

## Useful Tips for Successful Skin Grafting

Rei Ogawa, Hiko Hyakusoku and Shimpei Ono

Department of Plastic, Reconstructive and Regenerative Surgery,  
Graduate School of Medicine, Nippon Medical School

### Abstract

Skin grafting is a common operative method widely used in the field of plastic, reconstructive, and aesthetic surgery. However, we offer five suggestions to reduce complications and surgical invasiveness. Our tips are as follows. (1) Skin grafts should be harvested on the basis of a swimsuit with high-cut leg openings. (2) A drum dermatome is still useful when a split-thickness skin graft is needed after a full-thickness graft has been harvested. (3) A flower holder is useful for making drainage holes. (4) A tie-over dressing using external wire-frame fixation is recommended. (5) Povidone-iodine gel is recommended with a tie-over dressing. These procedures have been found to be extremely helpful for ensuring the success of skin-grafting procedures.

(J Nippon Med Sch 2007; 74: 386–392)

**Key words:** burn reconstruction, skin graft, tie-over, wire-frame fixation, Kenzan skin graft

### Introduction

Skin grafting is a common operative method that is widely used in the field of plastic, reconstructive, and aesthetic surgery. Beyond mere graft survival, however, the goals of surgery include good matching of texture and color and minimizing donor morbidity. These factors and optimal donor sites require careful consideration in each patient. We have found that the recommendations offered below can help achieve these goals.

#### 1. Skin-graft Harvesting on the Basis of a High-cut Bathing Suit

When harvesting full-thickness skin grafts, it is important to consider each patient's age and sex to select the appropriate donor sites<sup>1</sup>. The correct color

and texture is of paramount importance, but also important is minimal donor-site morbidity. The favored donor sites usually include the postauricular and subclavicular regions, the medial side of the upper arm, and the inguinal region. Of these sites, the inguinal region is often preferred because of its inconspicuous position and the facility of primary closure. However, a wound on the crease of inguinal region is much more objectionable than we had expected, especially for young female patients, because of the current vogue for swimsuits and short pants with high-cut leg openings. An example of such a case is that of a young woman in whom we selected the inguinal region as the donor site (**Fig. 1a**). Moreover, the crease of the inguinal region is often pigmented because of chronic inflammation due to sweat or sebum. It is, therefore, best to focus on the high-cut leg region rather than the inguinal

---

Correspondence to Rei Ogawa, MD, PhD, Department of Plastic and Reconstructive Surgery, Nippon Medical School, 1-1-5 Sendagi, Bunkyo-ku, Tokyo 113-8603, Japan  
E-mail: r.ogawa@nms.ac.jp  
Journal Website (<http://www.nms.ac.jp/jnms/>)



Fig. 1a Skin-graft harvesting along the line of the high-cut leg opening  
Young women may choose to expose the region around the inguinal crease. Thus, we have selected a high-cut leg line for the donor site of the full thickness skin graft.



Fig. 1b The grafted skin and its donor site  
This method should be indicated in female infant patients for the future.

crease. Another benefit of this approach is that the patient can be permitted to walk immediately after the operation, because when the legs are moved a wound in the high-cut leg region is subjected to less tension than is a wound in the inguinal region. This method should be indicated in female infant patients for the future (**Fig. 1b**).



Fig. 2a Skin graft applied to the drum dermatome  
The drum dermatome can be used to make a split-thickness skin graft after a full-thickness skin graft has been harvested. A full-thickness graft was applied to the drum.



Fig. 2b Removal of adipose tissue and deep dermal layers of the skin graft  
After calibration dial for thickness has been adjusted, the handle is turned. In this way, split-thickness skin grafts and the denuded skin of flaps can be prepared after grafts with epidermis have been harvested.

## 2. Use of a Drum Dermatome for Making a Split-thickness Skin Graft from a Full-thickness Graft

Hand-turned drum dermatomes have recently largely been replaced by electric dermatomes. However, the drum device remains useful when a split-thickness skin graft is needed after a full-thickness graft has been harvested. Moreover, the drum dermatome can be used to modify grafts that are thicker than expected. After tape or glue is applied to the drum in the usual way, the graft is attached to the drum (with the epidermis facing the



Fig. 3a Japanese flower arranging  
*Kenzan* flower holders are commonly used for ikebana flower arranging.

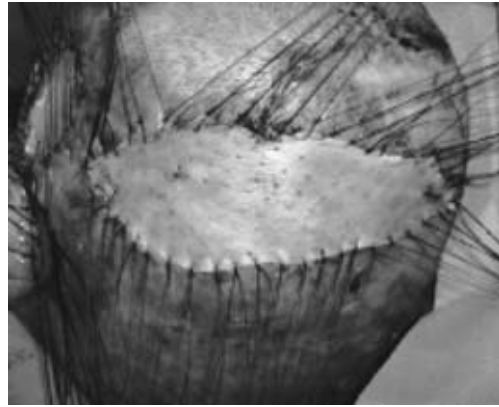


Fig. 3d Application to the recipient site  
We can observe many small holes in the skin graft. These holes are considered to be useful for the drainage of blood, exudates, and bacteria into the compression gauze.



Fig. 3b Instruments for making drainage holes using the flower holder  
Skin grafts were applied to a rubber sheet and turned over onto a flower holder.



Fig. 3e Two weeks after the operation  
Holes functioned adequately for drainage and underwent epithelialization after almost 10 days.



Fig. 3c Striking with a hammer to make small drainage holes  
The rubber sheets on the skin grafts were struck with a hammer. In a matter of minutes, numerous small holes could be made on the graft.

drum, **Fig. 2a**). After the calibration dial is adjusted for thickness, the handle is turned (**Fig. 2b**). In this way, a full-thickness skin graft can be modified to the split-thickness desired and the donor site can be closed primarily. The drum dermatome can also be used to denude skin for making dermal-fat grafts or denuded skin flaps after they have been harvested with the epidermis. Drum dermatomes are still useful.

### 3. Use of a Flower Holder for Making Drainage Holes (*Kenzan* skin graft)

The success of a skin graft depends on (1)

appropriate debridement and cleanup of the recipient site down to the layer providing the blood supply; (2) adequate hemostasis of the recipient site to prevent the development of a hematoma; and (3) sufficient compression of skin grafts from corner to corner, using a tie-over dressing or bandages. Hemostasis is especially important in blood-rich regions such as the scalp, face, and hand. In such cases, drainage holes—which are also useful for the drainage of bacteria and exudates—should be made on the skin grafts. However, large drainage holes will leave scars; therefore, numerous small holes are preferred. To make such holes, a Japanese *kenzan* flower holder (**Fig. 3a**) is far more effective than surgical knives or needles. The graft, held by a rubber sheet, is turned onto a flower holder (**Fig. 3b**). It is then beaten (against the rubber sheet) with a hammer, as (**Fig. 3c**). In this way, numerous small holes can be made in a matter of minutes (**Fig. 3d**). These holes suffice for drainage and become epithelialized after about 10 days (**Fig. 3e**).

#### 4. Use of a Tie-over Dressing with External Wire-frame Fixation

We have used external wire-frame fixation for skin grafts since 1986. In 1991, we reported this method and described two advantages: (1) the technique is useful for securing grafts to wound beds and (2) preventing the graft edges from lifting<sup>2</sup>. Moreover, we confirmed the usefulness of this technique for skin grafting to regions with free borders, such as the lips and eyelids<sup>3</sup>. Particularly for eyelid grafts, external wire-frame fixation overcomes the disadvantages of tarsorrhaphy<sup>3</sup>. Moreover, this method can also be used for digital skin grafting<sup>4</sup>. Three-dimensional external wire frames are useful for fixing digital joints as well as skin grafts. If this method is used for digital skin grafts, the fixing of digital joints by pinning is not necessary, particularly for grafting the palmar surface of a finger.

During surgery, the skin graft is fixed with sutures by the usual method (**Fig. 4a-1**). At the same time, the wire frame, shaped like the graft itself, is made of 1.2-mm-diameter Kirschner wire. Then, one part of each suture is bound up (**Fig. 4a-2**), and the

wire frame is applied to the graft (**Fig. 4a-3**). Next, the wire frame is attached with the same sutures already used for stitching the graft (**Fig. 4a-4, 4b**). Finally, tie-over fixation is performed in the usual way (**Fig. 4a-5, 6, 4c**). The skin graft is then taken from corner to corner even if it involves application on a free edge (**Fig. 4d**).

#### 5. Tie-over Dressing Using Povidone-iodine Gel

Skin grafting for a chronic wound begins with preparation of the wound bed, including adequate debridement, irrigation, and disinfection. Sometimes, however, contamination or infection occurs at the recipient site, so that the graft does not survive regardless of corrective measures. For such cases, a tie-over dressing with povidone-iodine gel (Iodine Gel, Meiji Seika Kaisha, Ltd., Tokyo) may be useful. (This type of gel is commonly used to treat chronic ulcers<sup>5</sup> and catheter-related infections<sup>6</sup>.) Ointments containing 10% povidone-iodine are reported to exhibit the broad-spectrum germicidal activity of iodine against the more commonly encountered organisms in skin and wound infections without the undesirable effects and disadvantages of iodine<sup>7</sup>. Moreover, the brown shade of povidone-iodine gel indicates its concentration, and this shade gradually becomes paler as the gel's oxidizing/disinfecting activity progresses. Thus, we can estimate the degree of contamination or infection in the grafted surface by carefully observing the color of the tie-over gauze.

After the skin graft has been fixed with the usual method (**Fig. 5a, b**) as outlined above, povidone-iodine gel is painted on the graft, after which petrolatum-impregnated gauze (Adaptic, Johnson & Johnson, Somerville, NJ, USA) is applied. At this point the tie-over dressing using povidone-iodine gel-infiltrated gauze is placed (**Fig. 5c**). After the operation, especially after 4 days have passed, it is important to monitor the color of the gauze. If the original brown color has faded completely and the gauze has become white, the tie-over dressing should be removed. After at least 4 days have passed under compression, we are generally able to save the grafted skin even if bacterial contamination or infection has occurred. If any brown color

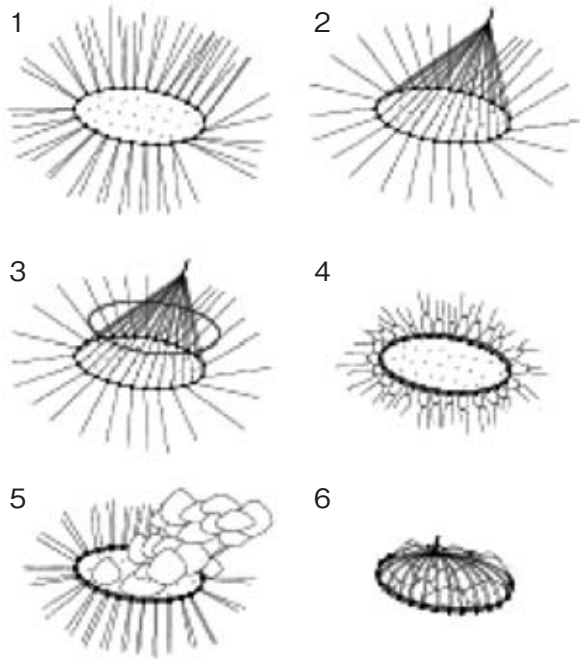


Fig. 4a Diagram of the tie-over dressing using external wire frame fixation

The skin graft was fixed with sutures by a conventional method (1). At the same time, a wire frame shaped like the graft was made from 1.2-mm-diameter Kirschner wire. Then, one part of each suture was bound up (2), and the wire frame was applied to the graft (3). Next, the wire frame was attached with sutures that had already been used for stitching the graft (4). Finally, tie-over fixation was performed in the usual way (5, 6).

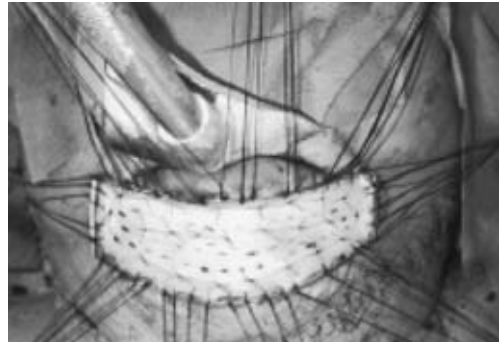


Fig. 4b External wire frame fixation of the skin graft

This patient showed lower lip ectropium due to scar contracture. The contracture was released completely, and full-thickness skin grafts were applied; tie-over fixation using an external wire frame was performed.



Fig. 4c Tie-over dressing by a conventional method  
Tie-over dressing was performed with povidone-iodine gel to prevent contamination or infection of the grafted surface.

remains, we will wait until 7 days after surgery to remove the tie-over dressing (Fig. 5d).

Several reports have described side effects, such as contact dermatitis and decreased thyroid activity<sup>9</sup>, of povidone-iodine products<sup>8</sup>. However, contact dermatitis can be prevented by removing the gel from the healthy skin surrounding the wound. Moreover, hypothyroidism is unlikely to occur after only 7 days if the gel is applied to only a small area. Of course, only a large randomized trial would be able to clarify these issues fully, and we intend to continue our study.

### Conclusions

We have presented five techniques that we have



Fig. 4d Two months after the operation  
The skin graft was taken from corner to corner even if it was grafted on a free edge.

found to reduce complications and surgical invasiveness. (1) Skin grafts should be harvested on the basis of a swimsuit with high-cut leg openings.



Fig. 5a Preoperative state of a chronic ulcer of the leg infected with methicillin-resistant *Staphylococcus aureus*  
This patient had a chronic ulcer of the leg. Methicillin-resistant *S. aureus* (MRSA) was detected on the wound. After careful debridement of the ill granulation and irrigation with water, a split-thickness skin graft was applied.



Fig. 5c Tie-over dressing with povidone-iodine gel  
Povidone-iodine gel was painted on the graft, and then petrolatum-impregnated gauze (Adaptic) was applied. Then, a tie-over dressing using povidone-iodine gel infiltrated gauze was applied.



Fig. 5b Applying the skin graft  
After the skin graft was applied to the recipient site, the grafted skin was fixed with sutures.



Fig. 5d Two weeks after the removal of the tie-over gauze  
The tie-over dressing was removed 7 days after the operation. The grafted skin survived completely without bacterial infection.

(2) A drum dermatome is still useful for creating a split-thickness skin graft after a full-thickness graft has been harvested. (3) A flower holder is recommended for making drainage holes. (4) A tie-over dressing using external wire-frame fixation is recommended. (5) Povidone-iodine gel and a tie-over dressing are useful for preventing infections. As mentioned, the success of a skin graft depends on: (1) appropriate debridement and cleanup of the recipient site down to the layer providing the blood

supply; (2) adequate hemostasis of the recipient site to prevent the development of a hematoma; and (3) sufficient compression of skin grafts from corner to corner, using a tie-over dressing or bandages. However, most important is the surgeon's determination to reduce complications and surgical invasiveness. With this attitude, we have developed these recommendations. We hope that they will become widely known among the many physicians working with patients who require surgery of this kind.



## References

1. Rigg BM: Importance of donor site selection in skin grafting. *Can Med Assoc J* 1977; 117: 1028-1029.
2. Hirai T, Hyakusoku H, Fumiiri M: The use of a wire frame to fix grafts externally. *Br J Plast Surg* 1991; 44: 69-70.
3. Murakami M, Hyakusoku H, Ishimaru S: External wire frame fixation of eyelid graft. *Br J Plast Surg* 2003; 56: 312-313.
4. Ogawa R, Aoki S, Aoki M, Oki K, Hyakusoku H: Three-dimensional external skin graft fixation of digital skin graft. *Plast Reconstr Surg* 2007; 119: 440-442.
5. Mcknight AG: A clinical trial of povidone-iodine in the treatment of chronic leg ulcers. *Practitioner* 1965; 195: 230-234.
6. Fukunaga A, Naritaka H, Fukaya R, Tabuse M, Nakamura T: Our method of povidone-iodine ointment and gauze dressings reduced catheter-related infection in serious cases. *Dermatology* 2006; 212 (Suppl 1): 47-52.
7. Venis SB: The treatment of minor wounds with povidone-iodine ointment. *Brit J Clin Pract* 1971; 25: 321-322.
8. Ebisawa M, Ikematsu K, Tachimoto H: Utility of 10% Isodine gel containing ointment for the treatment of acute lesions in atopic dermatitis. *Dermatology* 2002; 204 (Suppl 1): 125.
9. Pietsch J, Meakins JL: Complications of povidone-iodine absorption in topically treated burn patients. *Lancet* 1976; 7: 280-282.

(Received, July 5, 2007)

(Accepted, August 3, 2007)