Section: General Surgery

Original Research Article

# A COMPARATIVE STUDY OF THE OUTCOMES DUE TO COLLAGEN GRANULES DRESSING VERSUS NORMAL SALINE DRESSING IN CHRONIC NON HEALING ULCERS

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**ABSTRACT**

**Background:** Chronic non-healing ulcers pose a significant clinical challenge. This study aimed to compare the outcomes of collagen granules dressing with normal saline dressing in their management.

**Materials and Methods:** A prospective observational study was conducted on patients admitted at GIMSR, Visakhapatnam, India, with chronic non-healing ulcers of more than 6 weeks duration. Patients were treated with either collagen granules dressing or normal saline dressing. Outcomes measured included wound healing time, reduction in ulcer size, and the duration between first dressing and split skin graft.

**Results:** The collagen granules dressing group demonstrated a statistically significant reduction in wound size and shorter wound healing time compared to the normal saline dressing group. Additionally, the collagen granules group required fewer dressing changes.

**Conclusion:** Collagen granules dressing is a more effective treatment for chronic non-healing ulcers than normal saline dressing, leading to improved wound healing outcomes and potentially reduced healthcare resource utilization.

**Keywords:** Collagen granules, Dressing, Split skin graft, Outcomes.

## INTRODUCTION

Chronic non-healing ulcers represent a significant global health burden, affecting millions of individuals and imposing a substantial strain on healthcare systems. These wounds, which fail to proceed through the normal healing cascade within an expected timeframe, are often characterized by prolonged inflammation, impaired tissue repair, and an increased risk of infection. Common etiologies include diabetes mellitus, venous insufficiency, peripheral artery disease, and pressure injuries. The persistent nature of these ulcers can lead to diminished quality of life, increased morbidity, and even mortality.

Effective management of chronic non-healing ulcers is crucial for promoting healing, reducing complications, and improving patient outcomes. Wound care strategies vary widely, ranging from traditional dressings to advanced therapies. Normal saline dressings have been a mainstay of conventional wound care, providing a moist environment and aiding in the removal of debris.[1,2] However, they may not always provide the optimal conditions for healing in complex chronic wounds.In recent years, advanced wound dressings have gained prominence, offering enhanced properties that can accelerate the healing process. Collagen dressings, derived from a natural protein that is a key component of the extracellular matrix, have demonstrated potential benefits in promoting cellular proliferation, angiogenesis, and tissue regeneration. Collagen granules, a specific form of collagen dressing, can conform to the wound bed, providing a scaffold for tissue growth and potentially enhancing wound closure.[3,4]

While the benefits of advanced wound dressings like collagen have been explored, there remains a need for comparative studies evaluating their effectiveness against traditional methods in specific clinical settings. This study aimed to address this gap by comparing the outcomes of collagen granules dressing with normal saline dressing in the management of chronic non-healing ulcers in patients admitted at GIMSR, Visakhapatnam. The primary objective was to evaluate differences in wound healing time and ulcer size reduction between the two treatment groups. Secondary outcomes included comparing the duration between first dressing and split skin graft and the frequency of dressing changes. The findings of this study will contribute to the evidence base for optimal wound care practices and inform clinical decision-making in the management of chronic non-healing ulcers.

## MATERIALS AND METHODS

This was a prospective observational study conducted at the Department of General Surgery, GITAM Institute of Medical Sciences and Research (GIMSR), Visakhapatnam, India.

The study period extended from June 2023 to December 2024.

Ethical approval for the study was obtained from the Institutional Ethics Committee of GIMSR. (IEC-187/2023)

Informed consent was obtained from all patients prior to their participation in the study.

**Inclusion Criteria**

Patients admitted to the Department of General Surgery at GIMSR with chronic non-healing ulcers of more than 6 weeks duration:

- Diabetic ulcers
- Traumatic ulcers
- Pressure sores
- Amputation stump ulcers
- Post-surgical wound gaping of at least 6 weeks

- Ulcers more than 4 cm size
- Patients who provide written informed consent"

**Exclusion Criteria**

- Patients with acute ulcers.
- Patients aged below 18 years and above 65 years
- Patients with open ulcers involving raw tissue and visible bone
- Patients with malignant ulcers
- Patients having ulcers with reduced vascularity
- Patients with known connective tissue disorders
- Patients undergoing chemotherapy, radiotherapy and immunosuppressive therapy Patients with known allergy to the dressing materials.

**Treatment Groups**

Patients were consecutively enrolled and assigned to one of the two treatment groups based on

**Group 1: Collagen Granules Dressing:**

- Patients in this group received dressings with collagen granules (Collagen particles with Mupirocin and Metronidazole
- The collagen granules were applied directly to the cleansed ulcer bed.
- A secondary dressing was used to cover the collagen granules.

**Group 2: Normal Saline Dressing:**

- Patients in this group received dressings with normal saline (0.9% NaCl).
- Sterile gauze soaked in normal saline was applied to the ulcer bed.
- A secondary dressing was used to cover the saline-soaked gauze.

**Dressing Protocol**

- Wound Preparation:
- Prior to each dressing change, the ulcer was cleansed with normal saline.
- Debridement of necrotic tissue was performed as necessary (Surgical, Mechanical and enzymatic debridement).

**Dressing Change Frequency:**

- Dressings were changed every day for normal saline dressing and every third day for collagen granule dressing.

**Procedure for each dressing type**

- Describe in detail the procedure of how collagen granules and normal saline dressings are applied.

**Outcome Measures**

**Primary Outcome:**

- Wound Healing Time: The time (in days) from the start of treatment to complete wound closure (defined as complete epithelialization).
- Reduction in Ulcer Size: Measured as the change in ulcer area from baseline in days.

**Secondary Outcomes:**

- **Duration between First Dressing and Split Skin Graft:** The time (in days) from the initiation of dressing therapy to the date of split skin graft, if performed.
- **Frequency of Dressing Changes:** The total number of dressing changes required for each patient during the study period.

Data Collection: Baseline data collected for each patient included Age, Gender, Diagnosis, Location of the ulcer, Duration of disease, Initial ulcer size (measured in cm^2), Relevant medical history (e.g., diabetes mellitus, peripheral vascular disease)

Baseline investigation- Blood Haemoglobin, paced cell volume, RBS, RFT

Ulcer size was measured by a grid paper with uniform 1cm^2 squares was used to measure the wound surface area.

- Measurements were taken at baseline and at regular interval.
- Data was recorded in a pre-designed case report form (CRF).

**Statistical Analysis**

- Statistical analysis was performed using MS Excel and IBM SPSS Version 21.0.
- Continuous variables were presented as mean and standard deviation
- Categorical variables were presented as frequencies and percentages.

- Differences between groups were analysed using Chi-square test and independent sample t-test.

## RESULTS

This prospective observational study aimed "to evaluate the efficacy of collagen granule dressing compared to normal saline dressing in managing chronic non-healing ulcers". Chronic ulcers, defined as wounds persisting for more than six weeks, were assessed by reduction in ulcer size, average wound healing time and time between first dressing and application of split skin graft. The study enrolled 64 patients with foot ulcers, meeting strict inclusion and exclusion criteria to ensure uniformity and reliability. Participants were allocated into two groups: 32 to collagen granules group (CG) and 32 to normal saline group (NS).

Baseline investigations, including blood tests and wound assessments, were conducted before initiating treatment. Wound surface area was measured using a standardized grid method, and patients were followed up regularly to monitor healing progress. "Statistical analysis using t-tests and chi-square tests ensured robust comparisons between the groups". Ethical considerations were rigorously adhered to, maintaining participant anonymity and confidentiality. The results provide insights into the comparative effectiveness of collagen granules in accelerating wound healing, reducing hospital stays, and minimizing the need for frequent dressings compared to conventional saline dressing methods.

### Gender distribution

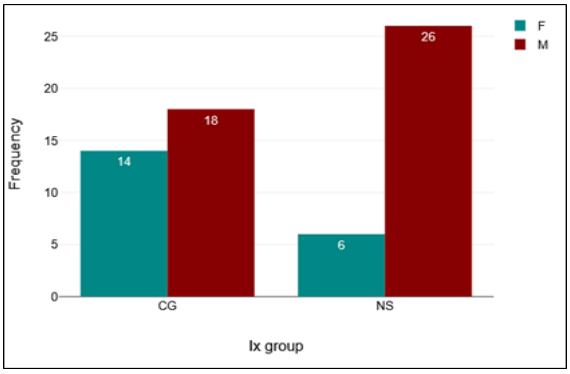


**Figure 1: Gender distribution among the study groups**

**Table 1: Gender distribution among the study groups.**

| | Sex | | | | |
|---|---|---|---|---|---|
| | Females | | Males | | Total |
| | N | % | N | % | N |
| CG | 14 | 53.85% | 18 | 47.37% | 32 |
| NS | 12 | 46.15% | 20 | 52.63% | 32 |
| Total | 26 | 100% | 38 | 100% | 64 |

The gender distribution of study subjects shows that in the CG group, females account for 53.85%, while males make up 47.37%. In the NS group, females constitute 46.15%, and males account for 52.63%. Overall, the study included 26 females and 38 males. This distribution suggested a relatively balanced gender representation in both groups, which is beneficial for ensuring that the results are not skewed by gender-related factors.

**Age distribution:** The age distribution of participants is relatively similar across both treatment groups. The majority of patients in both groups fall within the 51-60 age range, accounting for 34.37% of each group. The NS group has a slightly higher proportion of patients over 60 years old compared to the CG group. This age distribution suggested that age is unlikely to be a significant confounding factor in comparing treatment outcomes between the groups.

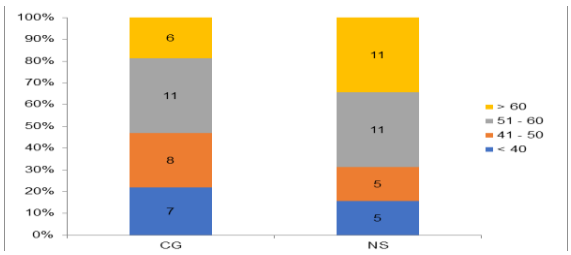


**Figure 2: Distribution of study subjects based on age group**

### Age distribution

**Table 2: Age-wise distribution of the study subjects in each study group.**

| Age group | Ix group | | | | |
|---|---|---|---|---|---|
| | CG | | NS | | Total |
| | N | % | N | % | N |
| < 40 | 7 | 21.87% | 5 | 15.62% | 12 |
| 41 - 50 | 8 | 25% | 5 | 15.62% | 13 |
| 51 - 60 | 11 | 34.37% | 11 | 34.37% | 22 |
| > 60 | 6 | 18.75% | 11 | 34.37% | 17 |
| Total | 32 | 100% | 32 | 100% | 64 |

## Area of ulcer before dressing

**Table 3: Average wound surface area before dressing**

| | | n | Mean | SD | t-test (p-value) |
|---|---|---|---|---|---|
| Wound surface area before dressings | CG | 32 | 15.94 | 3.25 | 0.066 |
| | NS | 32 | 18.94 | 2.57 | |

The CG group had a mean initial wound area of 15.94 cm² with a standard deviation of 3.25 cm², while the NS group had a slightly larger mean area of 18.94 cm² with a standard deviation of 2.57 cm². Although the NS group had larger wounds at baseline, the difference was not statistically significant ($p = 0.066$), indicating that the groups were reasonably comparable in terms of initial wound size.

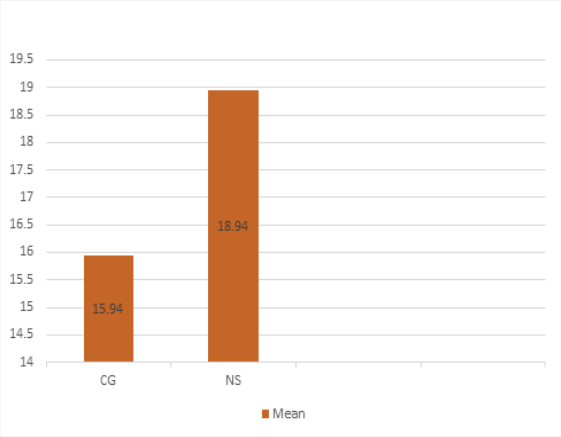


**Figure 3: Average wound surface area before dressing**

**Area of ulcer after dressing:** Following treatment, the wound surface areas were reassessed. The CG group showed a mean wound area of 9.87 cm² with a standard deviation of 2.52 cm², significantly smaller than the NS group's mean area of 15.53 cm² with a standard deviation of 2.14 cm². A t-test revealed a highly significant difference between the groups ($p < 0.001$), indicating that the CG group experienced more effective wound healing compared to the NS group.

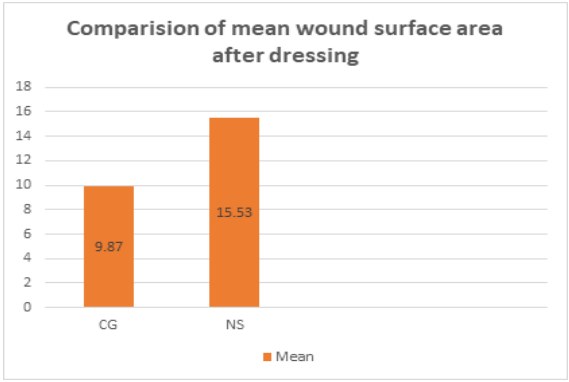


**Figure 4: Average wound surface area after dressing**

**Table 4: Average wound surface area after dressing**

| | | N | Mean | SD | t-test (p-value) |
|---|---|---|---|---|---|
| Wound surface area after dressings | CG | 32 | 9.87 | 2.52 | <0.001 |
| | NS | 32 | 15.53 | 2.14 | |

## Change in wound surface area

**Table 5: Average change in wound surface area throughout the study period**

| | | n | Mean | SD | t-test (p-value) |
|---|---|---|---|---|---|
| Change in wound surface area | CG | 32 | 6.07 | 1.22 | <0.001 |
| | NS | 32 | 3.56 | 0.78 | |

The CG group had a mean reduction of 6.07 cm² with a standard deviation of 1.22 cm², while the NS group showed a mean reduction of 3.56 cm² with a standard deviation of 0.78 cm². A t-test comparing these changes revealed a statistically significant difference ($p < 0.001$), demonstrating that the CG group achieved a substantially greater reduction in wound size compared to the NS group.

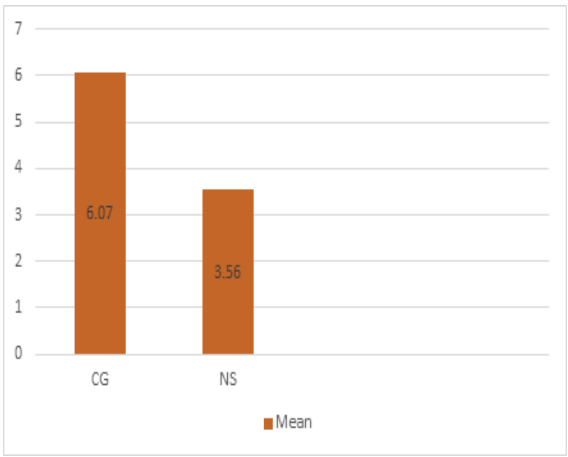


**Figure 5: Average change in wound surface area throughout the study period**

**Wound healing time:** Patients in the CG group had an average wound healing time of 23.89 days with a standard deviation of 4.05 days, while those in the NS group stayed for an average of 35.28 days with a

standard deviation of 3.34 days. A t-test showed a statistically significant difference ($p < 0.001$), demonstrating that the CG group benefited from a shorter healing period compared to the NS group, which suggested reduced healthcare costs and resource utilization.

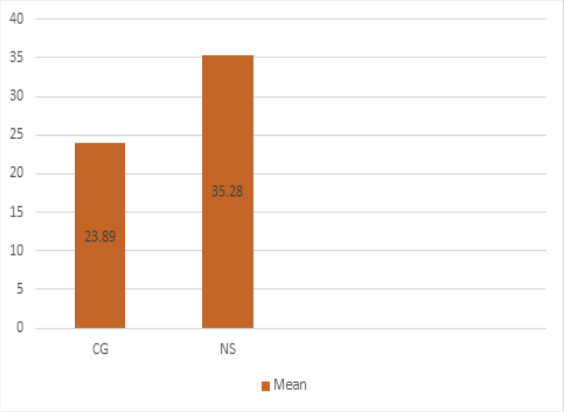


**Figure 6: Average wound healing time (in days)**

**Wound healing time**

**Table 7: Average wound healing time (in days)**

| | | n | Mean | SD | t-test (p-value) |
|---|---|---|---|---|---|
| Wound healing time (in days) | CG | 32 | 23.89 | 4.05 | <0.001 |
| | NS | 32 | 35.28 | 3.34 | |

## DISCUSSION

This study aimed at comparing the efficacy of collagen granule dressing (CG) and normal saline dressing (NS) in managing chronic non-healing ulcers. The results demonstrate that collagen granules significantly enhance wound healing outcomes compared to saline dressings, consistent with findings from Indian studies and global research.[7,8]

The study included 64 participants, with a balanced gender distribution (26 females and 38 males). Similar demographic patterns were observed in the study by Tiwari et al,[9] which included 178 patients with chronic ulcers treated with collagen granules or saline dressing, showing comparable results across genders. The age distribution in the current study, with most patients aged 51–60 years, aligns with findings from Kumar et al,[10] where diabetic and traumatic ulcers were predominant among middle-aged patients.

At baseline, the mean wound surface area was slightly larger in the NS group (18.94 $cm^2$) compared to the CG group (15.94 $cm^2$), but this difference was not statistically significant ($p = 0.066$). This comparability ensures that observed differences in outcomes can be attributed to the treatment modality rather than initial wound size. Similar findings were reported by Tiwari et al,[9] where initial wound sizes were comparable between groups.

The CG group achieved a mean wound size of 9.87 $cm^2$ compared to 15.53 $cm^2$ in the NS group ($p < 0.001$). A study by Kumar et al,[10] reported similar results, highlighting collagen's ability to accelerate granulation tissue formation and reduce wound size effectively.

The CG group showed a mean reduction of 38.50%, significantly higher than the NS group's 17.88% ($p < 0.001$). This aligns with findings from Tiwari et al,[9] where collagen granules demonstrated superior healing rates compared to saline dressings.

The CG group required fewer dressings (mean: 5.18 vs. 7.81; $p < 0.001$) and had shorter hospital stays (mean: 23.89 days vs. 35.28 days; $p < 0.001$) compared to the NS group. These outcomes suggest that collagen granules not only accelerate healing but also reduce healthcare resource utilization, making them a cost-effective option for managing chronic ulcers. Similar results were observed in studies by Kumar et al,[10] where collagen sheet dressing reduced hospital stays significantly, and Veves et al,[11] who highlighted collagen's efficiency in diabetic foot ulcers.

A strong positive correlation ($r = 0.758$, $p < 0.001$) was observed between the number of dressings required and hospital stay duration, indicating that treatments requiring fewer dressings are associated with shorter hospital stays. This further underscores the clinical efficiency of collagen granules, as seen in studies like Kumar et al and Tiwari et al.[9,10]

Indian studies have consistently shown that collagen-based dressings outperform conventional methods like saline or betadine in chronic ulcer management. For example, Tiwari et al,[9] study on 178 patients demonstrated significant reductions in ulcer size and depth with collagen granules compared to saline dressings, while Kumar et al,[10] study highlighted reduced pain and faster healing with collagen sheet applications. These findings align with global studies such as Donaghue et al,[12] which reported an 80% reduction in wound size using collagen-alginate dressings compared to 61% with saline gauze.

The strengths of this study include its prospective design, strict inclusion/exclusion criteria, and robust statistical analysis using t-tests and chi-square tests to compare outcomes between groups. However, limitations include the small sample size ($n = 64$), which may affect generalizability, and the use of convenient sampling instead of randomization, which could introduce selection bias.

Collagen granule dressing significantly outperformed normal saline dressing in terms of wound healing

time, reduction in ulcer size, and clinical efficiency metrics such as fewer dressings and shorter hospital stays. These results are consistent with findings from Indian studies like those by Tiwari et al,[9] and Kumar et al,[10] supporting the use of collagen-based therapies as an effective and resource-efficient option for managing chronic non-healing ulcers. Further large-scale randomized controlled trials are recommended to confirm these findings and explore cost-effectiveness on a broader scale.

**Strengths and Limitations:**

**Strengths**

- Rigorous statistical analysis (t-tests with $p<0.001$).
- Quantified metrics for wound area, dressings, and hospital stay.

**Limitations**

- No stratification by ulcer severity / comorbidities.
- Small sample size (n=64) and single centre study limit the external validity of the results.

## CONCLUSION

- Collagen granules significantly reduced wound area compared to normal saline, and resulted in a higher percentage reduction in ulcer area.
- Collagen granules required significantly fewer dressings compared to normal saline.
- Collagen granules dressings led to significantly shorter hospital stays compared to normal saline.
- Number of dressings positively correlated with length of hospital stay.

## REFERENCES


1. Michael Selvaraj J, Premchand K, Kannan S. Comparative Study Of The Outcome Of Antibiotic Coated Collagen Granules Vs Antibiotic Dressing In Chronic Ulcers. International Journal of Academic Medicine and Pharmacy, 2023; 5 (3); 721-724.
2. Grubbs H, Manna B. Wound Physiology. [Updated 2023 May 16]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK518964/
3. Wallace HA, Basehore BM, Zito PM. Wound Healing Phases. [Updated 2023 Jun 12]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470443/
4. Kathleen Rodgers, Sachin S. Jadhav, The application of mesenchymal stem cells to treat thermal and radiation burns. Advanced Drug Delivery Reviews, Volume 123, 2018, Pages 75-81.
5. Jegoda RK. A comparative study of collagen granules vs conventional dressing in the management of chronic ulcer. Int Surg J 2020;7:867-9
6. Prasad MD, Rao BAR. Wound Healing with Collagen Sheet in Chronic Ulcers. International Journal of Health Sciences & Research. 2018;8(3):19-25.
7. Prashant N Mukadam, Dip H Joshi, Jaykumar J Mandanka, Parth C Shah, Zeel U Khandla, Study of Collagen Based Dressing for Wound Healing, J Res Med Dent Sci, 2020, 8 (7): 355-358.
8. Dale Buchbinder, Sharon B. Buchbinder, Wound Healing: Adjuvant Therapy and Treatment Adherence. John J. Bergan, Cynthia K. Shortell, Venous Ulcers, Academic Press, 2007, Pages 91-103.
9. Tiwari NK, Department of Surgery, 188Military Hospital, Likabali, Assam,India, Department of Surgery, Command Hospital (Central Command), Lucknow, Uttar Pradesh (226002). A comparative study of collagen granules vs conventional saline dressing in the management of chronic wound [Internet]. Vol. 21, IOSR Journal of Dental and Medical Sciences. 2022 Sep p. 55–61.
10. Das, Subha; Kumar, Anjani; Kumar, Sanyal; Pandey, Sanjay Kumar; Kumar, Niraj; Kumar, Ranjeet. Comparison between Topical Platelet-rich Plasma and Normal Saline Dressing in Conjunction with Total Contact Casting in Treatment of Diabetic Foot Ulcer – A Randomised Control Trial. Indian Journal of Physical Medicine & Rehabilitation:2024 :34(3):p 212-217.
11. Veves A, Falanga V, Armstrong DG, Sabolinski ML; Apligraf Diabetic Foot Ulcer Study. Graftskin, a human skin equivalent, is effective in the management of noninfected neuropathic diabetic foot ulcers: a prospective randomized multicenter clinical trial. Diabetes Care. 2001 Feb;24(2):290-5.
12. O'Donoghue JM, O'Sullivan ST, O'Shaughnessy M, O'Connor TP (2000) Effects of a silicone-coated polyamide net dressing and calcium alginate on the healing of split skin graft donor sites: a prospective randomised trial. Acta Chirurgiae Plasticae 42(1): 3–6