Original Article

Comparison of the Effects of Alloderm and Agi Coat Dressings on the Recovery of Second-Degree Burn Patients Without the Need for Skin Grafting: A Randomized Clinical Trial

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ABSTRACT

Background: Second-degree burns are among the most common cutaneous injuries, and appropriate wound dressing plays a critical role in accelerating healing, reducing pain, and improving clinical outcomes. We aimed to compare the therapeutic efficacy of Alloderm and Agi coat dressings in patients with second-degree burns not requiring skin grafting.

Methods: In this double-blind randomized clinical trial, 40 patients with second-degree burns admitted to Taleghani Hospital, Ahvaz, Iran, in 2025 were randomly enrolled to receive either Agi coat or Alloderm dressing. Pain intensity during dressing changes was assessed on days 4, 8, and 16 using the Visual Analog Scale (VAS). Wound healing rate, incidence of infection, duration to complete epithelialization, scar severity based on the Vancouver Scar Scale (VSS), and length of hospital stay were compared between the two groups.

Results: No significant difference was observed in the mean total burn surface area between the Agi coat and Alloderm groups (29.5% vs. 27.84%, P=0.07). Patients treated with Alloderm had a significantly shorter hospital stay compared with the Agi coat group (12.28 ± 2.49 vs. 16.70 ± 3.33 days, P=0.04). Pain scores were significantly lower in the Alloderm group on both day 4 (4.02 ± 2.30 vs. 6.36 ± 1.87, P<0.001) and day 8 (1.14 ± 1.21 vs. 2.82 ± 1.20, P<0.001). Complete epithelialization occurred faster in the Alloderm group (13.64 ± 3.16 vs. 16.04 ± 3.75 days, P=0.001). However, scar severity was significantly lower in the Agi coat group according to VSS scores (P<0.001). Infection rates were comparable between groups (P=0.372).

Conclusion: Alloderm dressing was associated with reduced pain, accelerated wound healing, and shorter hospitalization in second-degree burn patients, whereas Agi coat demonstrated superior scar quality outcomes.

KEYWORDS
Second-degree burn; Alloderm; Agi coat; epithelialization; scar formation; Vancouver Scar Scale

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INTRODUCTION

Second-degree burns, also known as partial-thickness burns, represent one of the most common forms of thermal injury encountered in burn and reconstructive surgery. These injuries involve complete destruction of the epidermis with variable extension into the dermis and are generally classified as superficial or deep partial-thickness burns according to the depth of dermal involvement [1].

Clinically, these burns are characterized by erythema, blister formation, severe pain, and exudative wound surfaces due to preservation of viable dermal nerve endings [2].

Healing burn wounds as soon as possible not only reduces complications, pain, and costs, but also leads to better cosmetic and functional outcomes. Burn wounds are more likely to become infected due to the large size and accumulation of dead tissue, as well as a weakened immune system[3].

Although superficial partial-thickness burns may heal spontaneously within 10–21 days, deeper dermal involvement is frequently associated with delayed epithelialization, hypertrophic scarring, infection, prolonged hospitalization, and impaired functional and aesthetic outcomes. Therefore, optimizing wound management remains a major priority in contemporary burn care[4].

In recent years, advances in wound-healing biology have led to the development of modern dressings designed to improve tissue regeneration while minimizing local inflammation and microbial colonization[5].

Among these, silver-containing dressings have gained considerable attention because of their broad-spectrum antimicrobial activity and anti-inflammatory properties. Nanocrystalline silver dressings such as Agi coat release biologically active silver ions (Ag^+), which disrupt bacterial cell membranes, interfere with enzymatic activity, and inhibit microbial DNA replication[6].

These effects provide effective coverage against common burn wound pathogens, including *Staphylococcus aureus* and *Pseudomonas aeruginosa* [7].

In addition, sustained silver ion release allows prolonged antimicrobial activity with fewer dressing changes, thereby reducing wound manipulation and patient discomfort [8].

Despite these advantages, concerns remain regarding the potential cytotoxic effects of silver on keratinocytes and fibroblasts, which may adversely affect epithelialization and long-term scar quality [9].

Polyurethane foam dressings such as Alloderm have emerged as promising options for the treatment of partial-thickness burns. These semi-permeable dressings are designed to absorb excess exudate while preserving a moist wound microenvironment that facilitates keratinocyte migration and cellular proliferation [10]. Their multilayer structure also provides thermal insulation and mechanical protection of the wound bed while functioning as a barrier against external contamination [11].

Favorable outcomes with foam dressings in terms of patient comfort, wound healing, and reduction of hospitalization duration is reported [12].

Although numerous investigations have evaluated silver-containing dressings in burn care, limited evidence exists regarding direct comparisons between Agi coat and Alloderm dressings in patients with second-degree burns managed conservatively without skin grafting. Moreover, data concerning their comparative effects on pain severity, epithelialization rate, infection control, scar formation, and hospital stay remain insufficient, particularly in Middle Eastern burn populations [13, 14].

We aimed to compare the therapeutic efficacy of Alloderm and Agi coat dressings in patients with second-degree burns not requiring skin grafting.

MATERIALS AND METHODS

Study Design and Participants

This double-blind randomized clinical trial was conducted on 40 patients with second-degree burns admitted to Taleghani Burn Hospital, Ahvaz, Iran, in 2025.

Eligible patients were aged 8–70 years and had partial-thickness burns involving 10%–30% of the total body surface area (TBSA). Patients with significant underlying comorbidities, clinically evident wound infection, or hypersensitivity to silver- or aluminum-containing dressings were excluded.

Randomization and Blinding

Participants were randomly allocated in a 1:1 ratio to receive either Agi coat or Alloderm dressing using computer-generated block randomization (block size = 4) through the Sealed Envelope web-based

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randomization system. Allocation concealment was achieved using sequentially numbered opaque sealed envelopes.

The study was designed as a double-blind trial. Patients and nursing staff involved in wound care assessment were blinded to treatment allocation. Dressings were prepared in a similar manner to maintain blinding; however, the treating surgeon was aware of the assigned intervention.

Intervention and Follow-Up

Following initial burn evaluation and standard supportive care, patients received either Agicoat or Alloderm dressings according to randomization assignment. Dressings were changed every four days under sterile conditions. At each dressing change, wound healing was independently evaluated by a burn surgeon and a trained nurse, and the percentage of epithelialization was documented. Serial wound photographs were also obtained during follow-up. Treatment continued until complete epithelialization was achieved.

Patients were simultaneously monitored for clinical signs of wound infection, including purulent discharge, progressive erythema, edema, and malodor.

Outcome Measures

The primary outcomes included pain severity, epithelialization rate, scar quality, infection rate, and duration of hospitalization.

Pain intensity during dressing changes was assessed on days 4, 8, and 16 using the Visual Analog Scale (VAS), scored from 0 (no pain) to 10 (worst imaginable pain).

Scar quality was evaluated using the Vancouver Scar Scale (VSS), which assesses vascularity, pigmentation, pliability, and scar height, with total scores ranging from 0 to 13; higher scores indicate more severe scar formation [13].

The consolidated standards of reporting trials (CONSORT) flow diagram are shown in Figure 1, documenting the flow of participants through the different stages of the study.

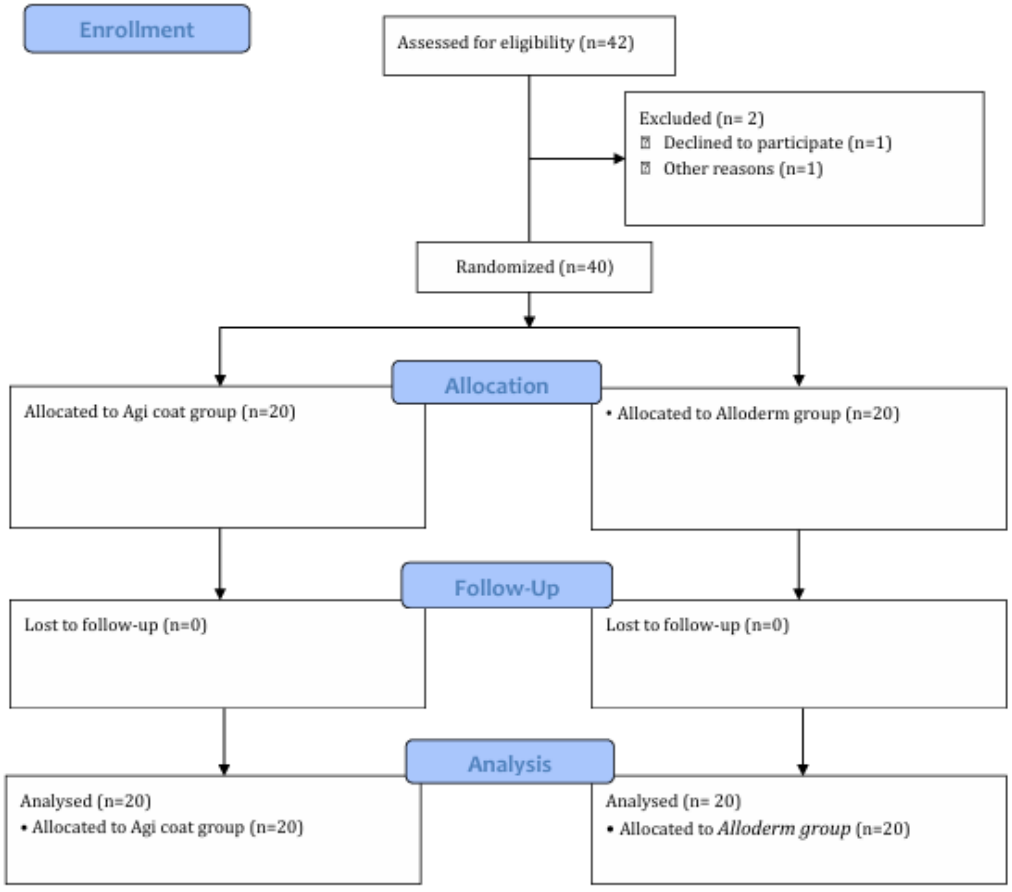


Figure 1: Consolidated standards of reporting trials (CONSORT) flow diagram

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Statistical Analysis

Data were analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequency and percentage. Between-group comparisons were performed using the independent *t*-test and chi-square test as appropriate. Multivariable regression analysis was applied to adjust for potential confounding variables, including age, body mass index, burn severity, burn location, burn etiology, and wound infection. A *P*-value <0.05 was considered statistically significant.

RESULTS

Baseline demographic and clinical characteristics are summarized in Table 1. No statistically significant difference was observed between the two groups regarding mean burn surface area (*P*=0.07) or age distribution (*P*=0.08). However, sex distribution differed significantly between groups, with a higher proportion of female patients in the Alloderm group (*P*=0.001). In addition, patients treated with Alloderm demonstrated a significantly shorter duration of hospitalization compared with the Agi coat group (12.28 ± 2.49 vs. 16.70 ± 3.33 days, *P*=0.04).

Pain severity progressively decreased in both groups during follow-up; however, significantly lower pain scores were consistently observed in the Alloderm group (Table 2). On day 4, the mean VAS pain score was 6.36 ± 1.87 in the Agicoat group compared with 4.02 ± 2.30 in the Alloderm group (*P*<0.001). Similarly, on day 8, pain scores remained significantly lower among patients treated with Alloderm (1.14 ± 1.21 vs. 2.82 ± 1.20, *P*<0.001).

Wound epithelialization occurred more rapidly in the Alloderm group throughout the early phases of healing (Table 3). On days 4, 8, and 12, epithelialization percentages were significantly higher in patients receiving Alloderm (*P*<0.05 for all comparisons). Nevertheless, by day 16, epithelialization rates approached completion in both groups, and the difference was no longer statistically significant (*P*=0.314). Furthermore, the mean time to complete wound healing was significantly shorter in the Alloderm group compared with the Agi coat

Table 1: Baseline demographic and clinical characteristics of the study population

Variable		Agi coat group	Alloderm group	P-value
Age distribution	<10 years	6.0%	12.0%	0.08
	11–20 years	4.0%	8.0%	
	21–50 years	42.0%	64.0%	
	>51 years	48.0%	16.0%	
Sex	Female sex	50%	84%	0.001
	Male sex	50%	16%	
Burn surface area (%)		29.50 ± 13.10	27.84 ± 12.02	0.07
Length of hospital stay (days)		16.70 ± 3.33	12.28 ± 2.49	0.04

Table 2: Comparison of pain severity (VAS scores) between groups

Variable	Agi coat group	Alloderm group	P-value
Pain score – Day 4	6.36 ± 1.87	4.02 ± 2.30	<0.001
Pain score – Day 8	2.82 ± 1.20	1.14 ± 1.21	<0.001

Table 3: Comparison of wound epithelialization and healing time

Variable	Agi coat group	Alloderm group	P-value
Epithelialization – Day 4 (%)	14.04 ± 3.21	17.74 ± 5.93	<0.001
Epithelialization – Day 8 (%)	28.08 ± 6.42	35.48 ± 11.86	<0.001
Epithelialization – Day 12 (%)	76.76 ± 7.75	80.48 ± 7.20	0.015
Epithelialization – Day 16 (%)	96.08 ± 5.03	97.04 ± 4.43	0.314
Complete healing time (days)	16.04 ± 3.75	13.64 ± 3.16	0.001

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Table 4: Comparison of scar quality and infection rate

Variable	Agi coat group	Alloderm group	P-value
Total VSS score	3.42 ± 1.23	6.38 ± 1.29	<0.001
Infection rate	10%	16%	0.372

group (13.64 ± 3.16 vs. 16.04 ± 3.75 days, *P*=0.001). Scar assessment using the VSS demonstrated significantly better scar quality in the Agi coat group (Table 4). The mean total VSS score was significantly lower in patients treated with Agi coat compared with Alloderm (3.42 ± 1.23 vs. 6.38 ± 1.29, *P*<0.001). Although wound infection was observed more frequently in the Alloderm group (16% vs. 10%), the difference did not reach statistical significance (*P*=0.372).

Overall, Alloderm dressing was associated with lower pain intensity, accelerated epithelialization, shorter healing duration, and reduced hospital stay. In contrast, Agi coat demonstrated superior scar outcomes, while infection rates were comparable between the two treatment modalities.

DISCUSSION

The present randomized double-blind clinical trial compared the clinical outcomes of Alloderm and Agi coat dressings in patients with second-degree burns managed without skin grafting. The main findings demonstrated that Alloderm was associated with significantly reduced pain intensity, faster epithelialization, and shorter hospitalization, whereas Agi coat showed superior scar quality. No significant difference was observed in infection rates between the two groups. These results indicate that the two dressing modalities exert distinct and potentially complementary effects on different phases of burn wound healing.

Pain control is a critical endpoint in burn management, directly influencing patient tolerance, opioid consumption, and overall treatment burden. In the current study, Alloderm significantly reduced pain scores during dressing changes compared with Agi coat. This finding is consistent with previous evidence supporting the role of advanced foam-based dressings in minimizing procedural pain. The likely explanation is the maintenance of a moist wound environment, reduced adhesion to the wound bed, and protection of exposed nerve endings, which collectively decrease mechanical and inflammatory stimulation during dressing changes. Similar results have been reported in clinical studies comparing modern hydro fiber or foam dressings with conventional antimicrobial agents, where significantly improved patient comfort and reduced dressing-related trauma were observed [15, 16].

A second key finding was the significantly faster epithelialization and shorter healing time in the Alloderm group. Early wound closure is essential in reducing infection risk, hospital stay, and long-term morbidity in burn patients. Foam-based dressings facilitate epithelial migration by preserving optimal moisture balance, absorbing excess exudate, and providing a stable scaffold for keratinocyte proliferation. These findings are in agreement with prior studies emphasizing the role of moist wound healing and biologically favorable microenvironments in accelerating re-epithelialization [17, 18].

However, despite earlier healing kinetics, final epithelialization rates at day 16 were comparable between groups, suggesting that dressing type primarily influences the rate rather than the ultimate extent of wound closure. From a clinical perspective, this difference in healing trajectory is highly relevant, as earlier closure translates into shorter hospitalization and reduced healthcare costs.

In contrast, scar assessment using the VSS revealed significantly better outcomes in the Agi coat group. This finding highlights an important distinction between early wound closure and long-term tissue remodeling. Excessive or rapid epithelialization in the absence of optimal dermal remodeling may predispose to disorganized collagen deposition and hypertrophic scarring. Silver-based dressings may modulate this process through their anti-inflammatory and antimicrobial properties, reducing prolonged inflammatory signaling that contributes to fibroblast overactivation. Dysregulated inflammation is a key driver of pathological scarring in burn wounds, and controlled inflammatory modulation may improve final scar quality [19]. Therefore, the superior scar outcomes observed with Agi coat may reflect a more balanced inflammatory environment during the proliferative and remodeling phases of healing.

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Regarding infection, no statistically significant difference was observed between the two groups. Although silver-containing dressings possess well-established antimicrobial activity, clinical evidence regarding their superiority in preventing burn wound infection remains inconsistent. This finding is in line with the Cochrane review by Storm-Versloot et al., which concluded that current evidence is insufficient to confirm a significant reduction in infection rates with silver-based dressings in burn patients [20].

Burn wound infection is a multifactorial process influenced by host immunity, wound depth, debridement quality, and systemic factors, which may outweigh the isolated effect of topical antimicrobial agents.

The present study highlights an important clinical trade-off between rapid wound healing and long-term scar quality. Alloderm appears to optimize early wound healing outcomes, including pain reduction and epithelialization speed, whereas Agi coat may provide advantages in dermal remodeling and scar modulation. This duality suggests that dressing selection in partial-thickness burns should be individualized based on clinical priorities, particularly when balancing functional recovery against aesthetic outcomes.

Taken together, these findings are supported by emerging literature indicating that no single dressing modality is universally superior in all dimensions of burn wound healing. Recent meta-analyses have similarly reported that while silver-based dressings may reduce inflammatory mediators and microbial load, their impact on overall healing time and final clinical outcomes is variable [8, 21]. Conversely, foam-based and biologic dressings have consistently demonstrated benefits in early wound closure and patient comfort but with less consistent effects on long-term scar quality.

This study is limited by its small sample size, short follow-up period for scar assessment, single-center design, and reliance on the VSS, partly subjective. Potential confounders such as burn depth variability and post-discharge care were not fully controlled.

CONCLUSION

Alloderm significantly improved early clinical outcomes in second-degree burns, including pain reduction, faster epithelialization, and shorter hospitalization, whereas Agi coat showed superior scar quality. Infection rates were similar between groups. These findings support an individualized approach to dressing selection based on clinical priorities.

Ethical Consideration

This study was conducted after approval from the Ethics Committee of Jundishapur University of Ahvaz (IR.AJUMS.REC.1404.301). Informed consent was obtained from all individuals included in this study.

The trial was registered in the Iranian clinical trial system with the registration number (IRCT20250924067350N1).

Competing interests

The authors declare that they have no conflicts of interest concerning this article.

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