



# The Meek Technique in the Treatment of Burns

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## 1 Introduction

To overcome the problem of extensive full thickness third-degree burns, the Meek technique was devised by Meek in 1963 [1]. This involved using a Meek-Wall microdermatome producing widely expanded postage stamp autografts, in which pre-folded gauzes were used to gain a regular distribution of the autografts [2]. The technique, with an expansion rate of 1:9, was cumbersome and not frequently used. Tanner et al. (1964) [3] devised meshed skin grafts that improved the treatment of severe full thickness burns that replaced the Meek technique. Kreis et al. (1993) [4] modified the Meek technique by using a different device for cutting the grafts and employed aluminum foil backing to help the expansion of the skin grafts. The mean epithelialization rate was 90% (range 70–100%) within 5 weeks. The

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Meek technique utilizes small pieces of autograft and has proved to be a practical alternative to mesh grafts when donor sites are limited.

The authors describe their use of the Meek technique in a fair number of cases.

## 2 Technique

The authors reviewed 148 skin grafting surgeries from 2006 to 2015. The mean percentage body surface burned was 65% (range 50–87%), and full thickness injury occurred in 52% (range 40–81%) (Table 1).

Patients with associated inhalation injury were intubated on admission. Wounds were dressed with Flamazine (Smith & Nephew, Canada) that contained 1% silver sulfadiazine. Fluid resuscitation followed the Parkland formula (Table 2) [5]. For example, a person weighing 75 kg with burns to 20% of his or her body surface area would require  $4 \times 75 \times 20 = 6000$  mL of fluid replacement within 24 h. The first half of this amount is delivered within 8 h from the burn incident, and the remaining fluid is delivered in the next 16 h [6]. The burn percentage in adults can be estimated by applying the Wallace rule of nines (see total body surface area): 9% for each arm, 18% for each leg, 18% for the front of the torso, 18% for the back of the torso, 9% for the head, and 1% for the perineum [7].

Surgery was performed on the 3rd to 5th post-burn day after stabilization with fluids and electrolytes [8]. The Weck knife and the Humby

**Table 1** Patient demographics and outcomes

Pat. No.	% 3rd degree	Cause	No. of operations	Outcome
1	43	Flame	2	Survived
2	54	Flame	3	Survived
3	46	Flame	2	Survived
4	67	Inhalation injury	1	Died
5	50	Flame	2	Survived
6	62	Flame	3	Survived
7	72	Flame	3	Survived
8	40	Flame	2	Survived
9	44	Electrical	2	Survived
10	47	Flame	2	Survived
11	41	Inhalation injury	3	Survived
12	46	Flame	2	Died
13	42	Flame	2	Survived
14	47	Flame	2	Survived
15	50	Chemical	2	Survived
16	48	Flame	2	Survived
17	63	Flame	3	Survived
18	74	Flame	2	Died
19	49	Flame	2	Survived
20	41	Flame	2	Survived
21	46	Flame	2	Survived
22	69	Flame	3	Survived
23	45	Inhalation injury	2	Survived
24	74	Inhalation injury	2	Died
25	64	Inhalation injury	3	Survived
26	41	Chemical	2	Survived
27	42	Flame	2	Survived
28	48	Inhalation injury	2	Survived
29	61	Flame	3	Survived
30	43	Flame	2	Survived
31	48	Flame	2	Survived
32	62	Flame	3	Survived
33	59	Inhalation injury	3	Survived
34	42	Flame	2	Survived
35	49	Flame	2	Survived
36	73	Inhalation injury	3	Survived
37	43	Flame	2	Survived
38	50	Flame	2	Survived
39	48	Flame	2	Survived

**Table 1** (continued)

Pat. No.	% 3rd degree	Cause	No. of operations	Outcome
40	43	Flame	2	Survived
41	40	Electrical	2	Survived
42	49	Flame	2	Survived
43	78	Flame	1	Died
44	46	Flame	2	Survived
45	42	Flame	2	Survived
46	48	Flame	2	Survived
47	77	Flame	3	Survived
48	47	Flame	2	Survived
49	40	Flame	2	Survived
50	55	Inhalation injury	3	Survived
51	64	Inhalation injury	4	Survived
52	46	Flame	2	Survived
53	42	Flame	2	Survived
54	48	Flame	2	Survived
55	41	Flame	2	Survived
56	81	Inhalation injury	1	Died
57	48	Flame	2	Survived
58	41	Flame	2	Survived
59	44	Flame	2	Survived
60	57	Flame	3	Survived
61	73	Inhalation injury	1	Died
62	69	Electrical	3	Survived
63	41	Flame	2	Survived
64	49	Chemical	2	Survived
65	40	Chemical	2	Survived
66	62	Flame	2	Survived
67	64	Inhalation injury	3	Survived

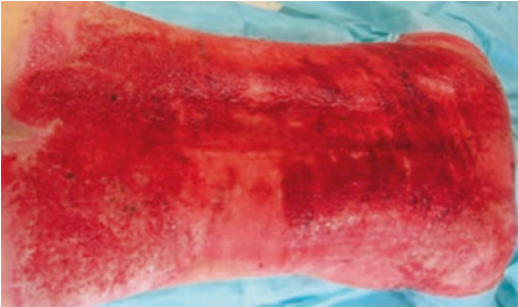
Modified from Almodumeegh A, Heidekrueger PI, Ninkovic M, Rubenbauer J, Hadjipanayi E, Broer PN. The MEEK technique: 10-year experience at a tertiary burn centre. *Int Wound J.* 2016 In publication

**Table 2** Parkland formula

The Parkland formula is mathematically expressed as:
$V = 4 \times m (A \times 100)$
V = volume (mL)
m = Mass (kg)
A × 100 = percent of body burned (2° plus 3°)

<http://kallus.com/er/calculations/parkland.htm>. Accessed 3 Aug 17

knife were used to debride until punctuate bleeding occurred and the layer was grossly judged to be viable. When indicated, the entire skin down to the fascia was removed and the Meek technique was employed to close the wound. Epigard alloplastic material was used to temporarily cover debrided wounds when portions of the debrided areas were not able to be covered immediately.



**Fig. 1** Tangential excision of full thickness burn of the whole back. Modified from Almodumeegh A, Heidekrueger PI, Ninkovic M, Rubenbauer J, Hadjipanayi E, Broer PN. The MEEK technique: 10-year experience at a tertiary burn centre. *Int Wound J.* 2016 In publication

This procedure was repeated every 2–5 days, providing the patient's condition allowed for surgical intervention.

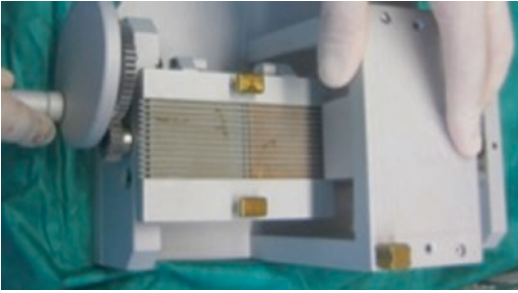
The wounds are excised down to the healthy layers and hemostasis secured (Fig. 1). The extent of skin expansion required was determined by the size of the wound and the size of the available skin for grafting. The harvested autograft skin is placed on  $42 \times 42$  mm dampened cork with the dermis side down and trimmed to the required size (Fig. 2). Then it is placed on the carrier block and passed through a modified Meek-Wall dermatome, which contains 13 parallel blades, spaced 3 mm apart that cut the graft but not the cork (Fig. 3). After the first pass, the cork plate is rotated to  $90^\circ$  and passed through the dermatome once more thus cutting the graft in to  $14 \times 14$  square islands measuring  $3 \times 3$  mm.

The cork, with the cut graft in place, is removed. The epidermal side of the graft is sprayed with an adhesive dressing spray (Leukospray, Beiersdorf GmbH, Germany). After about 2–5 min, the sticky surface of the graft is brought into contact with the prefolded

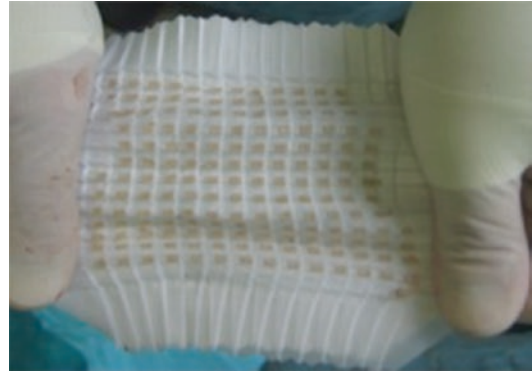


**Fig. 2** After harvesting the split-thickness skin grafts in a normal fashion, the grafts are manually cut in pieces and stretched over the  $42 \times 42$  mm moistened cork plate with the inner layer facing downward for final cutting. Modified

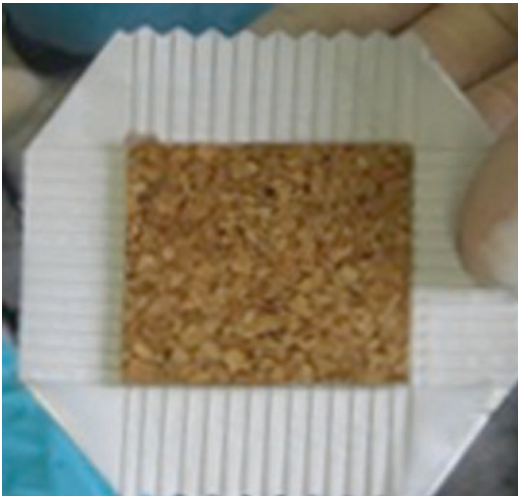
from Almodumeegh A, Heidekrueger PI, Ninkovic M, Rubenbauer J, Hadjipanayi E, Broer PN. The MEEK technique: 10-year experience at a tertiary burn centre. *Int Wound J.* 2016 In publication



**Fig. 3** Meshing of the graft is achieved using the modified Meek-Wall dermatome. Modified from Almodumeeagh A, Heidekrueger PI, Ninkovic M, Rubenbauer J, Hadjipanayi E, Broer PN. The MEEK technique: 10-year experience at a tertiary burn centre. *Int Wound J.* 2016 In publication



**Fig. 5** The gauze is pulled steadily and firmly in all directions until it is completely smooth and flattened. Modified from Almodumeeagh A, Heidekrueger PI, Ninkovic M, Rubenbauer J, Hadjipanayi E, Broer PN. The MEEK technique: 10-year experience at a tertiary burn centre. *Int Wound J.* 2016;14(4):601–5



**Fig. 4** The cork is removed once the minced grafts are transferred to prefolded polyamide gauze backed with aluminum foil. Modified from Almodumeeagh A, Heidekrueger PI, Ninkovic M, Rubenbauer J, Hadjipanayi E, Broer PN. The MEEK technique: 10-year experience at a tertiary burn centre. *Int Wound J.* 2016 In publication

(pleated) gauze (Fig. 4), and the pleats are pulled out on all the four sides to provide uniform expansion of the islands (Fig. 5), with ratios varying from 1:3 to 1:9. The gauze is pulled steadily in all directions until it was completely smooth and flattened.

The graft is applied to the wound bed and the gauze tacked down with surgical staples (Fig. 6). The grafted wound is covered with Jelonet gauze (Smith & Nephew, Canada) impregnated with Lavasept-Gel (B. Braun Melsungen AG,



**Fig. 6** (a) The skin graft is applied onto the wound bed, and the edges of gauze are tacked down with surgical staples. (b) The appearance of the grafted wound at the 10th day after the procedure. The viability of the graft was assessed as satisfactory. Modified from Almodumeeagh A, Heidekrueger PI, Ninkovic M, Rubenbauer J, Hadjipanayi E, Broer PN. The MEEK technique: 10-year experience at a tertiary burn centre. *Int Wound J.* 2016;14(4):601–5

Germany) containing polihexanide antimicrobial. The operative sites in the trunk and extremities are additionally dressed with Jelonet and wrapped with elastic bandages. After 3–5 days

the dressing are changed every 2 days. Staples are removed after 7–10 days. One percent silver sulfadiazine cream is used to cover the wound if it showed signs of local infection.

The mean area graft per procedure was 20% (range 15–25%). The viability of the graft as assessed on the 7–10th day was generally in the range of 60–90% (Fig. 6). The average number of operations required was 1–3 (Table 1). When the initial graft application failed, infection or hematoma was most commonly responsible. Although blood replacement was prescribed as needed at surgery, transfusions seldom exceeded two units per session. Functional and aesthetic outcomes of wounds treated with Meek grafts were satisfactory in most instances.

Infection was noted in five patients. There were seven deaths, four dying from respiratory failure due to severe inhalation injury and three dying from septic shock.

### 3 Discussion

Meshed split-thickness skin grafting has been an accepted method of treatment for severely burned patients at most burn centers [8–10]. However, especially in large area burns, lack of autograft skin may become a limiting factor. In order to prevent wound infection and septicemia, remaining areas of eschar should be excised even if they cannot be covered with autografts immediately [11, 12]. Our experience utilizing the Meek technique in large burn areas suggests that it provides a reliable method to achieve wound healing with expanded autografts. The main advantage is that the Meek technique allows a greater expansion ratio as compared to mesh grafts [12]. The small autografts can be easily applied in contrast to the oftentimes challenging handling of higher expansion (1:6 or 1:9) mesh grafts [4, 13].

Infection, as noted in five of our cases, can be a common cause for graft failure. Similar to others, we found that the thickness of skin grafts used for wound coverage does not seem to affect the incidence of infection. Indeed, small postage

stamp skin grafts appear to be more resistant to invasion by microorganisms, and we also observed that spacing and distribution of the micrografts allowed for faster and more uniform epithelialization [12–14].

In our experience, the cosmetic result following the Meek graft technique is comparable with that of widely expanded mesh grafts. A major downside of the micrografting technique is the fact that it is expensive and needs more staff in the operating room to be carried out [14].

### Conclusions

When faced with large surface area burns and limited donor sites, the Meek technique is a satisfactory method to cover large wounds. While labor extensive, paying attention to the outlined principles allows achieving good functional and aesthetic results in this challenging patient population.

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