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Technical tips to enhance micrografting results in burn surgery

Si Jack Chong, Abby Choke, Bien-Keem Tan*

Department of Plastic, Reconstructive and Aesthetic Surgery, Singapore General Hospital, Outram Road, 169608, Singapore

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ABSTRACT

The lack of autograft donor site is one of the greatest limiting factors for the treatment of extensive burn. Micrografting is an important revolution in burn surgery where autografts are cut into small pieces for wide and rapid coverage of burn wound. Our early experiences with the current standard micrografting technique were fraught with poor graft take as well being time and labor intensive. We have improvised our technique, where we combined the use of allograft to serve as a carrier for the micrograft. The objective of this paper is to share our experience in micrografting and several technical tips which had enhanced our micrografting results.

The improvisation in our technique includes: (1) Single-stage 'micrograft-allograft sandwich method' where allograft served as a direct carrier for the micrografts. Micrografts were laid uniformly 1cm apart onto allograft sheets, creating a 1:9 expansion ratio. This technique replaced the original two stage method. (2) The use of the Meek device (Humeca, Netherlands) to prepare micrograft. The Meek device can rapidly produce 3mm micrografts for easy transfer with a fine forceps. (3) The use of slow-acting fibrin sealant to promote graft take and hemostasis. (4) A two-team approach for micrograft preparation where one team processes micrograft and another prepares the allograft sheets. This reduces the lag time between micrograft preparation and grafting, and reduces the overall surgery time.

Micrografting remains an important treatment for major burn surgery. The aim of micro-allograft combination is to allow autografts re-epithelization under a reliable temporary skin coverage in a single stage procedure. A prospective study is warranted to measure the objective outcome of this renewed technique.

1. Introduction

One of the greatest limiting factor for treatment of extensive burn is the lack of autograft donor site. An important revolution in burn surgery was the introduction of micrograft by Meek in 1958, where a skin expansion device can rapidly produce skin grafts as small as 3 mm × 3 mm for coverage of large surface area burns [1]. In 1993, a new technique introduced by Kreis, known as the 'Modified Meek Micrograft' technique, combined the original technique with a second-stage delayed allograft coverage [2]. This two-stage technique is the current standard technique for Meek micrografting and was also used in our institution.

Micrografting was integrated into our newly implemented burns protocol in 2014. In the same year, a prospective cohort

* *Corresponding author.*
E-mail address: abbyc29@gmail.com (A. Choke).
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Fig. 1 – Autograft were harvested and laid onto cork bases.

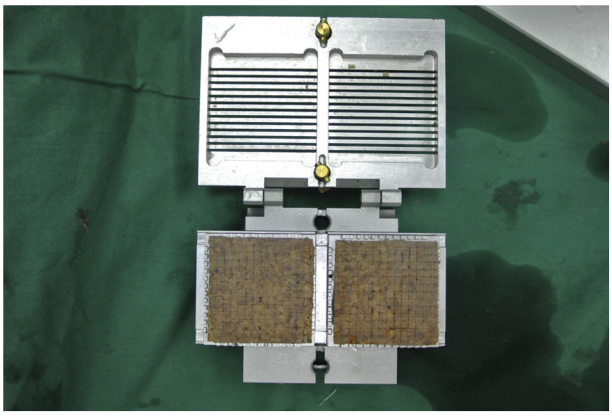

Fig. 3 – Uniform cut pieces of 3 mm × 3 mm micrografts were kept moist.

study was carried out in our institution to compare the economic outcome of micrograft and conventional split skin grafting. This study compared two techniques on 8 severely burnt patients (>45% TBSA burns), and the results demonstrated a significant positive outcome with the use of micrografts, i.e. overall cost reduction of 50%, shorter hospital stay, and lesser number of surgery sessions [3]. However, we found that the Modified Meek technique required a longer treatment duration with the delayed laying of allograft, and it was also fraught with poor micrograft 'take'. This has prompted several modifications in our technique, where we combined the original technique into a single stage method by direct laying of micrografts onto the allograft, with the allograft serving both as a carrier as well as a temporary skin coverage [4]. The objective of this paper is to share our experience in micrografting and several technical tips which had enhanced our micrografting results.

2. Modified meek technique

The two-stage 'Modified Meek Technique' was used when micrografting was firstly introduced in our institution. Firstly, skin grafts were laid onto small cork bases and cut into micrografts of 3 mm × 3 mm size using the Meek device *(Humeca, Netherlands)*. Next, the grafts were transferred onto a special expandable gauze with the aid of a special adhesive spray. The gauzes were laid open and manually expanded to the ratio of 1:3, 1:6, or 1:9 for wide distribution of the micrografts. These gauzes were then transferred onto the recipient wound bed for grafting, followed by dressing in layers. After 5 days, the gauzes were carefully removed, preserving the micrograft islands. Allograft sheets were then laid on for secondary coverage of the wound bed. This process is repeated until sufficient epithelisation takes place.

2.1. *Our technique*

In our improvised technique, we omitted the use of the special expandable gauzes and adhesive spray. Micrografts were prepared directly onto hand-fenestrated allograft in a single stage procedure. We termed this the 'micrograft-allograft sandwich method'.

Our technique is described as below:

1. Autografts are harvested using a skin dermatome and laid evenly onto the cork bases. It is important to ensure that skin does not exceed the edges of the cork bases (Fig. 1).

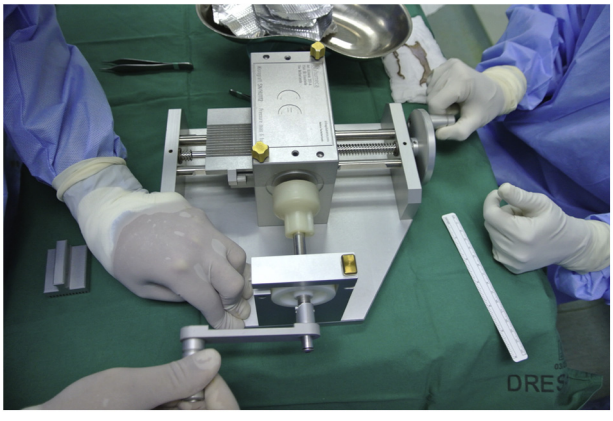

Fig. 2 – The Meek micrograft device cuts through the autografts in 2 planes.

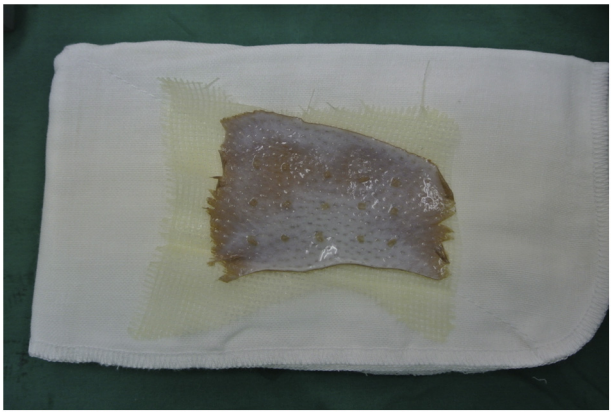

Fig. 4 – Individual micrograft pieces were laid onto allograft sheets using a fine forceps to create the dual layer 'micrograft-allograft sandwich'.

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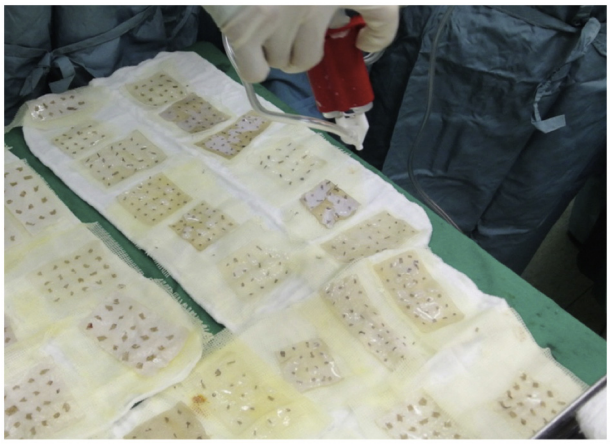

Fig. 5 – Fibrin sealant sprayed onto grafts and recipient wound prior grafting.

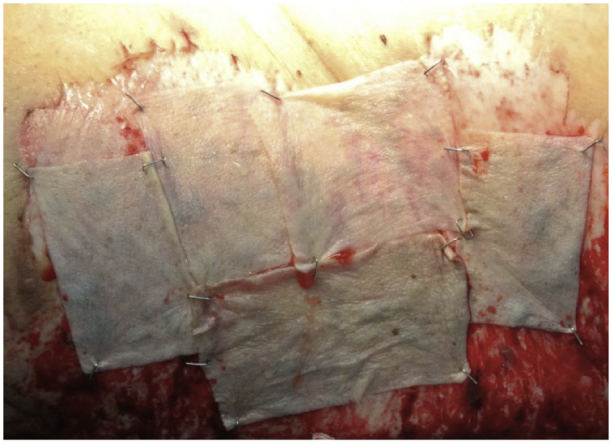

Fig. 6 – Grafting onto recipient wound.

2. Micrografts are cut into 3 mm × 3 mm pieces using the Meek device. (Figs. 2 and 3).
3. Allografts are prepared in short sheets of 10 cm × 8 cm and laid onto paraffin gauzes with the dermal surface facing upwards. The allografts are fenestrated with a surgical blade to allow seepage of plasma exudate after grafting.
4. Using a fine forceps, individual micrograft is picked up from the cork bases and lined it onto the allografts sheets. Micrografts are carefully spaced out 1 cm apart, similarly with the dermal surface facing upwards (Fig. 4).
5. When the recipient site is ready for grafting, a thin layer of slow-acting fibrin sealant (*Tissel, Baxter*, USA) is sprayed onto the grafts and recipient wound. (Fig. 5).
6. The dual layer grafts (micrograft-allograft sandwich) are then laid onto the recipient site and secured with surgical staples or sutures (Fig. 6).
7. Secondary dressing i.e. paraffin gauze or silver impregnanted dressing are applied followed by external dressing with diluted iodinized gauze and crepe bandage.
8. Change of external dressing is performed every 2 to 3 days. By Day 5, the dressing is taken down for inspection of the wound. Any non-adherent areas of the allograft are trimmed away and external dressing reapplied.
9. By Week 2 to 3, the adherent allograft is carefully removed with preservation of micrograft islands. The same procedure is repeated until sufficient epithelisation takes place (Fig. 7).

3. Discussion

The use of human cadaveric allograft as a temporary skin coverage is widely described in burns. The main advantage of allograft is the ability to act as a temporary skin cover. This helps to suppress bacterial proliferation, control exudates, and promote epithelisation of the wound [5]. Our allografts were sourced both locally and overseas, and stored in our skin bank. The locally sourced skin are cryopreserved, while imported skin are either frozen or glycerolized allografts. These allograft are typically harvested in 100 cm length. We trim them into shorter strips of 8 × 10 cm for better conformation into difficult to reach area like the joint line, neck, or groin. Smaller allograft sheets also allow plasma exudates or blood to seep out, preventing hematoma formation.

In our early experimenting of micrografting, we observed that burn excision was always ahead in time of micrograft preparation. The 'catching up' on graft preparation always causes undue delay and prolongation of surgery, which puts the patient at risk of hypothermia, fluid loss, and longer anaesthetic time. Now, we emphasized a proper delegation

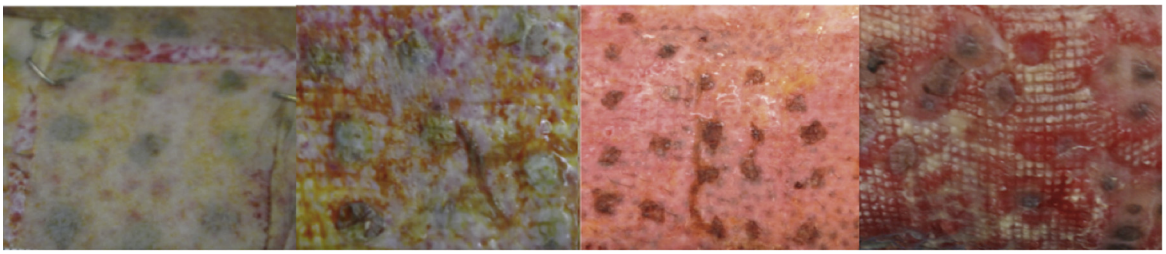

Fig. 7 – This sequential figure depicts the gradual epithelization of micrograft islands from week 1 to week 4. By Week 2 to 3, the allografts are carefully lifted away to allow expansion of the micrografts. Wound bed re-epithelization and radial expansion of the micrografts were also noticable by week 3.

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of tasks for each surgery sessions. For each session, we select two experienced assistants. One assistant is responsible for the preparation of micrografts using the Meek device, while another assistant prepares allograft sheets onto paraffin gauze. Once both processes are in check, they proceed to lay on individual cut pieces of micrografts onto the allograft sheets. This step is performed by plastic surgery residents, whom all had received basic microsurgery training. All did not report any difficulty transferring the micrograft, and did not require loupes magnification for the process. The darker Asian skin tone also makes it easier to identify the dermal surface (dermis is lighter in color and curls inwards). In our earlier experience, it took four people an average of 146 minutes to prepare for a 20% TBSA burn wound. Since the two-team approach was implemented, micrograft preparation time was reduced to 60 minutes for a a 20% TBSA coverage [6].

Previously, we have attempted manual preparation of micrografts using a surgical blade, but this method was cumbersome and ineffective. The cut pieces were poorly uniform and easily desiccated. The use of the Meek device allowed us to produce uniform cut pieces that can be easily handled by fine instruments, at the same time minimizes mechanical damage to the micrografts. We have also omitted the use of the adhesive spray and expandable gauze described in the original technique. We found that the adhesive glue causes over-adherence of the micrografts onto the expandble gauze, resulting in failure of graft transfer. Another reason was because we combine the use of Cultures Epithelial Autograft (CEA) after serial micrografting, and we believe that the chemical constituent in the adhesive spray could be potentially toxic to the cell cultures. Now, we introduced the use of slow-acting fibrin sealant glue to enhance graft adherence, this glue also has the added advantage of promoting hemostasis [7]. Fibrin sealant is also biologically compatible and non-cytotoxic to cells hence can be safely used in combination with CEA.

4. Conclusion

Micrografting remains an important treatment for major burn surgery with the advantage of achieving rapid and wide wound coverage with minimal donor site requirement. The aim of the micro-allograft combination is to allow autografts re-epithelization under a reliable temporary skin coverage in a single stage procedure. The multidisplinary two-team approach has also brought about improved communication and coordination of job tasks for more efficient surgery. A prospective study is still warranted to measure the objective outcome of this renewed technique.

REFERENCES

[1] Hadjiiski O. The method of micrografting in the treatment of large area full-thickness burns. Ann Burns Fire Disaster 2000;13 (3):155–8.
[2] Kreis RW, Mackie DP, Vloemans AW, Hermans RP, Hoekstra MJ. Widely expanded postage stamp skin grafts using a modified Meek technique in combination with an allograft overlay. Burns 1993;19(April (2)):142–5.
[3] Kok YO, Liang WH, Chong SJ, Tan KC, Tan BK. Revolutionizing major burns management with micrografting—improved healthcare costs, time and burns resources. Plast Reconstr Surg 2015;136(October (4 Suppl.)):64.
[4] Chong S, Mok J, Kok Y, Tan B. Single stage micrograft-allograft sandwich grafting for major burns. J Burn Care Res 2015;35(July/August (S4)):265.
[5] Calota DR, Nitescu C, Florescu IP, Lascar I. Surgical management of extensive burns treatment using allografts. J Med Life 20125(December (4)).
[6] Goh CS, Tan BK, Hasan M, Chong SJ. Presurgical micrograft-allograft sandwich preparation reduces operative time in massive burns. Burns 2016(January) pii: S0305-4179(15)00247-8.
[7] Dyess DL, Blache C, Wright T, et al. The use of fibrin sealant in burn treatment. Plastic Surgery, Nerve Repair, Burn. 1995, Chapter: fibrin sealing in surgical and nonsurgical field. 120–127..

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