

A New Local Flap Nipple Reconstruction Technique Using Dermal Bridge and Preoperatively Designed Tattoo

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Background: Nipple–areolar reconstruction is the final step in breast reconstruction. Reconstruction using local flaps and tattooing is useful in cases of bilateral reconstruction, a small nipple–areolar complex (NAC) as the donor site, and avoiding disturbance of the normal side and other body parts. However, this method can cause projection loss and color fading of the nipple. Moreover, the breast mound is reconstructed with an implant.

Methods: We performed nipple–areolar reconstruction of 90 nipples using clover-designed flaps oriented at 120 degrees and tattooing after breast silicone implantation in 64 women. The tattoo was designed before flap operation and stained darker. Following donor site closure, a dermal flap was made as a bridge for nipple support. The nipple space was separated by the dermal flap from the breast mound and was filled with subcutaneous tissue. The size of the reconstructed nipple projection was measured postoperatively and 1 year later. The projection maintenance rate was calculated.

Results: The heights of the nipple projection were 11.3 ± 1.8 mm (95% confidence interval [CI]: 10.9–11.7) just after the operation and 6.09 ± 2.4 mm (95% CI: 5.6–6.6) 1 year later. The actual range of nipple projection between these 2 heights was 5.2 ± 2.4 mm (95% CI: 4.7–5.7). The maintenance rate of the reconstructed nipple projection after 12 months was 54.1 ± 20.9 (95% CI: 49.7–58.5). The nipple color was maintained for over a year.

Conclusions: Our nipple–areolar reconstruction technique could maintain the projection and color of the reconstructed nipple for a long period. Good outcomes were obtained in this implant-based breast reconstruction. (*Plast Reconstr Surg Glob Open* 2017;5:e1264; doi: 10.1097/GOX.0000000000001264; Published online 13 April 2017.)

Nipple–areolar reconstruction is the final step in breast reconstruction.^{1–3} A reconstructed breast without a nipple and areola remains anatomically incomplete.⁴ Over the years, improvements in breast reconstruction outcomes have consistently encouraged a more authentic restoration of the lost nipple.^{5–7} Symmetry in position and the appropriate size, shape, and color of the nipple should be carefully considered for

the reconstructed nipple and areola.^{5–7} Skin grafts from the thigh and labia from the normal side of the nipple–areolar complex (NAC) are usually used as donor sites for the reconstruction. In cases of bilateral reconstruction, very small NAC diameter as the donor site, or individuals whose normal side and other body parts must not be disturbed, the use of autologous grafts is not possible.⁸ In these cases, a nipple–areolar reconstruction technique using local flaps and tattooing is very useful. For this reconstruction technique, the most difficult aspect is preventing the shrinking and color fading of the nipple.^{3,9} When the breast mound is reconstructed with an implant, particularly in this technique, nipple

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projection decreases because of the thin expanded skin-subcutaneous tissue base and the mastectomy scar around the center of the breast.⁵ Long-lasting projection and unfaded color of the nipple are aimed for by most plastic surgeons.⁸ However, the use of local flaps can also result in loss of nipple volume and projection and fading of all colors.^{3,5} To maintain nipple projection, flap contraction is reduced by elevating a thick flap, creating a high nipple, and inserting a supporting device. To maintain the nipple color, the nipple must be stained darker than the desired color by frequent re-tattooing.

We describe a new nipple–areolar reconstruction technique using clover-designed flaps oriented at 120 degrees. In this new technique, the tattoo is designed before the local flap operation and is stained darker. For the closure of the donor site, a dermal flap is made to serve as a bridge to support the nipple. For the nipple space separated by the dermal flap from the breast mound, the subcutaneous tissue is used to fill the space. This reconstruction technique maintains the nipple projection and color for a long period. Good outcomes were obtained in implant-based breast reconstructions.

MATERIALS AND METHODS

Nipple–areolar reconstructions of 90 nipples (unilateral 38, bilateral 26) using clover flaps and tattooing after breast silicone implantation were performed in 64 women (average age, 48 years; range, 26–74 years) at the Breast Surgery Clinic, Tokyo, Japan between January 2012 and March 2015. The follow-up period was more than 1 year.

All patients underwent tattooing before the nipple–areolar reconstruction. Intradermal designed tattooing was performed 3 to 6 months after the breast mound reconstruction. One month after the tattooing, the nipple was reconstructed with clover flaps. Final areolar tattooing was made after the clover flap reconstruction.

Nipple–areolar Position and Design

The nipple–areolar position was marked to match the opposite normal side with the patient in the standing position. In the case of bilateral reconstruction, the position was determined by measurements from the sternal notch and midsternal line. The nipple–areolar position was photographed to confirm that the area was correct. The photograph was shown to the patient and consent was obtained. The nipple was designed as a clover-shaped flap oriented 120 degrees symmetrical to the contralateral nipple. The shape, size as determined by measurement projections, and width are specified in Figure 1. The nipple projection (indicated as P) was twice as high as that of the desired normal side. The width (indicated as W) had the same size as that of the normal side. The flap length (indicated as L) was set at approximately 20–25 mm. In bilateral cases, the design involved an areolar flap length of 30–40 mm, a nipple projection of 12 mm, and a nipple width range of 11–12 mm. The sizes were arranged depending on the skin thickness and skin con-

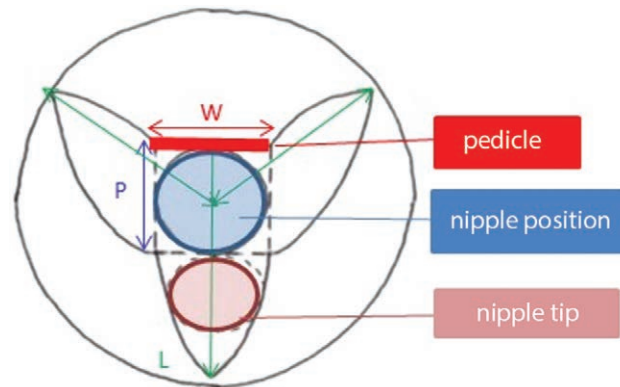


Fig. 1. Nipple design and reconstruction. The nipple was designed as a clover-shaped flap and was oriented at 120 degrees. The nipple projection (indicated as P) was twice as high as the desired normal side. The width (indicated as W) had the same size as that of the normal side. The flap length (indicated as L) was set at approximately 20–25 mm. In bilateral cases, the design involved an areolar flap length of 30–40 mm, a nipple projection of 12 mm, and a nipple width range of 11–12 mm.

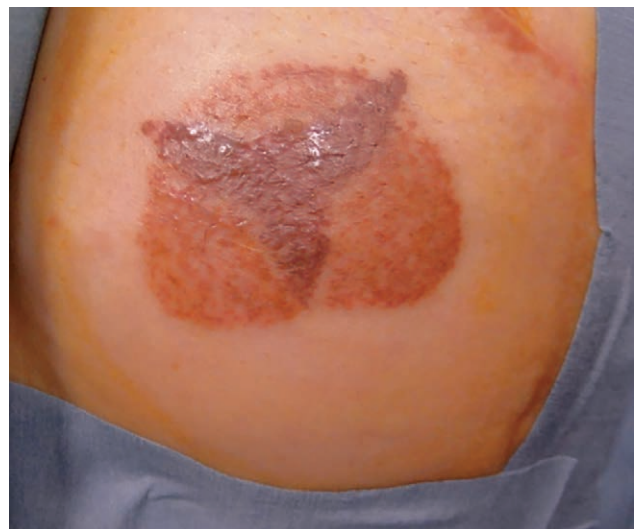


Fig. 2. Color of tattoo pigment. The color of the tattoo pigment was selected according to the native areolar color using a mixed average of 2.8 pigments. A color darker than that of the areola was applied to the nipple.

ditions such as the presence of a scar. The nipple was enlarged when the skin was thin. The pedicle was placed on the opposite side of the mastectomy scar to obtain a good blood supply.

Designed Tattoo

PERMARK MicroENHANCER 2 was used as pigmentation equipment. All tattooing procedures were performed by the authors or experienced nurse tattooists.

Lidocaine with 1:100,000 epinephrine was injected into the area to be tattooed. The contour of the nipple flaps was tattooed with a darker pigment using a 3-point needle. All of the flaps were subsequently tattooed with a darker pigment using an 18-point needle. For the central area of the



Video Graphic 1. See video, Supplemental Digital Content 1, which demonstrates the nipple reconstruction. This video is available in the “Related Videos” section of the Full-Text article on PRSGlobalOpen.com or available at <http://links.lww.com/PRSGO/A397>.

nipple considered as the milk duct opening, the pigment selected had a slight pink tint. The areola was tattooed with the appropriate pigment using a mixed average of 2.8 pigments (Fig. 2). In the case of bilateral reconstructions, the areolar color was decided by the patient, and the nipple color was made darker than the areolar color.

Nipple Reconstruction with Clover Flaps

All nipple reconstructions were performed by the authors (See video, Supplemental Digital Content 1, which demonstrates the nipple reconstruction. This video is available in the “Related Videos” section of the Full-Text article on PRSGlobalOpen.com or available

at <http://links.lww.com/PRSGO/A397>). Lidocaine with 1:100,000 epinephrine was injected to the subcutaneous layer of the flaps and the surrounding area except for the pedicle.

The flaps were incised along the tattooed contour and elevated together with the dermis and subcutaneous fat (Figure 3a). In the case of a scar in the skin, the scar was split in a uniform layer to maintain the blood flow. The flaps become thicker toward the pedicle base; thus, the base should be minimally undermined to allow the flaps to erect without the tension coming from the subcutaneous tissue.

The lateral flaps were folded to have a contralateral nipple shape (See figure, Supplemental Digital Content 2, <http://links.lww.com/PRSGO/A398>). The nipple had a column and sphere shape when the lateral flaps were wrapped (Supplemental Digital Content 2a). The nipple had a frustum shape when the tips of the lateral flaps were closed with 3 stitches (Supplemental Digital Content 2b). The nipple had an almost flat or gentle sloping shape when the tips of all the flaps were stitched (Supplemental Digital Content 2c).

As shown in the schematic diagram in Figure 3b, when the lateral donor sites (indicated as X and Y) were closed by suturing, this produced a gap (indicated as Z). Using this gap, 2 bow-shaped dermal flaps (indicated as D) were made, which could be used as a de-epithelialized skin flap. The actual image of Figure 3b showing the 2 bow-shaped dermal flaps (indicated by the yellow arrows) is shown in (Figure 3c). The surrounding tissue particularly under the mastectomy scar was undermined to reduce the retrac-

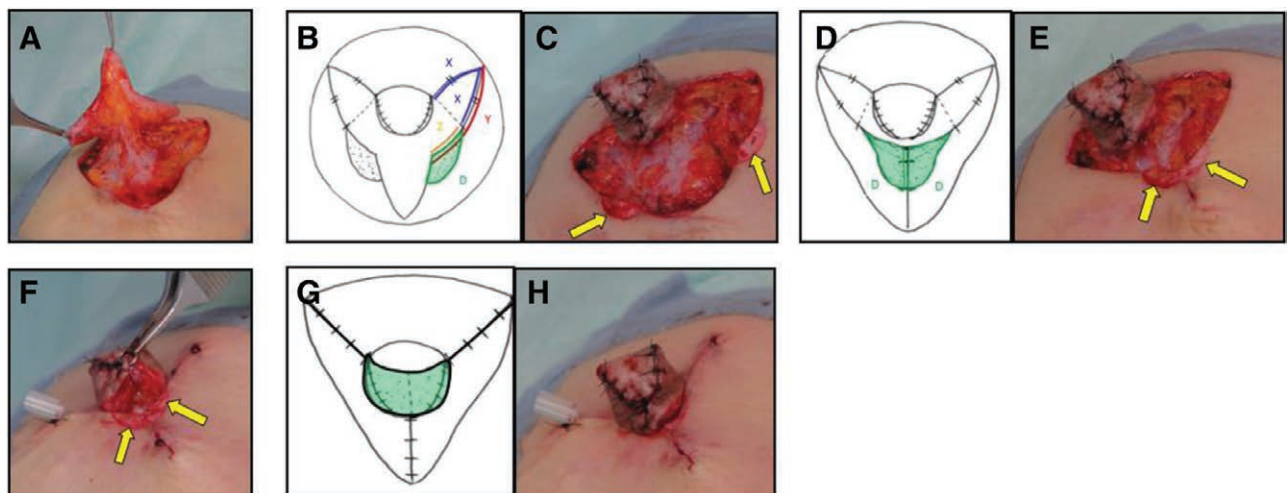


Fig. 3. Nipple reconstruction with clover flaps. (a) The flaps were incised along the tattooed contour and elevated together with the dermis and subcutaneous fat. (b) Schematic diagram of Fig. 3(c). When the lateral donor sites (indicated as X and Y) were closed by suturing, this produced a gap (indicated as Z). Using this gap, two bow-shaped dermal flaps (indicated as D) were made which could be used as a de-epithelialized skin flap. (c) Actual image of Fig. 3(b) showing the two bow-shaped dermal flaps (indicated by the yellow arrows). (d) Schematic diagram of Fig. 3(e) showing the two dermal flaps (indicated as D). (e) Actual image of Fig. 3(d) in which the two dermal flaps (indicated by the yellow arrows) were combined with 4-0 monocryl absorbable suture and this served as a bridge to support the nipple. (f) The reconstructed nipple was fixed on the dermal flaps (indicated by the yellow arrows) with 5-0 nylon. (g) Schematic diagram of Fig. 3(h) showing the filling of the nipple space with subdermal tissue. (h) Actual image of Fig. 3(g) in which the nipple space was filled with a certain amount of subdermal tissue, taking care not to increase the pressure in the space.

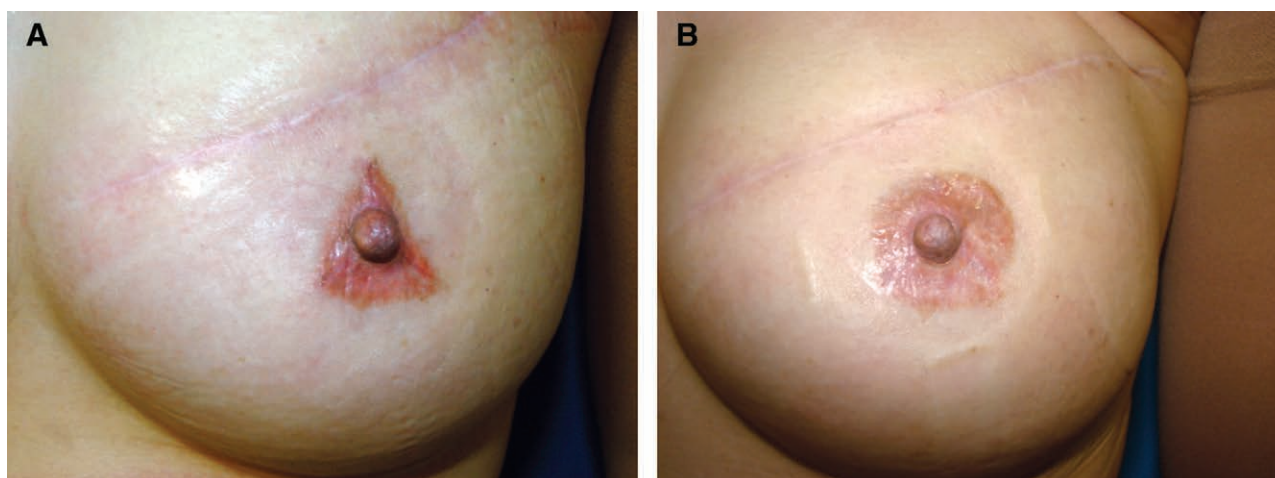


Fig. 4. Areolar periphery re-tattooing. A, One month after the nipple reconstruction, the areolar periphery was re-tattooed mainly along the contralateral side, so that the areolar tattoo would have a triangle shape resulting from closure. B, Additional tattoo was placed to achieve a normal areolar shape.

tion force. To maintain the blood supply, the area around the pedicle was not undermined.

The 2 dermal flaps (indicated as D in Figure 3d and by the yellow arrows in Figure 3e) were combined with 4-0 monocryl absorbable suture to serve as a bridge to support the nipple. The donor site was closed with 4-0 monocryl absorbable suture without disturbing the flap circulation.

The reconstructed nipple was fixed on the dermal flaps (indicated by the yellow arrows) with 5-0 nylon (Figure 3f) and the nipple space was filled with a certain amount of subdermal tissue from the flaps alone (Figure 3g), taking care not to increase the pressure in the space (Figure 3h).

The dermis was closed with 5-0 nylon suture together with a drain. A sponge with the center cut out to avoid placing pressure on the nipple was used as covering. Taping was gently applied to prevent disturbance of the blood supply to the pedicle.

Areolar Tattooing

One month after the nipple reconstruction, the areolar periphery was re-tattooed mainly on the contralateral side, so that the areolar tattoo would have a triangle shape resulting from closure (Fig. 4A). Additional tattoo was placed to achieve a normal areolar shape (Fig. 4B). For bilateral cases, a 30- to 40-mm-diameter circle was tattooed. For the scar of the donor site in the areolar area, lighter tattooing was necessary to produce a good stain.

Follow-up and After Care

The projection size of the reconstructed nipple was measured just after the operation and 1 year later. The maintenance rate of the reconstructed nipple projection was calculated.

Topical antibiotic ointment was applied after the operation until removal of the stitches. Shower could be taken the following day postoperation. Cephem antibiotics were taken 3 times a day for 3 days.

RESULTS

Ninety nipple reconstructions using preoperative tattooing and clover flaps were identified between January 2012 and March 2015. There were no cases of infection or wound dehiscence. Total flap necrosis was not observed in any of the cases. Partial flap necrosis was observed in 8 cases. The height of nipple projection just after the operation was 11.3 ± 1.8 mm (95% confidence interval [CI]: 10.9–11.7), and 1 year later was 6.09 ± 2.4 mm (95% CI: 5.6–6.6). The actual range of nipple projection between these 2 heights was 5.2 ± 2.4 mm (95% CI: 4.7–5.7). The maintenance rate of the reconstructed nipple projection after 12 months was 54.1 ± 20.9 (95% CI: 49.7–58.5) (Table 1). The color of the reconstructed nipple was well preserved for more than 1 year (Fig. 5). The reconstructed nipple was asymmetrical to the contralateral nipple because of the use of 3 types of lateral flaps (See figure, Supplemental Digital Content 3. <http://links.lww.com/PRSGO/A399>).

DISCUSSION

We describe a new nipple–areolar reconstruction technique using clover flaps, which can maintain the nipple projection for a long period and preserve the color of the reconstructed nipple. We have carefully assessed the technical descriptions and mechanisms of nipple–areolar reconstruction from reports in the literature, and describe

Table 1. Nipple Projection and Maintenance Rate of Reconstructed Nipple

Nipple Projection (n = 90)	Height	SD	95% CI
Just after the operation	11.3 mm	1.8	10.9–11.7
1 year later	6.09 mm	2.4	5.6–6.6
Actual range	5.2 mm	2.4	4.7–5.7
Maintenance rate	54.1%	20.9	49.7–58.5

The height of nipple projection just after the operation was 11.3 ± 1.8 mm (95% CI: 10.9–11.7), and 1 year later was 6.09 ± 2.4 mm (95% CI: 5.6–6.6). The actual range of nipple projection between these 2 heights was 5.2 ± 2.4 mm (95% CI: 4.7–5.7). The maintenance rate of the reconstructed nipple projection after 12 months was 54.1 ± 20.9 (95% CI: 49.7–58.5).

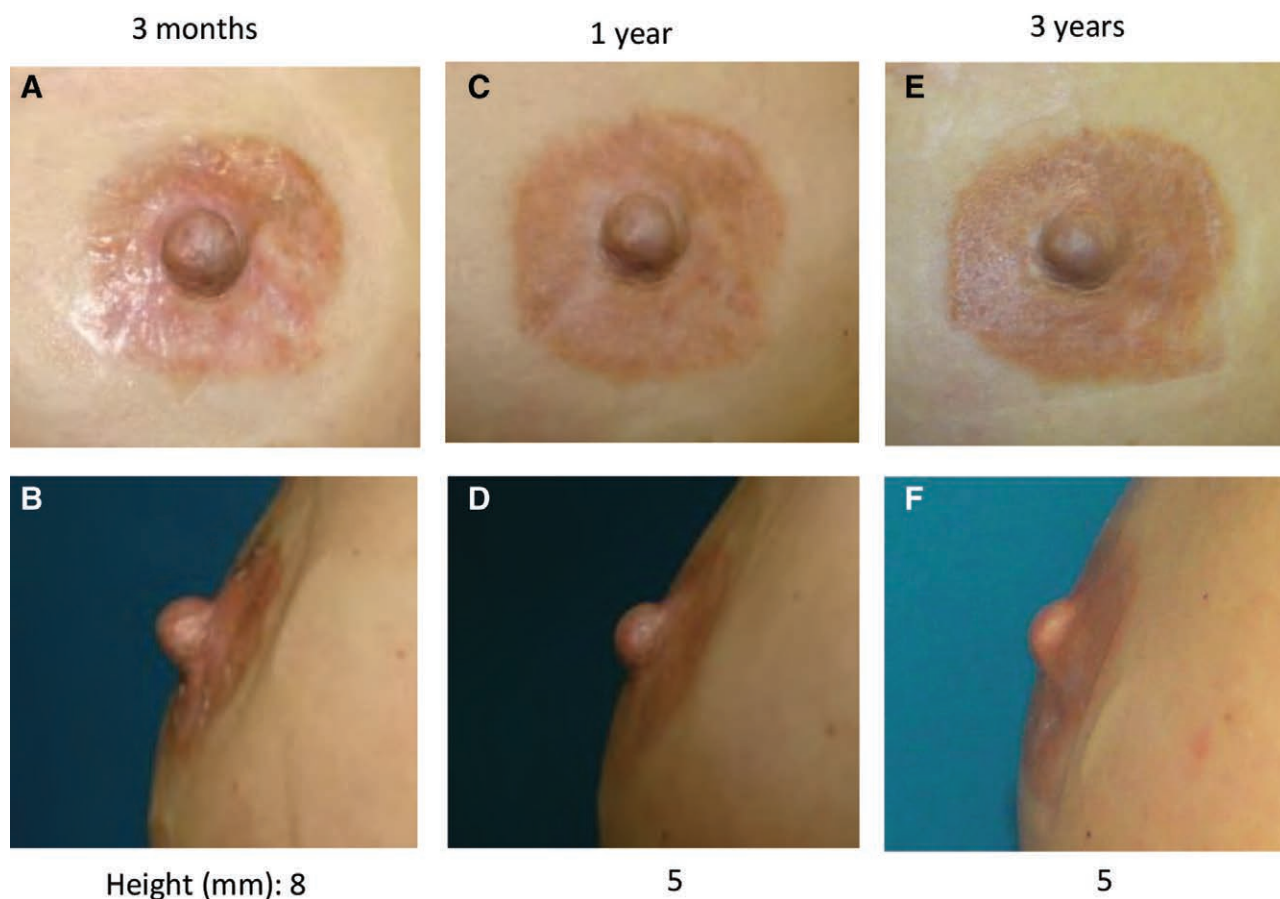


Fig. 5. Postoperative 3-month, 1-year, and 3-year follow-ups. The maintenance rate of the reconstructed nipple projection after 12 months was 54.1%. The color of the reconstructed nipple was well maintained for more than 1 year, although the areola needed re-tattooing. A, Postoperative frontal view of the reconstructed nipple at 3 months. B, Postoperative lateral view of the reconstructed nipple at 3 months (height: 8 mm). C, Postoperative frontal view of the reconstructed nipple at 1 year. D, Postoperative lateral view of the reconstructed nipple at 1 year (height: 5 mm). E, Postoperative frontal view of the reconstructed nipple at 3 years. F, Postoperative lateral view of the reconstructed nipple at 3 years (height: 5 mm).

here an improved technique involving the use of clover flaps. We obtained promising outcomes using this new technique in implant-based breast reconstructions.

To maintain nipple projection, 2 factors must be considered⁵: (1) the contraction of the flap and (2) the force of the surrounding environment tissues. As for the flap contraction, elevating a thick flap, creating a high nipple, inserting a supporting device, and ensuring ample blood supply are important and necessary. To obtain a thick flap, Eskenazi⁹ described raising of a flap including the dermis and subcutaneous fat, becoming thicker toward the base. For nipple height, White et al.⁴ reported the reconstruction of nipples that were 50% larger than the desired size. However, there is an increased risk of tissue distortion on the breast mound.¹⁰ As a supporting system, fat grafting^{11,12} and the utilization of autologous grafts,¹³ alloplastic implants, and allografts¹⁴ have been used as an axis of the nipple. For blood supply, Turgut et al.¹ reported on nipple reconstruction with a bipedicle dermal flap. Regarding the force of the surrounding environment structures, retraction of the surrounding tissue, retraction from the underlying tissue, sinking of the nipple, and pressure for the

reconstructed nipple after the operation are considered. Hugo et al.⁸ reported a more effective nipple elevation when the nipples are completely detached from the surrounding areolar skin. Tanabe et al.¹³ described a rolled auricular cartilage supported by a dermal bridge and wrapped by bilobed dermal-fat flaps. The dermal bridge worked as an inferior floor. Spear et al.⁶ described the benefits of having less pressure to achieve excellent results in the nipple–areolar area. We have analyzed and considered all these factors in terms of maintaining the nipple projection, and have incorporated the use of clover flaps. In this new technique, each flap contains subcutaneous tissue and is oriented at 120 degrees. The dermal flaps can be made with closure of the lateral donor sites. These combined flaps serve as a dermal bridge to support the nipple and simultaneously decrease the retraction force to the areola from the surrounding tissue. The nipple space separated by the dermal bridge from the breast mound is filled with subcutaneous tissue. This new technique offers the construction of a firm and elastic nipple with sufficient height. Careful consideration was also given to the blood supply because the breast mound was reconstructed

with a silicone implant, making the subcutaneous tissue expanded and thin with the mastectomy scar located in the center of the breast. In such cases, the blood supply is poor. Nimboriboonporn and Chuthapisith⁵ suggested that thin and expanded skin-subcutaneous tissue flaps can potentially decrease nipple projection, and that poorly located scars can restrict the use of certain flap techniques owing to interference with blood supply. To obtain a good blood flow, it is important to place the pedicle on the opposite side of the mastectomy scar, avoid undermining the tissue around the pedicle, not to increase the pressure in the nipple space with an undue amount of subcutaneous tissue, and prevent any disturbance to the flap circulation when placing a suture. As a final care to avoid increased pressure on the nipple, a sponge with its center cut out is used as covering for 1 year. These new steps help maintain nipple projection.

To preserve the nipple-areolar color, staining using a darker color than the desired color^{3,9,15} and regular re-tattooing are necessary.^{3,16} Although tattooing conveniently produces a pigmented skin, fading is expected. Re-tattooing is easy and causes minimal inconvenience.⁸ Spear and Arias³ indicated that repeated and touch-up tattoos are helpful for achieving the final outcome. In this study, the nipple flaps were designed and stained darker with tattoo before the local flap operation. Tattoo is represented by the best color from a mix of several pigments, and pigment addition is performed in re-tattooing.

Tattooing was traditionally performed after nipple reconstruction.^{9,17} Loh et al.¹⁷ described the application of the appropriate color in tattooing to create a natural shadow of the nipple. Hugo et al. reported a single-stage reconstruction using a local flap with the tattooing performed at a follow-up visit.^{8,9,18} In this case, the patient's satisfaction was reportedly high as both procedures were completed at a reasonable time.⁹ On the other hand, immediate tattooing often caused the tearing and breakdown of a newly placed suture.⁴ Wong et al.¹⁹ and White et al.⁴ reported on tattooing before nipple reconstruction. Under this condition, it was easier to tattoo a flat surface nipple than a projecting nipple,¹⁹ and no scar was formed from the nipple reconstruction.⁴ Scarred skin tended to hold less pigment and the color fades sooner.⁴ In construct, tattooing for the scar of an already projected nipple occasionally causes bleeding and wound dehiscence of the scar. To avoid these complications, staining must be performed using weak pressure. However, weak pressure cannot achieve good staining. Strong pressure is needed, but this may result in nipple height reduction. This application of strong pressure is different from the report of Spear et al.,⁶ who recommended using less pressure to achieve excellent result in the nipple-areolar area. In this study, the nipple flap was designed before the nipple reconstruction and was stained darker with pigments. Thus, our technique allows for less frequent re-tattooing of the reconstructed nipple and reduces the pressure received by the nipple from the re-tattooing needle. The present technique uses a "designed pre-op tattoo," making it easier to manage and control the reconstruction.

The projection and color of the reconstructed nipple were well maintained for over a year by combining several techniques. The maintenance rate of the reconstructed nipple projection after 12 months was 54.1%. Momeni et al.⁷ found from evidence-based reports in the literature that the maintenance rate of residual nipple projection after 12 months was in the range of 34.3%–35.4% for the star flap, 49.1% for the arrow flap, and 57% for the skate flap. Banducci et al.¹⁰ reported a significant difference in the shrinkage rate of the reconstructed nipple between an autologous mound group and an implant mound group in his modified star flap. In the autologous group, the mean decrease rate was 64% after 38.8 months. In the implant group, the mean decrease rate was 77% after 38.5 months. For the implant mound, Rubino et al.²⁰ reported residual nipple projections of 30.1% for the star flap and 49.1% for the arrow flap after 12 months. For the autologous mound group, Yang et al.²¹ reported reduction rates of nipple projection was 43.6% for the Hammond flap after 12 months. Compared with these data reported in the literature, our new method of nipple-areolar reconstruction using clover flaps can maintain a long-lasting projection of the reconstructed nipple. This gives high satisfaction to patients and reduces repeated nipple operation.

There are 3 issues that need to be considered in this study. First, the scar extended beyond the margin of the areola in the case of a small areola and a large nipple on the opposite side in unilateral reconstruction. In this case, the scar continuously widens over the areola for 6 months to become a mature scar, but it does not stand out. Second, the pre-reconstruction tattoo stain was not fixed. In this case, re-staining is ideally performed before the nipple reconstruction. However, as there was no chance for re-staining, re-tattooing was performed after the reconstruction. Nevertheless, part of the nipple pigmentation can reduce the degree of re-tattooing compared with re-tattooing from scratch. Third, tattooing had to be performed twice, that is, before and after the nipple reconstruction. Postoperative tattooing was performed to form the areolar contours. The areolar periphery was intensely re-tattooed on the contralateral side, so that the areolar tattoo would have a triangle shape resulting from closure. We attempted heart-shaped areolar tattooing in order for the initial areola tattooing to have a circle or oval shape after closure. However, unexpected shapes are occasionally obtained because of individual differences in surrounding tissue elasticity. It is difficult to correctly predict the areolar shape after the closure. Hugo et al.⁸ pointed out that the periphery of the areolar complex must be re-tattooed to compensate for any changes in the shape resulting from closure, and that 40% of patients usually have additional tattooing to help camouflage scars and darken the areolar pigmentation. Taken together, tattooing after nipple reconstruction results in aesthetic refinement in nipple-areolar reconstruction.

CONCLUSIONS

We describe a new nipple-areolar reconstruction technique using clover flaps that can maintain the projection and color of the reconstructed nipple for a long period.

In this technique, the clover-designed flaps are oriented at 120 degrees. A designed tattoo is applied before the local flap operation, which results in a darker stain. For closure of the donor site, a dermal flap can be prepared as a bridge to support the nipple. The nipple space, which is separated by the dermal flap from the breast mound, can be filled with subcutaneous tissue. Thus, the nipple projection and color are maintained. We have obtained good outcomes in our implant-based breast reconstructions. Additional studies are needed to further optimize this technique.

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