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Original Research Paper

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EVALUATION OF DIFFERENT DONOR SITE DRESSINGS FOLLOWING SPLIT THICKNESS SKIN GRAFT HARVEST: A PROSPECTIVE COMPARATIVE ANALYSIS

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ABSTRACT

Background: Split thickness skin grafting is a commonly used technique for reconstruction of soft tissue and skin defects in case of burns, trauma, chronic ulcers, scar contracture release, etc. It involves harvesting epidermis and varying depth of dermis from the donor site. Management of donor site with a good dressing method can avoid pain and infection and promote rapid wound healing and good cosmetic outcome. This study was initiated to analyse the outcomes of different dressing methods for donor site viz. chlorhexidine tulle gras, collagen, contact-layer silver lipido-colloid, non-adhesive silver foam and cadaver skin graft with respect to pain score, wound healing, infection and cosmetic outcome. **Methods:** Total 100 patients were included in the study and randomized into five different groups of 20 each, depending on the five types of dressing methods. Data was recorded regarding pain VAS score, wound healing, infection rate and cosmetic outcome by VSS score. **Results:** In the present study there was significant difference between all five dressing methods with respect to pain scores at all intervals, and wound healing and cosmetic outcome at 6 months. Cadaver skin graft was found to be the most effective type of dressing ($p<0.05$). Also, infection rate was least with cadaver skin graft dressing. **Conclusions:** Cadaver skin graft dressing is superior compared to other dressing methods in terms of lower pain score, lesser infection rate, maximum wound healing and better cosmetic outcome.

KEYWORDS : Donor site dressing, Cadaver skin graft, Silver-foam

INTRODUCTION

Split thickness skin grafting (STSG) is a widely used technique for reconstruction of soft tissue and skin defects caused by burns, trauma, chronic ulcers, scar contracture release, etc.[1] The technique of STSG has been used in India since pre-Christian times.[2] STSG involves harvesting epidermis and varying depths of dermis from the donor site.[3] After harvesting STSG, the donor site re-epithelializes within 7 to 21 days.[4] These patients usually complain of pain, infection, delayed wound healing and scarring. To reduce such complications, good initial management of donor site is important.[5] Ideal donor site dressing should be easy to apply, promote rapid re-epithelialization, should not cause pain and infection, should be easy to remove after complete healing, produce a good cosmetic outcome, and should be economical.[2]

In recent years, several DSW dressing materials have become commercially available. The wide variety of these dressings in the market indicates that there is still a lack of consensus regarding an ideal dressing material.[2,3]

We therefore conceived this novel trial with a primary objective of analysing the outcomes of different dressing methods for donor site with respect to pain score, wound healing, infection, and cosmetic outcome.

MATERIAL AND METHODS

This is a prospective comparative study conducted at our tertiary health care centre with approval by our institutional ethics committee. A total of 100 burns patients who underwent split thickness skin grafting from January 2021 to January 2022 were recruited in this study with equal distribution into each of the five groups: A) chlorhexidine tulle gras dressing, B) collagen dressing, C) contact-layer silver lipido-colloid dressing, D) non-adhesive silver foam dressing and E) cadaver skin graft dressing. Consent was taken from all patients for photography of their donor site wounds.

Inclusion criteria:

Patients aged between 18 to 60 years having donor site area ranging from 2% to 5% total body surface area on their either thigh and dressed with either of the aforementioned dressing materials.

Exclusion criteria:

Patients on steroids, local irradiation, malignancy, collagen vascular diseases, severe anaemia (Hb < 10gm/dl), hypoproteinaemia (total serum proteins < 6 g/dl and total serum albumin < 3.4 /dl), immunocompromise, diabetes mellitus, underlying skin disease, chronic smokers, and patients who failed to follow up for six months.

Surgical procedure and dressing protocol:

Patients who were already on antibiotics based on the culture sensitivity of their primary wound were continued with the same. Whereas patients without any existing infective wounds were given pre-operative single dose and post-operative 12-hourly three doses of intravenous amoxycillin and potassium clavulanate injection IP 1.2 gm. All surgeries were performed by a same single surgeon who harvested the graft, assisted by a same single assistant who held the thigh during grafting. Donor site chosen was anterior aspect of either thigh area. Donor surface area was marked and intradermally infiltrated with adrenaline saline (0.5 ml of 1:1000 adrenaline added to 500 ml of NS). Split thickness skin graft was harvested with an electric dermatome with a 0.4 mm cutting thickness setting on the blade. One of the five dressings was applied in a sterile method and covered with cotton gauzes, bandages, and crepe bandage. Oral paracetamol 500 mg was prescribed if patient complained of pain more than Visual Analogue Scale score 4 at donor site, with dosage not exceeding 1 gram per day. Dressing was opened slowly on post-operative day (POD) 21. After compete re-epithelialization, patients were advised to massage the wound with coconut oil and aloe vera gel once a day for 5 minutes and wear linen cloth covered by elastocrepe bandage for 1 year.

Outcomes:
Outcomes of all five dressing methods were evaluated in terms of:

1. Pain score using Visual Analogue Scale (VAS)[6] on POD 1, 7 and 21.
2. Wound healing in terms of percentage of total donor surface area re-epithelialized on POD 21.
3. Infection determined by presence of superficial incisional SSI[7] on or before POD 21.
4. Cosmetic outcome assessed by Vancouver Scar Scale (VSS)[8] on POD 21 and at the end of 6 months.

RESULTS

Data was tabulated using Microsoft Excel software and analysed using SPSS software. One way ANOVA test and Fisher's Exact test were used to calculate p-values and $p<0.05$ was considered as statistically significant.

Table 1 shows the demographic statistics Table 2 shows the comparison of pain, wound healing, infection rate and cosmetic outcome between 5 groups.

Pain

Figure 1 shows the comparison of pain VAS scores as recorded by the patients on POD 1, 7 and 21. Patient was asked about the intensity of pain before starting oral paracetamol and pain was scored using Visual Analogue Scale (VAS) which is a psychometric response scale where the patient rates the intensity of pain felt by him/her in a range from 0 to 10. 0 indicates no pain and 10 indicates worst imaginable pain.[6] There was significant difference ($p=0.00$) between the five donor site dressings on POD 1, POD 7, and POD 21.

Least pain score was observed with cadaver skin graft, followed by non-adhesive silver foam.

Wound Healing

Figure 2 shows the comparison of wound healing on POD 21. On removal of dressing on POD 21, the percentage of wound surface re-epithelialized was noted. There was significant difference between the five donor site dressings ($p=0.00$).

Maximum healing had occurred with cadaver skin graft, followed by non-adhesive silver foam.

Infection Rate

Figure 3 shows the comparison of infection rate on or before POD 21.

Infection rate was calculated as the number of patients in each group showing presence of infection on or before POD 21. CDC criteria of superficial incisional SSI chosen by us were:

1) Event occurs within 30 days of surgery
2) Involves only skin and subcutaneous tissue
3) Purulent drainage
4) Patient complains of at least one of the following: localized pain or tenderness; localized swelling; erythema; or heat.[7]

No infection occurred with cadaver skin graft dressing, followed by only 5% infection rate with non-adhesive silver foam.

Cosmetic Outcome

Figure 4 shows the comparison of cosmetic outcome by VSS score as assessed by surgeon on POD 21 and after 6 months.

Cosmetic outcome was assessed two specialist clinicians who were blinded with regards to the type of dressing method used on POD 21 and after 6 months by Vancouver Scar Scale (VSS) Score, which constitutes of 4 variables with individual scoring system: vascularity (0-3), pigmentation (0-2), pliability (0-5) and height/thickness (0-3). Total score was calculated as ranging from 0-13.[8] There was significant difference between the five donor site dressings on POD 21 ($p=0.00$). The best cosmetic outcome was produced by cadaver skin graft, followed by non-adhesive silver foam.

Image 1 shows the donor site wounds on application of dressing, on POD 21, and after 6 months. Image 2 shows the donor site wound infections.

DISCUSSION

Chlorhexidine Tulle Gras dressing is a leno-weave tulle gras impregnated with soft paraffin and 0.5% chlorhexidine acetate. Chlorhexidine has antibacterial effect against Gram-positive and Gram-negative bacteria. It binds to bacterial cell wall, alters the cell's osmotic equilibrium, and causes leakage[9]. Paraffin gauze has been a standard donor site dressing method[10]. It is considered to be non-adherent but it usually sticks to the wound as it absorbs the exudate[11]. Dressing displacement produces shearing force which impairs migration of epithelial cells causing burning sensation and pain. Also, at the time of removal, it can injure the regrown epithelium. Moreover, as the dressing gets soaked, it becomes a media for bacterial growth.[12] According to Muangman P et al. the resulting pain score was 6.81 ± 1.17 on POD 1, 5.13 ± 2.03 on POD 7, and 1.88 ± 2.33 from POD 14-21[9]. According to Sharma DJ et al. patients recorded VAS score of 6.8 ± 1.15 and 3.20 ± 1.15 on POD 1 and 5 respectively[13]. In our study, mean VAS score was 7.05 ± 0.94 on POD 1, 4.85 ± 0.99 on POD 7 and 2.45 ± 0.89 on POD 21. Dave TJ et al. noted infection in13.3% patients and the mean VSS score 2.9 ± 1.1 on POD 21[12]. In our analysis, 4% patients had surgical site infection and the mean VSS score of 3.15 ± 1.84on POD 21.

Collagen dressing is composed of type 1 and type 3 bovine collagen which is similar to human collagen and is well known for its natural properties which most artificial dressings lack. It provides a physiological interface between the wound surface and the environment allowing the body to function its immune and reparative system efficiently. It is non-immunogenic, hypoallergenic, anti-inflammatory, anti-fibrotic and speeds up neo-angiogenesis.[12,14] Collagen provides a scaffolding for epithelial regrowth and prevents exudate formation. After application of collagen dressing, it gets transformed into a stiff sheet which withstands pressure and shearing. After complete re-epithelialization the overlying film and coagulated blood separates spontaneously making its removal easy and painless. Disadvantage encountered is hematoma formation when meticulous haemostasis has not been achieved. Also, infection can cause degradation of the film and pain.[14] According to Sharma DJ et al. VAS score was 3.84 ± 1.62 on POD 1 and 0.48 ± 0.87 on POD 5.[13] According to Halankar P et al. 6.66% patients had infection with pain.[14] According to Ayaz SM et al. VAS scores on POD 1, 7 and 21 were 3.33 ± 1.95, 1.37 ± 0.89 and 0.90 ± 0.88 respectively.[15] In our study, the mean VAS scores were 4.15 ± 2.23, 2.3 ± 1.72 and 1.1 ± 1.21 on POD 1, 7 and 21 respectively. The infection rate in our patients was 10%. According to Moses PS et al. the mean VSS score on POD 21 was 5.73 ± 1.51.[16] In our study, the mean VSS score on POD 21 was 2.75 ± 1.89.

Contact-Layer Silver Lipido-Colloid dressing is a polyester mesh impregnated with hydrocolloid particles (carboxymethylcellulose), vaseline particles and silver salts. When this material comes in contact with wound exudate, the hydrocolloid particles interact with petroleum jelly component and absorb water forming a lipido-colloid gel which is favourable for wound healing.[17] The silver ions stimulate the formation of reactive oxygen species which destroy the bacterial cell wall causing bacterial death, disrupt bacterial enzymes, and bind to the bacterial cell DNA interfering with cell division and replication.[18,19] Antibacterial activity is

provided against MRSA, Staphylococcus Aureus, Pseudomonas Aeruginosa and yeasts. The water retention capacity of this dressing is responsible for reduction in pain and rapid re-epithelialization. Being a non-adherent dressing, its removal is relatively painless and atraumatic.[17] Disadvantage is that it cannot be used on patients undergoing MRI examination. According to Benbow M et al. mean total surface area healed on POD 21 was 85.07%. and presence of odour suggesting infection was seen in 22% patients.[20] In our study, 98% of donor surfaces were healed on POD 21 and 10% patients showed infection.

Non-adhesive Silver Foam dressing is a soft, highly absorbent hydrophilic polyurethane foam with homogeneously dispersed silver complex. It has a semi.permeable waterproof film providing a bacterial barrier. Silver is released to the wound bed through ionic exchange for up to 7 days when it comes in contact with the wound exudate. This provides a sustained antibacterial effect against Pseudomonas Aeruginosa, Staphylococcus Aureus, MRSA, VRE and B-haemolytic Streptococcus. Other advantages are rapid re-epithelialization, reduced exudate accumulation, fewer dressing changes, and reduced likelihood of hypertrophic scarring.[21] Due to its greater capacity for the absorption of exudates, it maintains a moist microenvironment leading to better healing and prevention of hyper-granulation.[22] The disadvantage is that foams tend to move in the initial postoperative period, and also increases the volume of dressing. Therefore, the work of placing the dressing is increased. Moreover, adherence in the late postoperative period was a complication noted by Souza SC et al.[21] According to Ki, Sae Hwi et al. the pain scores observed on POD 1, 7 and 21 were 6.33, 2.50 and 0.83 respectively.[23] In our study, the VAS scores on POD 1, 7 and 21 were 2.45 ± 0.60, 0.65 ± 0.67 and 0.1 ± 0.31 respectively. According to Souza SC et al. and Wang Z et al. none of the patients had infection.[21,24] Whereas in our study, 5% of our patients had surgical site infection.

Cadaver Skin Graft or human skin allograft is a biologic skin substitute that is being used at several burn centres all over the world. It was first described in the manuscript of Branca of Sicily in 1503.[25] The first skin bank was set up in the USA in 1949.[26] The first skin bank in India became functional at Lokmanya Tilak Municipal General Hospital (Mumbai) in 2000.[27] In our study we have used meshed glycerol preserved allografts of expansion rate 1.5:1. Cadaver skin graft accelerates epithelialization, facilitates pain control, reduces bacterial colonisation, and provides better cosmesis. By incorporating the dermal component into the wound bed, it facilitates more physiological healing.[26] It also helps in reducing loss of protein, electrolytes and fluids, a property which is especially useful in patients with burns. It allows painless dressing changes.[28] However, there are few disadvantages viz. it takes longer time to apply, it must be stored according to strict guidelines[29], and it must be easily available with appropriate transport facilities. Also, despite careful donor selection and stringent quality control, cadaver skin carries a certain risk of transmission of pathogens.[26] Another limitation of cadaver skin graft is also that it peels off on its own over a period of time which can be variable. In our study, cadaver skin graft caused least severity of pain, maximum wound healing, best cosmetic outcome and zero rate of infection in comparison to other dressing methods. (Table 2)

CONCLUSION

In our experience, all five donor site dressings had certain advantages and disadvantages, but after statistically comparing their outcomes, we concluded that banked cadaver skin graft has the potential to be as close as possible to the definition of an ideal donor dressing. The physiological healing property of human skin is evidently superior to the healing properties of other commercial products, leading to better outcomes and least complications. Unfortunately, in India, there are not many cadaver skin banks established and awareness about skin donation is also limited. So, due to difficult availability of cadaver skin grafts, we would recommend that the non-adhesive silver foam dressing, which is sold by most pharmacists, is a good choice of donor site dressing second only to cadaver skin graft. Furthermore, in case of unavailability of the above-mentioned dressing materials, either contact layer silver lipido-colloid dressing or collagen dressing can be a preferred choice. Chlorhexidine tulle gras, though a widely used donor site dressing by most surgeons, should be the least preferred material as per our analysis.

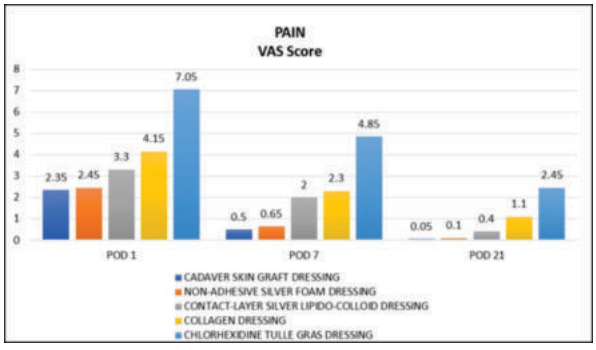

Figure 1

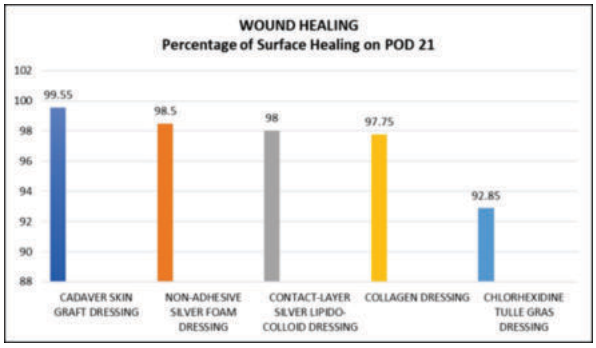

Figure 2

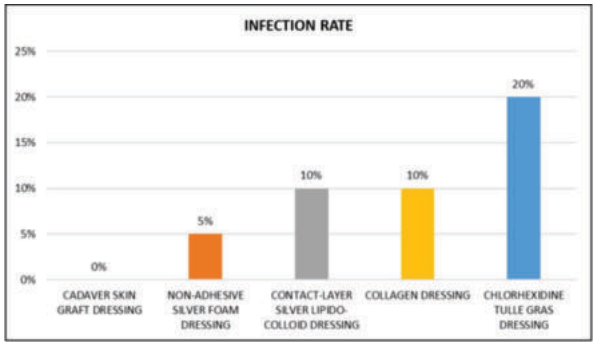

Figure 3

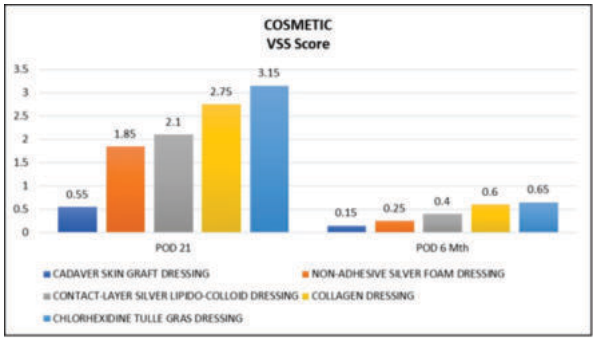

Figure 4

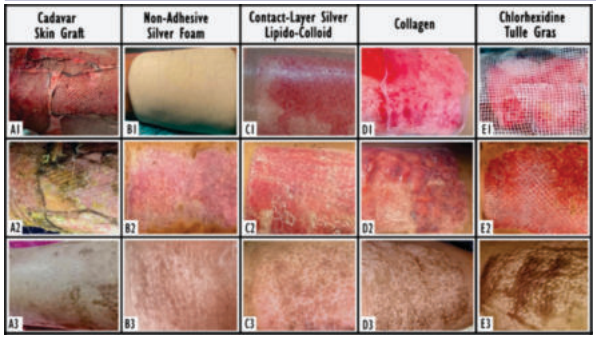

Image 1: Donor site wounds after dressing with Cadaver skin graft: (A1) on application, (A2) on POD 21, (A3) after 6 months; Non-adhesive silver foam dressing: (B1) on application, (B2) on POD 21, (B3) after 6 months; Contact-layer silver lipido-colloid dressing: (C1) on application, (C2) on POD 21, (C3) after 6 months ; Collagen dressing: (D1) on application, (D2) on POD 21, (D3) after 6 months; Chlorhexidine tulle gras dressing: (E1) on application, (E2) on POD 21, (E3) after 6 months

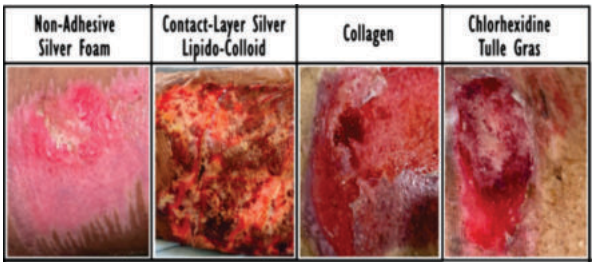

Image 2: Donor site wound infections on dressing with non-adhesive silver, contact-layer silver lipido-colloid, collagen and chlorhexidine tulle gras

Table 1

	Cadaver skin graft dressing N=20	Non-adhesive silver foam dressing N=20	Contact-layer silver lipido-colloid dressing N=20	Collagen dressing N=20	Chlorhexidine tulle gras dressing N=20
Mean Age	44	46	43	44	45
Males	14	12	15	15	14
Females	6	8	5	5	6

Table 2

	Cadaver skin graft dressing	Non-adhesive silver foam dressing	Contact-layer silver lipido-colloid dressing	Collagen dressing	Chlorhexidine tulle gras dressing	P value
Pain						
VAS Score POD 1 (1-10) mean (SD)	2.35 (0.75)	2.45 (0.60)	3.3 (1.95)	4.15 (2.23)	7.05 (0.94)	0.00*
VAS Score POD 7 (1-10) Mean (SD)	0.5 (0.61)	0.65 (0.67)	2 (1.97)	2.3 (1.72)	4.85 (0.99)	0.00*
VAS Score POD 21 (1-10) Mean (SD)	0.05 (0.22)	0.1 (0.31)	0.4 (0.75)	1.1 (1.21)	2.45 (0.89)	0.00*
Wound Healing						
% Of Surface Healing POD 21 (1-100%) Mean (SD)	99.55 (1.23)	98.5 (3.66)	98 (4.10)	97.75 (5.50)	92.85 (8.79)	0.00*
Infection Rate						
Superficial Incisional SSI (present) N (%)	0 (0.0%)	1 (5.0%)	2 (10%)	2 (10%)	4 (20%)	0.302**
Cosmetic Outcome						
VSS Vascularity POD 21 (0-3) Mean (SD)	0.25 (0.44)	0.5 (0.69)	0.95 (0.51)	1.25 (0.44)	1.25 (0.55)	0.00*
VSS Pigmentation POD 21 (0-2) Mean (SD)	0.2 (0.41)	0.75 (0.85)	0.7 (0.57)	0.8 (0.62)	1.00 (0.56)	0.00*
VSS Pliability POD 21 (0-5) Mean (SD)	0.10 (0.31)	0.45 (0.60)	0.30 (0.47)	0.35 (0.49)	0.65 (0.59)	0.02*
VSS Height POD 21 (0-3) Mean (SD)	0.00 (0.00)	0.15 (0.37)	0.15 (0.37)	0.35 (0.59)	0.25 (0.44)	0.09*
VSS Total Score POD 21 (0-13) Mean (SD)	0.55 (1.05)	1.85 (2.23)	2.1 (1.59)	2.75 (1.89)	3.15 (1.84)	0.00*
VSS Vascularity 6 month (0-3) Mean (SD)	0.10 (0.31)	0.00 (0.00)	0.10 (0.31)	0.10 (0.31)	0.20 (0.41)	0.36*
VSS Pigmentation 6 month (0-2) Mean (SD)	0.05 (0.22)	0.15 (0.37)	0.15 (0.37)	0.25 (0.44)	0.20 (0.41)	0.53*
VSS Pliability 6 month (0-5) Mean (SD)	0.00 (0.00)	0.00 (0.00)	0.05 (0.22)	0.05 (0.22)	0.15 (0.37)	0.18*
VSS Height 6 month (0-3) (mean±SD)	0.00 (0.00)	0.10 (0.31)	0.10 (0.31)	0.20 (0.41)	0.10 (0.31)	0.36*
VSS Total Score 6 month (0-13) (mean±SD)	0.15 (0.49)	0.25 (0.64)	0.40 (0.99)	0.60 (1.19)	0.65 (1.39)	0.44*
*One Way ANOVA, **Fisher's Exact Test						

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