

Widely expanded postage stamp skin grafts using a modified Meek technique in combination with an allograft overlay

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A method for obtaining widely expanded postage stamp autografts, first described in 1963 by C. P. Meek, has been evaluated in our burns unit. The technique, in which an expansion ratio of 1:9 is achieved with the aid of special prefolded gauzes, was combined with an overlay of glycerol-preserved allografts applied 1 week after grafting. This delay did not appear to affect graft take. In a series of 16 consecutive skin graft procedures performed on 10 patients with extensive burns, the mean epithelialization rate was 90 per cent (range 70–100 per cent) within 5 weeks. Cosmetic results were comparable to those achieved with widely expanded mesh grafts. The Meek technique utilizes small pieces of autograft, and has proved to be a practical alternative to mesh grafts when donor sites are limited.

Introduction

An ingenious method for obtaining widely expanded postage stamp autografts was described by Meek (1963), in which prefolded gauzes were used to achieve a regular distribution of autograft islands cut with a Meek–Wall dermatome (Meek, 1958). Despite the ninefold expansion obtained by this method, the technique became eclipsed by the introduction of mesh skin grafts (Tanner et al., 1964). Manufacture of the dermatome and prefolded gauzes was eventually discontinued, and the method is now in danger of fading into obscurity.

However, with the improved early survival of patients with extensive burn injuries, lack of autograft donor sites is increasingly encountered as a limiting factor in achieving wound closure. Mesh grafts require the presence of suitable donor sites, and epithelialization may be delayed with expansion ratios of greater than 1:6. Microskin grafting techniques, currently under study (Fang and Alexander, 1990; Lin et al., 1991; Shvets et al., 1991), have achieved expansion ratios of up to 1:18, but preliminary clinical results have been mixed (Fang et al., 1988; Zhang et al., 1988).

Recently, in cooperation with two instrument manufacturers, the Meek technique has been reintroduced in our clinic. The materials have been modified, and the dermatome has been adapted to run on compressed air. The components have been enlarged to allow expansion of larger pieces of autograft. In this paper, our preliminary clinical experience with the modified Meek technique is described.

Patients and methods

Sixteen early skin graft operations using the Meek technique, described below, have been carried out on 10 patients with extensive, full skin thickness burns. Summary details of the patients, including age and size of burn, are given in Table I. The mean age was 31 years (range 4–52 years). The mean percentage body surface area burned was 64 per cent (range 43–83 per cent), and the mean full skin thickness injury was 47 per cent (range 22–71 per cent). In accordance with our established surgical approach, areas of deep dermal injury were serially excised and grafted in staged primary operations limited to approximately 10 per cent total body surface area (TBSA) per procedure. The Meek technique was employed when insufficient suitable donor sites were available to achieve wound coverage with mesh grafts alone. All operations were performed within 14 days of injury. Prior to surgery, wounds were treated with daily application of cerium silver sulphadiazine, and gauze dressings. Following grafting, wounds were dressed daily either with Furacine ointment or by a 1 per cent solution of chlorhexidine in polyethylene glycol (35 per cent), glycerol (35 per cent) and water (30 per cent).

At operation, the area excised and grafted was estimated and expressed as a percentage of the total body surface area (TBSA). Graft take was assessed on the sixth or seventh day after grafting, when the expanded gauze was replaced by

Table I. Summary details of 10 patients undergoing primary excision and grafting using the Meek technique

Patient	Age (yr)	Sex	% TBSA burned	% Full skin thickness	Inhalation injury	Days in hospital
B.E.	35	F	43	35	No	80
O.O.	12	M	74	68	No	117
H.E.	31	M	49	49	Yes	143
M.U.	26	M	83	71	Yes	89
H.A.	40	M	50	44	No	79
N.G.	4	F	67	60	No	105
M.O.	52	F	48	35	Yes	107
E.Y.	19	M	71	22	No	65
W.A.	47	M	78	30	Yes	96
H.U.	43	M	77	55	Yes	10 (died)

TBSA, total body surface area.

the allograft overlay. The percentage of the grafted wound which had epithelialized was estimated during the fifth week after grafting. Areas which had not healed by this time were regrafted. The modified Meek-Wall dermatome is supplied by Aesculap GmbH, Germany; the prefolded gauzes and cork cutting squares have been developed in cooperation with Humeca bv., Holland (Figure 1).

Operative technique

At operation, wounds to be grafted are excised down to the underlying fascia and haemostasis is secured.

Split skin autografts are obtained following standard procedures. The cork square, which measures 4.2 cm × 4.2 cm, is dampened, and the graft spread, dermis side down, on the cork and trimmed to size (smaller graft remnants are also suitable). The cork containing the graft is placed in the carrier block of the dermatome, and secured by a grill. The carrier block is then passed through the dermatome, which contains 13 parallel blades, spaced 3 mm apart. The blades cut through the graft and into, but not through, the cork. After the first pass, the grill is carefully removed; the cork with the graft is rotated 90° reclamped, and passed through the dermatome once more, thus cutting the graft into 14 × 14 small squares measuring 3 × 3 mm (Figure 2).

The grill is carefully lifted off. A special serrated wedge, supplied with the dermatome, is used to hold the grafts in place on the cork while the grill is being loosened (Figure 1).

The cork, with the cut graft in place, is removed. The upper (epidermal) surface of the graft is sprayed with an adhesive dressing spray (Leukospray, Beiersdorf GmbH, Germany), and allowed to become tacky. The prefolded polyester gauze, which is folded on an aluminium foil backing into a series of square pleats corresponding to the cuts in the autograft is pressed on to the graft for a few seconds, after which the cork square can be gently removed, leaving the graft islands adhering to the gauze (Figure 3). The gauze is pulled out by firm traction on all four sides, until the pleats become completely unfolded. Finally, the aluminium backing is peeled off, to leave the expanded gauze with the separated, adherent autograft islands ready for transplantation. After trimming the margins, the gauze is applied, graft side down, to the wound bed, and secured with surgical staples (Figure 4).

After 6 days the grafts have grown sufficiently into the wound bed to allow removal of the gauze. At operation, the staples are removed and, using blunt forceps, the gauze is gently detached, leaving the autograft island in situ on the wound bed. The grafts are covered with an overlay of glycerol-preserved allografts, meshed 1:1.5 (Figure 5), and secured with a porous, semi transparent polyamide sheeting, SurfaSoft (Mediprof, Holland), which facilitates wound inspection and protects the grafts from physical disruption during dressing changes (Kreis, 1987). After a further 6 days, when the allografts are firmly adhered to the wound, the SurfaSoft is removed. Daily dressings are continued until epithelialization is complete (Figure 6). Details of the general surgical procedure have been described previously (Kreis et al., 1989).

Results

The results obtained with the Meek technique are given in Table II. The mean area grafted per procedure was 10.1 per cent of TBSA (range 5–15 per cent). One patient died on

Table II. Results obtained in 16 Meek skin grafting procedures

Patient	Day postburn operated	% TBSA grafted	% Take at 1 week	% Epithelialized by 5 weeks
B.E.	2	11	100	100
O.O.	4	12	90	85
H.E.	5	7	30	80
M.U.	10	14	70	70
H.A.	3	14	95	95
N.G.	5	10	100	100
N.G.	7	11	100	100
N.G.	9	5	100	100
N.G.	11	10	100	95
N.G.	13	7	100	100
M.O.	11	9	100	80
E.Y.	3	7	95	90
E.Y.	5	5	100	85
W.A.	7	15	100	80
W.A.	11	12	100	90
H.U.	7	13	—	—

day 3 postoperation from respiratory failure associated with severe inhalation injury. Of the 15 procedures performed on the remaining nine patients, the mean 'take' observed at 1 week was 92 per cent (range 30–100 per cent). The mean rate of epithelialization observed during the fifth week after operation was 90 per cent (range 70–100 per cent). There were no clinical graft failures.

Discussion

The results reported above suggest that, in combination with an overlay of glycerol-preserved allografts, the Meek technique provides reliable wound healing with autografts expanded to a ratio of 1:9. The delay in applying the allograft overlay did not appear to affect graft 'take'. Although the need for a second operative procedure is a relative disadvantage, we found in practice that the application of allografts could often be staged to coincide with some other procedure in these extensively injured patients.

Mesh grafts are easy to apply and allow immediate coverage with allografts (Alexander et al., 1981), and are therefore preferred by us when suitable donor sites are available. On the other hand, it has been pointed out that the true expansion rate of meshed skin graft is significantly less than expected (Peeters and Hubens, 1988). Furthermore, the distribution of the autograft mesh on the wound surface is relatively inefficient: grafts meshed to an expansion of 1:6 with a Zimmer dermatome produce a square network with sides of approximately 15 mm, requiring epithelium to grow over a distance of 7.5 mm. In comparison, the postage stamps obtained by the Meek technique are spaced 6 mm apart, requiring a maximal outgrowth of 4.2 mm.

These observations suggest that even greater expansion ratios might be attainable. Expansion ratios of up to 1:18 have been described using the technique of microskin grafting, in which micrografts are cut and distributed on an allograft overlay by hand prior to grafting. Although the results described with this method are encouraging, some failures have been reported (Fang et al., 1988; Zhang et al., 1988), and the method for preparing the grafts would appear to require experience and dexterity. In contrast, the Meek technique is a simple method for achieving a regular distribution of postage stamp grafts, correctly orientated, on the wound surface. The expansion ratio obtained is dependent on the size of the pleats incorporated in the prefolded gauzes. Modifications to the manufacture of the gauzes to

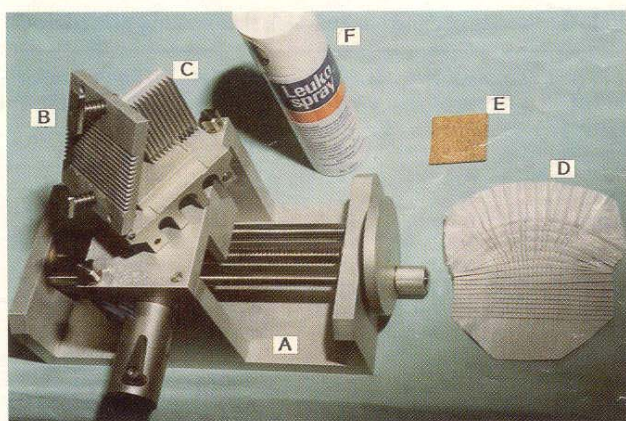


Figure 1. Materials required for the Meek expansion procedure: A, the modified Meek-Wall dermatome; B, the carrier block, shown here with the grill propped open with the special wedge; C, D, the prefolded gauze with aluminium backing, shown partially expanded to expose the pleats; E, the cork cutting square; F, the cannister containing adhesive spray.



Figure 2. Cork plate with autograft cut into small squares with the Meek-Wall dermatome.

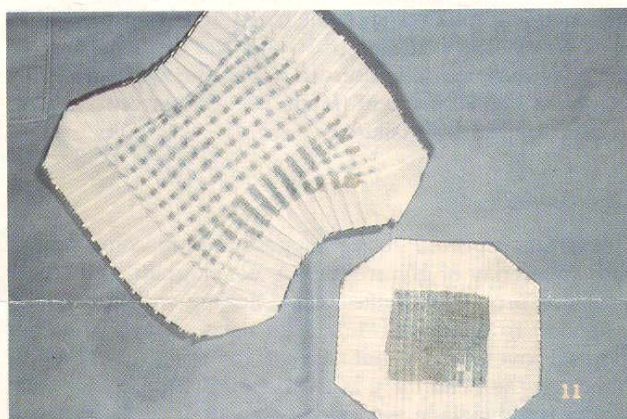


Figure 3. Prefolded gauze after transfer of autograft islands (right) and partially expanded (left).

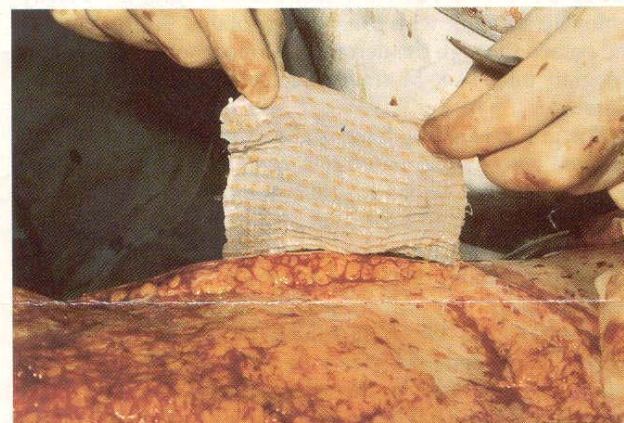


Figure 4. Expanded gauze containing autograft islands is applied to the excised wound.



Figure 5. Application of allograft overlay following removal of the gauzes at 6 days. Pale autograft islands are visible on the exposed wound surface.



Figure 6. Complete epithelialization: (patient B.E. photographed 6 weeks after grafting).

provide a range of expansions are currently under consideration.

The cosmetic results following Meek grafting are as good as those obtained with widely expanded mesh grafts in our unit. It has been suggested that the inclusion of an allograft overlay may reduce wound contracture following micro-

grafting (Fang and Alexander, 1990). It is possible that the orderly distribution of the autograft islands produced by the Meek technique may additionally favour rapid, regular epithelialization. A follow-up study of all patients who have undergone sandwich grafting procedures in our centre (in preparation) has revealed no differences in functional and

cosmetic results between the late results of Meek grafting procedures and those obtained from mesh grafts.

In conclusion, the Meek technique has proved to be a practical and reliable method for obtaining widely expanded autograft islands when donor sites are scarce. Our preliminary experience suggests that the results are comparable to those obtained with mesh grafts. The technique has become our method of choice when insufficient donor sites are available to achieve primary wound coverage with mesh grafts.

References

- Alexander J. W., MacMillan B. G., Law E. et al. (1981) Treatment of severe burns with widely meshed skin autografts and meshed allograft overlay. *J. Trauma* **21**, 433.
- Fang C. H. and Alexander J. W. (1990) Wound contraction following transplantation of microskin autografts with overlaid skin allograft in experimental animals. *Burns* **16**, 190.
- Fang C. H., Yu G. S., Fan Y. F. et al. (1988) A preliminary report on transplantation of microskin autografts overlaid with sheet allograft in the treatment of large burns. *J. Burn Care Rehabil.* **9**, 629.
- Kreis R. W. (1987) Skin graft fixation with SurfaSoft and staples: an analysis of the results. *Scand. J. Plast. Reconstr. Surg.* **21**, 249.
- Kreis R. W., Vloemans A. F., Hoekstra M. J. et al. (1989) The use of non-viable glycerol-preserved cadaver skin combined with widely expanded autografts in the treatment of extensive third degree burns. *J. Trauma* **29**, 51.
- Lin S. D., Chou C. K., Lai C. S. et al. (1991) Microskin grafting of rabbits with pigskin xenograft overlay. *Burns* **17**, 473.
- Meek C. P. (1958) Successful microdermagrafting using the Meek-Wall dermatome. *Am. J. Surg.* **96**, 557.
- Meek C. P. (1963) Extensive severe burn treated with enzymatic debridement and microdermagrafting. *Am. Surg.* **29**, 61.
- Peeters R. and Hubens A. (1988) The mesh skin graft – true expansion rates. *Burns* **14**, 239.
- Shvets V. N., Malakhov S. F., Egorov B. B. et al. (1991) Ability of microautotransplants to re-epithelialise deep and extensive skin injuries. *Burns* **17**, 243.
- Tanner J. C., Vandeput, M. S. and Olley, F. F. (1964) The mesh skin graft. *Plast. Reconstr. Surg.* **34**, 287.
- Zhang M. L., Chang Z. D., Wang C. Y. et al. (1988) Microskin grafting in the treatment of extensive burns: a preliminary report. *J. Trauma* **28**, 804.

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