

Economics of pressure-ulcer care: review of the literature on modern versus traditional dressings

Published evidence suggests that some of the benefits of modern dressings — longer wear times and less frequent dressing changes — make them more cost-effective than traditional gauze dressings in pressure ulcer management

modern dressings; traditional dressings; pressure ulcers; economic profile

Despite the breadth of literature on wound-care treatments, published systematic reviews^{1,2} of studies comparing clinical outcomes of modern versus traditional dressings on chronic wounds suggest the former did not clearly demonstrate effectiveness over the latter, mainly because the methodology used to test them was inadequate.

We propose adding another important dimension to this debate by evaluating the economic profile of modern and traditional dressings. For the purposes of this review, we have divided dressings into two separate treatment modalities:

- Traditional dressings: gauze based (dry or wet-to-dry)
- Modern dressings: these promote or maintain a moist wound environment and/or interact with the wound bed, such as collagen and silver dressings.

Method

We aimed to review the published literature on the economic aspects of modern and traditional dressings in pressure-ulcer care, such as dressing effectiveness, frequency of dressing changes and clinician time. We did not attempt to perform a

meta-analysis due to the different methodologies and endpoints measured in the literature.

Searches were undertaken in Medline (including Cochrane references) and Cinahl, and were limited to papers containing an abstract published from January 1986 to August 2006. The number of hits registered for each search term is given in Table 1.

The literature search and data extraction were performed by one reviewer, who summarised the available data for analysis and discussion by the authors. Data analysed were not limited to pure economic papers but also included clinical papers that captured data on the overall cost of treatment, cost of materials, nursing time or frequency of dressing changes over the treatment period. All of these factors have an important impact on the economic profile of a wound dressing.³

Papers were included that:

- Were published in peer-reviewed journals
- Compared one type of traditional dressing with one type of modern dressing
- Were randomised clinical studies, comparative studies, economic studies/models and meta-analyses relating to pressure ulcers.

The following types of papers were excluded:

- Case studies, literature reviews, studies that did not report results quantitatively or had very small sample sizes (less than 20 patients in total)
- Studies that compared one class of dressing with a group of dressings of different classes where the results were not reported by product type.

Acute wounds were excluded as we believe there is enough evidence proving the superiority of modern dressings in acute wounds,⁴⁻⁷ while reviews of chronic wound management have highlighted the need for further research.^{1,2,8}

Results

Once duplications were eliminated, 492 articles remained. Those that did not meet the inclusion criteria or failed to fully outline the methodology were

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- 3 Harding, K., Cutting, K., Price, P. The cost-effectiveness of wound management protocols of care. *Br J Nurs* 2000; 9: (19 Suppl), S6-S24.
- 4 Martini, L., Reali, U.M., Borgognoni, L. et al. Comparison of two dressings in the management of partial-thickness donor sites. *J Wound Care* 1999; 8: 9, 457-460.

Table 1. Number of hits produced by the search terms with Boolean operators

Search term	No. of hits Medline	No. of hits Cinhal
Pressure ulcers	5046	4375
Wound healing	36,985	4972
Bandages and dressings	439	3505
Bandages	9315	0
Costs and cost analysis	100,105	19,820
Comparative study	1,004,847	38,928

5 Wiechula, R. The use of moist wound healing dressings in the management of split-thickness skin graft donor sites: a systematic review. *Int J Nurs Pract* 2003; 9: 2, S9-S17.

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14 Gorse, G.J., Messner, R. L. Improved pressure sore healing with hydrocolloid dressings. *Arch Dermatol* 1987; 123: 766-771.

15 Singh, A., Halder, S., Menon, G.R. et al. Meta-

Table 2. Illustrative cost-minimisation model: modern versus traditional dressings

	Foam (adhesive)	Tape and gauze
Material costs per change:		
• dressings	£1.97	£0.23
• dressing pack	£0.79	£0.79
Labour costs per change:		
• nursing cost per visit	£18.00	£18.00
Dressing changes per week	2.5	15.03
Material cost per week	£6.90	£15.33
Labour cost per week	£45.00	£270.54
Total weekly costs	£51.9	£285.87

Prices from *Drug Tariff*, June 2006
 Prices for foam based on Allevyn Adhesive 10 x 10cm
 Dressing changes per week based on average rates reported in the literature³⁷
 Nursing costs from PSSRU 2005³⁷

excluded, leaving 28 papers for analysis. Nineteen papers compared moist wound dressings with gauze, and nine compared different modern dressings.

Modern dressings versus gauze

All but one of the 19 articles that compared modern dressings with gauze showed favourable results for the former. We have grouped our findings under four subsections, three corresponding to key cost drivers in wound management (frequency of dressing changes, effectiveness and nursing time) and one summarising general cost data.

• **Frequency of dressing changes** Fourteen articles demonstrated that modern agents reduced the frequency of dressing changes when compared with gauze. Reported frequencies for traditional dressings ranged from seven changes per week (once daily)⁹⁻¹² to 28 per week,¹³ with a mean of 15 changes per week (SD 6.64). Frequencies for modern dressings ranged from seven¹¹ to 1.40 per week,⁹ with a mean of three per week (SD 1.51). These differences were statistically significant ($p < 0.001$).

With modern wound dressings, the frequency of dressing changes was heavily influenced by the amount of wound exudate. Since this often reduced over time, less frequent changes were required. This reduced material costs over the whole treatment period (cash saving) and saved nursing time, enabling a better response to other health-care priorities (productivity gains).

Using the average number of dressing changes taken from the literature, we have illustrated the impact that the lower number of changes may have on UK costs (Table 2).

• **Effectiveness** The key results of these studies are summarised in Table 3. Fifteen studies, six of which

were statistically significant, demonstrated that modern dressings improved healing rates or healing times. Five were randomised controlled trials where differences in healing rates ranged from 21% ($p = 0.026$)¹⁴ to 64% (for grade II ulcers only) ($p < 0.01$)¹⁰ in favour of modern dressings. The sixth study, a meta-analysis, showed that 72% more ulcers healed with the hydrocolloid ($p < 0.001$).¹⁵

The different methodologies used and baseline characteristics of the patient populations did not allow for statistical analysis.

Grouping the healing rates was problematic due to the high variation in endpoints measured in each study. The most frequent was the percentage of ulcers healed. Others, such as time taken to heal 1cm², ulcer progression, final ulcer area as a percentage of its initial size, and general improvement, were also quoted. Wound area was a common way of measuring progression towards healing, but different methods were used to calculate it, and in most cases these were not specified.

• **Nursing time required** The reduction in nursing time spent on dressing changes with modern dressings versus gauze was captured in eight studies. With traditional dressings, the nursing time required to remove the old dressing and inspect, clean and dress the wound ranged from 75 minutes¹⁶ to 420 minutes per week,¹⁴ with a mean of 218 minutes (SD 106.87). Reported nursing times required for modern dressings ranged from 51 minutes⁹ to nine minutes per week,¹⁷ with a mean of 25 minutes (SD 14.60). The differences between the two groups were statistically significant ($p < 0.001$).

Studies that separated labour and material costs confirmed that nursing costs accounted for a significantly higher proportion of the total treatment cost. It is important, therefore, to include them in any analysis performed in this area.

• **Overall cost savings or cost differences** All 14 studies that investigated costs concluded that, despite their higher acquisition costs, modern dressings reduced overall costs. Methods of capturing costs included measuring costs for a specific treatment period (not considering healing rates) and costs per healed ulcer.

Four studies modelled costs in combination with outcomes obtained from the literature,^{3,18-20} with cost calculations based on either local/national costs or costs captured during the study.^{9,10,13,14,17,21-23}

Only two of the studies were specifically designed to explore the economic profile of the products analysed by calculating cost-effectiveness ratios.^{24,25}

Although it was not possible to group the results due to the heterogeneity of the methodologies used, the overall results appeared to consistently highlight the economic benefits of modern dressings. Further details of the studies' findings are given in Table 3.

Table 3. Main findings of studies comparing moist wound healing with gauze dressings

Reference	Sample size: patients/ulcers (no. of studies reviewed)	Indication	Type of study	Intervention	Results	p value
Sebern 1986 ¹⁰	48/77	PU (grades II and III)	Prospective randomised trial	Moisture vapour permeable (MVP) dressing vs gauze and tape	Grade II: 64% healed with MPV vs 0% with gauze at week 8 Average cost: \$845 with MPV vs \$1359 with gauze Grade III: no statistical difference	p<0.01 p<0.05
Gorse et al. 1987 ¹⁴	52/128	PU	Prospective comparative study	Saline-soaked gauze vs hydrocolloid	71% of patients given hydrocolloid healed vs 50% given gauze Weekly material cost: \$6.20 with hydrocolloid vs \$52.50 with gauze	p=0.026
Alm et al. 1989 ¹⁶	50	PU	Randomised controlled trial	Saline-soaked gauze vs hydrocolloid	Median remaining ulcer area at week 6: 0% hydrocolloid; 31% saline gauze Frequency of changes: 1.75–2.33 per week with hydrocolloid vs two per day with saline gauze	p=0.016
Xakellis et al. 1992 ¹⁷	39/not stated	PU	Randomised controlled trial	Non-sterile gauze vs hydrocolloid	Cost per treated ulcer (materials and labour) using national wages: \$15.90 with hydrocolloid vs \$25.31 with gauze	p=0.04
Colwell et al. 1993 ¹³	70/97	PU (grades II and III)	Randomised controlled trial	Hydrocolloid vs moist gauze	One ulcer healed with gauze vs 11 with hydrocolloid Average cost per case: \$53.68 with hydrocolloid vs \$176.90 with gauze	NA
Kraft et al. 1993 ²¹	38/not stated	PU (grades II and III)	Comparative study	Gauze vs foam	18.5 fewer dressing changes with foam	NA
Kim et al. 1996 ²²	44	PU (grades I and II)	Randomised controlled trial	Hydrocolloid vs wet-to-dry gauze	Average treatment cost and treatment time was significantly lower with hydrocolloid	p=0.05
Thomas et al. 1998 ¹¹	30	PU (grades II–IV)	Randomised controlled trial	Hydrogel dressing vs saline-soaked gauze	No statistical difference in healing rates or healing times Frequency of dressing changes was the same for both groups (daily changes)	
Bergemann et al. 1999 ²⁵	120/not stated	PU and VLU	Cost-effectiveness model	Gauze vs hydroactive dressing with an enzymatic ointment	PU: costs for the hydroactive dressing and gauze were DM1196 and DM9826 per case respectively	p<0.05
Capillas et al. 2000 ⁹	Not stated/70	PU (grades II and III) and VLU	Randomised controlled trial	Traditional (gauze) vs moist wound healing (MWH)	Nursing costs of re-epithelialising 1 cm ² : pesetas (PTS) 2610 with MWH vs PTS15490 with gauze	p<0.05
Harding et al. 2000 ³	Not stated (27)	Chronic leg ulcers and PU	Cost-effectiveness model using published data	Hydrocolloid vs gauze	PU: £422 per healed wound with hydrocolloid vs £2548 with gauze	NA
Aguiló Sánchez et al. 2001 ²³	70	PU	Randomised controlled trial	Hydrocolloid vs soaked gauze	29% healed with gauze vs 57% with hydrocolloid Total daily costs: PTS209.36 with gauze vs PTS180.50 with hydrocolloid	NA

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Table 3 (continued). Main findings of studies comparing moist wound healing with gauze dressings

Reference	Sample size: patients/ulcers (no. of studies reviewed)	Indication	Type of study	Intervention	Results	p value
Kerstein et al. 2001 ¹⁹	Not stated (26)	PU and VLU	Randomised controlled trial	Hydrocolloid vs wet saline gauze	Average cost per healed PU: \$910–1267 with hydrocolloid vs \$2179 with gauze	NA
Meaume and Gemmen, 2002 ¹⁸	Not stated (28)	PU and VLU	Cost-effectiveness model	PU: hydrocolloids vs tape and gauze	PU: savings with hydrocolloids vs tape and gauze €2986–3339	NA
Kerstein 2004 et al. ²⁰	Not stated (36)	Sacral PUs and VLUs	Cost-effectiveness model	Two hydrocolloids, saline gauze and a human skin construct	Total treatment costs for 12 weeks of pressure-ulcer care was much lower with the hydrocolloids. Gauze vs hydrocolloids nursing costs for the 12-week period: \$152-170 vs \$996 respectively. The nursing cost was \$7021 for the human skin construct	NA
Singh et al. 2004 ¹⁵	Not stated/819	Chronic wounds (PUs and VLUs)	Meta-analysis	Hydrocolloid vs gauze	Overall odds ratio: 1.72 (72% more ulcers healed with hydrocolloid)	p<0.001
Ohura et al. 2004 ²⁴	83/not stated	PU (grades II and III)	Comparative prospective study	Group 1: modern dressings with a standardised wound-management algorithm Group 2: traditional dressings with a standardised wound-management algorithm Group 3: traditional dressings without a standardised wound-management algorithm	Group 1 was more cost-effective than group 3 and significantly more cost-effective than group 2	p<0.044
Hollisaz et al. 2004 ³⁵	83/91	PU (grades I and II)	Randomised controlled trial	Group 1: hydrocolloid Group 2: phenytoin Group 3: saline-soaked gauze	Complete healing: 74.19% with hydrocolloid; 40% with phenytoin; 26.66% with gauze Frequency of changes: twice weekly with hydrocolloid; daily with phenytoin; twice daily with gauze	p<0.01 p<0.005
Kaya et al. 2005 ¹²	27/49	PU	Randomised controlled trial	Hydrogel dressing (Elasto-Gel) vs povidone-iodine soaked gauze	Healing rates were not significantly different: 84% of wounds treated with hydrogel epithelialised vs 54% treated with gauze Hydrogel was changed every four days and the gauze daily	p=0.04

PU = pressure ulcer
VLU = venous leg ulcer

Comparisons between modern dressings

Nine studies compared modern dressings with other modern dressings. Results are outlined below.

• **Hydrocolloid versus foam dressings** Of the four studies²⁶⁻²⁹ that compared hydrocolloid dressings with foams, only one presented statistically significant

results — foam healing rates were higher than those for the hydrocolloid (46% versus 33%). Wear time also favoured the hydrocolloid (mean 4.1 days versus 3.6), but this was not statistically significant.²⁹

• **Foam versus foam dressings** The two studies that compared foams did not show any significant

differences between the two groups.^{26,30}

• **Alginate versus alginate** One study compared a silver-releasing hydroalginate with a calcium alginate dressing. There was a significantly greater closure rate for the silver product (0.32cm²/day) versus the comparator (0.16cm²/day) (p=0.024).³¹ Frequency of dressing changes was similar for both agents.

• **Hydrocolloid versus hydrocolloid** One study compared two different hydrocolloid dressings on sacral ulcers. The longest wear times were seen with the triangular dressing. Seventeen wounds healed with the triangular dressing compared with 11 for the oval dressing (p=0.017).³²

• **Hydrogel versus hydrocolloid** This study showed the hydrogel was statistically superior to the hydrocolloid in terms of wound area and healing rates for grade II wounds. For grade I ulcers, the difference was not statistically significant. Dressing changes took place every three to four days for both agents.³³

Discussion

The results of these studies indicate that modern wound dressings offer economic advantages over traditional ones. These are realised by the benefits modern dressings bring, such as longer wear times and less frequent dressing changes (reducing nursing time).

With regard to product effectiveness, research^{1,8} has concluded that the methodology used in many studies is not strong enough to prove the superiority of modern dressings. However, a number of recent studies and reviews have favoured these agents.^{15,24,34}

Nevertheless, some standardisation for further studies will facilitate a combined analysis. We propose that future studies should focus on the percentage of healing within a wound or healing times as end-points as they are the most widely accepted and used by health technology assessment (HTA) agencies.¹

Other weaknesses included lack of explanation of the randomisation methods,^{11-14,16,17,21,22,24,27,29,33,35} lack of observer blinding in all studies (a common challenge with medical devices) and small sample sizes.^{11,12,21}

Looking at the studies chronologically, they seem to identify two different time periods. The first moist wound dressings, mostly polyurethane films and hydrocolloids, were introduced in 1986–1993. In the mid-1990s, the introduction of dressings such as hydrocellular polymeric foams encouraged comparative studies with hydrocolloids. These demonstrated they were at least as effective as each other.

We would also like to highlight the importance of a third aspect not considered in this paper — patient quality of life. Modern dressings can reduce dressing changes and manage exudate, theoretically improving quality of life. We would welcome and encourage research in this area to complete the vision and offer important guidance to practitioners.

Conclusion

This review appears to show there is evidence to support the use of modern dressings as opposed to reverting to traditional methods, which would seem clinically and economically unsound. ■

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