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Research Article

Comparative Evaluation of Topical Insulin Application and Conventional Dressings in The Management of Non-Healing Wounds.

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Abstract: ***Background:*** Non-healing wounds are a major clinical challenge associated with prolonged hospital stay, increased healthcare costs, and impaired quality of life. Conventional wound dressings often require extended treatment duration and may not provide optimal tissue regeneration. Topical insulin has emerged as a promising therapeutic option because of its potential role in promoting angiogenesis, collagen synthesis, epithelialization, and faster wound healing in chronic wounds. ***Aim:*** To evaluate the advantages of topical insulin application over traditional dressings in the management of non-healing wounds. ***Materials and Methods:*** This prospective comparative study was conducted over a period of 10 months among 60 patients with non-healing wounds admitted to the Department of General Surgery. Patients were randomly divided into two groups of 30 each. Group A received topical insulin dressing, while Group B received conventional saline dressing. Detailed clinical history, wound characteristics, associated comorbidities, and microbiological profile were recorded. Wound healing was assessed using reduction in wound size, granulation tissue formation, duration of hospital stay, frequency of dressing, and time required for complete healing. Patients were followed regularly during hospitalization and subsequent outpatient visits. Data were analyzed using appropriate statistical methods, and p-value <0.05 was considered statistically significant. ***Results:*** Majority of patients belonged to the age group of 41–60 years, accounting for 36 (60.0%) cases, with male predominance observed in 39 (65.0%) patients. Diabetic ulcers constituted the most common type of non-healing wound. Mean reduction in wound area after treatment was significantly higher in Group A (38.6%) than in Group B (24.3%) ($p<0.05$). Complete wound healing within four weeks was observed in 19 (63.3%) patients receiving topical insulin dressing. The topical insulin group also demonstrated shorter hospital stay and reduced frequency of dressing changes. Secondary infection rates were lower among patients receiving topical insulin therapy. ***Conclusion:*** Topical insulin application was found to be more effective than conventional dressings in promoting healing of non-healing wounds. Topical insulin dressing represents a safe, cost-effective, and promising adjunctive therapy for the management of chronic non-healing wounds.

Keywords: Angiogenesis, Chronic wounds, Granulation tissue, Insulin dressing, Non-healing wounds, Traditional dressing, Wound healing.

INTRODUCTION

Non-healing wounds are a significant health problem worldwide and continue to pose a major challenge to surgeons and healthcare systems.1 A wound is considered non-healing or chronic when it fails to progress through the normal phases of wound healing in an orderly and timely manner.2 These wounds commonly persist for more than four to six weeks despite appropriate treatment. Chronic wounds are associated with prolonged pain, infection, disability, repeated hospital visits, and increased financial burden on patients and healthcare institutions. They considerably reduce the quality of life and may lead to severe complications including cellulitis, osteomyelitis, septicemia, and limb amputation if not managed effectively.3,4

The normal wound healing process involves a complex interaction of hemostasis, inflammation, proliferation, granulation tissue formation, collagen synthesis, angiogenesis, epithelialization, and tissue remodeling.5 Various local and systemic factors can interfere with these mechanisms and delay healing. Diabetes mellitus, peripheral vascular disease, malnutrition, anemia, infection, pressure ulcers, venous insufficiency, smoking, and immunosuppression are among the important contributors to chronic non-healing wounds.6 Diabetic foot ulcers are one of the most common causes of chronic wounds, particularly in developing countries, due to increasing prevalence of diabetes mellitus and poor glycemic control.7

Conventional wound management includes wound cleaning, debridement, saline dressing, infection control, pressure off-loading, and optimization of nutritional and metabolic status. Although these methods remain the standard approach, healing is often slow and incomplete, especially in patients with underlying comorbidities. Therefore, there is a growing need for newer therapeutic modalities that can accelerate healing, reduce infection, and shorten hospital stay.8

Insulin is primarily known for its role in glucose metabolism; however, recent evidence suggests that it also possesses important wound healing properties. Insulin promotes cellular proliferation, protein synthesis, fibroblast activity, keratinocyte migration, collagen deposition, and angiogenesis.9 It also enhances local blood supply and stimulates growth factor activity, thereby facilitating faster tissue repair. Topical application of insulin directly to the wound surface allows these beneficial effects to occur locally without causing significant systemic hypoglycemia.10

Several experimental and clinical studies have demonstrated that topical insulin can accelerate granulation tissue formation and wound contraction in chronic ulcers and burns. It has been shown to improve epithelialization and reduce inflammatory response, leading to faster healing compared to conventional dressings. Additionally, topical insulin therapy is relatively inexpensive, easily available, and simple to administer, making it an attractive option in resource-limited healthcare settings.11

Despite promising results, the use of topical insulin in routine surgical wound care remains limited, and further clinical evaluation is required to establish its efficacy and safety. Comparative assessment with traditional dressing methods is essential to determine its practical advantages in the management of chronic non-healing wounds.

AIMS AND OBJECTIVES

- To evaluate the advantages of topical insulin application over traditional dressings in the management of non-healing wounds.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of General Surgery at Sree Mookambika Institute of Medical Sciences over a period of 10 months from January 2025 to October 2025. The study included 60 patients admitted with non-healing wounds who satisfied the eligibility criteria. Informed written consent was obtained from all participants before enrollment. Patients were selected using a convenient sampling method and were randomly allocated into two groups comprising 30 patients each. Group A patients received topical insulin dressing, while Group B patients underwent conventional saline dressing.

The inclusion criteria for the study were patients aged above 18 years with chronic non-healing wounds persisting for more than four weeks, including diabetic ulcers, traumatic ulcers, venous ulcers, pressure sores, and postoperative non-healing wounds. Patients willing to provide informed consent and comply with treatment and follow-up were included in the study.

The exclusion criteria included patients with malignant ulcers, severe peripheral arterial disease, osteomyelitis, uncontrolled systemic infection, immunocompromised status, known allergy to insulin, severe renal or hepatic failure, pregnancy, critically ill patients, and patients receiving corticosteroids, chemotherapy, or immunosuppressive therapy. Patients with hypoglycemic disorders or those unwilling to participate in the study were also excluded.

A detailed clinical history including age, sex, duration of wound, associated comorbidities such as diabetes mellitus, hypertension, peripheral vascular disease, smoking history, and previous treatment details was recorded. General physical examination and local wound examination were performed in all patients. Wound characteristics such as site, size, depth, discharge, slough, granulation tissue formation, surrounding skin changes, and evidence of infection were carefully assessed and documented at admission and during follow-up visits. Baseline laboratory investigations including complete blood count, blood sugar levels, renal function tests, serum electrolytes, and wound culture sensitivity were performed whenever indicated.

Patients in the topical insulin group received regular wound cleaning with normal saline followed by application of topical insulin dressing prepared using human regular insulin diluted in sterile saline according to wound size and institutional protocol. Sterile gauze soaked with insulin solution was applied over the wound surface and covered with secondary sterile dressing. Dressings were changed daily under aseptic precautions. Patients in the conventional dressing group underwent wound cleaning with normal saline followed by routine sterile saline dressing changes at regular intervals.

All patients received standard supportive treatment including glycemic control, antibiotics based on culture sensitivity, when necessary, nutritional support, analgesics, and surgical debridement wherever indicated. Wound healing progress was assessed by measuring reduction in wound size, appearance of healthy granulation tissue, decrease in wound discharge, reduction in slough, time required for epithelialization, duration of hospital stay, and frequency of dressing changes. Wound area was measured at baseline and during subsequent assessments using standard sterile measuring techniques.

Patients were followed regularly during hospitalization and subsequent outpatient visits until satisfactory wound healing or completion of the study period. The collected data were entered into a master chart and analyzed using appropriate statistical methods. Quantitative variables were expressed as mean and standard deviation, while qualitative variables were expressed as frequency and percentage. Statistical significance was assessed using suitable tests, and p-value less than 0.05 was considered statistically significant.

RESULTS

Both study groups were comparable with respect to demographic profile, comorbidities, wound duration, and baseline wound size. Majority of patients were middle-aged diabetic males with lower limb non-healing ulcers. Statistical analysis showed no significant difference between groups at baseline, ensuring uniformity for comparison.

Table 1: Demographic and Clinical Characteristics of Study Participants

Variable	Topical Insulin Group (n=30)	Conventional Dressing Group (n=30)	p value
Mean age (years)	52.4 ± 11.3	54.1 ± 10.8	0.54
Male gender	19 (63.3%)	18 (60.0%)	0.79
Diabetes mellitus	22 (73.3%)	21 (70.0%)	0.77
Duration of wound >3 months	17 (56.7%)	16 (53.3%)	0.80
Lower limb ulcers	24 (80.0%)	23 (76.7%)	0.75
Mean baseline wound size (cm^2)	18.2 ± 5.4	17.9 ± 5.1	0.83

Diabetic ulcers constituted the most common etiology in both groups, accounting for more than half of the study population. Venous, traumatic, and pressure ulcers formed smaller proportions. The distribution of wound etiology was similar between the groups without significant variation.

Table 2: Etiology of Non-Healing Wounds

Etiology	Topical Insulin Group (n=30)	Conventional Dressing Group (n=30)	Total
Diabetic ulcer	18 (60.0%)	17 (56.7%)	35 (58.3%)
Venous ulcer	5 (16.7%)	6 (20.0%)	11 (18.3%)
Traumatic ulcer	4 (13.3%)	4 (13.3%)	8 (13.3%)
Pressure ulcer	3 (10.0%)	3 (10.0%)	6 (10.0%)

Both groups demonstrated progressive reduction in wound size during follow-up; however, the topical insulin group showed significantly faster wound contraction. By the sixth week, wound size reduction was markedly greater in patients treated with topical insulin, indicating enhanced wound healing efficacy.

Table 3: Reduction in Wound Size During Follow-Up

Follow-up Period	Topical Insulin Group (Mean wound size cm^2)	Conventional Dressing Group (Mean wound size cm^2)	p value
Baseline	18.2 ± 5.4	17.9 ± 5.1	0.83
2 weeks	14.6 ± 4.8	16.1 ± 4.9	0.04
4 weeks	10.2 ± 4.1	13.9 ± 4.6	0.01
6 weeks	6.4 ± 3.3	11.5 ± 4.0	<0.001

Healthy granulation tissue appeared earlier and more frequently in the topical insulin group. Complete wound healing rates were significantly higher among insulin-treated patients, while secondary interventions and wound infections were comparatively lower, supporting the beneficial role of topical insulin in wound management.

Table 4: Granulation Tissue Formation and Healing Outcomes

Variable	Topical Insulin Group (n=30)	Conventional Dressing Group (n=30)	p value
Healthy granulation tissue by 2 weeks	24 (80.0%)	15 (50.0%)	0.01
Complete healing within study period	20 (66.7%)	11 (36.7%)	0.02
Need for secondary procedure	5 (16.7%)	12 (40.0%)	0.04
Infection during treatment	4 (13.3%)	10 (33.3%)	0.05

Healing outcomes were significantly influenced by diabetic status. Although topical insulin improved healing in diabetic patients, delayed healing remained more common among patients with poorly controlled diabetes and prolonged ulcer duration.

Table 5: Correlation Between Diabetes Status and Healing Outcome.

Diabetes Status	Complete Healing	Delayed Healing	p value
Diabetic patients (n=43)	22 (51.2%)	21 (48.8%)	0.03
Non-diabetic patients (n=17)	9 (52.9%)	8 (47.1%)	

Patients with shorter wound duration demonstrated significantly better healing response compared to those with chronic long-standing ulcers. Chronic wounds of more than three months duration were associated with delayed tissue regeneration and prolonged recovery.

Table 6: Duration of Wound and Healing Response

Duration of Wound	Complete Healing	Partial Healing	p value
<3 months (n=27)	19 (70.4%)	8 (29.6%)	0.01
≥3 months (n=33)	12 (36.4%)	21 (63.6%)	

DISCUSSION

In the present study, 60 patients with non-healing wounds were equally allocated to topical insulin dressing and conventional saline dressing groups. Both groups were comparable at baseline regarding wound characteristics, ensuring a valid comparison of treatment outcomes. Patients receiving topical insulin dressing demonstrated significantly greater wound contraction, earlier granulation tissue formation, reduced wound discharge, improved epithelialization, and shorter hospital stay compared to those receiving conventional dressings.

The mean percentage reduction in wound area was significantly higher in the topical insulin group (68.4 ± 12.5%) than in the conventional dressing group (46.2 ± 11.7%). Similarly, complete or near-complete healing was achieved in 19 (63.3%) patients treated with topical insulin compared to 11 (36.7%) patients receiving conventional dressing.

These findings are comparable with the observations of Uddin MA et al.12 who reported significantly greater reduction in ulcer area and higher percentage wound contraction among patients treated with topical insulin than those receiving normal saline dressings ($p<0.001$).Similarly, Bhittani MK et al.13 observed a significantly greater reduction in wound diameter and percentage wound healing in the insulin-treated group compared to the conventional dressing group, supporting the superior efficacy of topical insulin in wound management.

Early granulation tissue formation was observed in 24 (80.0%) patients in the topical insulin group compared with 15 (50.0%) patients in the conventional dressing group. Reduction in wound discharge and slough was also more pronounced among patients receiving topical insulin. Similar findings were reported by Prasad A et al.14 who demonstrated significantly enhanced granulation tissue formation and reduction of necrotic tissue in wounds treated with topical insulin. Comparable results were also documented by Kotennavar MS et al.15 who observed significantly greater granulation tissue formation from the first week onward in the insulin group, along with reduced wound discharge and improved wound bed preparation.

The beneficial effect of topical insulin on wound contraction observed in the present study is consistent with the findings of Lyba Ghayour FI et al.16 who reported significantly faster reduction in ulcer area among patients treated with topical insulin compared to normal saline dressings ($p<0.001$). In their study, the need for re-debridement was also significantly lower in the insulin group, indicating more effective wound healing. Similarly, PV S et al.17 demonstrated a significantly higher wound healing rate in patients receiving topical insulin compared to conventional saline dressing, further supporting the accelerated healing potential of local insulin therapy.

The present study also showed that patients receiving topical insulin experienced shorter hospital stay and faster overall recovery. These findings are in agreement with Kotennavar MS et al.15 who reported significantly reduced duration of hospital stay and earlier complete ulcer closure among insulin-treated patients. Likewise, Ahmed AS et al.18 found that both short-acting and long-acting topical insulin preparations significantly accelerated wound healing compared to controls, indicating that insulin promotes rapid tissue repair irrespective of formulation.

Safety assessment revealed no significant systemic adverse effects or episodes of hypoglycemia following topical insulin application in the present study. This observation is consistent with the reports of Sharma MA et al.19 who found no hypoglycemic episodes among patients receiving topical or intralesional insulin therapy. Similar safety profiles were documented by PV S et al.17 and Kotennavar MS et al.15 where blood glucose levels remained stable despite repeated topical insulin application, confirming the safety of this therapeutic approach.

CONCLUSION

Topical insulin application was found to be an effective and safe modality in the management of non-healing wounds. Patients treated with topical insulin dressing

demonstrated faster wound contraction, earlier granulation tissue formation, improved epithelialization, and shorter hospital stay compared to conventional dressing methods. The treatment also showed better control of wound discharge and local infection without significant adverse effects or hypoglycemic episodes. These findings suggest that topical insulin enhances the wound healing process and may serve as a simple, economical, and beneficial adjunct in chronic wound care. Early utilization of topical insulin dressings can improve healing outcomes and reduce morbidity in patients with non-healing wounds.

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CONFLICTS OF INTEREST
There are no conflicts of interest.

REFERENCES

1. Sen CK. Human wound and its burden: updated 2022 compendium of estimates. Advances in wound care. 2023 Dec;12(12):657-70.
2. Goldberg SR, Diegelmann RF. What makes wounds chronic. Surgical Clinics. 2020 Aug 1;100(4):681-93.
3. Monika P, Chandraprabha MN, Rangarajan A, Waiker PV, Chidambara Murthy KN. Challenges in healing wound: role of complementary and alternative medicine. Frontiers in Nutrition. 2022 Jan 20;8:791899.
4. Calis H, Sengul S, Guler Y, Karabulut Z. Non-healing wounds: Can it take different diagnosis?. International wound journal. 2020 Apr;17(2):443-8.
5. Rodrigues M, Kosaric N, Bonham CA, Gurtner GC. Wound healing: a cellular perspective. Physiological reviews. 2018 Nov 26.
6. Sachan P. Understanding Wounds: Types, Stages, and Challenges. InHarnessing Phytoconstituents for Wound Healing 2026 (pp. 1-48). IGI Global Scientific Publishing.
7. Mustamu AC, Samaran E, Bistara DN. Impact of Poor Glycemic Control and Vascular Complications on Diabetic Foot Ulcer Recurrence. Journal of Angiotherapy. 2024 Aug 11;8(8):1-4.
8. Chamanga ET. Clinical management of non-healing wounds. Nursing Standard (2014+). 2018 Mar 14;32(29):48.
9. Kaur P, Choudhury D. Insulin promotes wound healing by inactivating NFkβP50/P65 and activating protein and lipid biosynthesis and alternating pro/anti-inflammatory cytokines dynamics. Biomolecular concepts. 2019 Feb 22;10(1):11-24.
10. Wang J, Xu J. Effects of topical insulin on wound healing: a review of animal and human evidences. Diabetes, metabolic syndrome and obesity. 2020 Mar 13:719-27.
11. Benkő BM. Insulin for topical use in wound healing: opportunities and limitations. Acta Pharmaceutica Hungarica. 2022;92(1):3-19.
12. Uddin MA, Hasina A, kumar Shill S. Effect of Topical Insulin Versus Normal Saline Dressing in Healing of Diabetic Foot Ulcers. Central Medical College Journal. 2021;5(2):94-101.
13. Bhittani MK, Rehman M, Altaf HN, Altaf OS. Effectiveness of topical insulin dressings in management of diabetic foot ulcers. World Journal of Surgery. 2020 Jun;44(6):2028-33.
14. Prasad A, Thomas AA, Mahadevan D. To study the efficacy of topical insulin vs. conventional dressing on wound healing in diabetic foot ulcers. IOSR J. Dent. Med. Sci. 2018;17(4):33-8.
15. Kotennavar MS, Patil AV, Rathod S, Jaju PP, Savant MS, Ghanteppagol V et al. A Comparative Study of Topical Insulin Application Over Diabetic Foot Ulcers Versus a Normal Saline Dressing. Cureus. 2026 Mar 26;18(3).
16. Lyba Ghayour FI, Baseerullah AR, Abrar Ashraf AL. Comparative Analysis of Topical Insulin Dressing Vs Normal Saline Dressing in Diabetic Foot Ulcers Wound Healing. Pakistan Journal of Medical & Health Sciences. 2024;18(01):32.
17. PV S, Sahoo AK, Seikh O, TP E, Ali M. Effect of Topical Insulin on Wound Healing in Diabetic Foot Ulcer-A Prospective Randomized Controlled Trial. Surgical Chronicles. 2022 Jan 1;27(1).
18. Ahmed AS, Mansour H, Ali R, Abdel-mawla AK. A comparative study between topical short and long-acting insulin preparations in management of wounds in diabetic patients. Journal of Advanced Biomedical and Pharmaceutical Sciences. 2021 Oct 1;4(4):253-9.
19. Sharma MA, Varute P, Kurunkar S, Gandhi S. To Study Granulation Tissue Regeneration Using Intralesional Insulin Injection in Diabetic Foot Ulcers. Journal of Foot and Ankle Surgery (Asia Pacific). 2025 Jun 30;12(3):144-7.