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Comparing DuoDERM E^R with scarlet red in the treatment of split skin graft donor sites

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SUMMARY. **A prospective, randomised, controlled study compared DuoDERM E^R (DE) with scarlet red (SR) in the treatment of split skin graft donor areas in 60 patients. Healing and donor site comfort were significantly better in the DE group. There was no clinical infection in either group. The wound leakage rate was higher in the DE group, requiring an average of 0.8 replacement dressings per donor site as compared with an average of 0.04 for the SR group. An estimate of the cost per donor site for the first ten days of dressing is given.**

Split skin graft donor sites are traditionally dressed with non-occlusive dressings which include paraffin gauze. However, the acceptance of "absorbent cover", which frequently produces a dry wound surface with problems of adhesion and subsequent trauma and pain, has been challenged by the theory that a moist wound provides a better healing environment.

Dressings that provide wounds with a moist environment include semipermeable films (*e.g.* OpSite^R), semiocclusive hydrogels (*e.g.* Geliperm^R) and occlusive hydrocolloids (*e.g.* DuoDERM^R) (Turner, 1985).

Semipermeable films are permeable to water vapour and gases including oxygen but impermeable to water and bacteria. Semiocclusive hydrogels, while having similar properties, possess an absorbent mechanism. The occlusive hydrocolloids are impermeable to gases, moisture, and bacteria. The moist environment beneath these dressings does not encourage wound infection (Hutchinson, 1989).

DuoDERM E^R (Squibb ConvaTec Ltd, USA) is a bilaminate, occlusive hydrocolloid dressing. The outer layer consists of a polyurethane foam which is impermeable to oxygen and water vapour. The inner layer consists of pectin, gelatin and carboxymethyl cellulose embedded in an adhesive polymer.

Scarlet red (Cheseborough-Ponds Inc., USA) is a non-occlusive dressing consisting of a fine mesh gauze impregnated with 5% scarlet red (o-tolylazo-o-tolylazo-beta-napthol) in white petrolatum, lanolin and olive oil. Scarlet red is an azo compound, shown to promote epithelialisation (Salomon *et al.*, 1974).

We conducted a prospective, randomised, controlled study to compare the relative advantages of DuoDERM E^R (DE) and scarlet red (SR) in the management of split skin graft donor sites with regard to the healing, donor site discomfort, convenience, incidence of infection, and cost.

Materials and methods

71 patients who required a split skin graft were entered into the study. Patients with major systemic illness, immuno-suppression or who had previously had a skin graft taken from the intended donor site were excluded. The donor site was restricted to a single site, either the inner arm or inner thigh, with a maximal length of 24 cm to allow at least a 3 cm overlap of the wound edge by the dressing.

Grafts were harvested with a hand dermatome under local, regional or general anaesthesia aiming to take a medium thickness graft as judged by the appearance of the donor bed (McGregor, 1989). Haemostasis of the donor site was achieved with topical adrenaline 1:10000. Eleven patients with donor site depth judged to be too thick or too thin were excluded from the study. The remaining 60 patients were randomly assigned to a dressing regime of either DE or SR. The two groups were well matched (Table 1). The edges of the DE dressings were taped down with 3 inch

Table 1 Demographic data and graft details

		DE	*SR*
Sex	M	11	13
	F	19	17
Age (years)	mean ± SD*	69.8 ± 15.6	65.7 ± 18.7
	range	16–86	27–91
Anaesthetics:			
General		8	8
Regional		3	3
Local		19	19
Donor Sites:			
Inner thigh		26	27
Inner arm		4	3
Conditions requiring SSG:			
Leg ulcers		3	3
Traumatic loss		13	15
Burns		1	2
Tumour excision		12	9
Others		1	1
Donor areas (cm^2):			
Mean ± SD*		76.0 ± 61.5	78.1 ± 69.5
Range		30–315	28–360

* Standard deviation

Microfoam^{R} (3M, USA). If SR was used a single layer was applied. The dressing in each case was completed with gauze, cotton wool and a crepe bandage.

Assessment

Donor site discomfort was recorded during the first 10 days postoperatively and at dressing change using a verbal analogue scale (0: no discomfort, 5: excruciating pain). Major leakage was treated by complete replacement of dressing while minor leakage was managed by repadding with a medium sized gamgee and a 6 inch crepe bandage.

All donor sites were inspected on the 10th postoperative day. The wounds were defined as healed when an intact epithelium could be detected clinically. Unhealed donor sites were traced on a sterile 1 cm-scaled transparency. The unhealed area was estimated by adding squares and the percentage unhealed of the total donor area calculated. The unhealed donor sites were crossed over to the opposite dressing regime and were reinspected at 5 day intervals until complete healing.

Statistical method

Data were analysed using the Students' t-test, the chi-square test for contingency tables or the Fisher probability exact test (2-tailed). An alpha level of 0.05 was used to determine significance.

Results

(*1*) *Healing.* 27 donor sites of the DE group (90%) and 17 donor sites of the SR group (57%) showed complete healing at the 10th postoperative day (Fig. 1) ($p < 0.01$). One patient in the DE group and 9 patients in the SR group had more than 10% of total donor area unhealed ($p < 0.001$). All unhealed donor sites, however, healed completely by day 15.

(*2*) *Donor site discomfort.* The intensity and duration of pain felt at the donor area was greater in the SR group than in the DE group ($p < 0.05$ for pain scores at least 2/5 up to day 7) (Fig. 2).

(*3*) *Convenience.* A total of 95 leakages occurred in the DE group; of these 23 were major (average of 0.8 per donor site), requiring complete replacement of dressing. Thirteen leakages occurred in the SR group and only 1 of these was a major leakage (0.04 per donor site).

(*4*) *Infection.* 23 patients in the DE group and 22 patients in the SR group received antibiotics for their primary pathology. No infection occurred in either group.

(*5*) *Cost.* An estimate of the average cost per donor site appears in Table 2.

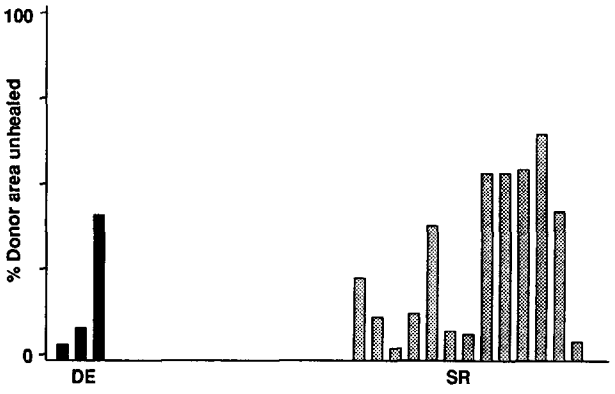

Fig. 1

Figure 1—Unhealed donor sites at 10 days. Each column represents an unhealed donor site.

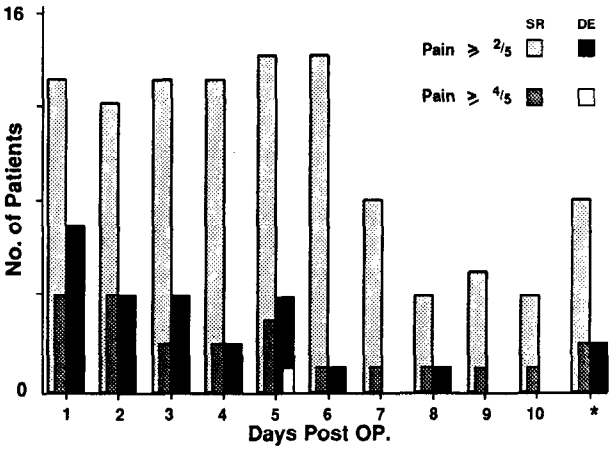

Fig. 2

Figure 2—Donor site discomfort ratings. The ordinate represents the number of patients (out of 30) in each group with pain scores of at least 2 and at least 4 (out of 5) during the first 10 post-operative days and at change of dressing.

Table 2 Estimated average cost per donor site (first 10 days)

Dressing		*Number*	*Cost per dressing*	*Subtotal*	*Total ($NZ)*
DE	Original + Replacement	1.8	$23.20*	$41.76	$47.57
	Repadding	2.4	$2.42	$5.81	
SR	Original + Replacement	1.04	$5.10†	$5.30	$6.27
	Repadding	0.4	$2.42	$0.97	

* 20 × 20 cm (average size used). † 12.5 × 22.5 cm.

Discussion

The theory that wound healing is better under moist conditions is based on the observation that unruptured blisters re-epithelialise faster than open blisters (Forage, 1962). Superficial wounds heal faster under occlusive dressings than if exposed (Winter, 1962; Hinman and Maibach, 1963) and superficial wounds covered with occlusive dressings heal faster and with

less pain than those treated with various non-occlusive dressings (Blitz *et al.*, 1985; Champsauar *et al.*, 1986; Madden *et al.*, 1989). The importance of exudate, and especially macrophages, for the proliferation of vascular endothelial cells has been demonstrated *in vitro* (Greenburg and Hunt, 1978). It has been shown that collagen synthesis was increased in wounds treated with occlusive dressings (Alvarez *et al.*, 1983).

Healing appears to be faster with the use of DE than with SR. Hydrocolloid dressing is impermeable to oxygen. Hypoxia on the cell surface and the hypoxic gradient result in an acceleration of angiogenesis (Knighton *et al.*, 1981) and, as vascularisation plays a central role in wound healing, this may help to explain the faster healing under occlusive dressings.

It is conceivable that the apparent high percentage of unhealed donor areas in the SR group may be due partly to damage to the delicate epithelium during dressing removal. Hydrocolloid dressing significantly reduces wound adherence by creating an exudate interface between the dressing and the wound. This appears to reduce donor site discomfort both with the dressing *in situ* and on removal.

The major disadvantage of DE is the high incidence of leakage in split skin graft donor areas, requiring more frequent replacement dressings and repadding. Leaking DE dressings were associated with an offensive odour and this was a source of patient concern and embarrassment.

The cost associated with the use of DE during the first 10 postoperative days is roughly 7.6 times that of SR in terms of dressing materials alone. The cost of dressing used for unhealed donor sites after day 10 and of nursing time in managing leaking dressings and unhealed donor areas was not included in this estimate.

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References

Alvarez, O. M., Mertz, P. M. and Eaglstein, W. H. (1983). The effect of occlusive dressings on collagen synthesis and re-epithelialisation in superficial wounds. *Journal of Surgical Research*, **35**, 142.

Blitz, H., Keissling, M. and Kreysel, H. W. (1985). Comparison of hydrocolloid dressing and saline gauze in the treatment of split skin graft donor sites. An environment for healing: the role of occlusion. In Ryan, T. J. (Ed). *Royal Society of Medicine International Congress and Symposium Series, No. 88*, London, Royal Society of Medicine, p. 125.

Champsauar, A., Amanon, R., Nefzi, A. and Marichy, J. (1986). Use of DuoDERM on skin graft donor sites: comparative study with tulle gras. *Annales de Chirurgie Plastique et Esthetique*, **31**, 273.

Forage, A. V. (1962). The effects of removing the epidermis from burnt skin. *The Lancet*, **2**, 690.

Greenburg, G. B. and Hunt, T. K. (1978). The proliferative response in-vitro of vascular endothelial cells exposed to wound fluids and macrophages. *Journal of Cell Physiology*, **97**, 355.

Hinman, C. D. and Maibach, H. (1963). Effect of air exposure and occlusion on experimental human skin wounds. *Nature*, **200**, 377.

Hutchinson, J. J. (1989). Prevalence of wound infection under occlusive dressings: a collective study of reported research. *Wounds*, **1**, 123.

Knighton, D. R., Silver, I. A. and Hunt, T. K. (1981). Regulation of wound angiogenesis – effect of oxygen gradients and inspired oxygen concentration. *Surgery*, **90**, 262.

McGregor, I. A. (1989). *Fundamental Techniques of Plastic Surgery and their Surgical Applications*. 8th Ed. Edinburgh, Churchill Livingstone, p. 49.

Madden, M. R., Nolan, E., Finkelstein, J. L., Yurt, R. W., Smeland, J., Goodwin, C. W., Hefton, J. and Staino-Coico, L. (1989). Comparison of an occlusive and a semi-occlusive dressing and the effect of wound exudate upon keratinocyte proliferation. *Journal of Trauma*, **29**, 924.

Salomon, J. C., Diegelmann, R. F. and Cohen, I. K. (1974). Effect of dressing on donor site epithelialisation. *Surgical Forum*, **25**, 516.

Turner, T. D. (1985). Semiocclusive and occlusive dressings. An environment of healing: the role of occlusion. In Ryan, T. J. (Ed.). *Royal Society of Medicine International Congress and Symposium Series. No. 88*, London, Royal Society of Medicine, p. 5.

Winter, G. D. (1962). Formation of the scab and the rate of epithelialisation of superficial wounds in the skin of the young domestic pig. *Nature*, **193**, 293.

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