

Treatment of Deliberate Self-harm Scars with Rotated Thin-skin Graft and Minced-skin Graft

Kento Takaya, MD*
 Ruka Hayashi, MD, PhD*
 Noriko Aramaki-Hattori, MD,
 PhD*
 Keisuke Okabe, MD, PhD*
 Shigeki Sakai, MD, PhD*
 Toru Asou, MD, PhD†
 Kazuo Kishi, MD, PhD*

Background: Scars developing after wrist cutting (a deliberate action of self-harm) have various patterns and are difficult to treat. In addition, they can occur at anatomically prominent sites and are easily recognized as caused by self-harm; thus, scars can cause lifelong regrets. However, there are no standard treatment guidelines for wounds inflicted through self-harm. This study aimed to evaluate the effectiveness of our novel technique using 90-degree rotated skin grafts, which were thinly collected at a thickness of 250 μm from a wound site, together with minced-skin grafts.

Methods: Five regions on the forearm of 5 Japanese women (age, 19–29 years) were treated from July 2011 to April 2012. The skin at the scar site was cut with an electric dermatome at a thickness of 250 μm . The scar contained therein was excised, and the skin was rotated 90 degree and transplanted. The scar remaining in the dermis of the wound was resected and resurfaced. At the site where the skin graft was insufficient, the skin was processed into a minced shape and then transplanted (minced-skin graft).

Results: In all cases, skin grafting was performed. The scar was successfully camouflaged and transformed into a socially acceptable appearance. At the wound site, the skin texture was reproduced. Following skin grafting, nodules, pigmentation, and redness around the graft transiently occurred, which then disappeared over time. No scar contractures were observed.

Conclusion: A combination of thin-skin graft rotated 90 degrees and minced-skin graft is useful in camouflaging a wide variety of deliberate self-harm scars. (*Plast Reconstr Surg Glob Open* 2020;8:e3020; doi: [10.1097/GOX.0000000000003020](https://doi.org/10.1097/GOX.0000000000003020); Published online 19 August 2020.)

INTRODUCTION

Deliberate self-harm (DSH) is the physical harm of oneself without a clear suicide attempt. Cutting the wrist is recognized as an expression of emotional distress, dissociation, and posttraumatic stress disorder in self-harm.¹ Globally, the incidence rates of DSH have been increasing in recent years, particularly in young adults and women.² Most DSH scars are caused by the use of scissors, knives, and razor blades, among other objects, on accessible body parts such as the upper and lower limbs, abdomen, and chest. These scars present a variety of appearances such as multiple (mostly lateral) lines in one direction, linear

and very thin or wide, atrophic, and flat or hypertrophic. In many cases, scars are closely spaced, and hypertrophic scars are relatively few. In the early stages, scars become red and then are gradually replaced by white and mature scar tissue. As previously reported, scars are observed in various patterns according to several different mechanisms of trauma. Therefore, it is difficult to evaluate scars by the existing evaluation or classification methods and to determine a treatment plan based on these results. Many studies have examined the motives underlying the involvement of patients in DSH. However, a few studies have been conducted on the treatment of scars. In addition, treatment guidelines for the management of pathological scars remain unmentioned.^{3–5}

DSH scars are socially recognizable to others, especially when located on the forearm.⁶ Several studies have reported that DSH wounds (of all scar types) have the strongest negative impact on patients' quality of life.⁷ Therefore, it is important to establish an appropriate treatment plan for DSH.

Conventional scar repair techniques and treatments are inadequate for treating DSH scars. Although laser

From the *Department of Plastic and Reconstructive Surgery, Keio University School of Medicine, Tokyo, Japan; and †Department of Plastic Surgery, Tokyo Cosmetic Surgery Clinic, Tokyo, Japan.

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treatment is sometimes effective,⁸ it could be time-consuming and occasionally produces unsatisfactory results. Microneedling, which involves creating small wounds in the dermis using a needle roller to induce wound healing, is frequently used to treat atrophic scars. However, a study has revealed that DSH scars do not benefit greatly from this treatment.⁹ Surgical approaches such as skin grafting and simple excision of scars or artificial dermis have been unsatisfactory due to the occurrence of new scars at the donor site and patchwork-like scar healing.^{10–12}

According to a previous report, the healing of skin wounds up to the superficial dermis after burns occurs quickly without leaving scars, whereas deep wounds in the dermis heal slower, thereby leaving scars.¹³ In other words, injuries with a depth of 220–250 μm (from the dermal papillary layer to the subpapillary layer) do not leave scars, and skin harvested at this thickness may result in skin grafting with less scarring. In addition, most DSH wounds are unidirectional; therefore, to make them less noticeable, a method was devised to change the direction of the scar by 90 degrees within the skin graft.

Based on our experience in the treatment of leukoderma after burns, and treatment of mature planar scars that are difficult to revise, “minced-skin grafting” was used to process and transplant excess minced skin during skin grafting.¹⁴ With this treatment, the final scar was less prominent because there was no loss in small skin grafts that do not match the shape of the skin defect, and there was no clear boundary between the normal skin and the pigmented skin area.

The study aimed to evaluate the effectiveness of camouflaging DSH scars on the forearm using a combination of thin-skin graft (which were rotated 90 degrees) and minced-skin graft.

PATIENTS AND METHODS

Patients

In our single center, typical DSH scars on the forearms (5 forearms: 4 flexors, 1 extension) in 5 Japanese women aged 19–29 years (mean age, 23 years) were treated individually between July 2010 and April 2012. Patients who had received medical treatment for an acute physical or psychological condition, had psychiatric problem, were pregnant or breastfeeding, had a history of skin infections, had malignancies, or used immunosuppressants were excluded from the treatment. The average time between treatment and the last self-harm was 52 months (6 months to 7 years). No patients had hypertrophic scars or keloids. This study was conducted in accordance with the Declaration of Helsinki, and the study protocol was reviewed and approved by the Medical Research Ethics Committee of Keio University (approval number: 2012477-1). All patients provided a written informed consent before their inclusion in the study. The whole process was clearly explained before the treatment that scars might have not been completely healed and they could be only improved to be less noticeable.

Operative Procedure

After induction of general anesthesia and endotracheal intubation, antiseptics of the forearm skin was performed with povidone–iodine, and the patient was draped under sterile conditions. The skin of the sterilized area was cut with an electric dermatome (Zimmer Biomet, Warsaw, Ind.) at a thickness of 250 μm . The collected skin was spread on a plastic work plate, and the scar contained therein was excised using a scalpel and sutured. The scar left on the surface from which the skin was collected was flattened with a pair of scissors. The harvested skin was implanted on the resurfaced wound at a 90-degree rotation perpendicular to the original scar.

The skin graft was fixed onto the wound using a nonabsorbable nylon thread. Since the scar was cut and sutured, the skin graft was not enough to cover some parts of the wound. Therefore, the portion of the skin graft that did not match the shape of the wound surface was excised and used as a minced-skin graft. The small pieces of skin grafts (that were surplus) were placed on a plastic plate and cut into pieces as small as possible (500 μm or less) using two No. 22 scalpels. The minced skin with a mud-like appearance spread evenly over the resurfaced wound. Both the skin graft and the minced-skin graft were covered with a nonadhesive gauze, gauze and cotton were placed thereon, and fixed with a tie-over dressing. The surgical scheme is shown in [Figure 1](#). The treated limbs were fixed with splints. The tie-over dressing was removed on postoperative day 4, and subsequent dressings were changed every 3 days for 15 days.

Evaluation of Patient Satisfaction

A telephone survey was conducted in May 2020, about 10 years after the operation, to quantitatively evaluate the patients’ postoperative satisfaction. We investigated the results of a 5-level evaluation of their satisfaction regarding changes in the appearance of scars due to the surgical procedure: 5, excellent; 4, good; 3, average; 2, below average; and 1, poor.

RESULTS

Rotated skin grafts and minced-skin grafts survived completely in all patients. Rotated skin grafts were not enough in 3 cases, and a minced-skin graft was used in combination. The postoperative observation period ranged from 6 to 24 months (average period was 13.5 months). Partial graft loss caused by insufficient fixation was observed in 1 patient; however, the wound re-epithelialized spontaneously. After grafting, from the recipient side, nodules appeared temporarily due to hair extension from the remaining hair follicles; however, they disappeared over time. Although pigmentation and redness around the skin graft occurred in some cases, these similarly disappeared over time. No new hypertrophic scar, keloid formation, or scar contracture occurred at any of the treatment sites. The pattern of DSH scars on the forearm was successfully transformed into a socially acceptable appearance ([Fig. 2, 3](#)). Some of the skin textures that were originally unnoticeable in the original scar resembled

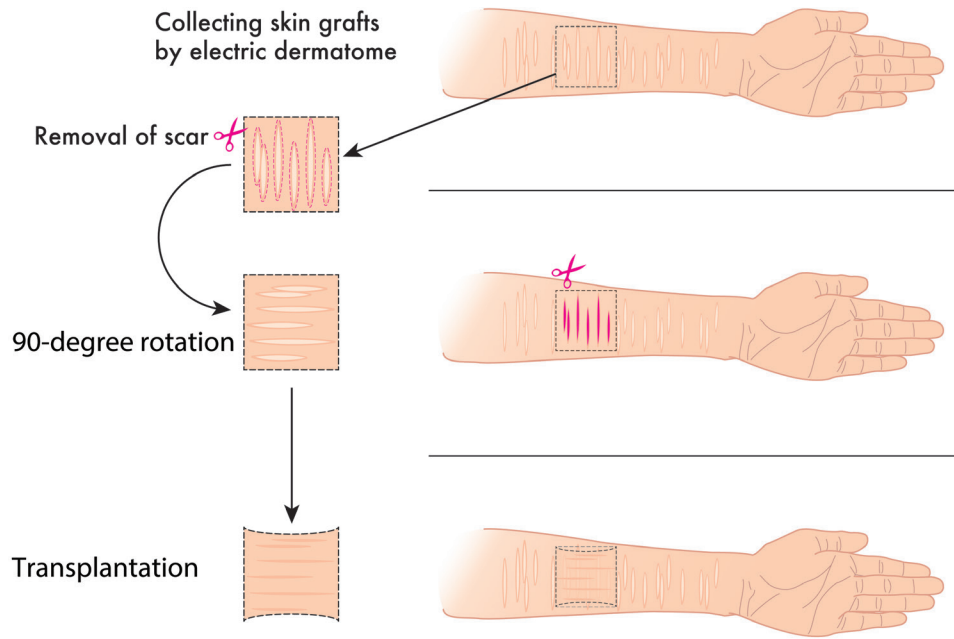


Fig. 1. Schema of 90-degree rotated thin-skin grafting.

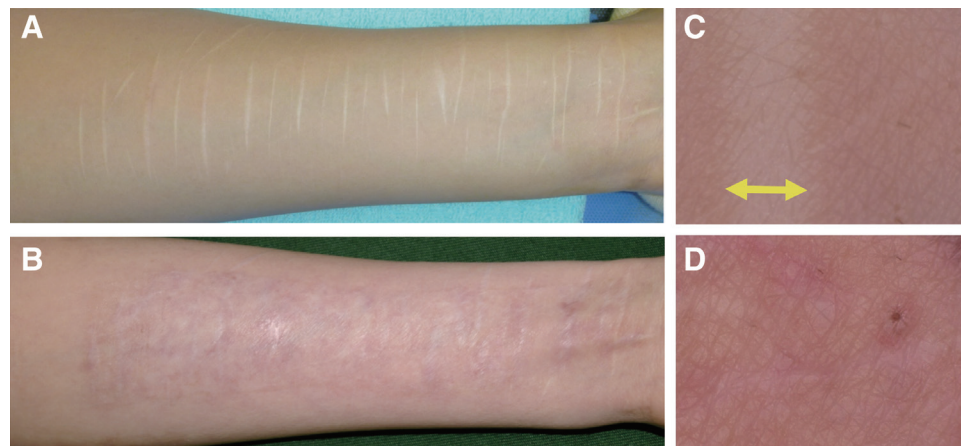


Fig. 2. A 25-year-old woman (patient 2 in Table 1) had self-inflicted scars in multiple directions on the left forearm. A, Preoperative view. B, Postoperative view after 1 year. C, Dermoscopy of preoperative scar (6×). The scar is white and the surface texture has disappeared (the scar is indicated by a yellow arrow). D, Dermoscopy of postoperative scar. The texture has almost recovered to a state similar to that of the normal skin.

normal skin. All patients were satisfied with their appearance, and no new self-harm was observed in the 5 women during the follow-up period. As a result of the telephone survey conducted about 10 years after the operation, all 5 patients answered the survey, and the average patient satisfaction was 4.8 of 5.

DISCUSSION

Various patterns of DSH scars on the forearm have not been treated satisfactorily with the existing treatment methods. However, DSH scars were transformed into a socially acceptable appearance, and a high patient

satisfaction was obtained using a 90-degree rotated thin-skin graft together with a minced-skin graft.

Many DSH patients have a history of depression and anxiety, inflict DSH on themselves as a result of trauma, and have alcohol and substance abuse problems.¹⁵ Therefore, the patients' mental health should be checked by the surgeon before a procedure, and patients' expectations of surgical procedure outcomes should be discussed. In addition, it must be emphasized that this procedure does not completely remove wound scars, but it could make the wound less noticeable and give a socially acceptable appearance.

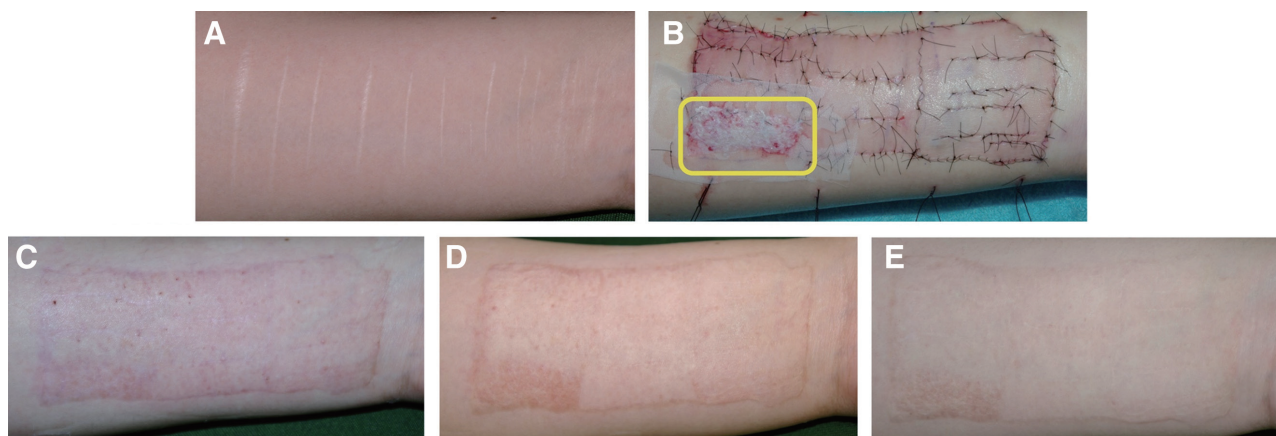


Fig. 3. A 29-year-old woman (patient 4 in Table 1) had self-inflicted scars in multiple directions on the left forearm. A, Preoperative view. B, Thin-skin grafts were applied. Due to lack of skin grafting, minced-skin grafts were transplanted (the area marked by the yellow box). C, Postoperative view after 4 months. D, Postoperative view after 7 months. E, Postoperative view after 1 year.

Table 1. Patient Characteristics

Pt.	Age	Sex	Location	Procedure	Dermal Side
1	19	F	Lt. forearm (flexor)	Rotated thin-skin graft	Excision + pilcation
2	25	F	Lt. forearm (flexor)	Rotated thin-skin graft	Excision + pilcation
3	19	F	Rt. forearm (extensor)	Rotated thin-skin graft + minced-skin graft	Resurfacing
4	29	F	Lt. forearm (flexor)	Rotated thin-skin graft + minced-skin graft	Resurfacing
5	28	F	Lt. forearm (flexor)	Rotated thin-skin graft + minced-skin graft	Resurfacing

Resurfacing was performed by scissoring the ridge of the scar with scissors to flatten the scar remaining in the surface. No new hypertrophic scar or scar contracture occurred at any of the treatment sites.

Lt, left; Pt, patient; Rt, right.

The surgical procedure of collecting skin thinly at a thickness of 250 μm from the original scar, removing scars from the graft, and then transplanting the graft did not require a new donor site. Therefore, it was possible to reproduce the texture of the skin surface. In addition, the color tone of the skin graft was more similar to that of the original skin than that collected from other parts, and the boundary between the skin graft and the normal part was inconspicuous. Thicker skin grafts had a patchier appearance with sharper boundaries. Therefore, the use of skin grafts thinner than 200 μm may be insufficient to make scars less noticeable. Previous reports have shown that there could be a loss in scar texture due to fibroblast overgrowth, extracellular matrix overproduction,¹⁶ presence of myofibroblasts,¹⁷ and abnormal crosstalk between the epidermis and dermis.¹⁸ In the course of collecting skin from the shallow layer of the dermis, the dermis and epidermis were integrated into a single piece to form a skin graft, thereby making it possible to transplant the texture itself onto the wound without causing a disturbance in the crosstalk between the epidermis and dermis that form the texture.

There are few reports of thin-skin grafting on wounds after DSH.¹⁹ However, the innovative aspect of this technique was to rotate the graft 90 degree, thereby changing the direction of the wound, and making the resulting unidirectional wound less noticeable. In addition, by transplanting the split-thickness skin graft that leaves no scar at the original site (donor site) to maintain the unique form of the texture's structure depending on the body part, we

succeeded in making the boundary between the margin and the surrounding skin almost indistinguishable.

However, DSH has various wound patterns, and depending on the number, thickness, and width between scars, it may be unfeasible to obtain a sufficiently large explant. A number of wounds from a small donor area were treated by a combination of rotated skin graft and minced-skin graft. An immediate coverage of the raw surface with a small piece of skin further minimizes the inflammatory response to the wound, promotes re-epithelialization by epidermal and intrafollicular stem cells, and transplants mesenchymal cells that improve the skin texture by interaction with the epidermis.²⁰ In addition, it is worthy to mention that scars were less noticeable because there was no clear borderline between the skin and the pigmented area.

Concerning the limitations of this study, all cases were Asian women; the indications for patients with nonlateral scars and cases with a narrow distance between scars were unknown. The removal of a very narrow gap between scars may not provide enough range of skin grafts. However, in this case, it was hypothesized that an improvement by singly treating with a minced-skin graft could be feasible. The donor of minced-skin graft requires only one-third to one-fifth of the recipient's wound size.¹⁴ If removing the scars makes the donor skin smaller than the recipient site, treatment with minced skin grafts alone may be indicated. It is therefore necessary to observe the treatment of other patients in the future.

In the cases treated, the color and texture could not be matched perfectly. However, the treated area was less

noticeable. A surgical procedure for DSH scar performed with an understanding of the patient's mental state can improve the patient's psychology and self-confidence by camouflaging socially unacceptable scars.

CONCLUSIONS

All patients were satisfied with the combined treatment of rotated thin-skin graft and minced-skin graft, which resulted in a less noticeable DSH scar and a socially acceptable appearance. Therefore, this method could be effective in camouflaging a wide variety of DSH scars on the forearm.

Kento Takaya, MD

Keio University School of Medicine
35 Shinanomachi, Shinjuku-ku
Tokyo 160-8582, Japan
E-mail: kento-takaya312@keio.jp

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