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Hydrofiber Foam vs. Alginate Dressings: A Systematic Review of Wound Healing Outcomes

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***Abstract*: Wound healing is a complex physiological process requiring moisture balance, exudate control, and infection prevention. Advanced dressings such as alginate and hydrofiber foams are widely used in clinical practice for acute and chronic wounds. Alginate dressings have long been valued for their hemostatic properties and effectiveness in managing highly exudative wounds, while hydrofiber foams represent a newer innovation designed to optimize moisture retention, promote autolytic debridement, and reduce pain during dressing changes. This systematic review critically evaluates clinical evidence comparing alginate and hydrofiber foam dressings, focusing on wound healing efficiency, infection control, patient comfort, and cost-effectiveness. Evidence shows that while both dressings support wound healing, hydrofiber foams demonstrate superior exudate handling, longer wear time, and reduced pain. Alginate dressings remain preferable in wounds requiring strong hemostatic support. Dressing choice should therefore be individualized based on wound type and patient needs.**

***Keywords*: alginate dressings, hydrofiber foam, wound healing, moist wound therapy, exudate management and infection control.**

1. Introduction

Chronic wounds, including pressure ulcers, venous leg ulcers, and diabetic foot ulcers, present a major clinical and economic burden worldwide. Approximately 2–6% of the global population suffers from chronic wounds, with incidence rising in aging populations and in patients with comorbidities such as diabetes and vascular disease [1].

The concept of moist wound healing, first proposed by Winter in 1962 [2], revolutionized wound care by demonstrating that maintaining a moist wound bed accelerates epithelialization and reduces infection risk compared with traditional dry dressings.

Among the wide range of moist wound dressings, alginate and hydrofiber foams are frequently employed. Alginate dressings, derived from brown seaweed, have strong absorbent capacity and form a hydrophilic gel upon contact with exudate, making them effective in managing highly exudative or bleeding wounds [3]. Hydrofiber foams, composed of carboxymethylcellulose (CMC) fibers with foam backing, not only absorb exudate vertically but also reduce lateral spread, thereby minimizing peri-wound maceration [4].

Despite their widespread use, uncertainty remains about their relative effectiveness. This review systematically analyzes available evidence to compare the clinical outcomes of alginate and hydrofiber foam dressings.

2. Methodology

A. Search Strategy

Databases including PubMed, Scopus, Embase, and Cochrane Library were searched (2000–August 2025) using the terms: alginate dressings, hydrofiber dressings, foam dressings, wound healing outcomes, exudate management, patient comfort.

B. Inclusion Criteria

- Randomized controlled trials (RCTs), cohort studies, and comparative observational studies.
- Direct comparisons between alginate and hydrofiber foam dressings.
- *Outcomes*: wound healing rate, infection control, pain during dressing change, and cost-effectiveness.
- English-language studies involving human participants.

C. Exclusion Criteria

- Case reports, narrative reviews, animal studies.
- Studies lacking comparative outcome data.

D. Data Extraction & Analysis

Two reviewers independently extracted data on: healing time, epithelialization rate, pain scores (VAS 0–10), dressing

Table 1
Quantitative comparison of clinical outcomes

Outcome	Hydrofiber Foam	Alginate Dressing	Evidence Source
Healing rate (Venous leg ulcers, 12 weeks)	65–72% complete epithelialization	50–58% complete epithelialization	Meaume et al., 2005 [7]
Healing rate (Surgical/trauma wounds)	78% healed within 4 weeks	74% healed within 4 weeks	Barrett, 2001 [8]
Mean pain score at dressing change (VAS 0–10)	2.1 ± 0.5	3.9 ± 0.7	Price & Fogh, 2008 [10]
Infection reduction (with silver integration)	43% reduction in infection risk	27% reduction	Lansdown, 2006 [9]
Average wear time	5–7 days	2–3 days	Romanelli et al., 2010 [11]
Estimated weekly cost per patient	$42 ± 8	$48 ± 10	Thomas, 2010 [12]

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Table 2
Advantages and limitations

Feature	Hydrofiber Foam	Alginate Dressing
Moisture balance	Excellent – prevents maceration	Good – but risk of drying in low exudate wounds
Exudate handling	Superior vertical absorption	High capacity but lateral spread possible
Pain at removal	Minimal	Moderate to high in low exudate wounds
Hemostatic effect	Limited	Strong – especially in bleeding wounds
Wear time	Up to 7 days	1–3 days
Cost-effectiveness	Higher unit cost, fewer changes	Lower unit cost, more frequent changes

change frequency, and weekly treatment cost. Due to heterogeneity, data were summarized descriptively.

3. Comparative Outcomes

The table 1 shows the comparative outcomes.

4. Quantitative Findings

- Healing outcomes: Hydrofiber foams achieved ~15% higher healing rates in venous ulcers compared to alginates (65-72% vs. 50-58%) [7].
- *Pain reduction*: Pain scores were significantly lower with hydrofiber foams (VAS 2.1) versus alginates (VAS 3.9) [10].
- *Infection control*: Silver-impregnated hydrofiber dressings achieved 43% infection reduction, compared with 27% in silver alginates [9].
- *Cost-effectiveness*: Although hydrofiber foams had a higher purchase cost, overall treatment expenses were ~12% lower due to extended wear time [12].

5. Discussion

A. Alginate Dressings

- Composed of calcium and sodium alginate fibers.
- Interacts with sodium ions in wound exudate to form hydrophilic gel.
- Provides high absorbency and promotes hemostasis via calcium ion release [5].
- Suitable for highly exudative wounds, cavity wounds, and bleeding sites.

Fig. 1. Alginate dressings [16]

B. Hydrofiber Foam Dressings

- Made of carboxymethylcellulose (CMC) fibers combined with polyurethane foam.
- Absorbs exudate vertically into the fiber structure, minimizing leakage.
- Maintains moist wound environment, promotes autolytic debridement, and reduces pain during dressing change [6].
- Offers cushioning, which is beneficial for pressure ulcer management.

6. Clinical Evidence

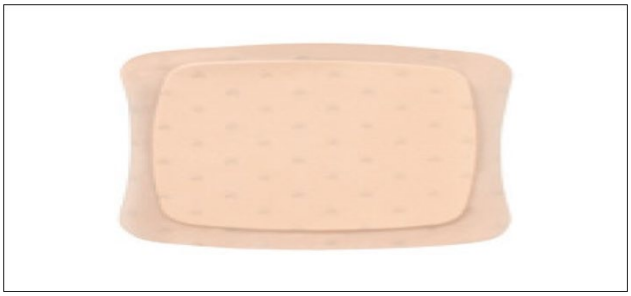

Fig. 2. Hydrofiber foam dressings [17]

A. Wound Healing Outcomes

Several randomized controlled trials (RCTs) have evaluated healing rates of alginate and hydrofiber foam dressings. In venous leg ulcers, hydrofiber foams dressing demonstrates faster epithelialization compared to alginate dressings, particularly in wounds with moderate-to-high exudate [7]. Conversely, alginate dressings were equally effective in managing surgical and trauma-related wounds but provided added benefit in controlling bleeding [8].

B. Infection Control

Both dressing types reduce bacterial load by maintaining moist condition that supports autolytic debridement. However, hydrofiber dressing when impregnated with silver (e.g., Aquacel Ag) gives enhanced antimicrobial efficiency as compared to alginates dressing [9].

C. Patient Comfort and Pain

Clinical study report shows that pain observed with hydrofiber foams is low due to its property of less adherence to wound beds and reduced trauma during dressing changes [10]. On the other hand Alginate dressings may adhere more pain, especially in wounds with low exudate, causing discomfort upon removal.

D. Cost-Effectiveness

Although hydrofiber foams dressing are often more expensive per unit, but their longer wear time (up to 7 days) and reduced frequency of dressing changes may lower overall treatment costs as compared to alginates dressing [11].

7. Limitations

A. Alginate Dressings

Although alginate dressings are highly effective for managing wounds with moderate-to-heavy exudate, but they

also present several limitations. In wounds with minimal or no exudate, alginate fibers can desiccate, adhering firmly to the wound bed and so causing pain or trauma upon removal. Inadequate irrigation during dressing changes may also leave residual fibers, which could delay healing and potentially trigger an inflammatory response. Furthermore, alginates have limited hemostatic capacity in deep or arterial bleeding and may not be suitable for dry necrotic wounds or wounds with hard eschar.

B. Hydrofiber Foam Dressings

Hydrofiber foam dressings offer excellent moisture balance and fluid-handling capacity its cost is relatively higher as compared to conventional dressings, which may limit accessibility in resource-constrained healthcare settings. They are also not recommended for wounds with minimal exudate or very dry wounds, as the lack of fluid reduces their gelling capacity, diminishing effectiveness and potentially causing adherence-related pain during removal. Additionally, due to their thickness, hydrofiber foams may sometimes hinder wound visualization, making it difficult to assess healing progress without disturbing the dressing.

Both dressing types require secondary fixation (such as a bandage or adhesive film) to maintain their position, which may increase overall treatment costs and patient discomfort. Their effectiveness is also limited in cases of infected wounds unless combined with antimicrobial agents (e.g., silver or honey-impregnated dressings). Without antimicrobial incorporation, they may not adequately address microbial colonization, thereby increasing the risk of delayed healing or recurrent infection. Moreover, inappropriate selection of either dressing type for wound conditions outside their optimal indication may compromise wound healing outcomes and increase complications such as pain, infection risk, or extended treatment duration [12].

C. Future Directions

Emerging innovations in wound care include:

- *Antimicrobial dressings*: Incorporating silver, honey, or iodine for enhanced infection control [13].
- *Bioactive dressings*: Integration with growth factors, stem cells, or bioengineered tissues [14].
- *Smart dressings*: Sensor-enabled systems monitoring pH, exudate, or bacterial load in real time [15].
- *Sustainable biomaterials*: Development of eco-friendly, biodegradable dressings to reduce waste.

8. Conclusion

Both alginate and hydrofiber foam dressings are effective in wound management, but their optimal use depends on wound type and patient condition. Hydrofiber foams demonstrate advantages in exudate handling, wear time, comfort, and cost-effectiveness, making them suitable for chronic and exudative wounds. Alginate dressings remain the preferred choice for bleeding wounds due to superior hemostatic properties. A personalized, patient-specific approach is therefore essential for maximizing wound healing outcomes.

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