

Four Layers of Laminated Split-Thickness Skin Graft Harvested in One Stage

Tiem Chuenkongkaew, MD

Plastic Surgery Unit, Surgery Division, Nakhon Pathom Regional Hospital, Nakhon Pathom Province 73000, Thailand

Abstract

Background: Conventional split thickness skin grafts have some drawbacks, such as pain, pigmentation changes, hypertrophic scarring, delayed healing, inadequate skin at the donor sites. The author previously reported a modification of skin graft, laminated skin grafts, that can reduced these drawbacks.

Patients and Methods: This article reported another technique of harvesting four layers of thin split thickness skin grafts simultaneously in one stage. During the past 2 years, 24 patients received skin grafts using this technique, 16 males and 8 females, ages ranged from 19 to 60 years. The dimension of skin grafts averaged 3.5 cm in width and 6.4 in length.

Conclusion: After 15 months, the author observed that 1) the area of donor site was greatly reduced; 2) the cosmetic effect was satisfactory; and 3) rehabilitation was achieved early. Nevertheless, this technique had some drawbacks such as scaling, temporary milia and longer operative time.

Skin grafting is one of the most useful techniques in plastic surgery. They are used to cover well vascularized open wounds where insufficient skin is available to permit direct closure. The pinch graft introduced by Jacques Louis Reverdin in 1869 was followed by thin split-thickness grafts, introduced by Louis Ollier and more carefully studied and described by Carl Thiersch.¹ The modern, thicker split-thickness graft was popularized by Brown and McDowell.²

A skin graft is a sheet of skin including epidermis and a variable thickness of dermis that is completely freed from its donor blood supply and transplanted to a recipient site to be closed. Skin graft may be either full thickness, including all epidermis and dermis, or partial (split) thickness, in which the skin is harvested at some level within the dermis. Split-thickness skin is

used to cover wounds with precarious circulation and those with large areas of skin loss from burns or other traumatic wound, as well as to cover full-thickness skin donor sites. The skin is cut through a preselected level of the dermis. The dermis is approximately 20 times thicker than the epidermis in most areas of the body, permitting a wide latitude in graft thicknesses. Average grafts are between 12/1000 to 18/1000 inches thick (0.30 to 0.45 mm.), but thinner grafts can be taken from children, from the aged, and from certain areas of the face where the skin is thinner. Since only a part of the dermis is taken, the donor site heals spontaneously by epithelial outgrowth from the remaining epithelial islands, sweat glands, and hair follicles.³ According to Thompson,⁴ the donor site of thick split-thickness skin graft heals more rapidly and

with less scarring when it is overgrafted with thin split-thickness skin graft.

The technique of grafting skin using previously decolorized donor areas seems to prevent severe melanin hyperpigmentation of the graft at the recipient site.⁵ The important factor in preventing wound contraction is the total percentage of the dermis grafted, rather than absolute thickness of the skin graft⁶ and the amount of structurally intact collagen present in the graft, rather than epidermis.⁷

The author⁸ reported an alternative technique of caring for donor site of split-thickness skin graft which involves the immediate return of superficial thin-layer split skin graft to the donor site while using the deep layer for replacement over the defect. This technique decreases the morbidity associated with other established techniques of donor site management, including prolonged healing time, fluid loss, discomfort, pain, and undesirable cosmetic results. As for the recipient site, satisfactory cosmetic results and less pigmentation changes can be achieved with a simple modification of the laminated graft.

The author presents another technique of harvesting four layers of thin split-thickness skin grafts simultaneously in one stage.

MATERIALS AND METHODS

During the past two years (2001-2002), 24 patients who required skin grafts were recruited to undergo four layers of the laminated skin graft scheme at Nakhon Pathom Regional Hospital. The patients were fully informed and written consent were obtained.

Operative Technique

Four laminated grafts were harvested in one stage. The blade was first set to 6/1000 of an inch, then four layers of thin skin grafts were cut exactly on the same donor site (Figure 1). The oozing donor site was then packed with topical low-concentrated vasoconstrictor. The deep three de-epithelialized grafts were used for the reconstruction, and the remaining freshly cut superficial layer skin graft was then replaced on the donor site for coverage after adequate hemostasis was achieved (Figure 2). The grafts covering the wound were secured in place with a few interrupted sutures along the periphery. The deeper grafts were then immobilized on the wound bed by a slap and a bolus

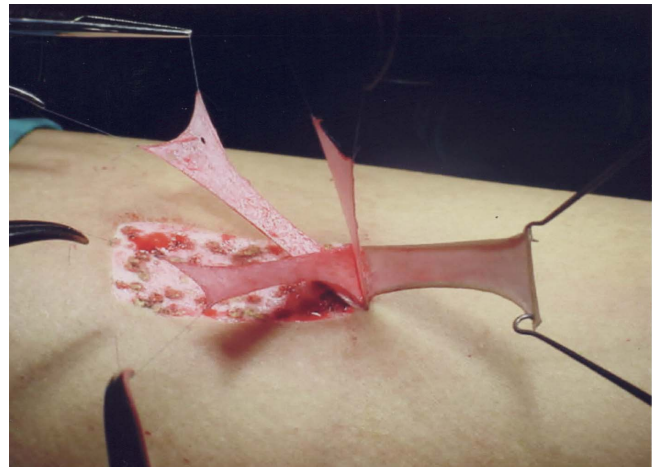


Fig. 1 Laminated grafts were harvested in one stage, for thin split-thickness skin graft. Some dermis still remained in the donor site.



Fig. 2 The graft covering the donor site was well taken with good results. (15 days). The star indicated conventional non-grafted donor area.

dressing for approximately 4 to 5 days. The donor site was covered with fine mesh gauze. The grafted area was examined regularly on the fourth and tenth day to observe the acceptability of the skin graft.

RESULTS

There were 16 male and 8 female patients in this study, ranging from 19 to 60 years of age (average age was 28 years). Clinical indications were trauma (N = 16), tumor (N = 2), burns (N = 5), and skin necrosis after severe infection (N = 1). The dimensions of split-thickness skin graft averaged 3.5 cm in width (range, 2.5-5 cm.) and 6.4 cm in length (range, 5-11 cm).

The grafts covering the donor site and recipient

site took well within 6 days (range, 5-8 days) (Figure 2) and 8 days (range, 6-10 days) respectively. However, re-epithelialization of recipient dermis graft was not completed until 19 days (range 17-23 days) (Figure 4). Eighteen of these split-thickness skin grafts took completely. The split-thickness skin graft took uneventfully in the other six patients, without any additional surgical procedures. Mild degree of hyperpigmentation was noted in the area where hematoma occurred. A few milia were found at the donor site within six weeks after grafting. None persisted after that time. In ten patients, mild scaling at the donor skin graft was also noted, even in the long term period (Figures 2 and 3).



Fig. 3 Donor site five months after operation showed better aesthetic results compared with the non-grafted area (star). Mild hyperpigmentation and scaling were observed.



Fig. 4 Recipient site one month after the operation showed complete re-epithelialization and good color match.



Fig. 5 Two years later the patient in Fig. 4 showed good cosmetic results in both recipient site (star) and donor site (arrow). There were no keloids, milia, scaling or hyperpigmentation changes at both sites

After the 15 months follow-up (range, 5-24 mos.), the author observed that every patient's donor site area reduced markedly with satisfactory cosmetic results (Figures 3 and 5). They were able to receive early rehabilitation.

DISCUSSION

The technique of using multiple layers of laminated grafts is straightforward and does not require special expertise or equipment. Although the technique is simple and the additional time required is negligible, the author advocates this technique for use in selected patients. This technique is ideal for patients concerned with scarring of the donor area and burned patients whose donor sites of skin grafts are limited. By cutting four layers of dermis on the same donor site simultaneously in one stage, the area of skin grafts harvested is maximized by four times. The ability of a skin graft to inhibit wound contraction is directly proportional to the amount of structurally intact dermal collagen present in the graft.⁹ The presence of epidermis does not affect the rate of wound contraction.⁷ Therefore it is reasonable to return the most superficial layer back to cover the donor site. The graft covering the donor site took within 6 days, which was faster than the healing of donor areas treated under the standard fashion in which reepithelialization occurred from 10 to 21 days in the medium split-thickness skin graft and 21 to 56

days in the thick split-thickness skin graft.⁹

Overall benefits of regrafting the donor site at the time of initial skin grafting procedure include decreased pain, faster healing, lower incidence of hypertrophic scarring, better pigment esthetics, and generalized improved quality of the healed skin at the donor site in terms of elasticity and durability.^{4,8}

However this technique also has some drawbacks, such as scaling, temporary milia and longer operating time.

In addition, in the case of partial graft loss, the graft at the donor site can be partially removed to re-graft the defect easily and without anesthesia for up to 10 days.⁹ This prepared graft can be revascularized more rapidly than a fresh or refrigerated graft.¹⁰ Harvesting skin at this level will leave some dermis as well as skin appendages such as hair follicles and sweat glands in the donor site. These skin appendages then allow regeneration of new epidermis to close the donor site.

Surgeons should keep in mind the principle of multiple layers of laminated split-thickness skin graft when performing skin grafting procedures because it is reasonable and practical.

REFERENCES

1. Saunders JB, deDM. A conceptual history of transplantation. In: Najarian JS, Simmons R, editors. Transplantation. Philadelphia: Lea & Febiger; 1972. p. 206-57.
2. Brown JB, McDowell F. Skin grafting. 3rd ed. Philadelphia: JB Lippincott; 1958.
3. Rudolph R, Fisher JC, Ninnemann JL. Skin grafting. Boston: Little Brown; 1979.
4. Thompson N. A clinical and histological investigation into the fate of epithelial elements buried following the graft of "shaved" skin surfaces. *Br J Plast Surg* 1960; 13: 219-42.
5. Lopez-mas J, Monasterio FO, Gonzalez MVD, et al. Skin graft pigmentation. *Plast Reconstr Surg* 1972; 49: 18-21.
6. Rudolph R. Inhibition of myofibroblasts by skin grafts. *Plast Reconstr Surg* 1979; 63: 473-80.
7. Brown D, Garner W, Yong L. Skin grafting: dermal components in inhibition of wound contraction. *South Med J* 1990; 83: 789-95.
8. Chuenkongkaew T. Modification of split-thickness skin graft: cosmetic donor site and better recipient site. *Ann Plast Surg* 2003; 50: 212-4.
9. Jankauska S, Cohen IK, Grabb WC. Basic technique of plastic Surgery. In: Smith JW, Aston SJ, editors. Grabb and Smith's plastic surgery. New York: Little Brown and Company; 1991. p. 3-90.
10. Zarem HA. Transplantation of the skin. In: Krizek TJ, Hoopes JE, editors. Symposium on basic science in plastic surgery. St Louis: CV Mosby Co; 1967. p. 157.