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Original Research Article

An Observational Comparative Study between Conventional Dressing and Collagen Dressing in a Case of Second Degree Burn

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Abstract:

Aim: To assess the efficacy of Collagen dressing versus conventional silver sulfadiazine dressing in patients with second-degree burns, focusing on pain during dressing changes, infection rates, wound healing rates, and the necessity for higher-grade antibiotics and painkillers.

Methods and Materials: 60 patients were enrolled, with 30 receiving conventional dressings and the other 30 receiving collagen dressings. Various factors including wound healing rate, pain experienced during dressing changes, infection rate, use of higher-grade antibiotics, and analgesic consumption were evaluated for both groups.

Results: Effectiveness of collagen dressing was better in terms of rate of wound healing, pain on dressing change, rate of infection and use of analgesics in comparison with conventional dressing like silver sulfadiazine. Higher antibiotics were not used in either dressing.

Conclusions: Collagen stands out as an optimal choice for dressing second-degree burns due to its unique properties, distinguishing it from conventional dressings.

Keywords: Collagen, Conventional, Dressing, Burns.

Introduction

Burn injuries are among the most devastating of all injuries, significantly affecting patients physically, physiologically, and psychologically. They remain one of the leading causes of death and disability worldwide [1]. Since the 1800s, silver has been employed as an antimicrobial agent, possessing antiseptic, antimicrobial, and anti-inflammatory characteristics, making it a broad-spectrum antibiotic [2,3]. Free silver cations exhibit strong antimicrobial effects by binding to and denaturing bacterial DNA and RNA, consequently impeding cell replication [4]. Notably, both silver nitrate dressings and silver sulfadiazine cream necessitate frequent dressing changes [5].

Collagen serves as the primary insoluble protein found in the extracellular matrix and various connective tissues. It plays multiple essential roles, acting as a substrate for haemostasis, attracting cellular elements crucial for healing such as granulocytes, macrophages, and fibroblasts. Additionally, collagen provides a scaffold for the accelerated transition to mature collagen production and alignment, while also offering a template for cellular attachment, migration, and proliferation [6]. As a natural and readily available material, collagen offers several advantages: it is non-immunogenic, non-pyrogenic, and easily accessible for immediate use. Furthermore, collagen provides the optimal physiological interface between the wound surface and the environment, facilitating the effective function of the body's reparative and immune systems [7]. The present study was performed to evaluate the efficacy of collagen dressing over conventional dressing in second degree burn.

Materials & Methods

Study population: The research encompassed a study group comprising 60 patients presenting with second-degree burns ranging from 10% to 20% of their total body surface area. These patients were treated at LTMMC, Sion Hospital, located in Mumbai, Maharashtra, India.

Materials

Materials required for the procedure included collagen sheets, normal saline and dryer for collagen dressing and silver sulfadiazine ointment with gauze for conventional dressing.

Inclusion Criteria: Patients with 10%-20% second degree burn. Patients of age group equal to or greater than 18 years

Exclusion Criteria: Patient with allergy to collagen dressing, patient who are critically ill, patient with any evidence of underlying bone osteomyelitis, malignancy, first, third and fourth degree burns, patients with second degree burn with extent of burns less than 10% and more than 20%, patients of age group less than 18 years.

Data Collection: Data collection employed a simple random sampling method. Patients provided written informed consent before participating. A standardized case record form was employed to gather essential information pertaining to each individual case.

Statistical Analysis: The collected data underwent analysis employing the chi-square test and were stratified based on various factors including age, sex, pain score, duration of wound healing, infection rate, utilization of higher-grade antibiotics, and consumption of analgesics.

Results

Age Distribution: Mean age of the patients was around 26-27 years in both the groups indicating that there was no significant difference in age group.

Table 1: shows distribution of study subjects according to their age group (n= 60)

Age (in years)	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
≤ 30	27 (90.0)	26 (86.7)	53 (88.3)
31-40	1 (3.3)	2 (6.7)	3 (5.0)
41-50	0	0	0
51-60	0	1 (3.3)	1 (1.7)
>60	2 (6.7)	1 (3.3)	3 (5.0)
Mean (SD)	27.93 (10.29)	26.70 (9.68)	27.32 (9.92)
Chi-square test, p value = 0.640, not significant			

Sex Distribution: There were 15 males and 15 females in each group respectively indicating that there was equal distribution according to gender.

Table 2: Distribution of Study Subjects according to their age group (n= 60)

Age (in years)	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
≤ 30	27 (90.0)	26 (86.7)	53 (88.3)
31-40	1 (3.3)	2 (6.7)	3 (5.0)
41-50	0	0	0
51-60	0	1 (3.3)	1 (1.7)
>60	2 (6.7)	1 (3.3)	3 (5.0)
Mean (SD)	27.93 (10.29)	26.70 (9.68)	27.32 (9.92)
Chi-square test, p value = 0.640, not significant			

Duration of Wound Healing: Wound healing, defined as the complete epithelialization of the wound, displayed a substantial discrepancy in healing time between the two groups, with a p-value of less than 0.001. This indicates that patients treated with collagen dressing experienced a notably accelerated rate of wound healing compared to those treated with conventional dressing.

Table 3: Comparison of duration of wound healing between collagen and conventional dressing (n=60)

Duration of wound healing (days)	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
≤ 15	10 (33.3)	0	10 (16.7)
16-20	19 (63.3)	8 (26.7)	27 (45.0)
21-25	1 (3.3)	14 (46.7)	15 (25.0)
>25	0	8 (26.7)	8 (13.3)
Mean (SD)	16.63 (2.17)	23.40 (3.82)	20.02 (4.60)
Chi-square test, p value <0.001, significant			

Pain Assessment: In this study, a 10-point visual analogue scoring system was utilized, with 0 representing no pain and 10 indicating maximum pain.

Pain scores were documented on day seven and day 14. The average pain scores recorded were as follows: On day seven, in collagen dressing group, 90% of patients had pain score less than three, whereas all patients in conventional dressing group had pain score more than or equal to three. Comparison in both the groups on day seven showed a significant difference with p value<0.001, inferring that pain in collagen dressing is significantly less compared to that in conventional dressing on day seven.

Table 4: Comparison of pain on day seven between collagen and conventional dressing (n=60)

Pain on day 7	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
1-2	27 (90.0)	0	27 (45.0)
3-4	3 (10.0)	19 (63.3)	22 (36.7)
5	0	11 (36.7)	11 (18.3)
Mean (SD)	1.87 (0.57)	4.17 (0.74)	3.02 (1.33)
Chi-square test, p value <0.001, significant			

On day 14, in collagen dressing group, 100% of patients had pain score less than three whereas 46.7% of patients with conventional dressing had pain score less than three.

Table 5: Comparison of pain on day 14 between collagen and conventional dressing (n=60)

Pain on day 14	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
1-2	30 (100.0)	14 (46.7)	44 (73.3)
3-4	0	15 (50.0)	15 (25.0)
5	0	1 (3.3)	1 (1.7)
Mean (SD)	1.10 (0.30)	2.83 (0.91)	1.97 (1.10)
Chi-square test, p value <0.001, significant			

Diabetic Patients: In this study, there was one diabetic in collagen dressing group and two diabetics in conventional dressing group with p value=0.554 indicating that it was not significant. As diabetic patients have delayed wound healing, these parameter being not significant does not act as confounding factor.

Table 6: Comparison of diabetic patients between collagen and conventional dressings (n=60)

Diabetic	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
Yes	1 (3.3)	2 (6.7)	3 (5.0)
No	29 (96.7)	28 (93.3)	57 (95.0)
Chi-square test, p value = 0.554, not significant			

Rate of Infection: A statistically significant difference was observed when comparing the rate of infection, with a p-value of less than 0.001. This suggests that the collagen dressing group exhibited a lower incidence of infections in comparison to the conventional dressing group.

Table 7: Comparison of wound swab between collagen and conventional dressing (n=60)

Wound swab	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
Growth present	1 (3.3)	27 (90.0)	28 (46.7)
Growth absent	29 (96.7)	3 (10.0)	32 (53.3)
Chi-square test, p value <0.001, significant			

Use of Higher Antibiotics: Ceftriaxone sulbactum, ceftriaxone, Augmentin, clindamycin, metronidazole, amikacin were antibiotics used for treating burns patients. All other antibiotics were included as higher antibiotics. No higher antibiotics were used in both groups.

Table 9: Comparison of higher antibiotics between collagen and conventional dressing (n=60)

Higher antibiotics	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
No	30 (100.0)	30 (100.0)	60 (100.0)

Use of only NSAIDS and NSAIDS plus opioids as painkiller: NSAIDS plus opioids were used in 3.3% of patients in collagen group as compared to 20% in conventional group, indicating more pain killer requirement in conventional group.

Table 10: Comparison of NSAIDs + opioids between collagen and conventional Dressing (n=60)

NSAIDs plus opioids	Group		Total
	Collagen dressing (n=30) n (%)	Conventional dressing (n=30) n (%)	
Yes	1 (3.3)	6 (20.0)	7 (11.7)
No	29 (96.7)	24 (80.0)	53 (88.3)
Chi-square test, p value = 0.044, significant			

Discussion

Burn injuries often result in coagulative necrosis of the skin and underlying tissues, causing significant pain and correlating with intricate systemic pathology and high mortality rates. In this study, collagen dressing was explored as an alternative to conventional dressing through a prospective comparative analysis. Lazovic and colleagues highlighted the crucial physical properties of collagen material in their study, as outlined below:

The collagen material exhibits several essential properties: it is non-inflammatory and non-toxic, fostering the migration of fibroblasts and microvascular cells while generating neodermal collagen matrices. It possesses low antigenicity and undergoes minimal biodegradation, thereby resulting in minimal scar formation. Physiologically, collagen sheets act as a barrier, preventing the entry of microorganisms, and regulate fluid flux from the wound. Additionally, collagen demonstrates elasticity, softness, and suppleness, along with excellent tear strength, making it easy to remove from the wound site [8].

In our study, we observed several characteristics consistent with those outlined in the aforementioned study regarding collagen sheets. These include the non-allergenic and non-toxic nature of collagen, which promotes early wound healing and results in reduced pain perception. Additionally, we found that the use of collagen sheets led to a decrease in infection rates, aligning with the reported benefits of collagen in wound management.

Pain Score

In Mukund B. Tayade et al's study, the average pain score recorded was 1.2 for the collagen group and 2.64 for the silver sulfadiazine group. Pain was assessed using a visual analogue scale ranging from zero to five, where zero indicated no pain and five represented maximum unbearable pain. This assessment was conducted within the first 24 hours following treatment [9].

In our study, a 10-point visual analogue scoring system was employed, where zero indicated no pain and 10 represented maximum pain. Pain scores were documented on day seven and day 14. The average pain scores recorded were as follows: on day seven, 1.87 for the collagen group and 4.17 for the conventional dressing group; on day 14, 1.1 for the collagen group and 2.83 for the conventional dressing group.

Healing Time

The duration required for complete epithelialization of the wound. In the study by Mukund et al., the average time taken for complete epithelialization of the wound was 12.64 days in the collagen group and 18.44 days in the silver sulfadiazine group. Conversely, Gupta et al. reported an average healing time of 14 days among patients treated with collagen dressing [9,10].

In the current study, the collagen group exhibited an average healing time of 16.63 days, whereas the conventional group required 23.40 days for complete epithelialization of the wound. This discrepancy yielded a significant p-value of less than 0.001. These findings suggest that the properties inherent to collagen foster an optimal environment conducive to early wound healing.

Rate of Infection

Infections were notably lower in the collagen group compared to the conventional group, which can be attributed to collagen's function as a mechanical barrier between the wound and the environment.

In a study conducted by Gupta et al., collagen sheet cover was applied to 32 cases of fresh burns and 26 cases of post-burn contractures. In the majority of burn cases, the collagen sheet remained dry, effectively preventing infection. It acted as a safeguard against exogenous infection, inhibited exudation from raw areas, and facilitated rapid epithelialization and wound healing [10].

Use of Painkillers

In the collagen group, NSAIDs alone were utilized as painkillers in 96.7% of cases, compared to 80% in the conventional group. Additionally, a combination of NSAIDs and opioids was required in 20% of the conventional group, indicating a higher need for analgesics in this group. This discrepancy can be attributed to the property of collagen to cover exposed nerve endings, thereby reducing their vulnerability to pain.

Similar results were observed in a study conducted by Gerding R et al., which concluded that when bio brane therapy was applied to appropriately selected wounds, it significantly reduced pain and total healing time. Additionally, improved patient compliance may serve as an added benefit of this treatment approach [11].

Use of Higher Antibiotics

Both of the groups did not require higher antibiotics and had few diabetic patients which were not significant in the study

Conclusion

Collagen emerges as an optimal dressing choice for second-degree burns due to its inherent properties. It proves to be more effective than conventional dressings concerning various aspects including rate of wound healing, pain experienced during dressing changes, infection rate, and the need for analgesics.

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