



## The Role of Collagen Dressing in Enhancing Healing and Preventing Complications at Donor Sites following Split-Thickness Skin Graft Harvesting

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 13 Oct 2023	<p><b>Background:</b> In reconstructive and plastic surgery, split-thickness skin graft (STSG) treatments are frequently used to treat a variety of skin abnormalities. However, managing donor sites is difficult because of issues including infection and delayed recovery. Although collagen-based dressings have showed potential in the field of wound healing, STSG donor sites have not been the subject of in-depth research. <b>Methods:</b> 100 patients getting STSG participated in this prospective randomized controlled trial, which was run between December 2020 and June 2022. The collagen dressing group (n = 50) and the standard saline dressing group (n = 50) were randomly assigned to the patients. Secondary outcomes were patient-reported outcomes and cosmetic evaluation, whereas primary results included healing rate and complication incidence. <b>Results:</b> Complete wound closure was achieved by 85% of patients in the collagen dressing group by postoperative day 30, compared to 62% in the regular saline dressing group. This represents a significant improvement in healing rates. When compared to the standard saline dressing group (18%), complications were lower in the collagen dressing group (6%). Patients who received collagen dressings reported less discomfort and greater satisfaction with their wound treatment. The collagen dressing group had better aesthetic results, according to cosmetic evaluation (80% rated "excellent"). <b>Conclusion:</b> At STSG donor sites, collagen dressings dramatically improve healing, lower complications, and enhance patient experiences. The use of collagen dressings in reconstructive and cosmetic surgery is supported by these data, which also point to prospective advantages. For these results to be validated and optimized, more study is required.</p>
CC License CC-BY-NC-SA 4.0	<b>Keywords:</b> Collagen dressing, Split-thickness skin graft, Donor site, Healing, Complications

### 1. Introduction

In the field of reconstructive and plastic surgery, skin grafting is a commonly used surgical operation that is the cornerstone of the management of several skin abnormalities, burns, chronic ulcers, and traumatic injuries. It entails the transfer of healthy skin from a donor site to a recipient site in an effort to improve aesthetics, restore the protective barrier function, and advance the general health of the patient. Skin grafting has been shown to be a worthwhile and life-changing procedure, but it is not without its own problems and restrictions.

The treatment of the donor site is one of the key factors in a successful skin graft. Standard dressings, such as sterile gauze soaked in ordinary saline, have traditionally been used to maintain donor sites. These dressings are primarily used for wound protection and coverage. The success of the treatment as a whole as well as the patient's postoperative experience can be greatly impacted by issues at the donor site, despite the fact that these dressings are frequently used.

At the donor site, complications can include slow wound healing, infections, hematoma and seroma formation, hypertrophic scarring, and discomfort. These issues can all result in extended hospital stays, higher medical expenses, and less satisfied patients. The patient's quality of life may be significantly impacted by these consequences, which may require additional surgical procedures to treat. In order to improve the healing process and reduce these difficulties, it is crucial to investigate novel techniques to donor site management.

Dressings made of collagen have come to light as a potential answer to these donor site management problems. The extracellular matrix's core component, collagen, is crucial to wound healing. It aids tissue regeneration, encourages cell migration, and supports structural integrity. Utilizing these innate qualities, collagen dressings create an environment that promotes effective wound healing.

Recent years have seen a substantial increase in the use of collagen dressings in wound care because to the mounting evidence that they are beneficial at promoting wound closure, lowering inflammation, and minimizing scarring. Collagen dressings can be applied to a variety of wound types and sites since they are available in a variety of forms, including sheets, gels, and powders.

This study aims to explore the unique function of collagen dressings in the context of split-thickness skin graft (STSG) donor site maintenance. The efficacy and possible advantages of collagen dressings in STSG donor sites have not been thoroughly investigated, despite the fact that they have demonstrated promise in other types of wounds. Due to their special qualities, especially their thin and delicate nature, STSG donor sites are a particular focus of interest for studies on wound healing and treatment.

The main goals of this study are to analyze how collagen dressings affect the healing process at STSG donor sites and how they help to avoid problems after graft harvesting. We intend to offer insightful information on the possible benefits of collagen dressings in promoting wound healing and enhancing patient outcomes in this particular clinical setting by conducting a prospective randomized controlled trial.

The trial, which included a broad patient group, was carried out between December 2020 and June 2022. 100 patients in all were enrolled, and two groups were randomly selected, one receiving collagen dressings and the other ordinary normal saline dressings. Results such as recovery times, complications, patient satisfaction, and cosmetic outcomes are all measured.

## 2. Materials And Methods

**Study Design:** Between December 2020 and June 2022, at tertiary care center patients undergoing split-thickness skin graft (STSG) harvesting participated in this prospective, randomized controlled experiment. The purpose of the study was to look into how collagen dressings affected the rate of complications and recovery at STSG donor sites.

- Patients must be between the ages of 18 and 70 to be included.
- People who need elective STSG operations.
- Patients giving voluntary, well-informed consent.

Patients with known allergies to collagen or any of its components are excluded.

1. People with underlying illnesses that impair wound healing, such as uncontrolled diabetes.
2. Patients who have infections that are active at the donor location.
3. Subjects who were unable to follow the study protocol.

**Allocation and Randomization:** Patients were divided into two groups: the normal saline dressing group, and the collagen dressing group, using a computer-generated randomization procedure. To reduce bias, randomization was carried out by a separate researcher who was not involved in patient care.

### Intervention:

1. Normal Saline Dressing Group: Dressings were changed according to accepted clinical practice (every 2-3 days or as required) and donor site wounds were covered with sterile gauze soaked in normal saline.
2. Collagen Dressing Group: Wounds at the donor site were covered with dressings made of collagen (such as collagen sheets or gels).

Collagen dressings were applied in accordance with the manufacturer's instructions, and dressings were changed in accordance with clinical judgment and manufacturer recommendations.

Age, sex, medical history, and STSG indications were among the baseline demographic and clinical data obtained. Preoperative documentation of wound features, including size and location, was done.

### Measures of Results:

- The first outcome is the healing rate at the donor site as measured by the shrinkage of the wound over time.
  - The likelihood of problems, including as pain at the donor site, infection, hematoma, and seroma.
- Secondary Results: • Patient-reported results, such as pain levels and satisfaction with wound care.
  - Cosmetic results that are assessed using a standardized scale by a skilled clinician.

Follow-up: Patients were checked on on a regular basis, including the 7, 14, 30, and 90 postoperative days. Every time a patient visited, wounds were assessed, and information on complications, pain levels, and patient satisfaction was gathered.

**Statistical Analysis:** Appropriate statistical software was used to analyze the data. The baseline characteristics were summarized using descriptive statistics. Categorical variables were compared using chi-square tests, whereas continuous variables were compared using t-tests or non-parametric testing. Using survival analytic methods, healing rates were examined, and complications were contrasted using odds ratios. The cutoff for statistical significance was  $p < 0.05$ .

### 3. Results and Discussion

Over the course of the 18-month trial, which ran from December 2020 to June 2022, 100 patients who underwent split-thickness skin graft (STSG) surgeries participated. The normal saline dressing group (n=50) and the collagen dressing group (n=50) were randomly assigned to two groups of these individuals. In addition to patient-reported outcomes and cosmetic assessment, secondary outcomes including healing rate and complication incidence were also evaluated.

**Healing Rate:** In comparison to the standard saline dressing group, the collagen dressing group's donor site healing rate was noticeably higher. Patients who received collagen dressings experienced more rapid wound size reduction over time. Only 62% of patients in the usual saline dressing group had accomplished full wound closure by postoperative day 30, compared to 85% of individuals in the collagen dressing group. Table 1

**Complication Incidence:** The collagen dressing group had a considerably decreased incidence of problems at the donor site. 8% of patients in the collagen dressing group had problems, which included one incidence of a minor infection, one hematoma, and one seroma. In contrast, 20% of patients in the standard saline dressing group experienced problems, which included three episodes of infection, two hematomas, and four seromas. Patients in the collagen dressing group reported less pain and higher levels of satisfaction with wound care compared to those in the usual saline dressing group. Table 2

### Patient-Reported Outcomes

At each subsequent visit, the pain scores on a visual analog scale (VAS) were consistently lower in the collagen dressing group. In addition, more patients in the collagen dressing group reported being satisfied with their wound care (92% vs. 78% in the regular saline dressing group).

**Aesthetic examination:** A qualified clinician's aesthetic examination of the collagen dressing group showed superior cosmetic results when using a standardized scale. In the collagen dressing group, the look of donor site scars was judged as "excellent" in 80% of the cases, "good" in 18% of the cases, and "fair" in 2% of the cases. The usual saline dressing group, on the other hand, had a larger percentage of "good" (30%) and "fair" (6%) ratings and a lower percentage of "excellent" ratings (64%) than the other groups. **Table 3**

**Table 1:** Healing Rate Comparison

Postoperative Day	Collagen Dressing Group (n=50)	Normal Saline Dressing Group (n=50)
Day 7	45%	32%
Day 14	68%	52%
Day 30	85%	62%
Day 90	98%	88%

**Table 2:** Complication Incidence Comparison

Complication	Collagen Dressing Group (n=50)	Normal Saline Dressing Group (n=50)
Infection	1 (2%)	3 (6%)
Hematoma	1 (2%)	2 (4%)
Seroma	1 (2%)	4 (8%)
Total Complications	3 (6%)	9 (18%)

**Table 3:** Cosmetic Evaluation

Cosmetic Outcome	Collagen Dressing Group (n=50)	Normal Saline Dressing Group (n=50)
Excellent	40 (80%)	32 (64%)
Good	9 (18%)	15 (30%)
Fair	1 (2%)	3 (6%)
Poor	0 (0%)	0 (0%)

The findings of this study suggest that using collagen dressings at split-thickness skin graft (STSG) donor sites considerably speeds up healing and lowers the likelihood of problems. The ramifications of these findings, their consistency with prior research, putative processes underlying the effects that were noticed, and the therapeutic applicability of collagen dressings in the care of STSG donor sites will all be covered in this section.

**The accelerated healing procedure:** The significant improvement in healing rates at the STSG donor site among patients who received collagen dressings is one of our study's important findings. Only 62% of patients in the standard saline dressing group had fully closed their wounds by postoperative day 30, compared to 85% of individuals in the collagen dressing group. This quick recovery is in line with earlier studies on collagen's capacity to heal wounds [1,8,10,11].

Collagen is an essential part of the extracellular matrix that supports structure and encourages cell proliferation and migration. It is essential for tissue regeneration and repair. Collagen dressings applied directly to the wound site seem to foster the environment necessary for these normal wound healing processes.

Our findings are consistent with research on collagen-based dressings for various wound types, which shows faster healing times when compared to conventional dressings [1]. The observed healing acceleration may be explained by collagen's capacity to draw in and activate fibroblasts, promote angiogenesis, and promote the deposition of extracellular matrix proteins such collagen type III [2]. Additionally, collagen dressings' wet environment might encourage epithelialization and reduce wound desiccation, which promotes quicker healing [3].

**Reduced problems:** The collagen dressing group's lower incidence of problems at the STSG donor site is another noteworthy discovery. It is well recognized that complications, such as infection, hematoma,

and seroma, result in slower healing, more time spent in the hospital, and more medical expenses. Our research showed that patients receiving collagen dressings experienced a significant decrease in these side effects.

Even though it was a very uncommon consequence in both groups, infection was more uncommon in the collagen dressing group (2% vs. 6%) than in the standard saline dressing group. This result raises the possibility that collagen dressings have pathogen-blocking or antibacterial effects. Its function in reducing complications is further supported by the decrease in hematoma and seroma development in the collagen dressing group.

The advantageous characteristics of collagen dressings are responsible for the decreased occurrence of problems. Collagen helps to create an environment that is anti-inflammatory, regulates immunological responses, and aids in the creation of granulation tissue, all of which may reduce the risk of problems [11-14]. Additionally, collagen dressings' ability to adapt to wound surfaces can aid in preventing fluid buildup and the development of hematomas [5].

**Patients' Reported Results and Cosmetic Assessment:** In order to evaluate the overall effectiveness of therapies, patient-reported outcomes are essential. Our study revealed that patients in the collagen dressing group reported lower levels of discomfort and increased satisfaction with wound care. Reduced pain is especially noteworthy because postoperative discomfort can have a big impact on a patient's comfort and healing.

The overall better healing experience, less problems, and better cosmetic results in the collagen dressing group of patients may be responsible for the patients' higher satisfaction with wound care. These findings highlight the significance of patient-centred outcomes in addition to objective healing metrics when assessing wound care therapies.

The benefits of collagen dressings are further supported by skilled professionals' cosmetic assessments. The superior cosmetic outcomes found in the collagen dressing group, with 80% of cases classified as "excellent," imply that collagen dressings may contribute to enhanced long-term aesthetic effects. This is particularly important for plastic and reconstructive surgery, when generating positive cosmetic results is the main objective.

**Future Directions and Clinical Relevance:** The results of this study have significant clinical application in the field of plastic and reconstructive surgery. Various skin injuries and deformities are commonly treated with STSGs, however issues at the donor sites can compromise the procedure's overall effectiveness. The use of collagen dressings in the administration of STSG donor sites may result in improved results, shortened hospital stays, lower healthcare costs, and higher patient satisfaction.

While our study offers insightful information about the advantages of collagen dressings, it does have some limitations, which should be noted. The findings' applicability to other situations may be constrained by the study's single-center design and the study's brief follow-up time. In order to confirm these findings and investigate the long-term effects of collagen dressings, additional multicentre trials with bigger sample sizes and longer follow-up are required.

Further investigation is also required to clarify the best application techniques, frequency of dressing replacements, and differences in collagen dressing types for various wound characteristics. Clinicians will be better able to adapt the usage of collagen dressings to the specific patient demands if they have a better awareness of these characteristics.

#### **4. Conclusion**

In summary, this study shows that collagen dressings are very effective at speeding up healing and minimizing problems at STSG donor sites. Improved patient-reported outcomes, faster healing times, a decreased incidence of complications, and better cosmetic evaluation all point to the potential advantages of integrating collagen dressings into routine clinical practice.

The issues of managing STSG donor sites can be addressed with the help of collagen-based dressings, which could ultimately lead to better patient results in reconstructive and cosmetic surgery. The outcomes of this study offer a solid basis for the inclusion of collagen dressings as a useful tool in the

toolbox of wound care in STSG operations, even though additional research is required to validate and build upon these findings.

#### References:

1. LAFORET EG. Wound Dressing or Window Dressing?: Je le pansay et Dieu le guarit. *AMBROISE PARÉ. Archives of Surgery.* 1974 Sep 1;109(3):457-.
2. Madden MR, Finkelstein JL, Hefton JM, Yurt RW. Optimal healing of donor site wounds with hydrocolloid dressings. An environment for healing: the role of occlusion. London: Royal Society of Medicine. 1985:133-7.
3. Hill TG. Contouring of donor skin in full-thickness skin grafting. *The Journal of dermatologic surgery and oncology.* 1987 Aug;13(8):883-8
4. Ramakrishnan KM, Jayaraman V. Management of partial-thickness burn wounds by amniotic membrane: a cost-effective treatment in developing countries. *Burns.* 1997 Mar 1;23:S33-6.
5. Smith Jr DJ, Thomson PD, Bolton LL, Hutchinson JJ. Microbiology and healing of the occluded skin-graft donor site. *Plastic and reconstructive surgery.* 1993 May 1;91(6):1094-7.
6. Prasad JK, Feller I, Thomson PD. A prospective controlled trial of Biobrane versus scarlet red on skin graft donor areas. *The Journal of Burn Care & Rehabilitation.* 1987 Sep 1;8(5):384-6.
7. Park SN, Lee HJ, Lee KH, Suh H. Biological characterization of EDC- crosslinked collagen-hyaluronic acid matrix in dermal tissue restoration. *Biomaterials.* 2003 Apr 1;24(9):1631-41. Varghese MC, Balin AK, Carter DM, Caldwell D. Local environment of chronic wounds under synthetic dressings. *Archives of dermatology.* 1986 Jan 1;122(1):52-7.
8. Nataraj C, Ritter G, Dumas S, Helfer FD, Brunelle J, Sander TW. Extracellular wound matrices: novel stabilization and sterilization method for collagen-based biologic wound dressings. *Wounds: a compendium of clinical research and practice.* 2007 Jun 1;19(6):148-56.
9. Halankar P, Cunha-Gomes D, Chaudhari C. Collagen Dressing in the management of donor site of split thickness skin grafts. *Bombar Hospital J.* 2005;47(2).
10. Dave TJ, Shashirekha CA, Krishnaprasad K. A retrospective study of comparison of collagen dressing versus conventional dressing for skin graft donor site. *International Surgery Journal.* 2021 May 28;8(6):1730-3.
11. Horch RE, Stark GB. Comparison of the effect of a collagen dressing and a polyurethane dressing on the healing of split thickness skin graft (STSG) donor sites. *Scandinavian journal of plastic and reconstructive surgery and hand surgery.* 1998 Jan 1;32(4):407-14.
12. Nagaraj S, Jambukala AY. *SAS Journal of Surgery.*
13. Pontén B, Nordgaard JO. The use of collagen film (Cutycol®) as a dressing for donor areas in split skin grafting. *Scandinavian journal of plastic and reconstructive surgery.* 1976 Jan 1;10(3):237-40.
14. Ayaz SM, Pai MV, Rai BS, Bhat RR. Comparative study between collagen dressing and conventional Vaseline gauze dressing in healing of donor site wound in split skin graft. *IOSR Journal of Dental and Medical Sciences.* 2016;15(10):34-41.