International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

A Randomised Control Study to Assess the Scar of Donor Site by Using Collagen Dressing Vs Conventional Dressing in Split Skin Grafting

Dr Chetan Raikwar[1*], Dr Sachin Verma[2], Dr Varsha Dhakad[3], Dr Jubin Sonane[4]

[1]Post Graduate Resident, Department of General Surgery, M.G.M Medical College, Indore (M.P.)
[2]Associate Professor, Department of General Surgery, M.G.M Medical College, Indore (M.P.)
[3]Associate Professor, Department of General Surgery, M.G.M Medical College, Indore (M.P.)
[4]Associate, Department of General Surgery, M.G.M Medical College, Indore (M.P.)

Corresponding Author:

Dr Chetan Raikwar
Post Graduate Resident,
Department of General Surgery,
M.G.M Medical College, Indore
(M.P.)

Received: 17-03-2026
Accepted: 28-04-2026
Available online: 06-05-2026

ABSTRACT

Background: Split-thickness skin grafting (STSG) is widely used for wound coverage; however, donor-site morbidity remains a significant concern due to pain, delayed healing, itching, and scarring. Optimizing dressing material is essential to improve healing outcomes and patient comfort. This study aimed to compare collagen dressing with conventional dressing in STSG donor-site management.
Methods: A prospective randomized controlled study was conducted on 100 patients undergoing STSG, divided into collagen dressing (Group A, n=50) and conventional dressing (Group B, n=50). Primary outcomes included time to complete re-epithelialization and scar quality assessed using the Patient and Observer Scar Assessment Scale (POSAS). Secondary outcomes included pain and itching measured using the Visual Analogue Scale (VAS) and incidence of complications. Data were analyzed using SPSS version 26.0.
Results: Baseline characteristics were comparable between groups. The collagen group demonstrated significantly lower pain and itching scores at all time points ($p < 0.001$). POSAS scores (observer, patient, and total) were significantly lower in the collagen group, indicating superior scar quality ($p < 0.001$). Complications such as bleeding and pruritus severity were also reduced ($p < 0.05$). The mean time to complete re-epithelialization was significantly shorter in the collagen group (14.62 ± 3.11 days vs 19.38 ± 3.29 days, $p < 0.001$).
Conclusion: Collagen dressing is superior to conventional dressing in STSG donor-site management, offering faster healing, reduced morbidity, and improved scar outcomes. Its use can enhance patient comfort and overall surgical outcomes.

Keywords: *Collagen dressing, Split-thickness skin graft, Donor site, Wound healing, POSAS.*

INTRODUCTION

Split-thickness skin grafting (STSG) continues to be a fundamental reconstructive procedure for the management of extensive skin loss resulting from burns, trauma, chronic ulcers, infections, and post-surgical defects, primarily due to its ability to achieve rapid wound coverage with relatively low donor-site morbidity [1]. However, the donor site itself represents a controlled partial-thickness wound that heals by re-epithelialization from residual dermal appendages, and is frequently associated with significant postoperative concerns such as pain, delayed healing, itching, bleeding, and long-term scarring, all of which can negatively impact patient comfort and overall recovery [2]. In many cases, the donor site may be more symptomatic than the recipient area, making its management a critical aspect of postoperative care.

Optimal dressing selection plays a central role in enhancing donor-site healing by maintaining an appropriate moist environment, reducing infection risk, and minimizing trauma during dressing changes. Traditional dressings such as paraffin gauze and acriflavine-glycerine gauze remain widely used because of their affordability and accessibility, but they are often associated with adherence to the wound bed, increased pain during removal, and inconsistent moisture control

[3,4]. In contrast, modern wound care emphasizes biologically active materials that promote faster healing. Among these, collagen-based dressings have gained considerable attention due to their ability to mimic the extracellular matrix, support fibroblast activity, enhance angiogenesis, and facilitate epithelial migration while also reducing inflammation and protease activity [5–7].

Pain and itching are two of the most distressing symptoms following STSG donor-site creation, often quantified using validated tools such as the Visual Analogue Scale (VAS). Persistent inflammation and delayed epithelialization can further contribute to poor scar outcomes. The quality of scarring, now recognized as a multidimensional outcome, is best evaluated using comprehensive tools like the Patient and Observer Scar Assessment Scale (POSAS), which integrates both clinical and patient-reported parameters [8–10]. Despite advances in dressing materials, there remains a lack of robust comparative evidence, particularly in the Indian clinical setting, regarding the superiority of collagen dressings over conventional options such as acriflavine-glycerine gauze.

Against this background, the present study aims to determine whether collagen dressing offers superior outcomes compared to conventional acriflavine-glycerine gauze in STSG donor-site management. The objectives include evaluating time to complete re-epithelialization, assessing postoperative pain and itching using VAS, and comparing scar quality using POSAS. By integrating both objective healing parameters and patient-centered outcomes, this study seeks to generate evidence that can guide optimal dressing selection, improve patient comfort, and standardize donor-site care practices in routine surgical settings.

MATERIAL AND METHODS

After obtaining approval from the Institutional Ethics Committee, this hospital-based prospective randomized controlled study was conducted among patients undergoing split-thickness skin grafting (STSG) in the Department of General Surgery at Mahatma Gandhi Memorial Medical College and M.Y. Hospital, Indore, along with the Department of Plastic Surgery at S.S. Hospital, Indore, over a period of one year. Written informed consent was obtained from all participants prior to enrolment. Confidentiality of patient data and voluntary participation were strictly maintained throughout the study.

The *sample size* was calculated using a standard formula for comparison of two means, assuming a confidence level of 95% and power of 80%, based on previously reported differences in POSAS scores. A minimum of 50 participants per group was required. To ensure adequate statistical validity, a total of 100 patients were included in the study and were randomly allocated into two groups using a closed envelope method.

Inclusion and Exclusion Criteria:

Patients aged 18 years and above undergoing STSG for various indications such as burns, trauma, diabetic ulcers, venous ulcers, and chronic non-healing wounds, with a donor-site wound size of at least 10 cm^2 and willingness to participate in follow-up were included. Whereas, patients with known allergy to collagen, immunocompromised status, presence of local infection at the donor site, severe systemic illness affecting wound healing, refusal to consent, or loss to follow-up were excluded.

Procedure

After obtaining consent, eligible patients were enrolled consecutively at the time of admission. A detailed clinical history was recorded using a predesigned structured proforma, including demographic details (age, sex), indication for grafting, and relevant comorbidities. A thorough clinical examination was performed, and baseline parameters were documented.

All patients underwent split-thickness skin grafting under standard aseptic conditions. The donor site, commonly the lateral thigh, was prepared and the graft was harvested using a dermatome at a standardized thickness. Hemostasis was achieved using adrenaline-soaked gauze where necessary. Immediately following graft harvest, patients were allocated to one of two groups. In Group A, collagen sheet dressing was applied over the donor site, whereas in Group B, conventional dressing using acriflavine glycerine gauze or liquid paraffin gauze was applied. Dressings were secured with sterile bandaging, and all patients received standard postoperative care.

Postoperative monitoring included daily assessment of pain using the Visual Analogue Scale (VAS) for the first two weeks, followed by twice-weekly assessment during the third and fourth weeks. Patients were instructed to maintain a diary to record pain and itching scores. Donor-site wound healing was assessed clinically, and time to complete epithelialization was recorded, defined as complete healing without raw areas or crusting.

Outcome Assessment included evaluation of both primary and secondary parameters. The primary outcomes were time to complete epithelialization, defined as healing of the donor site without raw areas or crusting, and scar quality assessed using the Patient and Observer Scar Assessment Scale (POSAS). Secondary outcomes included assessment of pain intensity and itching severity using the Visual Analogue Scale (VAS), along with the incidence of donor-site complications such as

infection, bleeding, hematoma, and pruritus. Scar evaluation was performed at predefined intervals by an independent blinded observer to minimize assessment bias.

Follow-up Protocol: Patients were followed up during their hospital stay and subsequently at regular intervals on postoperative day 21, at one month, and at three months. During each follow-up visit, wound healing status, pain, itching, and scar quality were assessed. Any complications or delayed healing were documented.

Statistical Analysis

Data were recorded using a predesigned structured proforma, including demographic details, indication for grafting, donor-site characteristics, pain and itching scores, time to epithelialization, POSAS scores, and postoperative complications. Patient-reported outcomes were documented using diaries. The data were entered into Microsoft Excel and analyzed using SPSS software version 26.0. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Group comparisons were performed using the unpaired t-test and Chi-square test, with a p-value <0.05 considered statistically significant.

RESULTS

The present study included 100 patients undergoing split-thickness skin grafting (STSG), who were randomly allocated into two groups: collagen dressing (Group A, n=50) and conventional dressing (Group B, n=50). The baseline demographic and clinical characteristics of the study population were comparable between the two groups, with no statistically significant differences observed. The majority of patients belonged to the 31–50 years age group, with a slight male predominance in both groups. The most common aetiologies of wounds were mechanical trauma and thermal burns, while hypertension and diabetes mellitus were the most frequent comorbidities. The thigh was the most commonly used donor site in both groups. These findings indicate adequate randomization and homogeneity of the study population [Table 1].

Table 1: Baseline Demographic and Clinical Characteristics of Study Subjects

Variable	Category	Group A (Collagen) n=50	Group B (Conventional) n=50	Total n=100	p-value
Age Group (Years)	18–30	12 (24.0%)	13 (26.0%)	25 (25.0%)	0.727
	31–40	14 (28.0%)	14 (28.0%)	28 (28.0%)	
	41–50	17 (34.0%)	12 (24.0%)	29 (29.0%)	
	51–60	5 (10.0%)	9 (18.0%)	14 (14.0%)	
	>60	2 (4.0%)	2 (4.0%)	4 (4.0%)	
Mean Age (Years)	Mean ± SD	37.88 ± 11.84	38.92 ± 12.35	—	0.668
Gender	Male	34 (68.0%)	33 (66.0%)	67 (67.0%)	0.832
	Female	16 (32.0%)	17 (34.0%)	33 (33.0%)	
Aetiology of Wound	Mechanical Trauma	12 (24.0%)	18 (36.0%)	30 (30.0%)	0.781
	Thermal Burns	16 (32.0%)	14 (28.0%)	30 (30.0%)	
	Venous Ulcer	9 (18.0%)	7 (14.0%)	16 (16.0%)	
	Diabetic Foot Ulcer	7 (14.0%)	6 (12.0%)	13 (13.0%)	
	Other	6 (12.0%)	5 (10.0%)	11 (11.0%)	
Comorbidities	Diabetes Mellitus	6 (12.0%)	8 (16.0%)	14 (14.0%)	0.883
	Hypertension	11 (22.0%)	9 (18.0%)	20 (20.0%)	
	Smoking	8 (16.0%)	6 (12.0%)	14 (14.0%)	
	Anaemia	4 (8.0%)	6 (12.0%)	10 (10.0%)	
	None	21 (42.0%)	21 (42.0%)	42 (42.0%)	
Donor Site	Thigh	26 (52.0%)	23 (46.0%)	49 (49.0%)	0.692
	Leg	14 (28.0%)	18 (36.0%)	32 (32.0%)	
	Arm	10 (20.0%)	9 (18.0%)	19 (19.0%)	

Baseline wound characteristics were also comparable between the two groups. The mean wound size in the collagen group was 87.43 ± 27.80 cm² compared to 82.20 ± 24.43 cm² in the conventional group. Similarly, the mean duration of wound prior to grafting was 46.40 ± 24.27 days in Group A and 53.94 ± 23.61 days in Group B. These differences were not statistically significant ($p > 0.05$), indicating similar wound profiles at baseline [Table 2].

Table 2: Comparison of Wound Characteristics Between Study Groups

Parameter	Group A (Collagen) Mean ± SD	Group B (Conventional) Mean ± SD	t-value	p-value
Wound Size (cm^2)	87.43 ± 27.80	82.20 ± 24.43	0.999	0.320
Duration of Wound (Days)	46.40 ± 24.27	53.94 ± 23.61	-1.575	0.119

Postoperative pain assessment using the Visual Analogue Scale (VAS) demonstrated significantly lower pain scores in the collagen dressing group at all time points from Day 1 to Day 28 ($p < 0.001$). A progressive decline in pain was observed in both groups; however, patients treated with collagen dressing experienced faster pain relief, with near-complete resolution by Day 28. Similarly, itching scores were significantly lower in the collagen group across all follow-up weeks ($p < 0.001$), indicating superior symptomatic control [Table 3].

Table 3: Comparison of Pain and Itching Scores Between Study Groups

Parameter	Time Point	Group A (Collagen) Mean ± SD	Group B (Conventional) Mean ± SD	p-value
VAS Pain Score	Day 1	3.72 ± 1.28	5.86 ± 1.41	<0.001
	Day 3	3.20 ± 1.01	5.62 ± 1.44	<0.001
	Day 7	2.52 ± 0.79	4.76 ± 1.19	<0.001
	Day 14	1.20 ± 0.81	3.46 ± 0.93	<0.001
	Day 21	0.58 ± 0.57	2.18 ± 0.77	<0.001
	Day 28	0.10 ± 0.30	1.14 ± 0.70	<0.001
VAS Itching Score	Week 1	2.86 ± 1.44	4.52 ± 1.31	<0.001
	Week 2	2.28 ± 0.90	4.24 ± 1.45	<0.001
	Week 3	1.42 ± 0.84	3.24 ± 1.10	<0.001
	Week 4	0.82 ± 0.52	1.72 ± 0.90	<0.001

Scar quality assessment using the Patient and Observer Scar Assessment Scale (POSAS) revealed significantly better outcomes in the collagen dressing group. Both observer and patient scores were consistently lower in Group A at Day 21, 1st month, and 3rd month ($p < 0.001$). The combined POSAS scores further confirmed superior scar quality with collagen dressing. Additionally, analysis of individual scar parameters at 3 months demonstrated significantly improved vascularity, pigmentation, thickness, pliability, and overall appearance in the collagen group, along with better patient-reported outcomes such as reduced pain, itching, and stiffness ($p < 0.001$) [Table 4 & Table 5].

Table 4: Comparison of POSAS Total Scores Between Study Groups

Parameter	Time Point	Group A Mean ± SD	Group B Mean ± SD	p-value
Observer Score	Day 21	28.26 ± 2.55	35.22 ± 2.83	<0.001
	1st Month	23.42 ± 2.76	32.60 ± 2.86	<0.001
	3rd Month	16.60 ± 2.32	23.94 ± 2.86	<0.001
Patient Score	Day 21	29.56 ± 2.70	38.36 ± 3.39	<0.001
	1st Month	23.60 ± 2.48	33.94 ± 3.55	<0.001
	3rd Month	17.44 ± 2.30	26.78 ± 2.98	<0.001
Grand Total	Day 21	57.82 ± 4.15	73.58 ± 4.41	<0.001
	1st Month	47.02 ± 3.43	66.54 ± 3.76	<0.001
	3rd Month	34.04 ± 2.89	50.72 ± 4.50	<0.001

Table 5: Comparison of Individual POSAS Parameters at 3rd Month

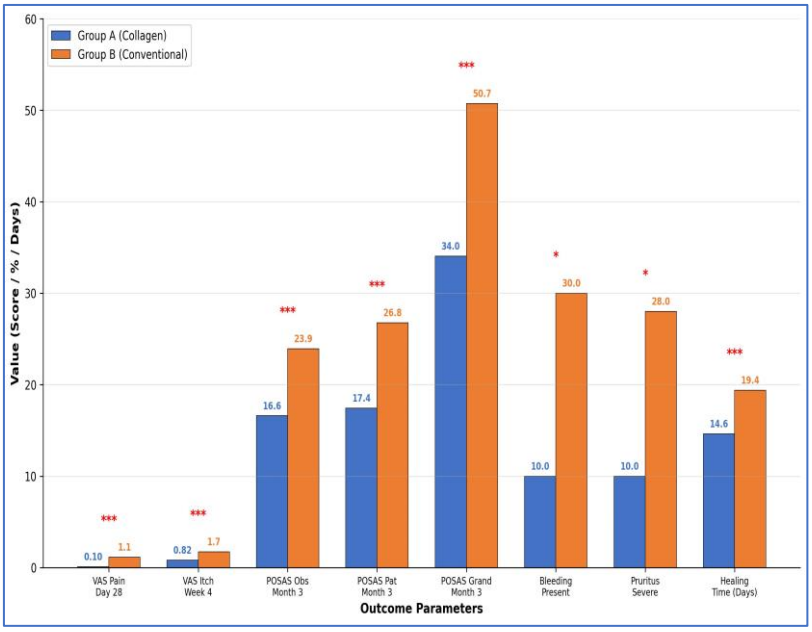
Parameter	Group A Mean ± SD	Group B Mean ± SD	p-value
Observer Scale			
Vascularity	2.86 ± 1.01	4.10 ± 1.31	<0.001
Pigmentation	2.70 ± 1.07	3.98 ± 1.06	<0.001
Thickness	2.30 ± 0.79	3.90 ± 1.02	<0.001
Relief	2.86 ± 0.83	3.88 ± 1.19	<0.001
Pliability	2.96 ± 1.11	4.28 ± 1.20	<0.001
Surface Area	2.92 ± 1.05	3.80 ± 1.05	<0.001
Patient Scale			
Pain	2.28 ± 0.76	4.00 ± 1.05	<0.001
Itching	2.58 ± 0.84	4.64 ± 1.21	<0.001
Color	3.08 ± 0.90	4.56 ± 1.01	<0.001

Stiffness	3.12 ± 1.12	4.94 ± 1.19	<0.001
Thickness	3.18 ± 0.90	4.46 ± 1.39	<0.001
Irregularity	3.20 ± 0.99	4.18 ± 1.02	<0.001

With respect to complications and healing outcomes, collagen dressing showed clear clinical advantages. The incidence of bleeding at the donor site on Day 21 was significantly lower in the collagen group (10.0%) compared to the conventional group (30.0%) ($p = 0.012$). Pruritus severity was also reduced, with a higher proportion of patients reporting no pruritus and fewer experiencing severe pruritus in the collagen group ($p = 0.010$). Furthermore, the mean time to complete re-epithelialization was significantly shorter in the collagen group (14.62 ± 3.11 days) compared to the conventional group (19.38 ± 3.29 days), demonstrating faster wound healing ($p < 0.001$) [Table 6].

Table 6: Comparison of Complications and Healing Outcomes Between Study Groups

Parameter	Category	Group A (Collagen) n=50	Group B (Conventional) n=50	Total n=100	p-value
Bleeding (Day 21)	Present	5 (10.0%)	15 (30.0%)	20 (20.0%)	0.012
	Absent	45 (90.0%)	35 (70.0%)	80 (80.0%)	
Pruritus Severity (Day 21)	None	18 (36.0%)	6 (12.0%)	24 (24.0%)	0.010
	Mild	16 (32.0%)	14 (28.0%)	30 (30.0%)	
	Moderate	11 (22.0%)	16 (32.0%)	27 (27.0%)	
	Severe	5 (10.0%)	14 (28.0%)	19 (19.0%)	
Healing Time (Days)	Mean ± SD	14.62 ± 3.11	19.38 ± 3.29	—	<0.001



Graph 1: Summary Comparison of Key Outcome Parameters Between Group A and Group B

DISCUSSION

The present study was undertaken to compare collagen dressing with conventional dressing in the management of split-thickness skin graft (STSG) donor sites, with emphasis on wound healing, postoperative symptoms, and scar quality. Donor-site morbidity remains a clinically relevant issue, often underestimated despite its significant contribution to patient discomfort, delayed recovery, and dissatisfaction. By evaluating both objective healing parameters and patient-centered outcomes such as pain, itching, and scar perception, this study provides a comprehensive assessment of donor-site management strategies. The findings demonstrate that collagen dressing offers clear advantages over conventional dressing in terms of faster epithelialization, reduced morbidity, and improved scar outcomes.

Baseline characteristics including age, gender distribution, aetiology of wound, comorbidities, donor-site location, wound size, and duration before grafting were comparable between the two groups, ensuring internal validity. The mean age and gender distribution were similar ($p > 0.05$), consistent with randomized trials such as Dornseifer et al. [11] and Higgins et al. [12], although these studies did not provide detailed demographic stratification. Similarly, wound aetiology and comorbidity profiles were evenly distributed, minimizing confounding factors that could influence healing. Many previous

studies, including those by Bista et al. [13] and Jain et al. [14], primarily focused on outcomes rather than detailed baseline comparability, making the present study methodologically robust.

Pain reduction was one of the most significant findings. The collagen group showed consistently lower VAS pain scores at all time points from Day 1 to Day 28 ($p < 0.001$), with faster resolution of pain. These findings are in agreement with Jain et al. [14], who reported a rapid decline in VAS scores with collagen compared to petroleum gauze, and Bista et al. [13], who also observed significantly lower pain scores with collagen. Dornseifer et al. [11] similarly reported reduced pain with advanced dressings, although Higgins et al. [12] and Nouri et al. [15] found no significant difference in pain outcomes. The superior pain control observed in the present study may be attributed to the non-adherent nature of collagen and its ability to maintain a moist wound environment, thereby reducing trauma during dressing changes.

Itching is another important but often underreported symptom in donor-site healing. In the present study, VAS itching scores were significantly lower in the collagen group across all follow-up intervals ($p < 0.001$). Furthermore, categorical analysis showed a higher proportion of patients with no or mild pruritus and fewer with severe pruritus in the collagen group. In contrast, studies such as McBride et al. [16] and Ismail et al. [17] reported no significant differences in itching among various dressing types. The improved itching profile in the present study may be explained by the biological properties of collagen, which provide a protective scaffold, reduce inflammatory mediators, and promote stable epithelial regeneration.

Scar quality assessment using POSAS demonstrated consistent superiority of collagen dressing in both observer and patient domains. Observer scores, patient scores, and combined scores were significantly lower in the collagen group at all follow-up intervals ($p < 0.001$), indicating better scar maturation. These findings align with studies by Hecker et al. [18] and Alsaif et al. [19], which reported improved cosmetic outcomes with advanced dressings. However, several studies including Dornseifer et al. [11], McBride et al. [16], and Ismail et al. [17] did not observe significant long-term differences in scarring despite improvements in early healing. The present study strengthens the evidence by demonstrating concordant improvements in both subjective and objective scar parameters.

Analysis of individual POSAS components further revealed that collagen dressing improved all aspects of scar morphology, including vascularity, pigmentation, thickness, pliability, and surface characteristics ($p < 0.001$). Patient-reported parameters such as pain, itching, stiffness, and irregularity were also significantly better. These findings suggest that collagen not only accelerates healing but also modulates the quality of tissue regeneration. Similar observations have been reported by Hecker et al. [18], while earlier studies such as Nouri et al. [15] and McBride et al. [16] did not demonstrate such comprehensive benefits.

Complication rates were significantly lower in the collagen group. Persistent bleeding at Day 21 was reduced (10.0% vs 30.0%, $p = 0.012$), indicating improved wound stability. Comparable findings have not been consistently reported in previous literature, although Jain et al. [14] observed reduced complications with collagen. Higgins et al. [12] reported differences in exudate and dressing changes, indirectly suggesting variability in wound stability across dressing types. The reduced bleeding in the present study may be attributed to faster epithelial coverage and better structural support provided by collagen.

Pruritus severity was also significantly reduced in the collagen group ($p = 0.010$), reinforcing its role in improving patient comfort. Unlike prior studies such as Ismail et al. [17] and McBride et al. [16], which did not find significant differences in itching, the present study demonstrates both quantitative and qualitative improvement in pruritus, suggesting a stronger anti-inflammatory and protective effect of collagen dressing.

Time to complete re-epithelialization was significantly shorter in the collagen group (14.62 ± 3.11 days vs 19.38 ± 3.29 days, $p < 0.001$), representing a reduction of approximately 4.76 days. This finding is consistent with multiple studies including Dornseifer et al. [11], Barret et al. [20], Cheema et al. [21], Bista et al. [13], and Jain et al. [14], all of which demonstrated faster healing with advanced or biologic dressings. However, some studies such as Higgins et al. [12], McBride et al. [16], and Nouri et al. [15] did not observe significant differences, indicating that healing outcomes may depend on the specific dressing material used.

Overall, the present study provides strong evidence that collagen dressing is superior to conventional dressing in STSG donor-site management. It offers significant benefits in reducing pain, itching, complications, and healing time, while also improving scar quality. These findings support the routine use of collagen dressing as an effective and patient-friendly option for donor-site care.

Despite its strengths, the study was limited by its single-center design, moderate sample size, and short follow-up duration. Lack of blinding, absence of cost-effectiveness analysis, and limited evaluation of infection outcomes may introduce bias.

Additionally, comparison with only conventional dressing and unassessed patient-related factors could influence the results.

CONCLUSION

Collagen dressing demonstrated clear superiority over conventional dressing in the management of split-thickness skin graft donor sites. It significantly reduced postoperative pain, itching, and complication rates while promoting faster re-epithelialization. Additionally, both observer- and patient-based scar assessments showed improved outcomes with collagen, indicating better scar quality and patient satisfaction. These findings suggest that collagen provides a more favorable wound-healing environment by maintaining moisture balance and minimizing tissue trauma. Given its clinical benefits, collagen dressing can be considered an effective and reliable option for routine donor-site management, with potential to enhance recovery, reduce morbidity, and improve overall postoperative outcomes in patients undergoing skin grafting.

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