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ORIGINAL ARTICLE

A Clinical Study on Comparing Topical Steroid Cream vs Compressive Dressing for Management of Hypergranulation Tissue in Residual Raw Area Post Skin Grafting in Burn Patients

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Abstract

Introduction: Hypergranulation tissue is an excessive proliferation of immature granulation tissue that rises above the wound surface, delaying re-epithelialization. It frequently occurs in post-burn residual raw areas after skin grafting and impedes wound healing. Various management options exist, but there is limited comparative evidence between topical steroid application and compressive dressing. **Materials and Methods:** A prospective cohort study was conducted at the Department of Burns, Plastic and Reconstructive Surgery, Government Kilpauk Medical College, Chennai, from January to August 2025. Fifty patients with hypergranulation tissue following split-thickness skin grafting were randomly assigned into two groups of twenty-five each. Group A received 0.1% betamethasone with fusidic acid ointment, and Group B received saline compressive dressings. **Results:** The topical steroid group showed a significantly greater reduction in wound dimensions and pain, with mean raw area decreasing from 34.2 cm^2 to 7.2 cm^2 compared to 26.3 cm^2 to 17.2 cm^2 in the compressive group ($p < 0.01$). Mean healing time was 21.6 ± 7.4 days versus 32.7 ± 10.5 days, and no complications were observed in the steroid group. **Conclusion:** Short-term topical steroid therapy effectively reduces hypergranulation tissue, accelerates epithelialization, and minimizes hospital visits compared to compressive dressing, with no adverse effects.

Keywords: Hypergranulation, Burn wounds, Topical corticosteroid, Betamethasone, Epithelialization

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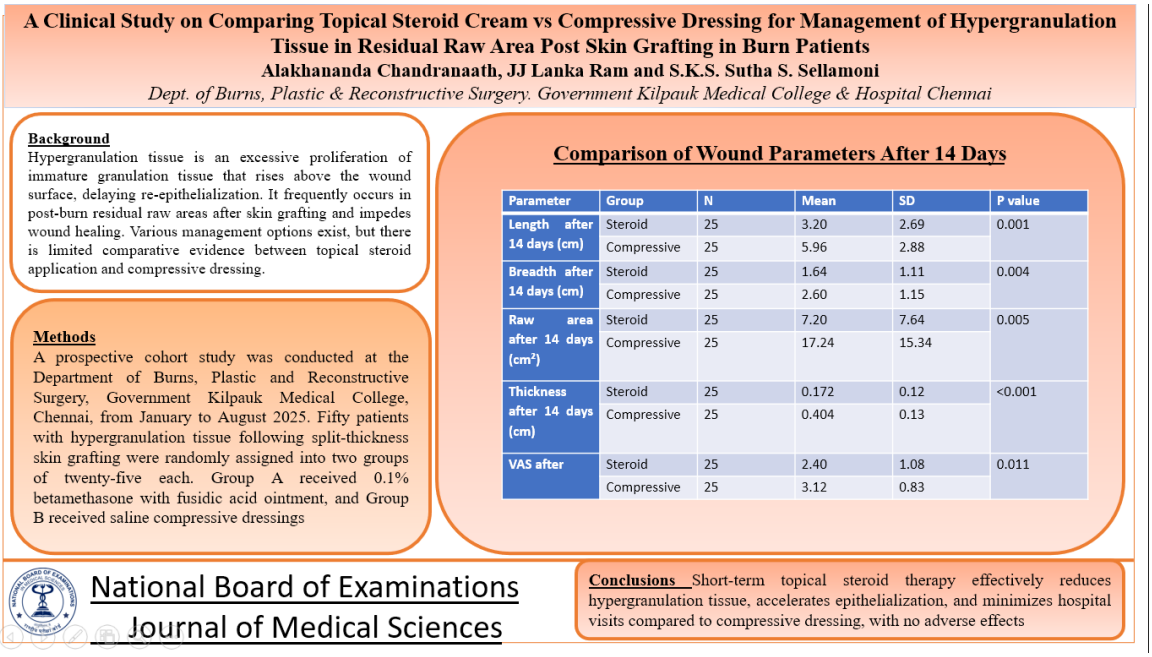
Graphical Abstract



Introduction

Hypergranulation tissue is an overgrowth of granulation tissue that rises above the surface level of a wound and is characterized by excessive fibroblast proliferation, abundant extracellular matrix deposition, and persistent angiogenesis. It appears as a raised, moist, friable, reddish mass that prevents epithelial migration and delays wound closure. Hypergranulation is frequently encountered in post-burn wounds and residual raw areas following split-thickness skin grafting, posing a significant challenge to wound healing and aesthetic outcomes [1].

The development of hypergranulation tissue is multifactorial, often resulting from chronic inflammation, persistent moisture, infection, frictional trauma, or excessive mechanical stress on the wound bed. On a cellular level, an imbalance between matrix metalloproteinases (MMPs) and collagenase activity has been implicated, leading to impaired remodeling and uncontrolled fibroplasia [2]. This abnormal wound response interferes with keratinocyte migration and epithelialization, resulting in delayed healing, recurrent breakdown, and hypertrophic scarring. Therefore, timely and effective management of hypergranulation tissue is essential to optimize wound outcomes in burn patients.

Several therapeutic modalities have been described for the management of hypergranulation tissue, including surgical excision, sharp debridement, chemical cauterization with silver nitrate, laser ablation, topical antibiotics, foam dressings, and pressure dressings [3,4]. Among these, silver-based agents have historically been popular due to their antimicrobial properties; however, they may cause local pain, tissue necrosis, and cytotoxicity, potentially delaying epithelialization [5]. Conservative approaches such as compressive dressings provide a simple, low-cost method by applying uniform pressure that limits

capillary overgrowth, decreases exudate, and promotes tissue flattening [6]. Nevertheless, their efficacy in rapidly resolving established hypergranulation remains limited and largely supportive rather than curative [7].

In recent years, topical corticosteroids have gained attention as a targeted therapy for hypergranulation tissue due to their anti-inflammatory, anti-proliferative, and anti-angiogenic properties. These agents help suppress fibroblast activity, reduce vascular proliferation, and accelerate re-epithelialization [8]. When applied locally, corticosteroids minimize systemic absorption and associated adverse effects, making them a safe alternative to systemic therapy. Studies by Lam et al. [2] demonstrated complete regression of hypergranulation within 1–2 weeks using topical hydrocortisone 1% combined with chloramphenicol, without major side effects. Similarly, Saleem et al. [5] reported faster wound healing and improved epithelialization with short-term topical steroid use in burn wounds.

Despite the growing evidence for topical steroids, comparative clinical data directly evaluating their efficacy against traditional conservative approaches such as compressive dressings in burn wounds remain limited. Moreover, standardized protocols regarding steroid potency, duration, and frequency of application are yet to be universally defined.

Hence, the present study was conducted to compare the efficacy of topical steroid cream versus compressive dressing in the management of hypergranulation tissue in residual raw areas following skin grafting in burn patients. The study specifically evaluated reduction in wound size, time to complete epithelialization, pain control, and need for regrafting, aiming to establish evidence-based recommendations for clinical practice.

Materials and Methods

This was a prospective cohort study conducted in the Department of Burns, Plastic and Reconstructive Surgery, Government Kilpauk Medical College and Hospital, Chennai, India. The study aimed to compare the efficacy of topical steroid cream with compressive dressing in the management of hypergranulation tissue that developed over residual raw areas following split-thickness skin grafting in burn patients. The study was carried out over a period of six months, from January 2025 to August 2025, and included continuous recruitment and follow-up of patients until complete epithelialization or occurrence of complications.

The study population consisted of both in-patients and out-patients with residual raw areas after skin grafting for post-burn wounds. A total of fifty eligible patients were enrolled and randomly divided into two groups of twenty-five each. Group A received local application of 0.1% betamethasone ointment combined with fusidic acid once daily over the hypergranulation tissue. Group B was managed conservatively with tight saline-soaked gauze or crepe bandage compressive dressings. Randomization was performed by an independent resident not involved in the treatment or data analysis.

Patients aged above two years and below seventy years with post-skin grafting residual raw areas were included after obtaining consent. Those in sepsis or shock, patients with multiple comorbidities, pregnant or breastfeeding

women, individuals with known hypersensitivity to corticosteroids, and non-compliant patients were excluded.

All procedures were performed in accordance with the ethical standards of the Declaration of Helsinki (2013 revision). Written informed consent was obtained from all adult participants after explaining the nature and purpose of the study in their local language. For children between 7 and 18 years, written assent was obtained along with parental or guardian consent. For participants below seven years, oral assent was taken and documented in the study record, accompanied by written consent from the parent or legally authorized representative.

Baseline data were recorded at the time of enrollment. Pretreatment photographs were taken to document the appearance and extent of hypergranulation tissue. The wound was assessed for length and breadth using a transparent graph sheet, and the total surface area was expressed in square centimeters. The thickness of the hypergranulation tissue was measured using a sterile needle. The level of pain was assessed using the Visual Analogue Scale (VAS) at the time of presentation. Subsequent wound assessments were performed by a different plastic surgeon during follow-up visits on days 3, 6, 9, 12, and 15. Changes in wound dimensions, thickness, and pain scores were recorded during each visit.

All patients were followed up until complete epithelialization or the occurrence of complications. The total number of hospital visits and the duration of healing were noted. Complications such as infection, persistence of raw area, or need for regrafting were documented.

For the purpose of data uniformity, a structured proforma was maintained for each patient. The proforma recorded demographic details (name, age, sex, occupation, inpatient number, and date of admission), wound characteristics (initial and final size, surface area, and thickness), pain score (VAS), number of dressing changes or hospital visits, time taken for complete healing, and complications if any.

All data were entered into Microsoft Excel and analyzed using IBM SPSS software. Descriptive statistics such as frequency and percentage were used for categorical variables, and mean and standard deviation were used for continuous variables. Comparisons between the two groups were made using independent sample t-tests for continuous data. A p-value of <0.05 was considered statistically significant (Figure 1)

Figure 1. Comparative healing response between steroid cream and compressive dressing groups at Day 0 and Day 14

Results

A total of 50 patients were included in the study, with 25 patients each in the topical steroid group and the compressive dressing group. The study population consisted of 31 males (62%) and 19 females (38%). The majority of patients (38%) were between 20–40 years of age, followed by 30% in the 40–60 years category. The mean age of the population was 32.8 ± 16.6 years.

Baseline characteristics were comparable between the two groups ($p > 0.05$) across all parameters, confirming effective randomization. Pre-treatment wound parameters were similar between groups — mean wound length (8.3 ± 4.6 cm), breadth (3.0 ± 1.4 cm), and raw area (30.3 ± 34.1 cm^2). The mean pre-treatment wound thickness was 0.60 ± 0.17 cm, and average VAS score for pain was 6.4 ± 1.05, indicating moderate to severe pain before intervention (Table 1).

Table 1. Baseline Characteristics of the Study Population

Parameter	Group	N	Mean	SD	P value
Age (years)	Steroid	25	28.72	16.25	0.076
	Compressive	25	36.96	15.91	
Initial wound length (cm)	Steroid	25	8.48	5.39	0.786
	Compressive	25	8.12	3.81	
Initial wound breadth (cm)	Steroid	25	3.12	1.72	0.627
	Compressive	25	2.92	1.12	
Raw area before treatment (cm^2)	Steroid	25	34.20	43.05	0.420
	Compressive	25	26.32	22.25	
Thickness before (cm)	Steroid	25	0.552	0.18	0.722
	Compressive	25	0.596	0.15	
VAS before	Steroid	25	6.24	1.09	0.230
	Compressive	25	6.60	1.00	

After 14 days of treatment, there was a significant reduction in wound size, thickness, and pain scores in both groups, with the topical steroid group showing superior outcomes. The mean wound length reduced to 3.2 ± 2.7 cm in the steroid group compared to 5.96 ± 2.9 cm in the compressive dressing group ($p = 0.001$). The raw wound area significantly reduced from 34.2 ± 43.1 cm^2 to 7.2 ± 7.6 cm^2 in the steroid group, compared to 26.3 ± 22.3 cm^2 to 17.2 ± 15.3 cm^2 in the compressive group ($p = 0.005$). Mean wound thickness and VAS pain scores were also significantly lower in the steroid group ($p < 0.05$). These findings highlight the anti-inflammatory and fibroblast-modulating effects of steroids, leading to faster wound remodeling (Table 2).

Table 2. Comparison of Wound Parameters After 14 Days

Parameter	Group	N	Mean	SD	P value
Length after 14 days (cm)	Steroid	25	3.20	2.69	0.001
	Compressive	25	5.96	2.88	
Breadth after 14 days (cm)	Steroid	25	1.64	1.11	0.004
	Compressive	25	2.60	1.15	
Raw area after 14 days (cm^2)	Steroid	25	7.20	7.64	0.005
	Compressive	25	17.24	15.34	
Thickness after 14 days (cm)	Steroid	25	0.172	0.12	<0.001
	Compressive	25	0.404	0.13	
VAS after	Steroid	25	2.40	1.08	0.011
	Compressive	25	3.12	0.83	

The mean time to complete epithelialization was significantly shorter in the topical steroid group (21.6 ± 7.4 days) compared to the compressive dressing group (32.7 ± 10.5 days, $p < 0.001$). Similarly, the mean number of hospital visits was lower among patients receiving topical steroids (5.5 ± 2.5) than those managed conservatively (9.7 ± 2.9, $p < 0.001$). No complications were reported in the steroid group, whereas four patients in the compressive dressing group required regrafting due to persistent raw areas. These findings indicate that topical steroid therapy not only hastened healing but also reduced hospital visits and prevented complications, improving cost-effectiveness and patient comfort (Table 3).

Table 3. Healing Outcome and Follow-Up Comparison

Parameter	Group	N	Mean	SD	P value
Total days taken to heal	Steroid	25	21.60	7.44	<0.001
	Compressive	25	32.68	10.47	
Total hospital visits	Steroid	25	5.52	2.49	<0.001
	Compressive	25	9.72	2.87	

Although both groups demonstrated clinical improvement, the magnitude of healing was greater in the steroid-treated wounds. The absolute reduction in raw area was 27.0 cm^2 in the steroid group compared to 9.1 cm^2 in the compressive group. VAS scores decreased by 3.8 points in the steroid group versus 3.5 in the compressive group.

Discussion

Hypergranulation is a common yet often under-recognized impediment in the wound healing process, particularly in burn patients. It represents an excessive proliferation of immature granulation tissue that extends above the wound surface and interferes with re-epithelialization. The underlying pathogenesis is multifactorial, involving persistent inflammation, infection, mechanical irritation, and excessive moisture. On a molecular level, an imbalance between matrix metalloproteinases (MMPs) and collagenase activity has been identified as a key driver of uncontrolled fibroblast proliferation and angiogenesis, resulting in exuberant tissue growth [1,2]. These enzymes play a central role in extracellular matrix remodeling, and their dysregulation contributes to delayed epithelialization and chronic wound formation [9,10].

Such exuberant granulation tissue not only delays healing but may also lead to hypertrophic scars and contractures if left untreated. Various therapeutic strategies have been attempted to manage hypergranulation, including sharp or surgical debridement, chemical cauterization with silver nitrate, laser ablation, topical antimicrobials, and foam or hydrocolloid dressings [3,4]. Although silver nitrate has historically been used for chemical cauterization, several studies have shown that it may cause local pain, necrosis of healthy tissue, and delayed epithelialization due to cytotoxic effects [11]. In contrast, compressive dressings are non-invasive and act by applying uniform pressure, thereby inducing localized ischemia, reducing exudation, and limiting angiogenesis [5]. However, the process is slow, requires frequent dressing changes, and may not effectively regress well-established hypergranulation [6,7].

In the present study, topical corticosteroids demonstrated superior outcomes compared to compressive dressings in terms of wound size reduction, thickness regression, pain control, and overall healing time. After 14 days of treatment, the mean wound surface area in the steroid group reduced significantly from 34.2 cm^2 to 7.2 cm^2, compared to 26.3 cm^2 to 17.2 cm^2 in the compressive group. Wound thickness and pain scores also improved more prominently in the steroid group ($p < 0.01$). The mean time taken for complete epithelialization was 21.6 ± 7.4 days in the steroid group versus 32.7 ± 10.5 days in the compressive group. Similarly, the average number of hospital visits was fewer (5.5 vs. 9.7). These findings establish that short-term topical steroid application not only accelerates epithelialization but also decreases hospital visits and dressing frequency, improving patient comfort and cost-effectiveness.

The beneficial effects of topical corticosteroids in hypergranulation control are attributed to their anti-inflammatory, anti-proliferative, and anti-angiogenic properties [6]. Steroids inhibit the production of inflammatory cytokines such

as interleukin-1 (IL-1), tumor necrosis factor-α (TNF-α), and vascular endothelial growth factor (VEGF), thereby reducing fibroblast activity and angiogenesis [7,12]. They also limit macrophage infiltration and myofibroblast differentiation, preventing contraction and hypertrophic granulation [13]. The significant reduction in wound thickness and vascularity observed in our study corroborates these molecular mechanisms.

Our findings are consistent with earlier reports. Lam et al. [2] observed complete regression of hypergranulation tissue within one to two weeks using topical hydrocortisone 1% with chloramphenicol, without any adverse reactions. Saleem et al. [5] demonstrated complete healing in 70% of burn patients within two weeks following short-term topical steroid therapy. Similarly, Margulies et al. (3) reported excellent outcomes using potent corticosteroids for pediatric burn wounds, highlighting their safety and efficacy. A systematic review by Mujahid et al. [14] confirmed that topical corticosteroids significantly accelerate hypergranulation regression compared to non-steroidal modalities, particularly in burns and trauma-related wounds. Jaeger et al. [4] also emphasized that short cycles of steroid application achieved faster flattening of granulation tissue compared to conservative pressure dressings alone.

Compressive dressings, though beneficial for exudative wounds, require prolonged use to show tangible improvement. In our study, 16% of patients in the compressive group required regrafting due to persistent raw areas, whereas no complications were observed in the steroid group. Similar results were noted by Shoham et al. [1], who reported that topical steroid application significantly reduced healing time in post-burn hypergranulation compared to conventional approaches.

Concerns regarding the adverse effects of topical corticosteroids, such as skin atrophy, telangiectasia, or secondary infections, are largely associated with prolonged or high-potency usage. When used short term and at appropriate potency, these complications are rare (8). In our study, no adverse events were observed during the two-week follow-up, confirming the safety of localized, time-limited steroid application.

Recent mechanistic evidence further supports the role of corticosteroids in regulating inflammatory mediators and growth factors that drive excessive granulation [12,13]. Institutional wound care guidelines now recommend short-term use of low- to moderate-potency topical steroids (hydrocortisone 1%, betamethasone 0.05–0.1%) in refractory hypergranulation, with close monitoring for infection or delayed healing [15,16]. These recommendations align with our findings, emphasizing the therapeutic value of topical corticosteroids as a safe, effective, and accessible option in burn wound management.

From a practical perspective, the regimen used in this study—daily application of betamethasone 0.1% with fusidic acid—offered several advantages, including ease of use, reduced pain during dressing changes, antimicrobial protection, and fewer hospital visits. The combination of anti-inflammatory and antibacterial action makes it particularly suitable for managing exudative post-graft wounds prone to infection.

Conclusion

The present study demonstrates that short-term topical steroid therapy is significantly more effective than compressive dressings in treating hypergranulation tissue after split-thickness skin grafting in burn patients. It provides faster epithelialization, better pain control, fewer complications, and improved patient compliance. Further multicentric randomized controlled trials with larger cohorts and longer follow-up are recommended to validate these findings and optimize steroid formulations, potency, and duration protocols for broader clinical use.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

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