

A COMPARATIVE STUDY ON SILVER SULFADIAZINE WITH COLLAGEN DRESSING IN BURNS PATIENT

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ABSTRACT

Background: Burn injuries are a significant public health issue, particularly in resource-limited settings. Silver sulfadiazine (SSD) has long been used for burn wound care, but recent evidence suggests that collagen-based dressings may promote faster healing with less pain and better scarring outcomes. This study compares the efficacy of SSD and collagen dressing in second-degree burn patients. **Materials and Methods:** A prospective, randomized controlled trial was conducted at Dhanalakshmi Srinivasan Medical College involving 32 patients with second-degree burns affecting 20-50% total body surface area. Patients were randomly assigned to either SSD (n=16) or collagen dressing (n=16). Primary outcomes included wound healing (epithelialization $\geq 90\%$ by day 7), pain (measured by Visual Analog Scale), hospital stay, scar quality, and complications. Statistical analysis was performed using chi-square and t-tests. **Results:** By Day 7, complete healing was observed in 87.5% of patients in the collagen group versus 62.5% in the SSD group ($p < 0.001$). Mean pain scores on Day 7 were significantly lower in the collagen group (1.2 ± 0.8) compared to the SSD group (3.6 ± 0.9 ; $p < 0.001$). The average hospital stay was also shorter in the collagen group (8.6 ± 2.1 days) versus the SSD group (12.3 ± 2.5 days; $p < 0.001$). Good scar formation was noted in 93% of the collagen group compared to 68% in the SSD group. Fewer infections and complications occurred in the collagen group. **Conclusion:** Collagen dressings were significantly more effective than SSD in promoting faster healing, reducing pain, shortening hospital stays, and improving scar quality in second-degree burn patients. Collagen should be considered a preferred alternative to SSD in clinical burn management.

INTRODUCTION

Burn injuries represent a major public health challenge, particularly in low- and middle-income countries where access to specialized wound care is limited. With over 180,000 deaths globally each year due to burn-related complications, effective wound management strategies are essential to improve patient outcomes.^[1] The primary goals in burn wound care include infection control, pain reduction, promotion of reepithelialization, and minimization of scarring. Silver sulfadiazine (SSD) has been widely used for decades as a topical antimicrobial agent for burn wounds. It exerts bactericidal action by disrupting bacterial DNA and inhibiting metabolic processes.^[1] However, recent studies have raised concerns regarding SSD's impact on wound healing. In particular, SSD has been associated with delayed epithelialization, pseudo-eschar formation, and

cytotoxic effects on keratinocytes and fibroblasts.^[2] Moreover, repeated dressing changes with SSD can be painful and increase treatment costs.^[3]

As a response to these challenges, collagen-based dressings have emerged as a biologically active alternative. Collagen provides a structural matrix that facilitates cell migration, angiogenesis, and tissue remodeling. A randomized trial using collagen-rich tilapia fish skin dressing showed accelerated reepithelialization, reduced pain, and lower healthcare costs compared to SSD in superficial partial-thickness burns.^[4] In animal models, stromal vascular fraction (SVF) therapy has also been shown to enhance collagen deposition and fibroblast proliferation more effectively than SSD, pointing to the regenerative advantage of biologically active materials.^[5]

Another comparative study found that silver-releasing foam dressings, while antimicrobial, resulted in faster wound area reduction and better

healing rates than SSD in diabetic foot ulcers, suggesting that dressing composition plays a significant role in wound recovery.^[6] Furthermore, the use of nanocrystalline silver-based dressings, compared with SSD, led to better outcomes in deep dermal burns with lower infection rates and faster healing.^[7] However, these advanced dressings may be cost-prohibitive and less accessible in low-resource settings. Innovative dressing systems, such as silver sulfadiazine-loaded nanofiber mats, are being investigated for their controlled drug-release and improved antibacterial activity. Yet, their clinical utility remains experimental at this stage.^[8]

Taken together, current evidence suggests that while SSD remains a cornerstone in burn treatment, collagen-based dressings may offer significant advantages in terms of healing speed, patient comfort, and cost-effectiveness. Therefore, a direct comparative clinical evaluation between silver sulfadiazine and collagen dressings in burn patients is warranted to inform clinical decision-making and optimize wound care strategies.

Aim

To compare the effectiveness between silver sulfadiazine and collagen dressing in patients with burns wound.

Objectives

- To compare progression of granulation tissue as percentage of total ulcer surface area
- To compare the average duration of hospital stay and pain scores.

REVIEW OF LITERATURE

D. Shankar (2024)^[9]

The study found that the use of nanocrystalline silver with collagen base cream resulted in enhanced epithelialization and granulation tissue formation, with a greater reduction in slough compared to the application of 1% silver sulfadiazine cream. This was evidenced by the early and increased appearance of granulation tissue in the wounds treated with nanocrystalline silver.

Patients treated with nanocrystalline silver with collagen base cream experienced a shorter mean hospital stay, indicating a more effective healing process and a reduction in healing time and necrotic tissue compared to those treated with 1% silver sulfadiazine cream.

Liman Kumar Dhar (2022)^[10]

The study found that the collagen sheet dressing resulted in significantly better healing quality compared to the 1% silver sulfadiazine dressing, with a mean complete healing time of 10.47±2.21 days for the collagen group versus 13.07±2.33 days for the SSD group (p<0.001).

There was no significant difference in the infection rate between the two groups (p>0.05), but the collagen sheet dressing was associated with decreased pain and reduced need for analgesics,

indicating a more favorable overall outcome for patients treated with collagen sheets.

Ram Kumar (2022)^[11]

The study found that patients using collagen dressings experienced a faster healing rate, with an average duration of healing of 15.9 days compared to those using conventional silver sulphadiazine dressings.

Infections were significantly reduced in the collagen dressing group, with only 5 out of 35 patients developing infections, and Staphylococcus Aureus was identified as the most common offending organism.

Sunil Mathew (2021)^[12]

The study found that patients treated with collagen dressings (group I) experienced significantly lower pain scores compared to those treated with silver sulfadiazine dressings (group II). On day 1, the mean pain score for the collagen group was 4.8, while the silver sulfadiazine group had a score of 7.4. This trend continued on day 3 (3.7 vs. 5.1) and day 7 (2 vs. 3.5), with a statistically significant reduction in pain for the collagen group (p < 0.0001).

The average healing time for patients in the collagen dressing group was 12.94 days, significantly faster than the 17.17 days observed in the silver sulfadiazine group, with a p-value of less than 0.0001.

Additionally, the collagen group demonstrated better scar formation and required fewer dressings, making it a more cost-effective option for managing partial thickness burns.

A Singh (2020)^[13]

In the study, patients treated with collagen dressing (group A) experienced complete healing in 5-7 days for 59% of cases, while those treated with paraffin gauze plus silver sulfadiazine (group B) healed in 8-12 days for 66.66% of cases. This indicates that collagen dressing may lead to faster healing times for superficial partial thickness burns.

Additionally, 95.5% of patients in group A required analgesia for 2 days or less, compared to 90.90% of patients in group B who needed analgesia for 6 days or more. This suggests that collagen dressing provides better pain relief and requires fewer dressing changes, resulting in a shorter hospital stay and less trauma to the wound surface.

Milind A. (2019)^[14]

The study found that in the group treated with silver-sulfadiazine-impregnated collagen (SIC), improved wound healing was observed in all patients after 7 days, with only two patients requiring skin grafting, and no serious complications reported.

In contrast, the group treated with conventional dressings showed improved wound healing in only 14 patients, while the remaining patients required prolonged dressing or skin grafting, indicating that SIC was more effective in managing second-degree burn wounds.

MATERIALS AND METHODS

Study Design and Setting

This study was designed as a prospective, randomized controlled trial (RCT) conducted over a period of six months at the Department of General Surgery, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur.

Sample Size and Allocation

A total of 32 patients who presented with second-degree burns involving 20-50% of body surface area (BSA) were enrolled in the study. After meeting inclusion criteria and obtaining informed consent, participants were randomly allocated into two equal groups (n = 16 each):

- Group 1: Treated with 1% Silver Sulfadiazine (SSD) cream.
- Group 2: Treated with Collagen dressing.

Inclusion Criteria

- Patients with second-degree burns involving 20-50% of total BSA.
- Presentation within 48 hours of injury.
- Clinically and hemodynamically stable.
- Provided informed written consent for participation.

Exclusion Criteria

- Burns involving less than 20% of BSA.
- Full-thickness (third-degree) burns.
- Patients presenting more than 48 hours after burn injury.
- Hemodynamically unstable patients.
- Patients with significant chronic illnesses (e.g., diabetes, immunosuppression).

Data Collection Procedure

All patients presenting to the surgery outpatient department (OPD) or emergency department with burns were screened. Eligible patients were subjected to thorough clinical examination and detailed history taking.

Group 1 (Silver Sulfadiazine Treatment)

- The wound was cleaned and 1% SSD cream was applied.
- The wound was then covered with sterile gauze and secured with a roller bandage.
- The first dressing change occurred 48 hours after initial application.
- Subsequent dressings were changed every alternate day.
- Patients were advised to bathe every two days using soap prior to dressing changes.

Group 2 (Collagen Dressing Treatment)

- Wounds were cleaned with sterile normal saline under aseptic conditions.
- Local anesthesia was administered if required.
- Collagen dressing was applied and secured using paraffin gauze and outer sterile dressing.
- A wound swab for culture and sensitivity was collected prior to dressing.
- Antibiotics were initiated and adjusted based on culture results.
- Dressing remained undisturbed for 7 days unless clinical parameters (e.g., excessive discharge, fever, pain) indicated otherwise.

Monitoring and Follow-Up

Patients were monitored throughout their hospital stay using:

- **Clinical Parameters:** Pain, fever, wound discharge, and dressing soakage.
- **Hematological Parameters:** Complete blood count (CBC) monitored on alternate days.
- On the seventh day, dressings were removed and wounds were evaluated based on:
 - Presence of granulation tissue.
 - Degree of epithelization.
 - Wound size reduction.
 - Presence of slough or infection.

Outcome Measures

Primary and secondary outcomes were assessed as follows:

- **Pain Assessment:** Visual Analog Scale (VAS) scores recorded on Days 2, 7, and 14.
- **Wound Healing:** Percentage of wound epithelization on Day 7 ($\geq 90\%$ epithelization considered complete healing).
- **Hospital Stay:** Total duration of inpatient admission.
- **Scar Outcome:** Clinically evaluated at the end of follow-up.
- **Complications:** Documented if any (e.g., infection, delayed healing, poor scarring).

Ethical Consideration

The study was approved by the Institutional Ethics Committee of Dhanalakshmi Srinivasan Medical College.

Written informed consent was obtained from all participants. Confidentiality and patient rights were strictly maintained throughout the study.

RESULTS

Patients were followed up for a period of 6 weeks or until complete re-epithelialization was observed.

Wound Healing on Day 7

The degree of wound healing was assessed on Day 7 based on the presence of $>90\%$ epithelialization. The comparison is shown below:

Table 1: Wound Healing Status on Day 7

Healing status on Day 7	Silver Sulfadiazine (n=16)	Collagen Dressing (n=16)
Complete Healing (>90%)	10 (62%)	14 (87%)
Incomplete Healing (<90%)	6 (38%)	2 (13%)

By Day 7, 87.5% of patients (14 out of 16) in the Collagen group showed complete wound healing compared to 62.5% (10 out of 16) in the Silver Sulfadiazine group. This suggests faster re-epithelialization with collagen

dressing and this association was statistically significant ($\chi^2 = 8.83, p < 0.001$)

2. Pain Scores (Visual Analog Scale)

Pain was evaluated on Days 2 and 7 using the Visual Analog Scale (VAS) from 0 (no pain) to 10 (worst pain).

Table 2: Mean Pain Scores (VAS)

Time point	Silver Sulfadiazine (Mean± SD)	Collagen Dressing (Mean± SD)
Day 2	6.8± 1.1	4.1± 1.3
Day 7	3.6± 0.9	1.2± 0.8

Patients in the Collagen group consistently reported lower pain scores on both Day 2 and Day 7. The difference was more pronounced on Day 7, where most collagen-treated patients were pain-free or

experienced only mild discomfort, while those in the SSD group continued to report moderate pain. This difference was statistically significant ($t = 6.18, p < 0.001$).

3. Duration of Hospital Stay

Table 3: Mean Duration of Hospital Stay

Group	Mean Duration (Days) ± SD
Silver Sulfadiazine	12.3± 2.5
Collagen Dressing (Mean± SD)	8.6± 2.1

The average hospital stay for patients treated with collagen was significantly shorter (8.6 days) compared to those treated with silver sulfadiazine (12.3 days). This reflects faster healing and reduced need for dressing changes in the collagen group. This

difference was statistically significant ($t = 11.18, p < 0.001$)

4. Scar Outcome and Complications

Scarring and complications such as infection or delayed healing were monitored throughout follow-up.

Table 4: Scar and Complication Summary

Outcome	Silver Sulfadiazine (n=16)	Collagen Dressing (n=16)
Good Scar Formation	11 (68%)	15 (93%)
Mild Hypertrophy	5 (32%)	1 (7%)
Wound Infection	3 (18%)	1 (6%)
Incomplete Healing	2 (12%)	1 (6%)

The Collagen group showed better scar quality, with 15 out of 16 developing cosmetically favourable scars and fewer complications such as infection or delayed healing. In contrast, the Silver Sulfadiazine group had a higher rate of minor infections and suboptimal scar outcomes. This association was statistically significant ($\chi^2 = 5.53, p = 0.021$) Faster healing and higher rate of complete epithelization were observed in the collagen group by Day 7. Patients receiving collagen dressing reported less pain and required fewer dressing changes. Shorter hospital stay and better scar quality were associated with collagen dressing. Complications such as infection and poor healing were less frequent in the collagen group.





DISCUSSION

A total of 32 patients were randomized equally into two groups: silver sulfadiazine (SSD) and collagen dressing. On Day 7, complete wound healing (>90% epithelialization) was observed in 87.5% of the collagen group versus 62.5% in the SSD group, indicating faster healing with collagen. Pain scores were consistently lower in the collagen group. On Day 2, the mean VAS was 4.1 compared to 6.8 in the SSD group; by Day 7, scores dropped to 1.2 and 3.6 respectively, showing significantly better pain relief with collagen.

The average hospital stay was shorter in the collagen group (8.6 days) than the SSD group (12.3 days). Scar quality was also better with collagen—15 out of 16 had good scars, compared to 11 in the SSD group. Minor complications like infections and delayed healing were more common in the SSD group. Overall, collagen dressings led to quicker healing, less pain, fewer complications, and better scar outcomes.

The present study demonstrates that collagen dressing is more effective than silver sulfadiazine (SSD) in promoting wound healing in second-degree burn patients. By Day 7, 87.5% of patients in the collagen group achieved complete epithelialization, significantly higher than the 62.5% in the SSD group.

Additionally, collagen dressing was associated with lower pain scores, shorter hospital stay, and better scar quality. These findings are consistent with previous studies comparing traditional and biologically active dressings for burn management. Our findings align closely with a study by Singh et al., which reported that collagen dressings led to faster wound closure and reduced discomfort compared to SSD in burn and chronic wound patients (Singh et al., 2011).^[15] Similarly, Cardoso et al. (2016) found that stromal vascular fraction therapy significantly enhanced fibroblast proliferation and collagen deposition compared to SSD, leading to accelerated healing in animal burn models (Cardoso et al., 2016).^[16]

Pain management is a critical factor in burn treatment. In our study, the collagen group experienced significantly less pain by both Day 2 and Day 7. This is consistent with the findings of Wattanaploy et al. (2017), who observed that patients treated with polyhexanide/betaine gel had significantly lower pain scores than those treated with SSD, despite comparable healing times (Wattanaploy et al., 2017).^[17]

In terms of healing time, a randomized trial by Abdullahzadeh and Shafiee (2021) showed that patients treated with sea buckthorn cream healed faster than those treated with 1% SSD, emphasizing that newer biologically active dressings often outperform SSD in both healing duration and patient comfort (Abdullahzadeh & Shafiee, 2021).^[18] Although SSD remains a widely used and affordable treatment option, its limitations are well-documented.

According to a comprehensive review by Shrestha et al. (2024), silver dressings including SSD can delay wound healing due to cytotoxic effects and require frequent dressing changes, increasing the risk of pain and infection (Shrestha et al., 2024).^[19]

In contrast, collagen dressings provide a biocompatible scaffold that promotes cell migration, angiogenesis, and epithelialization. Zimba et al. (2024) highlighted the benefits of collagen-rich tilapia fish skin, which, like the collagen sheets used in our study, creates a moist, protective environment and accelerates wound repair (Zimba et al., 2024).^[1] Finally, our findings also echo those of Adhya et al. (2015), who found that nanocrystalline silver was more effective than SSD in deep-dermal burns, reinforcing the growing consensus that SSD is no longer the optimal standard for all burn cases (Adhya et al., 2015).^[7]

In summary, the superiority of collagen dressing over silver sulfadiazine in our study is consistent with a wide body of literature. Collagen promotes faster healing, reduces pain, lowers complication rates, and improves patient satisfaction. These findings support the use of collagen dressings as a preferable alternative to SSD in second-degree burn management, particularly in settings where rapid recovery and comfort are prioritized.

CONCLUSION

This randomized controlled study demonstrated that collagen dressings are significantly more effective than silver sulfadiazine (SSD) in the management of second-degree burns. Patients treated with collagen showed faster epithelialization, significantly lower pain scores, shorter hospital stays, fewer complications, and better scar quality. These outcomes suggest that collagen not only enhances the biological healing process but also improves the overall patient experience and recovery.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

Clinical Practice: Collagen dressings should be considered as a preferred treatment option over silver sulfadiazine for patients with superficial to deep second-degree burns due to their superior healing outcomes and reduced need for frequent dressing changes.

Pain Management: Collagen dressings are beneficial for pain reduction and should be used particularly in pediatric or pain-sensitive patient populations.

Limitations

While the study presents encouraging results, certain limitations must be acknowledged:

Small Sample Size: The study was conducted on a limited number of patients (n=32), which may affect the generalizability of the findings.

Single-Center Study: The study was conducted in a single tertiary care hospital, which may limit external validity across different healthcare settings.

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