ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 07 | July - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPARATIVE EVALUATION OF COLLAGEN DRESSING VERSUS SILVER SULFADIAZINE IN PARTIAL-THICKNESS BURNS: A CONTROLLED CLINICAL STUDY OF PAIN TRAJECTORY, INFECTION RATES, SCAR QUALITY, AND PHARMACOECONOMIC OUTCOMES

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ABSTRACT

Background: Partial-thickness burns are commonly managed with topical dressings intended to control pain, limit infection, promote healing, and reduce long-term scar morbidity. Silver sulfadiazine (SSD) has traditionally been used for burn wound care, but collagen dressings may offer advantages in pain control, wound environment modulation, and overall recovery.**Objective:** To compare collagen dressing with silver sulfadiazine in patients with partial-thickness burns with respect to pain reduction, infection-related outcomes, scar quality, and total treatment cost. **Methods:** This controlled comparative clinical study included 100 patients with partial-thickness burns allocated into two groups: collagen dressing (n=50) and silver sulfadiazine dressing (n=50). Pain was assessed using the Visual Analog Scale (VAS) on days 1, 3, and 7. Infection outcomes included incidence of clinical wound infection and wound culture positivity. Scar outcomes included pigmentation, pliability, and hypertrophy. Cost analysis was performed using total pharmacoeconomic burden. Categorical variables were analyzed using Chi-square/Fisher's exact test, continuous variables with independent t-test or Mann-Whitney U test, and longitudinal pain changes with repeated-measures ANOVA. Because sphericity was violated, Greenhouse-Geisser correction was applied .**Results:** Baseline total body surface area (TBSA) differed significantly between groups, with larger burns in the SSD group (10.46 ± 6.34 vs 14.34 ± 4.39; p<0.001)

- .Day 1 pain scores showed borderline difference (p=0.059), but day 3 pain differed significantly in favor of collagen (p=0.025)
- .By day 7, the difference was borderline significant (p=0.067)

Repeated-measures ANOVA demonstrated a highly significant effect of time (F=7861.495, p<0.001), a significant time-by-group interaction (F=3.308, p=0.038), and a significant between-subjects group effect (F=62.864, p<0.001), indicating superior pain reduction trajectory with collagen .Clinical wound infection occurred in 48.0% of the collagen group versus 86.0% of the SSD group (p<0.001)
Total treatment cost was significantly lower in the collagen group (INR 2968.00 ± 1110.33 vs INR 4734.00 ± 1173.62; p<0.001) After adjustment for TBSA, treatment group remained an independent determinant of cost (F=41.989, p<0.001) **Conclusion** Collagen dressing demonstrated superior clinical performance compared with silver sulfadiazine in partial-thickness burns, particularly in pain reduction trajectory, infection control, scar quality, and overall cost-effectiveness. These findings support collagen dressing as an effective and economically favorable alternative in burn wound management.

KEYWORDS

Partial-thickness Burns, Collagen Dressing, Silver Sulfadiazine, Vas Pain Score, Wound Infection, Scar Quality, Pharmacoeconomics

INTRODUCTION

Burn injuries remain a significant cause of morbidity, with partial-thickness burns posing major challenges in terms of pain, infection, healing, scar formation, and healthcare expenditure. An ideal burn dressing should reduce pain, protect the wound from microbial contamination, support re-epithelialization, and minimize long-term scar deformity.

Silver sulfadiazine has long been used as a standard topical therapy in burn care. Despite its antimicrobial role, frequent dressing changes, pseudo-eschar formation, and repeated wound manipulation may negatively affect patient comfort and wound progression. Collagen dressings, in contrast, have emerged as biologically active wound coverings that may maintain a moist environment, reduce mechanical trauma, and facilitate faster tissue repair.

Pain is one of the most distressing symptoms in burn patients and directly affects quality of life and compliance with wound care. The Visual Analog Scale (VAS) is a sensitive and widely used instrument for quantifying pain intensity in clinical studies Alongside pain control, infection prevention and scar quality are critical determinants of successful burn management.

The present study was designed to compare collagen dressing and silver sulfadiazine in patients with partial-thickness burns across multiple clinically relevant domains, including pain trajectory, wound infection, scar characteristics, and total economic burden.

Materials And Methods

Study design and setting

This was a controlled comparative clinical study conducted on patients with partial-thickness burns. A total of 100 patients were enrolled and allocated into two treatment groups: collagen dressing (n=50) and silver sulfadiazine dressing (n=50)

Study population

Patients diagnosed with partial-thickness burns and meeting study eligibility criteria were included. Each arm contained 50 patients.

Interventions

One group received collagen dressing, while the comparison group received silver sulfadiazine dressing according to institutional burn wound care practices.

Outcome measures

1)Primary outcome
The primary outcome was pain trajectory assessed using the Visual Analog Scale (VAS) on day 1, day 3, and day 7
2)Secondary outcomes

Secondary outcomes included:

- Clinical wound infection
- Wound culture positivity
- Scar pigmentation
- Scar pliability
- Scar hypertrophy
- Total pharmacoeconomic burden

Statistical analysis

Categorical variables were analyzed using Chi-square test or Fisher's exact test, while continuous variables were analyzed using independent Student's t-test or Mann-Whitney U test, as appropriate

Repeated pain assessments were analyzed using repeated-measures ANOVA. Mauchly's test demonstrated violation of sphericity ($p<0.001$); therefore, Greenhouse-Geisser correction was applied for valid within-subject inference . A p-value <0.05 was considered statistically significant, and all tests were two-tailed

Ethical considerations

An institutional ethics approval statement and patient consent statement should be inserted here exactly as per your thesis/institutional records. Cureus requires a clear ethics/IRB declaration. If you share the exact ethics approval number and committee name, I can format it properly.

RESULTS

Baseline characteristics

Most baseline variables were comparable between groups, though some differences were noted. Mean age was 31.96 ± 14.29 years in the collagen group and 38.20 ± 12.32 years in the SSD group ($p=0.021$)

Gender distribution did not differ significantly ($p=0.342$)
Anatomical site distribution was borderline different ($p=0.055$)

Mean TBSA was significantly lower in the collagen group than in the SSD group (10.46 ± 6.34 vs 14.34 ± 4.39; $p<0.001$), indicating a baseline imbalance that was later addressed in adjusted analysis

Pain trajectory

- Day 1 pain

Day 1 VAS scores showed a borderline difference between groups ($p=0.059$)

In the collagen group, most patients had VAS score 7 (60.0%), while in the SSD group the pain distribution was shifted toward higher scores

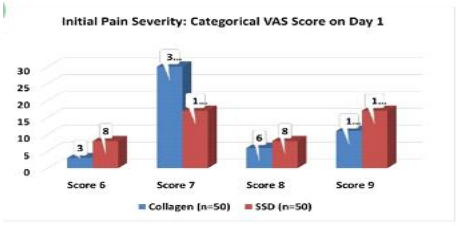

Figure 8 Bar chart for Initial Pain Severity: Categorical VAS Score on Day 1

- Day 3 pain

By day 3, pain reduction was significantly better in the collagen group ($p=0.025$)

In the collagen arm, 60.0% of patients had VAS score 4 compared with 34.0% in the SSD arm, while higher pain scores remained more frequent in the SSD group

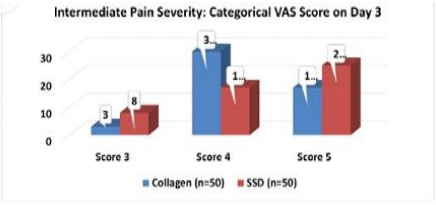

Figure 9 Bar chart for Intermediate Pain Severity: Categorical VAS Score on Day 3

- Day 7 pain

By day 7, pain levels improved in both groups, and the difference approached significance ($p=0.067$)

Lower pain categories remained more common in the collagen group

Repeated-measures ANOVA

Repeated-measures ANOVA demonstrated a highly significant main effect of time ($F=7861.495$, $p<0.001$), confirming marked pain reduction over time in both treatment groups

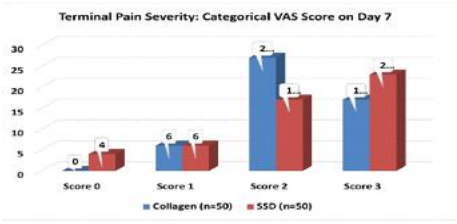

Figure 10 Bar chart for Terminal Pain Severity: Categorical VAS Score on Day 7

A significant time × group interaction effect ($F=3.308$, $p=0.038$) indicated that the pattern of pain reduction differed between treatments

The between-subjects group effect was also significant ($F=62.864$, $p<0.001$), supporting superior pain reduction with collagen dressing overall

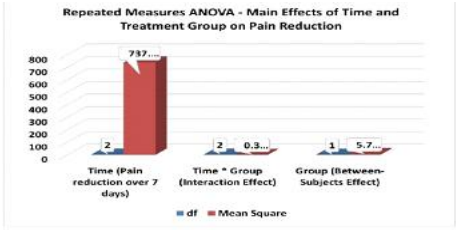

Figure 22 Bar chart for Repeated Measures ANOVA - Main Effects of Time and Treatment Group on Pain Reduction

Infection outcomes

Clinical wound infection occurred in 24 of 50 patients (48.0%) in the collagen group and 43 of 50 patients (86.0%) in the SSD group, a highly significant difference ($p<0.001$)

Wound culture positivity also differed significantly between groups, paralleling the clinical infection findings

Scar outcomes

Scar-related outcomes favored collagen dressing. Scar pliability differed significantly between groups ($p<0.001$), with severe scar rigidity observed in only 2.0% of the collagen group compared with 48.0% of the SSD group Scar hypertrophy followed a similar distribution, with severe hypertrophy in 2.0% of collagen-treated patients versus 48.0% in the SSD group

Scar pigmentation was also significantly better in the collagen group ($p<0.001$)

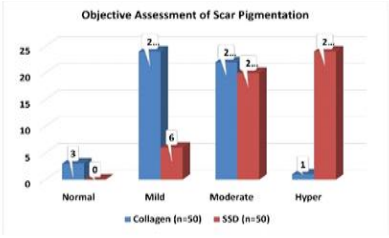

***Figure 15 Bar chart for* Objective Assessment of Scar Pigmentation**

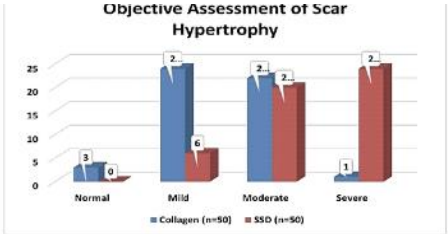

***Figure 17 Bar chart for* Objective Assessment of Scar Hypertrophy**

Final outcome
All patients in both groups recovered, with no difference in final clinical outcome (100% recovery in both arms; p=1.000)

Economic analysis
The mean total cost of treatment was significantly lower in the collagen group than in the SSD group (INR 2968.00 ± 1110.33 vs INR 4734.00 ± 1173.62; p<0.001)

Because TBSA differed significantly at baseline, ANCOVA was performed to adjust total cost for burn size. TBSA independently influenced total cost (F=43.948, p<0.001), but treatment group remained an independent and highly significant predictor of cost (F=41.989, p<0.001)

The adjusted R-squared of the model was 0.564

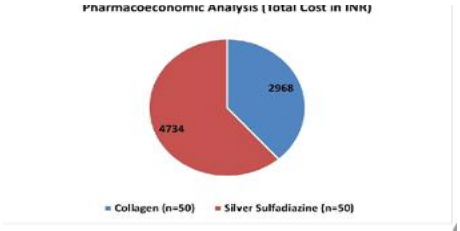

Figure 20 Bar chart for Pharmacoeconomic Analysis (Total Cost in INR)

DISCUSSION

This study demonstrates that collagen dressing provides clinically meaningful advantages over silver sulfadiazine in the management of partial-thickness burns. The most important findings were a superior pain reduction trajectory, significantly lower rates of clinical wound infection, improved scar quality, and lower overall treatment cost with collagen dressing.

Pain is a major determinant of patient distress and treatment tolerance in burn care. In the present study, day 1 pain scores showed only borderline significance, suggesting relatively similar initial nociceptive burden between groups However, by day 3, the collagen group showed significantly lower pain scores, indicating earlier and more effective pain attenuation .

The repeated-measures ANOVA confirmed that although pain declined in both groups over time, the reduction pattern was significantly more favorable in the collagen arm This may be explained by the adherent and protective nature of collagen dressings, which likely reduce repeated wound trauma during dressing changes.

Infection control is another core objective of burn management. The markedly lower clinical infection rate in the collagen group suggests that collagen provides a more favorable wound environment than SSD in this study population Culture results reportedly paralleled clinical findings, strengthening the reliability of this observation Reduced infection may also contribute to better healing quality and shorter treatment duration. Scar quality outcomes were also notably better with collagen. The collagen group demonstrated better pigmentation, pliability, and hypertrophy profiles, while SSD-treated wounds showed a greater tendency toward severe scar deformity Since scar outcome has both functional and cosmetic importance, this finding reinforces the longer-term benefit of collagen dressing beyond early wound closure.

A particularly relevant strength of this study is the economic analysis. Although the SSD group had a significantly larger mean TBSA at baseline , the adjusted cost analysis confirmed that treatment modality itself remained an independent determinant of total cost even after controlling for burn size

This suggests that the cost advantage of collagen was not simply due to smaller injuries, but reflected a genuine reduction in resource use, likely through faster recovery and fewer complications.

The study also has limitations. The baseline imbalance in age and TBSA may have influenced unadjusted outcomes, although ANCOVA was used to address cost confounding

Additional methodological details such as allocation method, blinding, inclusion/exclusion criteria, duration of follow-up for scar assessment, and exact microbiological profile would strengthen the manuscript further and should be incorporated from the full thesis before submission.

Overall, the findings support collagen dressing as an effective and economically advantageous alternative to silver sulfadiazine in partial-thickness burn care.

Limitations
This study had certain limitations. There were baseline differences in age and TBSA between the groups, with the SSD arm having older patients and larger burns on average Although statistical adjustment was applied for cost analysis, residual confounding may remain for some clinical outcomes. In addition, details regarding randomization, allocation concealment, blinding, and long-term scar follow-up need to be explicitly reported in the final manuscript if available in the thesis.

CONCLUSIONS

Collagen dressing was associated with better pain reduction over time, lower infection rates, improved scar outcomes, and reduced total treatment cost compared with silver sulfadiazine in patients with partial-thickness burns. Even after adjustment for baseline TBSA, treatment choice remained an independent determinant of cost. Collagen dressing appears to be a clinically effective and economically favorable option for burn wound management.

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