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To Compare The Outcomes of Collagen Dressing, Polyurethane Dressing and Paraffin Gauze Dressing on Split Skin Thickness Graft Donor Site

Bedi Chaitanya*, Ranjit Rana, Kakkar Vikas, Mittal Seema, Kapoor Sudershan

Abstract

Background: The effectiveness of a skin graft is determined not only by the integration of the graft itself, but also the quality of donor site recovery. Main morbidity of split skin graft is donor site pain, soaking delayed healing and scar. There are many donor site dressing modalities. The drawbacks of current dressings, especially in the therapy of moderate to large donor sites, emphasize the relevance of the polyurethane dressing and collagen dressing concept as a treatment option for split-thickness skin graft donor sites.

Method: Study was conducted in Department of Surgery, SGRDIMSAR, Sri Amritsar. After obtaining approval from institutional ethics committee and written informed consent from the patients. We had compared the outcome of the collagen dressing, polyurethane dressing and paraffin gauze dressing on split thickness skin graft donor site wound in 90 patients. Patients were randomly divided in three groups, after harvesting graft by standard technique donor site will be covered with collagen sheet in group I, polyurethane in group II and paraffin gauze in group III. Outcome variables are healing time, quality of scar, pain at donor site.

Results: Collagen and Polyurethane dressing groups showed significant results in all outcome variables of donor site pain, wound healing and scar quality, in comparison to Paraffin gauze group.

Conclusion: Both collagen and polyurethane dressing material results in rapid epithelization, less donor site pain and good cosmetic outcome, in comparison to paraffin gauze dressing.

Keywords: Split thickness skin graft; Donor site wound

Introduction

Skin grafting is the most widely used method of covering skin defects and plays important role in reconstructive ladder. Split thickness skin graft consists of epidermis and superficial dermis. Thighs, legs back and buttocks are the common sites for harvesting STSG as these are accessible donor sites. The anterolateral thigh skin is the best type of skin to use for skin grafts. Thus, after the skin graft is harvested, a new iatrogenic partial thickness wound is created, donor site wound. These donor site wounds cause significant distress to the patients during and after the healing process in terms of itching, hyperpigmentation, patchy epithelialisation, infection and cosmetic discomfort. To overcome this various dressing materials have been used. The dressing should protect the donor site from infection, micro organisms and desiccation while accelerating re-epithelialisation. The dressing should be

Affiliation:

Department General Surgery, Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Sri Amritsar, India 143501

***Corresponding author:**

Bedi Chaitanya, Department General Surgery, Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Sri Amritsar, India 143501

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comfortable for the patient, able to withstand linear and shear stress, economical to use, and cause minimal or no discomfort to the patient. Traditionally paraffin gauze dressing is used, owing to its simplicity of application, adaptability, and low cost. However, such a dressing material has a disadvantages such as discomfort at the donor site, delayed healing etc. With recent advances in technology and a better understanding of wound healing, newer dressing materials have been developed such as collagen dressing and polyurethane dressing which intend to accelerate healing and reduce comorbidities such as pain. Patient satisfaction, recovery, and wound healing are significantly affected by the choice of dressing used. So, in this study, we had investigated the outcomes of the collagen dressing, polyurethane dressing, paraffin gauze dressing on split skin thickness graft donor site and we also compare the results of each dressing.

Materials and Methods

This comparative interventional prospective study was designed to include 90 cases were selected who were admitted in Sri Guru Ram Das Institute of Health Sciences and Research, Vallah, Amritsar department of surgery, after attaining approval from ethical committee. Cases were selected on the basis of inclusion and exclusion criteria. Written informed consent was taken from the patients. Patients were randomized using EPI info software. Group I (30 patients) were the patients in which collagen dressing is used to cover STSG DSW, Group II (30 patients) were the patients in which polyurethane dressing was applied over STSG DSW and Group III (30 patients) were the patients in which paraffin gauze dressing was applied over the STSG DSW. To ensure blinding both the patient and surgical team member observing the wound postoperatively were unaware of the type of dressing used for STSG DSW. The collected data was analysed and evaluated and valid conclusion was drawn.

Inclusion Criteria

1. Age 18 to 72years
2. Post traumatic raw area
3. Surgically created defect/raw area
4. Donor site – thigh
5. All patients requiring split skin grafts of approx. 100-500cm^2

Exclusion Criteria

1. Seropositive patients (HIV, Hepatitis b and Hepatitis c)
2. Patients with burns whose analgesic requirement were more and difficult to compare with the study proposed.
3. Immunocompromised patients where wound healing may be affected.

The materials needed for the study includes:

1. Socio-demographic data from Patient
2. Clinical Data from Patient's file
3. Collagen, polyurethane dressing and paraffin gauze dressing

Primary endpoint with respect to the effectiveness of wound dressings in the treatment of DSW is time taken for complete wound healing. 1= complete epithelialisation, 2= scattered or spotty epithelialisation, 3= no epithelialisation or infected. Wound inspected on 14th and on 21st postoperative day. Pain was assessed using VAS (visual analogue scale) is measured as (0 – 10). It is documented by the patient on a Visual Analogue Scale, varying from 0 (absent pain) to 10 (intolerable pain). This is scored daily for one week post operatively and once in a week during next three to four postoperative weeks on follow up in a diary held by the patient. Assessment of quality of scar using patient and observer scar assessment scale (POSAS) at 14th postoperative then at 21th postoperative and then on 6th month.

Statistical Analysis

Sample size was calculated keeping in view at most 5% risk, with minimum 85% power and 5% significance level (significant at 95% confidence interval). Raw data was recorded in a Microsoft excel spread sheet and analysed using Statistical Package for the Social Sciences (SPSS version 22.00). Continuous data was presented as mean with standard deviation. Categorical data was expressed as percentages. Numerical variables were normally distributed and were compared using Chi Square test for non-parametric data and Anova Tuckey's Posthoc test for parametric data. The p value was then determined to evaluate the level of significance. The results were analysed and compared to previous studies to draw relevant conclusions.

Sample Size

Analysis:A priori: Compute required sample size

Input:	Effect size f	=	0.34
	α err prob	=	0.41
	Power (1-β err prob)	=	0.85
	Numerator df	=	10
	Number of groups	=	3
	Number of covariates	=	1
Output:	Noncentrality parameter λ	=	9.9416000
	Critical F	=	1.0502587
	Denominator df	=	82
	Total sample size	=	86
	Actual power	=	0.85006

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Results

Mean age and gender distribution in the three groups were 39.2±13.6 with 2 female patients and 28 male in group I, 41±14.2 with 7 female and 23 male in group II and 39.1±16.6group with 7 female patients and 23 male in group III. By postoperative day 14, only seven of the thirty patients in group III had completely epithelized, twenty had scattered or spotty epithelization, and three had none at all. As demonstrated in table 1, by postoperative day 21, 18 patients had attained complete epithelialisation, whereas 12 still displayed spotty or scattered epithelialisation as shown in table 2. By postoperative day 14 (table 1), the majority of patients in groups I and II- 27 out of 30 in group I and 21 out of 30 in group II- had fully epithelialized and by postoperative day 21 (table 2), remaining patients also had complete epithelization. Data between group I and group II are statistically insignificant (p value 0.15), but between group II/III and group I/III they are statistically significant (p value 0.001) and (p value 0.001) respectively. Comparing the mean visual analogue ratings on days 1, 2, 3, 4, 5, 6, 7, 14, 21, and 28 after surgery, it was found that patients in the collagen group reported considerably less pain than those in the polyurethane group on all days except for days 14, 21, and 28. mean VAS were 2.8±1.03 vs 3.33±0.48 (p value 0.023), 2.1±0.74 vs 3.06±0.25 (p value0.001), 1.5±0.51 vs 2.7±0.5 (p value 0.001), 1.2±0.45 vs 2.2±0.5 (p value 0.001), 1.2±0.45 vs 1.9±0.3 (p value 0.001), 0.8±0.41 vs 1.7±0.47 (p value0.001), 0.8±0.41 vs 1.3±0.48 (p value0.001), 0.57±0.5 vs 0.57±0.5 (p value 1.0), 0.0±0.0 vs 0.0±0.0 (p value 1.0) 0.0±0.0 vs 0.0±0.0 (p value 1.0) respectively. As shown in table 3. Mean VAS for the collagen vs. paraffin gauze dressing group on days 1, 2, 3, 4, 5, 6, 7, 14th, 21st, and 28th were 2.8±1.03 vs 5.73±0.69 (p value 0.01), 2.1±0.74 vs 5.47±0.51 (p value0.001), 1.5±0.51 vs 5.23±0.57(p value 0.001), 1.2±0.45 vs 5.23±0.57(p value 0.001), 1.2±0.45 vs 5.13±0.68(p value 0.001), 0.8±0.41 vs 5.13±0.68 (p value0.001), 0.8±0.41 vs 4.7±0.59 (p value0.001), 0.57±0.5 vs 4.17±0.53 (p value 0.01), 0.0±0.0 vs 2.7±0.46 (p value 0.01) 0.0±0.0 vs 0.83±0.46 (p value 0.01) respectively. Patients in the polyurethane group likewise experienced considerably less discomfort than those in the paraffin gauze group on all days with a significant p value. Mean VAS for the polyurethane dressing group compared to the paraffin gauze dressing group on days 1, 2, 3, 4, 5, 6, 7, 14th, 21st, and 28th were 3.33±0.48 vs 5.73±0.69 (p value 0.01), 3.06±0.25 vs 5.47±0.51 (p value0.001), 2.7±0.5 vs 5.23±0.57 (p value 0.001), 2.2±0.5 vs 5.23±0.57(p value 0.001), 1.9±0.3 vs 5.13±0.68(p value 0.001), 1.7±0.41 vs 5.13±0.68 (p value0.001), 1.3±0.48 vs 4.7±0.59 (p value0.001), 0.57±0.5

Table 1: Wound healing at 14th postoperative day

Wound healing at 14th day	Group I		Group II		Group III	
	No. of patients	Percentage	No. of patients	Percentage	No. of patients	Percentage
Complete epithelialisation	27	90	21	70	7	23.3
Scattered or spotty epithelialisation	3	10	9	30	20	66.7
No epithelialisation	0	0	0	0	3	10
Total	30	100	30	100	30	100
p-value	Group I/II: 0.15					
	Group II/III: 0.001					
	Group I/III: 0.001					

Table 2: Wound healing at 21st postoperative day

Wound healing at 21st day	Group I		Group II		Group III	
	No. of patients	Percentage	No. of patients	Percentage	No. of patients	Percentage
Complete epithelialisation	30	100	30	100	18	60
Scattered or spotty epithelialisation	0	0	0	0	12	40
No epithelialisation	0	0	0	0	0	0
Total	30	100	30	100	30	100
p-value	Group I/II: 1.00					
	Group II/III: 0.001					
	Group I/III: 0.001					

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Table 3: Vas (visual analog score).

Post operative day	Group I		Group II		Group III		p-value		
	Mean	SD	Mean	SD	Mean	SD	I/II	II/III	I/III
Day 1	2.81	1.03	3.33	0.48	5.73	0.69	0.023	0.001	0.001
Day 2	2.1	0.74	3.06	0.25	5.47	0.51	0.001	0.001	0.001
Day 3	1.53	0.51	2.71	0.51	5.23	0.57	0.001	0.001	0.001
Day 4	1.21	0.45	2.24	0.52	5.23	0.57	0.001	0.001	0.001
Day 5	1.24	0.45	1.92	0.3	5.13	0.68	0.001	0.001	0.001
Day 6	0.81	0.41	1.71	0.47	5.13	0.68	0.001	0.001	0.001
Day 7	0.81	0.41	1.3	0.48	4.71	0.59	0.001	0.001	0.001
Day 14	0.57	0.52	0.57	0.54	4.17	0.53	1	0.001	0.001
Day 21	0	0	0	0	2.7	0.46	1	0.001	0.001
Day 28	0	0	0	0	0.83	0.46	1	0.001	0.001

Table 4: Posas (observer component)

Postoperative day	Group I		Group II		Group III		p-value		
	Mean	SD	Mean	SD	Mean	SD	I/II	II/III	I/III
14 days	6.93	0.81	7.47	1.137	8.13	1.53	0.202	0.085	0.001
21 days	6.03	0.18	7.33	1.124	8.23	1.61	0.001	0.008	0.001
6 months	6.83	0.83	7.73	1.23	10.5	2.28	0.074	0.001	0.001

Table 5: Posas (patient component)

Post operative day (patient)	Group I		Group II		Group III		p-value		
	Mean	SD	Mean	SD	Mean	SD	I/II	II/III	I/III
14 days	7.37	0.96	8.27	1.41	10.9	1.96	0.06	0.001	0.001
21 days	6.2	0.4	8.07	1.26	9.27	1.74	0.001	0.001	0.001
6 months	6.53	0.51	7.13	1.19	8.67	2.26	0.277	0.001	0.001

vs 4.17±0.53 (p value 0.01), 0.0±0.0 vs 2.7±0.46 (p value 0.01) 0.0±0.0 vs 0.83±0.46 (p value 0.01) respectively. The results of POSAS score for postop days 14, 21 and 6 months observer (table 4) and patient (table 5) component of groups I, II, III show significant values for collagen vs paraffin gauze (p value 0.001), polyurethane vs paraffin gauze (p value 0.001). Collagen vs polyurethane showed p value 0.20, which is statistically insignificant.

Discussion

Dressing with optimal results is an enigma for the surgeon [1]. Dressing preferences vary from individual to individual and none is virtually acceptable to all. Thus, it is necessary to research various possibilities and choose a dressing which has favourable outcomes. In the STSG donor site, free nerve endings which were damaged during procedure are exposed to outside stimuli. Many of these small stimuli converge and are perceived as augmented pain. As a result, the donor site's pain is far worse than the receiving site's agony. The occlusive dressing is believed to lessen pain by shielding exposed nerve terminals from the air. Occlusive dressings also lower oxygen levels, which in turn reduces the build-up of arachidonic acid metabolites in the environment, which are also believed to exacerbate pain perception [2].

During wound healing, collagen promotes epidermal cell migration and attachment [3,4].Collagen promotes rapid revascularization, reepithelialisation, immediate pain-relief and healing of wound beds. Few studies have previously attempted to compare various dressings for donor sites. Majority of them have come to conclusion that applying collagen dressing can significantly reduce pain [5]. Another dressing used is polyurethane dressing. Its key benefit is the build up of sanguineous fluid beneath the film, proving a moist environment and creating the best conditions for epithelialisation. Comparatively to paraffin gauze dressing, which has drawbacks like discomfort and a slow healing process, polyurethane dressing avoids shearing forces and decreases pain to a minimum [6-10]. In our study, patients underwent a routine grafting procedure to get STSG from the anterior or lateral thigh, resulting in the development of DSW, which was then covered with a collagen dressing, a polyurethane dressing, or a paraffin gauze dressing in group I, group II, or group III, respectively. Our study mentioned led to the following conclusions. Comparing the outcomes it was

found that patients in the collagen group reported considerably less pain, rapid epithelization and better cosmesis in terms of quality of scar. Polyurethane dressing also results in less donor site pain, with early epithelization and better cosmetic results as compared to paraffin gauze dressing but showed delayed healing in comparison to collagen dressing. Similar outcomes were also found in a study by Horch RE et al [7]. He concluded that on days 1, 3, 5, 7, and 10, complaints regarding discomfort at the donor site varied, with more discomfort being reported after dressing with polyurethane film than after administration of the collagen dressing. In our study it is also noted that patients in the collagen group experienced significantly less pain than those in the paraffin gauze group on all days. Which was also notes in studies conducted by Sreekumar et al5, Nagaraj et al [8], Das et al [3], Halankar et al [9]. Moses et al, compared collagen and paraffin dressing on STSG DSW with emphasis on VSS and POSAS 7results of their study consistent with the outcomes of our study. Dornseifer et al [10], in their investigation of 30 patients, they found that the pain related with replacing and removing the polyurethane dressing was negligible. Similar conclusions were drawn in a research by Fernandes de Carvalho et al [11] Lauchli et al [12], in their study noticed that the polyurethane group's time to epithelialisation was 21.9 days (14-41) which was similar to our study.

Limitations

Our study had small sample size and evaluation of donor site was based on visual inspection. larger multicentre randomized controlled trials would be desirable to corroborate the findings of this study.

Conclusion

Both collagen and polyurethane dressing material results in rapid epithelization, less donor site pain and good cosmetic outcome, in comparison to paraffin gauze dressing. Also, collagen took less time in wound healing than polyurethane dressing. However larger multicentre randomized controlled trials would be desirable to corroborate the findings of this study.

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Declarations

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Conflict of interest

No conflict of interest

Abbreviations

STSG: split skin thickness skin graft, DSW: donor site wound

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