 hours to protect the graft from being dislodged.

In our study we have kept a single layer of cotton gauze over the graft and protected the graft by bed cradles. And in first 24 hours we dapped the grafted area without lifting up the paraffin impregnated gauze so as to keep the grafted area dry and also not to disturb the grafted skin and prevent it from dislodging.

As mentioned earlier no graft failure was seen in both the group in our study. Graft uptake is most likely related to the type of wound treated rather than the treatment mechanism. In infected and moderately discharging wounds, graft uptake tends to be less, so perhaps the choice of treatment mechanism would have a greater influence in that subset of patients 13. In our study there was significantly higher uptake of graft in open group. Also there was better graft uptake in wounds having moderate discharge by open dressing than bolster dressing. And there was difference in graft uptake of wound with positive bacterial culture in open dressing than bolster dressing.

But the difference of mean graft uptake in wounds with moderate discharge and those having positive bacterial culture could not achieve statistical significance as the sample size was too small. It is important to note here that we have not included any patient with wounds having inoculation of "Group A β - Haemolytic Streptococcus" as it can

destroy split thickness skin grafting completely and is a contraindication of grafting.

Importantly it was also found that the period of occupancy of O.T in open dressing group was less than half the period of occupancy of O.T in bolster dressing group which was significant.

This was because the application of skin graft and dressing over it was done in the O.T in the bolster group. On the contrary in the open group the patient was shifted from the O.T early after the graft harvestation. The graft placement on the recipient area was done in the ward so that there may not be any dislodgement of the graft during transshipment from the O.T.

The mean hospital stay of patient in both the group was similar.

The findings from our study confirm the benefits of open dressing in STSG. The erroneous perception of patient dissatisfaction to open dressing among many surgeons, which makes them reluctant to perform open dressing technique in STSG, should undergo correction. Patients or their relatives should be preoperatively explained the rationale and informed of the probability of keeping the wound open after STSG. This may lead to a better patient acceptance of the procedure.

Conclusion

On concluding, open dressing of STSG can be effectively utilized in management of wound, even for that having persistently more amount of exudates and is inoculated with bacteria. It increases the graft uptake in such wounds and also decreases the operative time. Thus it gives better results of skin grafting in such situations and is eminently acceptable by the patient.

A large randomized, prospective trial that include long term follow up, assessment of

postoperative pain, analgesic requirement, long term complications and utilization of financial resources in treating grafts with high associated failure rates and these two

1. Llanos S, Danilla S, Barraza C, Armijo E, Piñeros JL, Quintas M, Searle S, Calderon W: Effectiveness of negative pressure closure in the integration of split thickness skin grafts: a randomized, double-masked, controlled trial. *Annals of surgery* 2006, 244:700.
2. Ozhatil DK, Tay MW, Wolf SE, Branski LK: A narrative review of the history of skin grafting in burn care. *Medicina* 2021, 57:380.
3. Hyakusoku H, Orgill DP, Téot L, Pribaz JJ, Ogawa R: *Color atlas of burn reconstructive surgery*: Springer Science & Business Media, 2010.
4. Hierner R, Degreef H, Vranckx JJ, Garmyn M, Massagé P, van Brussel M: Skin grafting and wound healing—the “dermato-plastic team approach”. *Clinics in dermatology* 2005, 23:343-52.
5. Gullick HD: Exposure and natural fixation of split-thickness skin grafts. *AMA Archives of Surgery* 1960, 80:244-52.
6. McCartan B, Dinh T: The use of split-thickness skin grafts on diabetic foot

treatment modalities would help answer questions about the appropriate use of open dressing in STSG.

References

- ulcerations: a literature review. *Plastic surgery international* 2012, 2012.
7. Braza ME, Fahrenkopf MP: Split-thickness skin grafts. 2019.
8. Ray S, Rao K: *Full thickness skin grafts. Skin Grafts-Indications, Applications and Current Research* 2011.
9. Thornton JF, Gosman A: *Skin grafts and skin substitutes. Selected readings in plastic surgery* 2004, 10:1-24.
10. Chedid NF: *Reconstruction of Soft Tissue Defects of the Foot. The Diabetic Foot*: Springer, 2002. pp. 345-84.
11. Sano ME: *Skin grafting: A new method based on the principles of tissue culture. The American Journal of Surgery* 1943, 61:105-6.
12. Pollock WJ, Parkes JC: *Open skin grafting of war wounds. JBJS* 1969, 51:926-34.
13. Cannon B: *Open grafting of raw surfaces. New England Journal of Medicine* 1957, 256:672-5.
14. Masson JK: *Exposure in free split-thickness skin grafts. Archives of Surgery* 1961, 82:342-6.