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Micrografting in the treatment of severely burned patients

Rita G. C. Zermani, Andrea Zarabini and Angelo Trivisonno
Department of Plastic Surgery and Burn Unit, University of Parma, Parma, Italy

The micrografting technique, employed to treat patients with extensive TBSA burns and reduced areas of healthy donor skin, was assessed simultaneously with traditional mesh grafts (STSG) or Tiersch grafts in the treatment five severely burned subjects (average TBSA burned 35.6 per cent; average per cent of full thickness wounds 32.6 per cent).

At the first clinical control on day 6 post-surgery, 93 per cent of the micrografted area was in situ and healthy; epithelialization of the wound sites was complete at day 21. Meshed STSG yielded 90 per cent attachment at day 6 post-surgery, with epithelialization complete at 12±2 days post-surgery.

Functional results were equivalent no matter what technique was used, while aesthetic results were better in the areas where micrografting was carried out.

Although the micrograft technique is labour-intensive, if the expansion needed is at least 1:6, the aesthetic and functional results obtained are comparable to, or better than, those with meshed grafts. Also, large segments of micrograft are not compromised if a small area of mesh becomes detached, and epithelialization is faster and more uniform, enabling a reduction in both infection and length of hospital stay. © 1997 Published by Elsevier Science Ltd for ISBI.

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Introduction

The Micrograft technique[1], an improved version of the original Meek technique[2] used to treat patients with extensive burns and significantly reduced areas of healthy donor skin, was re-introduced a few years ago by Kreis and Humeca, (Red Cross Hospital, Beverwijk, The Netherlands). This report compares the functional and aesthetic results obtained with the simultaneous use of micrografting, traditional mesh grafts (STSG) and, in one case, Tiersch grafting to treat five extensively burned patients (average age 23 years, range 12–51 years; affected areas: trunk and upper limbs). The patients had an average of 35.6 per cent TBSA burns and an average of 32.6 percent third-degree burns which were covered with grafts (*Table I*).

Materials and methods

Micrografting: single or fragmented sheets of autograft skin were placed on a 42 × 42 mm cork square and passed through a dermatome (*Figure 1*) with 13 parallel blades to obtain 14 × 14 (196) square "islands" measuring 3 × 3 mm^3. The epidermal side of the graft was then pressed onto a prefolded (pleated) gauze, and the pleats pulled out on all four sides to provide uniform expansion of the islands with ratios varying from 1:3 to 1:9 (*Figure 2*). The expanded gauze was then applied to the excised burn site (*Figure 3*). Micrografting was used to cover an average of 29 per cent of the full thickness burned area, equal to 9 per cent of the total body surface. Sites chosen for micrografting were the hips, shoulders and upper limbs (*Table I*). Surgery was carried out within 12 days after injury. The gauze was removed when the grafts had grown sufficiently into the wound bed, generally between 5 and 15 days post-surgery (*Figures 4* and *5*).

The standard surgical procedures were followed for Mesh STSG on the hips, upper limbs and trunk, and in one case for Tiersch grafting on the dorsal surface of the hands. Mesh and Tiersch grafting were used to cover an average of 71 per cent of the three full thickness burned areas, equal to 24 per cent of the total body surface[1,4–6].

Results

At the first clinical control on day 6 post-surgery, an average of 93 per cent, 140 out of 150 islands, of the Meek graft was *in situ*. The remaining 7 per cent of the micrograft squares had been detached or deformed during manipulation and transfer of the graft, as shown in *Figure 2*: the 10 discoloured, deformed squares are clearly evident on the right border of the graft. Epithelialization of the peripheral areas of the grafted region was observed at 2 weeks

Table I. Cases treated with mesh, Tiersch and micrografting

Case	*Age and sex*	*Per cent TBSA*	*Per cent third-degree burns*	*Per cent mesh grafting and area grafted*	*Per cent Tiersch grafting and area grafted*	*Per cent micro grafting and area grafted*	*Number of operations*
1	18 years, M	50	45	35 upper limbs, hips	—	10 shoulders	3
2	35 years, M	25	20	12 shoulders, face	—	8 hips	3
3	22 years, M	45	40	26 hips	5 hands	9 upper limbs	3
4	12 years, M	28	28	20 trunk	—	8 hips	2
5	51 years, M	30	30	20 trunk	—	10 hips	3

Averages

Average age	*Average per cent TBSA burns*	*Average per cent of body with third-degree burns*	*Average per cent of body covered with Mesh and Tiersch grafts*	*Average per cent of body covered with Micrografts*
23 years	35.6	32.6	23.6	9

post-surgery with dissipation of the Meek islands; the islands disappeared completely at day 21 post-surgery with complete epithelialization of the wound site[7,3,8,9]. We attribute the good epithelialization achieved for Meek grafts at day 21 to the choice of graft site. Meek grafts were employed only where skin thickness was greatest, i.e. the back, shoulders, and hips. As thick skin guarantees conservation of a greater number of pilo-sebaceous sites, the potential for rapid healing is significantly increased.

At the control of mesh and Tiersch grafts on day 6 post-surgery, 90 per cent of the grafted skin was *in situ* and appeared healthy. At this time, we estimated that the amount of unsuccessful graft extended over 10 per cent of the wound area, all of which was located on the borders where the graft skin is thinner and more subject to trauma during surgery. Epithelialization was confirmed at day 21 when a 1:6 ratio mesh was used and at day 8 when a 1:3 ratio mesh was used. These good results may be explained by the findings of Kreis et al. who noted that the expansion ratio achieved by a 1:6 meshing procedure is in reality 1:4[4].

In one patient, epithelialization was completed within 14 days: in this case, Meek islands were inserted within the spaces of a 1:6 ratio mesh net.

The incidence of infection in mesh, micro- and Tiersch grafts did not differ significantly. The following organisms were cultured from the surgical wounds: *Pseudomonas aeruginosa, Staphylococcus aureus, Staphylococcus epidermis, Enterococcus, Pseudomonas maltophilia.* Infections were treated with specific antibiotic therapy and resolved uneventfully

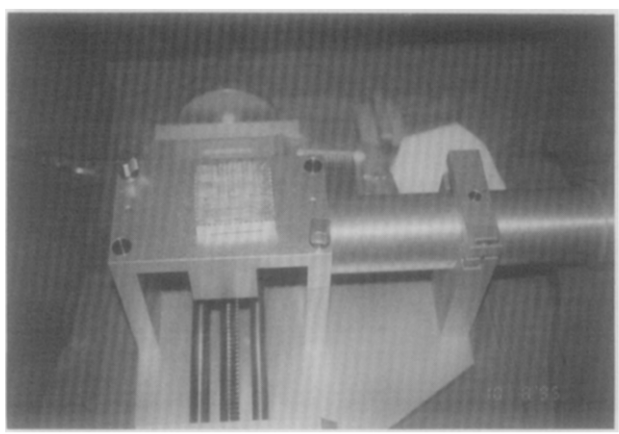

Figure 1. A 13-blade modified Meek-Wall dermatome powered by a 3–6 bar pneumatic motor is used for micrograft skin expansion.

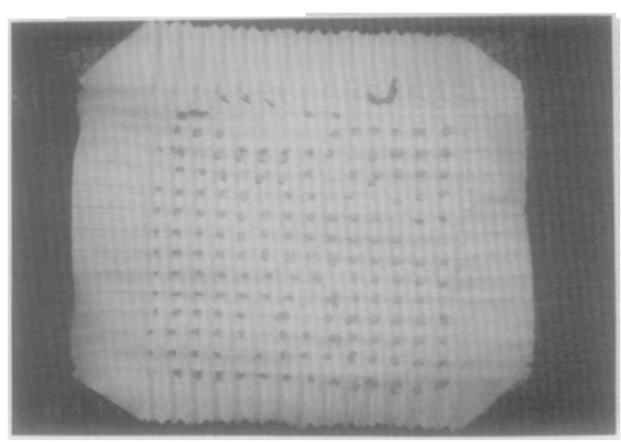

Figure 2. Expanded gauze with attached autograft islands ready for grafting.

except in patient 1, a homeless alcoholic subject in very poor initial physical condition who was affected by persistent *P. aeruginosa* infection. In no case did infection compromise the aesthetic or functional outcome of the grafts.

Discussion

While mesh STSG are generally the treatment of choice in our Burn Center, micrografts offer a number of advantages:

They allow greater expansion.

Since spacing and distribution of the micrografts enable faster and more uniform epithelialization, the risk period for complications is shortened and thus the risk of infection is decreased.

The gauze support enables the micrografts to be placed on irregular surfaces and areas subject to movement such as the hips and shoulders.

Micrografts are more manageable than large-sized meshed STSG.

Generally, when dressings are changed, the detachment of a small area of mesh often compromises large segments of the graft; however, the nature of the micrograft islands renders this problem irrelevant: detachment of one island in no way compromises graft outcome.

Even when infection arises, micrografted areas seem to be less compromised than those covered with STSG. (Micrograft "take" was not affected in the case of persistent *P. aeruginosa* infection that occurred.)

Since healing is more rapid, micrografting reduces hospitalization time and consequently costs. The average hospital stay of micrografted patients was 15 days shorter than that of patients who had traditional mesh grafts.

The micrograft technique is labour-intensive, requires considerable experience and manual dexterity and involves twice as many steps as mesh grafting. However, micrografting also enables an amount of skin to cover as much as twice the burned surface area.

Our preliminary experience indicates that modified Meek micrografting is the method of choice when there are insufficient autograft donor sites to allow primary coverage of the burned surface with meshed STSG. When the expansion necessary is at least 1:6, the modified Meek technique is superior to meshed STSG[10]. It is also particularly indicated for the back, shoulders, and hips because skin thickness is greatest in these areas. Moreover, while other sites are often favoured for initial grafting, our experience indicates that the 1:9 Meek ratio permits these areas

Figure 3. During surgery: micro- and mesh grafting used side by side.

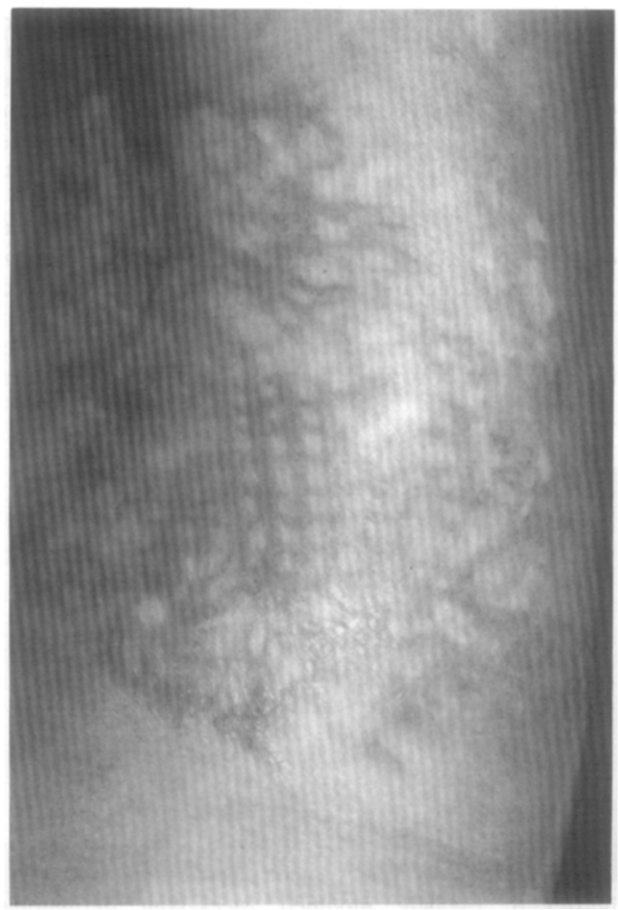

Figure 4. Six months after surgery: the single islands are still visible.

to be covered with a minimum of sacrifice of donor skin, and the numerous surviving pilo-sebaceous sites enable a significantly greater probability of rapid healing. Our patients were spared an average of 14 days of hospitalization and one operation because they underwent Meek grafting at these sites within the first two operations.

At 6 months post-surgery, the functional results of the micrografted areas were comparable to those of the areas treated with meshed STSG and the aesthetic results were better. This seems due to the different modalities of healing: the nature of the mesh itself causes uneven growth of new epidermal tissue. The Meek islands, however, seem to promote smoother and more uniform growth of healthy skin.

In the long-term, both the functional and aesthetic results were considered good to excellent in all cases.

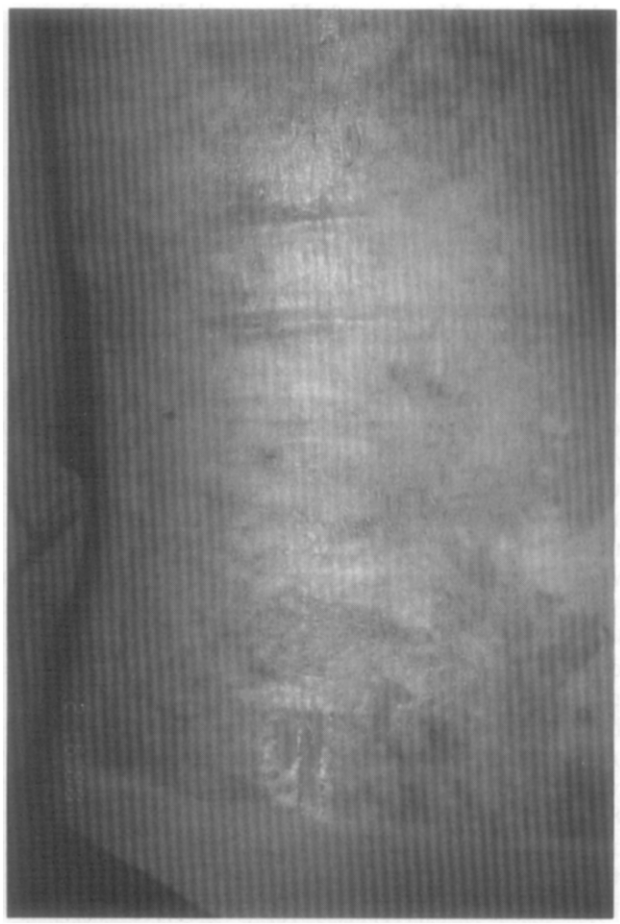

Figure 5. Patient with full thickness burns of the right flank treated with micrografting: 6 months after surgery.

Acknowledgements

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References

1 Kreis R. W., Vloeman A. F. P. M. Skin graft fixation with Surfasoft and staples: an analysis of the results. *Scandanavian Journal of Plastic and Reconstructive Surgery* 1987; **21:** 249–251.

2 Meek C. P. Successful microdermagrafting using the Meek-Wall dermatome. *American Journal of Surgery* 1958; **6:** 557.

3 Kreis R. W., Mackie D. P., Hermans R. P., Vloemans A. R. Expansion techique for skin grafts: comparison between mesh and Meek island (sandwich-grafts). *Burns* 1994; **20(1):** 539–541.

4 Kreis R. W., Vloeman A. F. P. M., Hoekstra M. J., et al. The nonviable glycerol preserved cadaver skin combined with widely expanded autograft in the treatment of extensive third degree burns. *Journal of Trauma* 1989; **29:** 51–54.

5 Meek C. P. Extensive severe burn treated with enzymatic debridement and microdermagrafting. *American Surgery* 1963; **29:** 61.

6 Peeters R., Hubens A. The mesh skin graft – true expansion rates. *Burns* 1988; **14:** 239.

7 Kreis R. W., Mackie D. P., Vloemans A. W. F. P., Hermans R. P., Hoekstra M. J. Widely expanded postage stamp skin grafts using a modified Meek technique in combination with an allograft overlay. *Burns* 1993; **19(2):** 142–143.

8 Shivets V. N., Malakhov S. F., Egorov B. B., et al. Ability of micro-autotransplants to re-epithelialize deep and extensive skin injuries. *Burns* 1991; **17:** 243.

9 Tanner J. C., Vandeput M. S., Olley F. F. The mesh skin graft. *Plastic and Reconstructive Surgery* 1964; **34:** 287.

10 Zhang M. L., Chang Z. D., Wang C. Y., et al. Microskin grafting in the treatment of extensive burns: a preliminary report. *Journal of Trauma* 1988; **28:** 504.

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Correspondence should be addressed to: Dr Rita G. C. Zermani, Via Carroni 28, 43035 Felino (PR), Italy.