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ORIGINAL RESEARCH

# THE EFFECTIVENESS OF MODERN DRESSINGS ON CHRONIC WOUND HEALING: A LITERATURE REVIEW

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**Abstract**

**Background**: Chronic wounds, such as diabetic foot ulcers, are a serious health problem with increasing prevalence and risk of complications like infection and amputation. Modern wound dressing, as an innovative approach, is considered effective in creating an optimal moist wound environment to accelerate healing.

**Purpose**: This literature review aims to analyze the effectiveness of various types of modern dressings on the chronic wound healing process.

**Methods**: Articles were collected from PubMed, Google Scholar, and ScienceDirect databases using the keywords "Modern wound dressing" AND ("hydrocolloid" OR "alginate" OR "silver dressing") AND "chronic wound healing", limited to publications from 2021 to 2025. A total of 10 articles met the inclusion criteria.

**Results**: The findings indicate that modern dressings (hydrocolloid, silver dressing, alginate) are effective in accelerating wound healing through mechanisms such as maintaining a moist environment, enhancing angiogenesis and collagen deposition, modulating immune responses (M2 macrophage polarization), and providing an antibacterial effect.

**Conclusion**: These dressings are relatively safe, biocompatible, and can improve patient comfort. However, their effectiveness depends greatly on the accurate selection of the dressing type according to wound characteristics. Training for healthcare workers in dressing selection and further research on the development of innovative materials, such as bioactiveloaded dressings, are recommended.

## Background

Chronic wounds are defined as wounds that deviate from the normal physiological healing process or fail to heal in an orderly and predictable manner, in contrast to acute wounds. Wounds are often classified as chronic if they do not heal within three months. Common examples include pressure ulcers (decubitus), leg ulcers, diabetic wounds, and malignant (fungating) wounds (Hidayat et al., 2024).

Chronic wounds fail to progress through the normal stages of healing—hemostasis, inflammation, proliferation, and remodeling—within the expected timeframe (usually more than 4–6 weeks) due to systemic and local factors such as microbial infection, poor perfusion, neuropathy, hyperglycemia, and moisture imbalance. In patients with metabolic diseases such as diabetes, impaired circulation and immune function lead to a prolonged inflammatory phase, delaying granulation tissue formation and increasing the risk of infection (Ousey et al., 2020).

According to the World Health Organization (WHO), approximately 6.5 million people worldwide suffer from chronic wounds such as diabetic foot ulcers (DFU), pressure ulcers, and venous leg ulcers, with lower extremity amputation rates reaching 15–25% among diabetic

patients with infected wounds. In developing countries, including Indonesia, the incidence of chronic wounds continues to rise alongside the growing prevalence of chronic diseases such as diabetes mellitus (Hidayat et al., 2024). Data from the Indonesian Ministry of Health (Kemenkes, 2023) show that the prevalence of diabetes in Indonesia reaches 11.8% of the adult population, with most cases undiagnosed at an early stage. Among these, 15–25% of patients develop diabetic foot ulcers during their disease progression, and about 85% of lower-limb amputations originate from these wounds. This condition increases healthcare costs and negatively affects patients' quality of life and mortality risk (Ousey et al., 2020).

Selecting the appropriate wound dressing is a key component in accelerating chronic wound healing. Conventional dressings such as sterile gauze tend to be dry, adhere to wound tissue, and cause trauma during dressing changes. In contrast, modern dressings are designed to maintain a moist wound environment (moist wound healing), promoting epithelial regeneration, stimulating fibroblast migration, and reducing pain and infection risk (Sriwiyati & Kristanto, 2020). Various types of modern dressings have been developed, including hydrocolloid, foam, alginate, hydrogel, and silver dressings. Each type offers distinct advantages, such as absorbing excess exudate, maintaining optimal moisture, and providing a barrier against pathogenic microorganisms. Alginate, a natural biopolymer derived from brown algae, is widely used due to its high fluid absorption capacity, biocompatibility, and ability to enhance granulation tissue formation. Meanwhile, hyaluronic acid supports cell proliferation and epithelialization (Sriwiyati & Kristanto, 2020).

Studies have shown that modern dressings containing bioactive elements such as zinc oxide nanoparticles (ZnO-NPs) effectively accelerate chronic wound healing, reduce hospitalization duration, and improve patient comfort. These technologies are safe, biocompatible, and easy to apply, making them ideal for modern clinical practice (Ousey et al., 2020). Therefore, this literature review aims to evaluate and analyze the effectiveness of various types of modern wound dressings in the healing of chronic wounds, with a particular focus on the development of innovative materials such as ZnO-loaded alginate–hyaluronic acid aerogels. This study is expected to provide comprehensive scientific insight and serve as a foundation for evidence-based nursing interventions to promote effective, safe, and sustainable wound care.

## Method

This article employed a literature review method, which involves examining, summarizing, and comparing previous research from credible sources to derive comprehensive conclusions, with the aim to collect relevant scientific evidence on the effectiveness of modern dressings for chronic wound healing and to provide an overview of the types of dressings—hydrocolloid, foam, alginate, and silver—in accelerating wound recovery. The literature search was conducted through PubMed, Google Scholar, and ScienceDirect using the keywords "Modern wound dressing" AND ("hydrocolloid" OR "foam dressing" OR "alginate" OR "silver dressing") AND "chronic wound healing" for publications from 2020–2025, with the inclusion criteria comprising studies involving subjects with chronic wounds (e.g., diabetic ulcers, pressure ulcers, venous ulcers), research evaluating the effectiveness of modern dressings on wound healing, articles in English or Indonesian, and full-text journal publications between

2020 and 2025, while the exclusion criteria consisted of non-full-text articles, studies unrelated to chronic wounds (e.g., acute wounds), and editorials, brief reviews, or single case reports.

The literature search was conducted in November 2025, following the steps below: 1) Determining the topic: the effectiveness of modern dressings in chronic wound healing. 2) Formulating research questions using the PICO framework:

P (Population): Patients with chronic wounds

I (Intervention): Use of modern dressings (hydrocolloid, foam, alginate, silver)

C (Comparison): Conventional dressing or no special intervention

O (Outcome): Improved wound healing rate

3) Setting inclusion and exclusion criteria. 4) Searching databases using keywords and publication year filters. 5) Extracting key information (author, year, study design, sample size, type of dressing, and results). 6) Analyzing comparable studies to identify patterns and synthesize findings. 7) Presenting results following the PRISMA Flow Diagram framework.

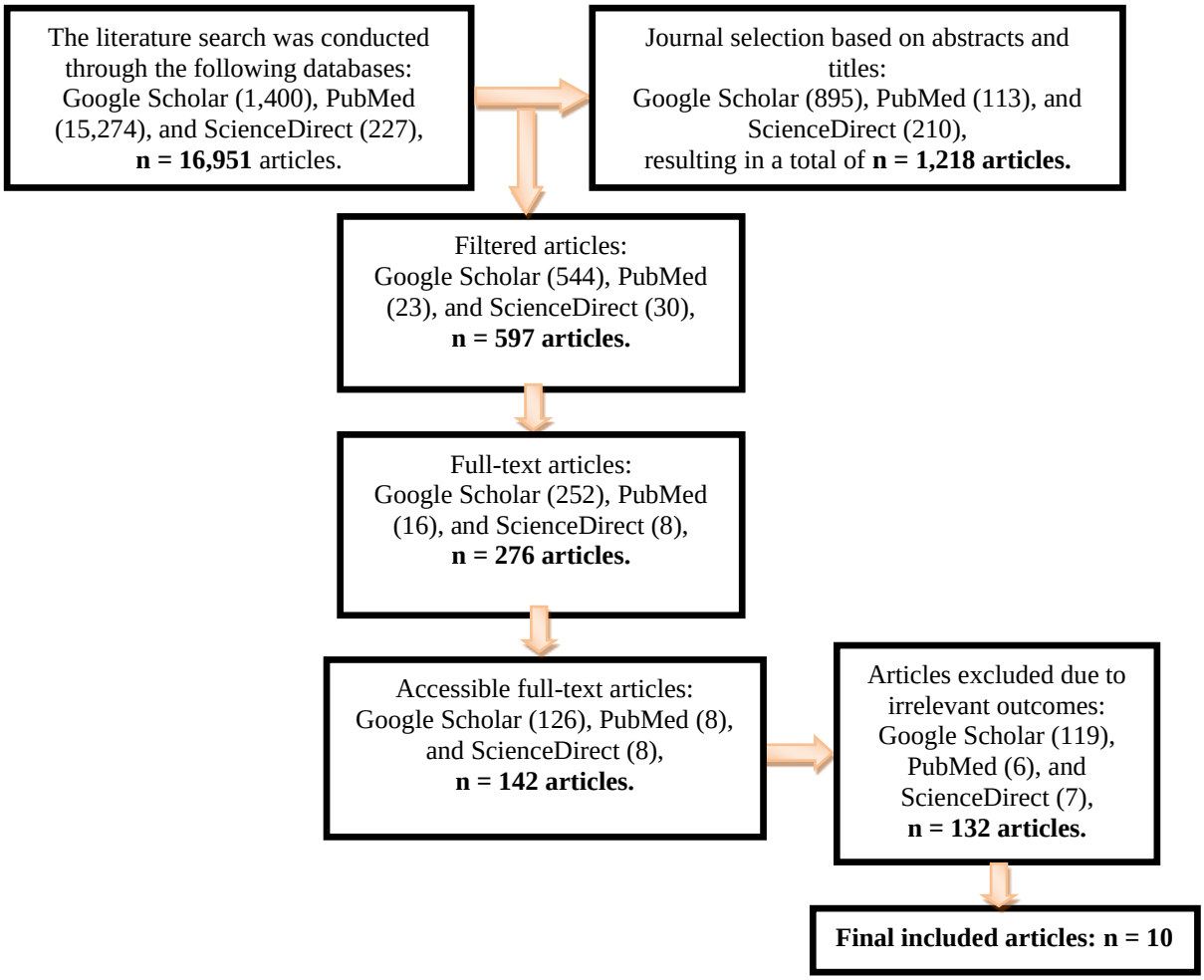


Figure 1. Literature Search

## Results

Based on the literature search conducted using the specified keywords, ten (10) articles met the inclusion criteria and were analyzed in this review. These studies were summarized in tabular form to facilitate analysis and comparison, as shown below.

| No | Author | Title | Objective | Method | Findings | Conclusion |
|---|---|---|---|---|---|---|
| 1. | (Takeuchi et al., 2020) | Hydrocolloid dressing improves wound healing by increasing M2 macrophage polarization in mice with diabetes | To explain the mechanism of hydrocolloid dressings in accelerating diabetic wound healing and to apply moist environment therapy as a non-pharmacological intervention to enhance angiogenesis and M2 macrophage polarization. | Experimental study conducted on diabetic mice with full-thickness skin wounds, comparing the effects of hydrocolloid dressings and gauze on wound healing by analyzing immune cell responses, growth factors, and histological changes over time. | Hydrocolloid dressings significantly accelerated diabetic wound healing in mice by enhancing angiogenesis through VEGF, promoting collagen deposition, and inducing macrophage polarization toward the anti-inflammatory M2 phenotype. | Hydrocolloid dressings effectively promote diabetic wound healing by creating a moist environment that accelerates angiogenesis via VEGF stimulation, encourages collagen deposition, and induces M2 macrophage polarization for inflammation resolution and tissue repair. |
| 2. | (Priyadarsini et al., 2023) | Assessment framework for the selection of a potential interactive dressing material for diabetic foot ulcer | To develop and implement a Graph Theoretic Approach (GTA)-based framework for selecting, analyzing, and ranking potential interactive dressing materials for Diabetic Foot Ulcers (DFU). | Graph Theoretic Approach was used to analyze relationships among factors and rank dressing materials based on expert evaluations. | The study found Alginate dressing to be the best material, while modified Hydrogel was considered the most promising due to its ability to serve as a drug delivery system. | Although Alginate ranked highest, modified Hydrogel was identified as the most promising candidate for DFU treatment because of its regenerative drug delivery potential. |
| 3. | (Nandatari et al., 2025) | Penatalaksanaan perawatan luka kaki diabetik dengan *Foam dressing* di klinik griya afiat | To examine the use of foam dressings in treating diabetic foot ulcers with impaired tissue integrity at Griya Afiat | Case study exploring detailed clinical observations and treatment outcomes. | After twice-weekly wound care sessions, no significant improvement was observed; wound appearance, granulation (60%), and slough (40%) remained unchanged between visits. | Foam dressings were found ineffective for diabetic foot ulcer healing. |

| No | Author | Title | Objective | Method | Findings | Conclusion |
|---|---|---|---|---|---|---|
| | | makassar tahun 2025 | Clinic, Makassar. | | | |
| 4. | (Sriwiyati & Kristanto, 2020) | Karakteristik luka dan penggunaan balutan Luka modern | To describe wound characteristics and the use of modern wound dressings at Salud Wound Care Clinic, Kartasura. | Descriptive-analytic study designed to present a comprehensive overview of wound characteristics and dressing types, using observation sheets for data collection. | The wounds treated included diabetic ulcers, post-surgical wounds, cancer wounds, and pressure ulcers, with durations ranging from 2 weeks to 1 year. Dressings used were foam, alginate, and hybrid technology dressings. Wound area decreased from a mean of 14.69 to 11.61, mostly stage 2 wounds with red wound beds and serous exudate. | There was a reduction in wound size, wound stage, and exudate level, along with improved wound bed color following wound care with modern dressings. |
| 5. | (Hudaf & Daryani, 2024) | Penerapan Modern Dressing pada Luka Ganggren Grade II Ulkus Diabetikum: Studi Kasus di Bangsal Wijaya Kusuma RSUD Wonosari | To describe nursing care involving the use of modern dressing for a patient with grade II gangrene due to diabetic ulcers. | Case study with direct observation of one diabetic patient with gangrene, treated using modern dressing over three days of wound care at Wonosari Hospital. | After five days of modern dressing treatment, improvements were noted: reduced exudate, decreased odor, diminished necrotic tissue, and increased granulation tissue formation. | Modern dressings are effective in maintaining wound moisture, accelerating new tissue formation, reducing odor, and promoting healing in gangrene caused by diabetic ulcers. |
| 6. | (Hidayat et al., 2024) | Efektivitas Penggunaan *Silver Dressing* terhadap Penyembuhan Luka Diabetikum | To determine the effectiveness of silver dressings in the healing process of diabetic wounds. | Quasi-experimental design with a pretest–posttest approach without control group involving 25 respondents. The BWAT instrument was used, and data were analyzed using paired sample t-test. | The mean BWAT score decreased from 38.44 ± 8.14 (pretest) to 24.80 ± 5.89 (posttest) with a p-value of 0.000 ($p < 0.05$), indicating a significant effect of silver dressing on wound healing. | Silver dressings significantly accelerate diabetic wound healing by maintaining moisture and inhibiting microbial growth. |
| 7. | (Yuliyanto et al., 2025) | Penerapan *Hydrocolloid* Dalam Proses | To describe the outcome of wound care | Descriptive case study involving two | Before treatment, BWAT scores were 26 and 24; after | Hydrocolloid dressings are effective in |

| No | Author | Title | Objective | Method | Findings | Conclusion |
|---|---|---|---|---|---|---|
| | | Penyembuhan Luka Ulkus Diabetik | using hydrocolloid modern dressings on diabetic ulcers. | patients at Salud Wound Care Clinic, Kartasura, over one week with two dressing applications. BWAT scores were measured before and after intervention. | intervention, they decreased to 19 and 13, respectively, indicating accelerated healing. | promoting diabetic ulcer healing by creating an optimal moist environment and improving wound care quality. |
| 8. | (Haji et al., 2025) | Efektivitas Perawatan Luka Kronik Dengan metode *Wound Healing Dressing* Terhadap Penyembuhan Luka Ulkus Diabetikum Di Praktek Perawat Pusat Perawatan Luka, Stoma, Inkontinensia Asri Wound Care Center MedanTahun 2024 | To examine the effectiveness of the wound healing dressing method in diabetic ulcer care. | Quantitative quasi-experimental design (one-group pre–post test) involving 21 diabetic ulcer patients. Data analyzed using paired sample t-test with the Winner Scale instrument. | Mean Winner Scale score decreased from 29.47 to 25.47 ($p = 0.000 < 0.05$), indicating a significant effect of the wound healing dressing method. | Wound healing dressing effectively accelerates diabetic ulcer healing by maintaining moisture, reducing infection, and promoting tissue regeneration. |
| 9. | (Hudaf & Daryani, 2024) | Assessment framework for the selection of a potential interactive dressing material for diabetic foot ulcer | To identify and evaluate the most potential wound dressing materials for diabetic foot ulcers (DFU), considering wound-healing capability and regenerative drug delivery potential. | Graph Theoretic Approach (GTA) used to evaluate and rank nine dressing materials based on ten wound-healing factors. Data were obtained from literature and expert opinions from five medical professionals. | Top five materials by graph index score: Alginate (0.934889), Honey (0.92752), MediFoam (0.923147), Saline (0.921321), and Hydrogel (0.916918). Hydrogel showed the greatest potential for regenerative drug delivery. | Although Alginate ranked highest, Hydrogel was identified as the most promising material for future use due to its regenerative drug delivery and exudate control capabilities. The GTA approach is applicable for assessing other biomaterials. |
| 10. | (Athamneh et al., 2025) | Investigation of the Antibacterial | To investigate the antibacterial | Laboratory experiment: aerogels were | ZnO-loaded aerogels showed stronger antibacterial activity | ZnO–NP-loaded alginate/hyal |

| No | Author | Title | Objective | Method | Findings | Conclusion |
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| | | Activity of ZnO-Loaded Alginate/Hyaluronic Acid Aerogels for Wound Dressing Applications | activity of alginate–hyaluronic acid aerogels loaded with zinc oxide nanoparticles (ZnO-NPs) as a potential wound dressing material. | fabricated using supercritical $CO_2$ drying, characterized via SEM, FTIR, BET, and antibacterial testing against *Staphylococcus aureus* and *Escherichia coli* using agar diffusion. | than hydrogels, especially at 20 mg/mL ZnO concentration, with fluid absorption of 5791% and sustained antibacterial release over 24 hours. | uronic acid aerogels have great potential as antibacterial wound dressings due to their porous structure, high absorbency, and sustained antibacterial release. Further *in vivo* studies are needed to evaluate safety and efficacy. |

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## Discussion

Based on the review of ten analyzed articles, it was found that the use of modern wound dressings has a positive impact on the healing process of chronic wounds, particularly in cases of diabetic ulcers. All studies employing hydrocolloid, silver, and wound healing dressings showed significant improvements in the rate of healing and in the characteristics of the wounds. Significant reductions in the Bates-Jensen Wound Assessment Tool (BWAT) and Winner Scale scores were observed following the application of modern dressings, both in case studies and experimental research.

In general, the findings indicate that modern dressings consistently accelerate the wound healing process. For instance, the study by (Hidayat et al., 2024) demonstrated the effectiveness of silver dressings, with a mean BWAT score reduction from 38.44 ± 8.14 to 24.80 ± 5.89. In chronic wound management, modern dressings are now widely used as a non-pharmacological approach due to their ability to create an optimal moist environment that facilitates wound healing.

The hydrocolloid dressing type has been proven effective in accelerating the healing of diabetic wounds through complex biological mechanisms, including the stimulation of angiogenesis via vascular endothelial growth factor (VEGF), enhancement of collagen deposition, and polarization of macrophages toward the M2 anti-inflammatory phenotype. This finding is supported by (Yuliyanto et al., 2025), who reported a significant decrease in BWAT scores after the application of hydrocolloid dressings on diabetic ulcers, indicating successful moisture maintenance and improved wound quality.

The study by (Hidayat et al., 2024) also demonstrated that the use of silver dressings significantly reduced BWAT scores ($p < 0.05$) due to their ability to retain moisture and inhibit microbial growth. Similar results were reported by (Haji et al., 2025), who found that the use of wound healing dressings resulted in a reduction in Winner Scale scores from 29.47 to 25.47, indicating the effectiveness of these dressings in reducing infection and promoting tissue regeneration.

The application of modern dressings in clinical practice has also produced positive results. A study by (Sriwiyati & Kristanto, 2020) showed a decrease in wound size from 14.69 to 11.61, accompanied by improvements in wound stage and exudate characteristics. This demonstrates that the effectiveness of modern dressings is evident not only in experimental studies but also in their practical use across various chronic wound types in healthcare facilities. A case study by (Hudaf & Daryani, 2024) supported these findings, showing that the use of modern dressings on grade II gangrene wounds caused by diabetic ulcers reduced exudate, eliminated odor, decreased necrotic tissue, and enhanced granulation tissue formation within only five days of treatment.

Overall, findings from multiple studies suggest that modern wound dressings serve as an effective complementary method for accelerating chronic wound healing. Their effectiveness is achieved through physiological mechanisms such as the activation of the immune system (M2 macrophage polarization), improved blood circulation (angiogenesis), and infection control through antimicrobial effects. The ability of these dressings to regulate the wound microenvironment makes them a vital intervention in modern nursing wound care practice.

In addition, studies by (Hudaf & Daryani, 2024; Priyadarsini et al., 2023) introduced the Graph Theoretic Approach (GTA) as a framework for evaluating and ranking dressing materials. The results identified alginate as the best-performing material, while modified hydrogel was considered the most promising due to its capacity to serve as a regenerative drug delivery system. (Hudaf & Daryani, 2024) also concluded that hydrogel has substantial potential as a future dressing material.

The development of dressing materials continues to evolve. Research by (Athamneh et al., 2025) revealed that ZnO nanoparticle (ZnO-NP)-loaded alginate/hyaluronic acid aerogels exhibited higher antibacterial activity than conventional hydrogels, with a fluid absorption capacity of 5791% and a sustained antibacterial release pattern. These findings suggest that future innovations in modern dressings will likely focus on dual functionality accelerating wound healing while also serving as regenerative drug delivery systems.

Nevertheless, the effectiveness of modern dressings depends greatly on the appropriate selection of dressing type according to wound characteristics. A study by (Nandatari et al., 2025) revealed that foam dressings were ineffective for diabetic foot ulcer healing, as no changes in wound condition were observed between the first and second visits. Therefore, the application of modern dressings in nursing practice should be conducted by qualified professionals who carefully consider clinical conditions and wound stages.

In conclusion, modern wound dressings play a crucial role in accelerating the healing of chronic wounds through various interrelated physiological and biological mechanisms. Their effectiveness has been demonstrated in maintaining wound moisture, promoting tissue regeneration, and reducing infection risk. However, the proper selection of dressing type remains a key determinant of therapeutic success, requiring careful clinical evaluation by healthcare professionals. The continuous innovation of dressing materials—such as bioactive-based hydrogels and aerogels—shows great potential in enhancing the quality of future wound care. Therefore, the integration of modern dressings into wound care practice should be strengthened through education, ongoing research, and evidence-based implementation to achieve optimal and sustainable healing outcomes.

## Conclusion

Based on the review of ten analyzed articles, it can be concluded that the use of modern wound dressings is an effective, safe, and innovative approach to accelerating the healing of chronic wounds, particularly in cases of diabetic ulcers. Their success is supported by their ability to

maintain wound moisture, promote the formation of new tissue, and inhibit the growth of infection-causing microorganisms. Further research with controlled clinical trial designs, larger sample sizes, and longer observation periods is needed to strengthen the scientific foundation and to support the development of modern dressing materials based on active biomaterials for more advanced and evidence-based wound care practices.

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