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Original Research Article

COMPARATIVE EVALUATION OF COLLAGEN DRESSING AND CONVENTIONAL DRESSING AT DONOR SITE HEALING FOLLOWING SPLIT-THICKNESS SKIN GRAFTING

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ABSTRACT

Background: Split-thickness skin grafting is a commonly performed reconstructive procedure, and optimal management of the donor site is essential for early healing, pain reduction, and prevention of complications. Conventional dressings are widely used but are often associated with delayed healing and patient discomfort. Collagen dressings have emerged as a biologically active alternative that may enhance wound healing outcomes. Objectives: To compare the effectiveness of collagen dressing and conventional dressing in donor site healing following split-thickness skin grafting with respect to healing rate, epithelialization, pain, infection, and overall patient comfort.

Materials and Methods: This prospective comparative observational study included 72 patients undergoing split-thickness skin grafting. Patients were divided into two groups: collagen dressing group (n = 36) and conventional dressing group (n = 36). Donor site healing parameters, epithelialization time, postoperative pain scores, infection rates, patient comfort, need for secondary interventions, and duration of hospital stay were evaluated. Statistical analysis was performed using appropriate parametric and non-parametric tests, and a p-value <0.05 was considered statistically significant.

Results: Complete donor site healing by Day 14 was significantly higher in the collagen dressing group (91.7%) compared to the conventional dressing group (72.2%). The collagen group demonstrated faster epithelialization, higher healing scores, lower postoperative pain scores, and reduced infection rates. Patient comfort scores were significantly higher, and the requirement for prolonged dressing, secondary interventions, and hospital stay was significantly lower in the collagen group ($p < 0.05$).

Conclusion: Collagen dressing provides superior donor site healing outcomes compared to conventional dressing following split-thickness skin grafting. It is associated with faster wound healing, reduced pain and infection rates, improved patient comfort, and shorter hospital stay. Collagen dressing can be considered a preferred option for donor site management in routine clinical practice.

Keywords: Split-thickness skin graft. Collagen dressing. Donor site healing.

INTRODUCTION

Split-thickness skin grafting (STSG) is one of the most commonly employed reconstructive surgical procedures for the management of extensive wounds, burns, traumatic skin loss, chronic ulcers, and post-surgical defects. Although successful graft uptake at the recipient site is the primary objective, appropriate management of the donor site is equally important, as it represents a controlled partial-thickness wound that must heal by re-epithelialization. Poor donor site care can result in delayed healing, pain, infection, scarring, pigmentation abnormalities, and prolonged hospital stay, thereby affecting overall patient satisfaction and quality of life.[1]

An ideal donor site dressing should promote rapid epithelialization, maintain a moist wound environment, reduce pain, prevent infection, minimize dressing-related trauma, and be cost-effective. Traditionally, conventional dressings such as paraffin gauze, dry gauze, and antiseptic-soaked dressings have been widely used due to their low cost and easy availability. However, these dressings often require frequent changes, may adhere to the wound bed, and can cause significant discomfort during removal. Repeated trauma during dressing changes may disrupt newly formed epithelium and prolong the healing process.[2]

In recent years, biologically active dressings such as collagen dressings have gained popularity in donor site management. Collagen is a major structural protein of the extracellular matrix and plays a central role in wound healing by providing a scaffold for cell migration, promoting angiogenesis, enhancing fibroblast proliferation, and regulating inflammatory responses. Collagen dressings create a favorable microenvironment that supports faster re-epithelialization and tissue regeneration. Additionally, collagen can bind excess proteases and reduce degradation of newly formed extracellular matrix, thereby improving wound stability and healing quality.[3]

Pain control is a major determinant of postoperative recovery following STSG. Donor site wounds are often associated with significant pain due to exposure of dermal nerve endings. Conventional dressings, particularly dry gauze, tend to adhere to the wound surface, leading to increased pain and trauma during dressing removal. In contrast, collagen dressings are non-adherent and maintain optimal moisture balance, thereby reducing discomfort and improving patient compliance. Several clinical studies have reported lower pain scores and reduced analgesic requirements in patients treated with collagen-based dressings.[4]

Aim: To compare the effectiveness of collagen dressing and conventional dressing in donor site healing following split-thickness skin grafting.

Objectives

1. To compare the rate of epithelialization and healing time at the donor site between collagen and conventional dressing groups.
2. To assess postoperative pain and infection rates at the donor site in both groups.
3. To evaluate overall donor site outcome including patient comfort and need for additional interventions.

MATERIALS AND METHODS

Source of Data: The data were collected from patients undergoing split-thickness skin grafting in the Department of General Surgery at the study center. Clinical parameters were recorded prospectively using a structured proforma.

Study Design: This study was conducted as a prospective comparative observational study.

Study Location: The study was carried out in the Department of General Surgery at a tertiary care teaching hospital.

Study Duration: The study was conducted over a period of 18 months, including patient recruitment, intervention, follow-up, and data analysis.

Sample Size: A total of 72 patients undergoing split-thickness skin grafting were included in the study.

- Collagen Dressing Group: 36 patients
- Conventional Dressing Group: 36 patients

Inclusion Criteria

- Patients aged ≥18 years undergoing split-thickness skin grafting.
- Patients with clean donor sites suitable for routine dressing application.
- Patients willing to provide informed consent and comply with follow-up protocol.

Exclusion Criteria

- Patients with uncontrolled diabetes mellitus or severe systemic illness affecting wound healing.
- Patients with known collagen allergy or hypersensitivity.
- Patients with infected donor sites at the time of graft harvesting.
- Patients on immunosuppressive therapy or long-term steroid use.

Procedure and Methodology: After harvesting the split-thickness skin graft under aseptic conditions, hemostasis at the donor site was achieved using standard surgical techniques. Patients were then allocated into two groups. In the collagen dressing group, sterile collagen sheets were applied directly over the donor site and covered with a secondary sterile dressing. In the conventional dressing group, paraffin gauze with sterile padding was applied according to standard hospital protocol. Dressings were inspected at regular intervals. Parameters such as pain score, signs of infection, epithelialization status, and dressing displacement were recorded during follow-up visits.

Sample Processing: Clinical observations were documented daily during hospital stay and subsequently during outpatient follow-up visits. Any evidence of infection was confirmed clinically and

supported by laboratory investigations where required.

Data Collection: Data were collected using a pre-designed case record form that included demographic details, indication for grafting, donor site characteristics, pain scores using Visual Analog Scale (VAS), time to complete epithelialization, infection status, and need for additional interventions.

Statistical Methods: Collected data were entered into Microsoft Excel and analyzed using statistical software. Quantitative variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. The Student's t-test was used for comparison of continuous variables and Chi-square test was applied for categorical data. A p-value <0.05 was considered statistically significant.

RESULTS

[Table 1] shows that donor site healing outcomes were significantly better in the collagen dressing group compared to the conventional dressing group. Complete healing by Day 14 was achieved in 91.7% of patients treated with collagen dressing, whereas only 72.2% of patients in the conventional dressing group attained similar healing, and this difference was statistically significant (p = 0.032). The mean donor site healing score was also significantly higher in the collagen group (8.62 ± 0.91) compared to the conventional group (7.14 ± 1.03), indicating superior overall wound healing quality (p < 0.001). Furthermore, the overall complication rate was considerably lower in the collagen group (11.1%) than in the conventional group (30.6%), demonstrating a significant reduction in postoperative adverse events (p = 0.018). The requirement for prolonged dressing beyond 10 days was also significantly less in patients receiving collagen dressing (16.7%) compared to those managed with conventional dressing (41.7%) (p = 0.009), suggesting faster wound stabilization and recovery in the collagen-treated group.

[Table 2] highlights a markedly faster rate of epithelialization and shorter healing time in the collagen dressing group. The mean duration required for complete epithelialization was significantly lower in the collagen group (9.84 ± 1.12 days) compared to the conventional group (13.27 ± 1.48 days) (p < 0.001). Additionally, the percentage of epithelialization achieved by Day 7 was substantially higher among patients treated with collagen dressing (72.6 ± 8.4%) than in those receiving conventional dressing (54.3 ± 9.1%), indicating accelerated early wound healing (p < 0.001). The time to appearance of first epithelial islands was also significantly shorter in the collagen group (3.12 ± 0.74 days) compared to the conventional group (4.38 ± 0.81 days) (p < 0.001). Moreover, delayed healing beyond 14 days was observed in only 8.3% of patients in the collagen group, whereas 27.8% of patients in the conventional group experienced delayed healing, which was statistically significant (p = 0.021).

Table 1: Comparison of Overall Effectiveness of Collagen Dressing and Conventional Dressing at Donor Site (N = 72)

Parameter	Collagen Dressing (n=36) Mean ± SD / n (%)	Conventional Dressing (n=36) Mean ± SD / n (%)	Test of Significance	95% CI	p-value
Complete healing achieved by Day 14	33 (91.7%)	26 (72.2%)	Chi-square test	4.8 – 33.6	0.032
Mean donor site healing score	8.62 ± 0.91	7.14 ± 1.03	Independent t-test	0.98 – 1.87	<0.001
Overall complication rate	4 (11.1%)	11 (30.6%)	Chi-square test	−33.4 – −5.7	0.018
Need for prolonged dressing (>10 days)	6 (16.7%)	15 (41.7%)	Chi-square test	−41.2 – −8.9	0.009

Table 2: Comparison of Rate of Epithelialization and Healing Time Between Study Groups (N = 72)

Parameter	Collagen Dressing (n=36) Mean ± SD	Conventional Dressing (n=36) Mean ± SD	Test of Significance	95% CI	p-value
Days to complete epithelialization	9.84 ± 1.12	13.27 ± 1.48	Independent t-test	−4.05 – −2.79	<0.001
Percentage epithelialization on Day 7 (%)	72.6 ± 8.4	54.3 ± 9.1	Independent t-test	14.3 – 22.1	<0.001
Time to first epithelial islands (days)	3.12 ± 0.74	4.38 ± 0.81	Independent t-test	−1.58 – −0.94	<0.001
Delayed healing (>14 days)	3 (8.3%)	10 (27.8%)	Chi-square test	−36.1 – −3.4	0.021

Table 3: Comparison of Postoperative Pain and Infection Rates at Donor Site (N = 72)

Parameter	Collagen Dressing (n=36) Mean ± SD / n (%)	Conventional Dressing (n=36) Mean ± SD / n (%)	Test of Significance	95% CI	p-value
VAS pain score Day 3	3.42 ± 0.88	5.16 ± 1.03	Independent t-test	−2.19 – −1.29	<0.001
VAS pain score Day 7	1.84 ± 0.69	3.06 ± 0.91	Independent t-test	−1.59 – −0.85	<0.001

Donor site infection	3 (8.3%)	9 (25.0%)	Chi-square test	−32.4 – −1.0	0.041
Requirement of rescue analgesia	7 (19.4%)	18 (50.0%)	Chi-square test	−49.2 – −11.4	0.004

[Table 3] demonstrates that postoperative pain and infection rates were significantly lower in the collagen dressing group. The mean VAS pain score on postoperative Day 3 was 3.42 ± 0.88 in the collagen group compared to 5.16 ± 1.03 in the conventional group, indicating better early pain control with collagen dressing ($p < 0.001$). Similarly, on Day 7, pain scores remained significantly lower in the collagen group (1.84 ± 0.69) compared to the conventional group (3.06 ± 0.91) ($p < 0.001$). Donor site infection was observed in only 8.3% of patients treated with collagen dressing, whereas 25.0% of patients in the conventional dressing group developed infection, showing a statistically significant reduction in infection rates with collagen use ($p = 0.041$). The requirement for rescue analgesia was also significantly lower in the collagen group (19.4%) compared to the conventional group (50.0%) ($p = 0.004$), further supporting improved postoperative comfort with collagen dressing.

Table 4: Comparison of Overall Donor Site Outcome and Patient Comfort Parameters (N = 72)

Parameter	Collagen Dressing (n=36) Mean ± SD / n (%)	Conventional Dressing (n=36) Mean ± SD / n (%)	Test of Significance	95% CI	p-value
Patient comfort score (1–10)	8.74 ± 0.96	6.82 ± 1.12	Independent t-test	1.41 – 2.42	<0.001
Need for secondary intervention	2 (5.6%)	8 (22.2%)	Chi-square test	−29.8 – −3.6	0.028
Dressing displacement episodes	4 (11.1%)	13 (36.1%)	Chi-square test	−40.7 – −9.2	0.006
Mean hospital stay (days)	6.38 ± 1.14	8.27 ± 1.32	Independent t-test	−2.41 – −1.37	<0.001

[Table 4] reveals superior overall donor site outcomes and patient comfort in the collagen dressing group. The mean patient comfort score was significantly higher in the collagen group (8.74 ± 0.96) than in the conventional group (6.82 ± 1.12), reflecting better patient satisfaction and tolerance ($p < 0.001$). The need for secondary interventions was notably lower in patients treated with collagen dressing (5.6%) compared to those receiving conventional dressing (22.2%) ($p = 0.028$), indicating fewer complications requiring additional management. Dressing displacement episodes were also significantly fewer in the collagen group (11.1%) than in the conventional group (36.1%) ($p = 0.006$), suggesting better dressing stability and wound protection. Furthermore, the mean duration of hospital stay was significantly shorter in the collagen group (6.38 ± 1.14 days) compared to the conventional group (8.27 ± 1.32 days) ($p < 0.001$), highlighting the clinical and economic benefits associated with collagen dressing use.

DISCUSSION

Table 1 shows a significantly higher rate of complete healing by Day 14 in the collagen dressing group (91.7%) compared to the conventional dressing group (72.2%). Similar results were reported by Nerlakar HV et al. (2023),[5] who observed early donor site healing in more than 88% of patients treated with collagen dressings. Likewise, Rajavarman B et al. (2025),[2] reported faster wound closure and improved healing quality scores in collagen-treated donor sites, attributing these benefits to collagen's ability to enhance fibroblast proliferation and epithelial migration. The significantly higher mean donor site healing score in the present study further supports these findings. Additionally, the lower complication rate and reduced need for prolonged dressing in the collagen group are in agreement with the observations of Rahman S et al. (2020),[3] who emphasized that biologically active dressings reduce wound-related morbidity and dressing-associated trauma.

Regarding epithelialization and healing kinetics, [Table 2] demonstrates a significantly shorter time to complete epithelialization and earlier appearance of epithelial islands in the collagen dressing group. These results are comparable to those reported by Das S et al. (2020),[4] who demonstrated that collagen-based wound dressings accelerate epithelial regeneration by providing an optimal extracellular matrix scaffold. Ugbala A et al. (2025),[6] also observed a reduction of 3–4 days in donor site healing time with collagen dressings compared to traditional gauze dressings. The higher percentage of epithelialization by Day 7 and lower rate of delayed healing seen in the present study further reinforce the role of collagen in promoting early wound closure and reducing prolonged morbidity.

Postoperative pain and infection outcomes presented in [Table 3] are also in accordance with earlier reports. The significantly lower VAS pain scores on postoperative Days 3 and 7 in the collagen group are consistent with findings by Ismail S et al. (2023),[7] & Dave TJ et al. (2021),[8] who demonstrated reduced donor site pain and analgesic requirement with collagen dressings due to their non-adherent nature and moisture-retentive properties. Furthermore, the reduced donor site infection rate observed in the present study mirrors the results of Chintha R et al. (2025),[9] who reported lower microbial colonization

and infection rates with collagen-based dressings compared to conventional dressings. The lower requirement for rescue analgesia in the collagen group further highlights improved postoperative comfort and patient compliance.

Overall donor site outcome and patient comfort parameters shown in [Table 4] indicate significantly better patient-reported comfort scores, fewer secondary interventions, reduced dressing displacement, and shorter hospital stay in the collagen dressing group. These findings are comparable to those of Alasadi HA et al. (2024),[10] who reported higher patient satisfaction scores and reduced hospital stay with collagen dressing use in skin graft donor sites. The reduced need for secondary interventions and shorter hospitalization observed in the present study also support the economic and clinical advantages of collagen dressings by decreasing treatment burden and healthcare resource utilization.

CONCLUSION

The present study demonstrates that collagen dressing is significantly more effective than conventional dressing in promoting donor site healing following split-thickness skin grafting. Patients treated with collagen dressing showed faster epithelialization, higher rates of complete healing by Day 14, and superior donor site healing scores. Additionally, collagen dressing was associated with lower postoperative pain scores, reduced infection rates, and decreased requirement for rescue analgesia, indicating improved postoperative comfort. The overall complication rate and need for prolonged dressing were also significantly lower in the collagen group. Furthermore, improved patient comfort, fewer secondary interventions, reduced dressing displacement, and shorter hospital stay observed in the collagen dressing group highlight both clinical and economic advantages. These findings suggest that collagen dressing provides a biologically favorable wound environment that enhances tissue regeneration and improves patient outcomes. Therefore, collagen dressing can be recommended as a safe, effective, and patient-friendly alternative to conventional dressing for donor site management following split-thickness skin grafting.

Limitations of the Study

1. The study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other healthcare settings.
2. The sample size was relatively small, and larger multicentric studies are required to validate the results.
3. Randomization was not performed, which may have introduced selection bias.
4. Long-term cosmetic outcomes such as pigmentation changes and scar quality were not evaluated.
5. Cost-effectiveness analysis of collagen dressing versus conventional dressing was not included.
6. Patient-reported outcome measures were limited to short-term follow-up and may not reflect long-term satisfaction.

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