

# Quadruped and Dermal Bridge Flap for Nipple Reconstruction

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**Background:** This report describes the authors' novel preferred method of nipple reconstruction over 10 years.

**Methods:** The procedure was used in 39 patients (unilateral 38, bilateral 1). The circle is designed as the new nipple cap. Then, 4 fan-shapes (one-quarter of the circle) are drawn so that the base portion is in contact with the circumference. These fanshapes are deepithelialized, and their linear portions are cut with full thickness of skin and elevated as dermal flaps. Then, the cross-type flap is elevated with sufficient subcutaneous fat. The two pairs of dermal flaps are sutured to each other on a diagonal line. Double-layer dermal bridge flaps sustain the base of the pocket. As a result, the cross flap becomes a birdcage-like tower. The rolled auricular cartilage is placed into the pocket.

**Results:** In one early case, the cartilage was exposed. Early postoperatively, the other three cases underwent reoperation during other procedures because the reconstructed nipple was too large or too small. The projection of the flap was designed to be 7–15 mm (average, 9.3 mm). The average follow-up period was 25.7±22.0 months. The reconstructed nipple projection was maintained at 4.4±2.4 mm (maintenance rate, 48.4% ± 27.0%).

**Conclusions:** All scars were contained within the periareolar region and thus could be completely camouflaged by tattooing. The perfusion of the skin flap is stable because of sufficient circulation from quadruped pedicle. The cartilage supported by the double-layered dermal bridge flaps contributes to nipple projection. We recommend it for patients seeking nipple reconstruction. (*Plast Reconstr Surg Glob Open* 2018;6:e1872; doi: 10.1097/GOX.0000000000001872; Published online 5 September 2018.)

Creation of a nipple-areola complex represents an important final step in the surgical treatment of breast cancer patients. In countries where it is customary to take hot spring and public baths, nipple-areola reconstruction is regarded as especially important. Over the past 40 years, various procedures have been available for nipple-areola reconstruction, including a graft from the contralateral side, composite grafts such as the toe

pulp or earlobe tissue, local flap and tattoo, and even tattoo alone. However, these techniques have been unable to sustain nipple projection for a long period because they have mainly used soft tissues, and the features are lost when the scar softens postoperatively. Brent and Bostwick<sup>1</sup> reported a case of nipple reconstruction using auricular cartilage as the supporting tissue, and Tanabe et al.<sup>2</sup> developed that technique. We are also in favor of the concept and attempted to invent a technique for reconstruction of the nipple with adequate volume and long-term projection that allows primary closure of the donor site with minimal scar and distortion of the breast.

The symmetric design allows us to create the nipple at the intended site without distortion or shift. Except for 1 early case, partial or total flap necrosis of the skin flap has never been seen with our method because of stable circulation from the quadruple pedicle. Projection is maintained by the implanted auricular cartilage. The cartilage graft does not tend to be depressed because there is support for the inferior floor of the graft. The areola is created according to the patient's preferred size and color by tattooing.

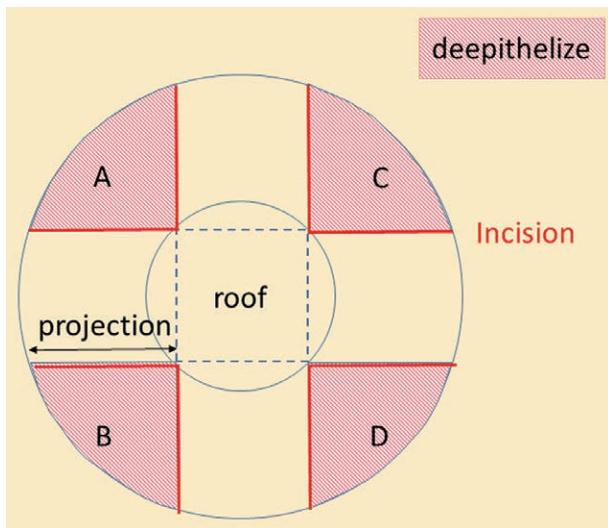
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**Fig. 1.** Flap design. Set the position of the nipple considering the other side. Design the diameter and projection. In the case of bilateral reconstruction, an appropriate value is determined. Four fan-shaped (shaded) areas are deepithelialized, the red line is cut with full thickness of skin, and dermal flaps are elevated. Then, a cross-type flap is elevated with sufficient subcutaneous fat.

## PATIENTS AND METHODS

### Patients

Over 10 years, 40 nipple reconstructions (unilateral 38, bilateral 1) were performed in 39 women (average age, 49.6 years; range, 30–69 years) using the quadruped cage flap technique. Twenty-three patients underwent autologous reconstruction (free transverse rectus abdominis myocutaneous (TRAM) or deep inferior epigastric perforator (DIEP) flaps), 14 patients (15 breasts) underwent reconstruction with silicone implants, and 2 patients underwent both methods. Only 1 patient received radiotherapy before nipple reconstructive surgery.

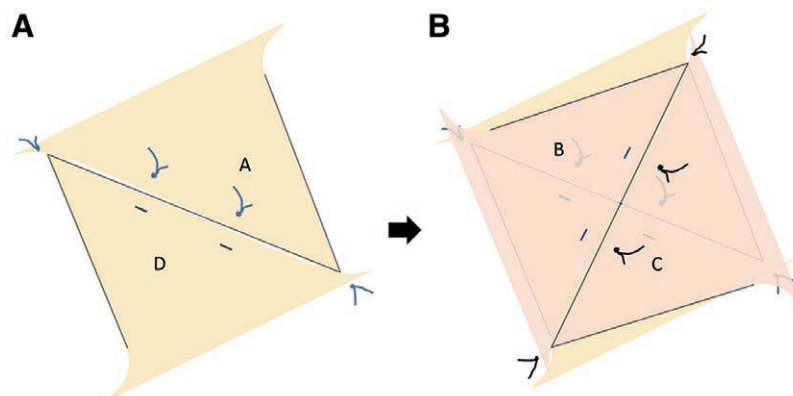
### Surgical Planning and Technique

We perform nipple reconstruction at least 6 months after mound reconstruction, whether with an implant

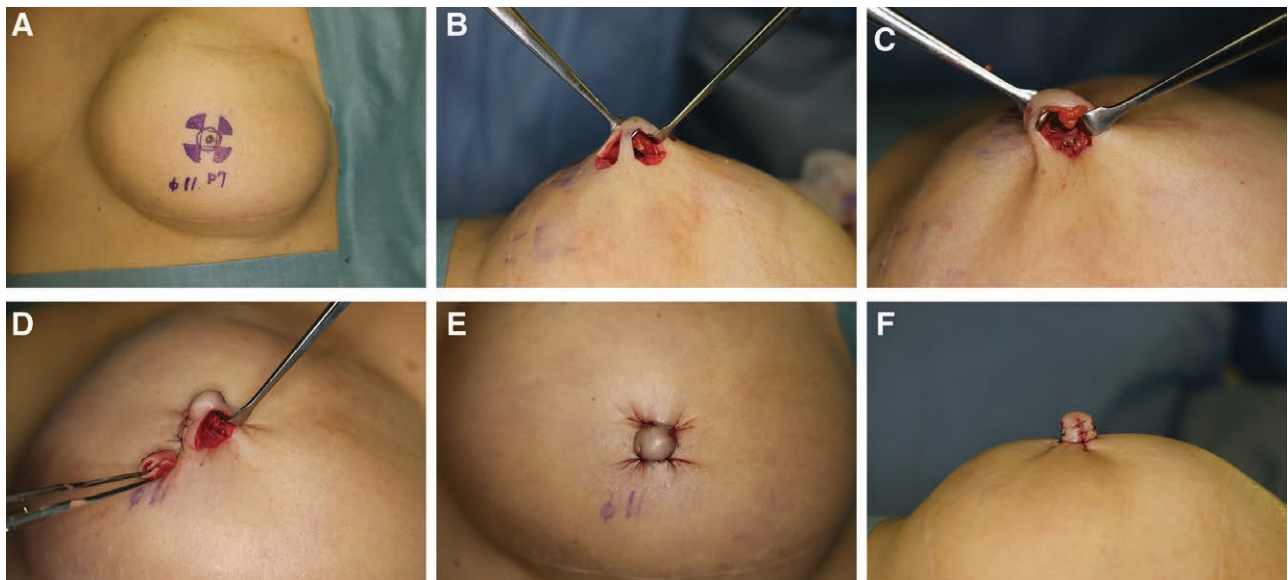
or autologous tissue. In the case of unilateral breast reconstruction, the nipple is usually positioned at the most projecting point of the reconstructed mound while considering the balance with the opposite side. The circle is designed as the new nipple cap. Then, 4 fan-shapes (one-quarter of the circle) are drawn so that the base portion is in contact with the circumference. These fan-shapes are deepithelialized, and their linear portions are cut with full thickness of skin and elevated as dermal flaps. Then, the cross-type flap is elevated with sufficient subcutaneous fat (Fig. 1). Two pairs of dermal flaps are sutured to each other on a diagonal line to make an N-shape using 4-0 nylon thread (Fig. 2). Double-layer dermal flaps sustain the base of the pocket. As a result, the cross flap becomes a bird-cage-like tower. The rolled auricular cartilage is placed into the pocket. The flaps are sutured using 4-0 polydioxane suture and 5-0 and 6-0 nylon threads (Figs. 1–3). In all cases, the reconstructed nipple is protected by a doughnut-shape sponge for 6 months after surgery. Intradermal tattooing is then performed approximately 6 months after nipple reconstruction.

## RESULTS

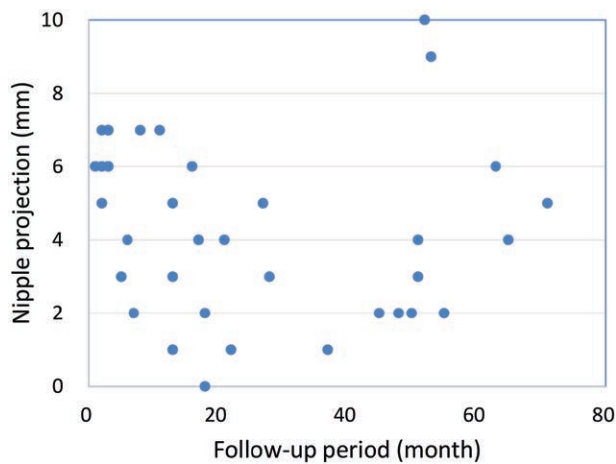
There were no surgical-site infections, and the aesthetic appearance of the nipples was satisfactory. In 1 early case, the cartilage was exposed. Early postoperatively, the other 3 cases underwent reoperation during other procedures because the reconstructed nipple was too large (1 case), or too small (2 cases). The projection of the flap was designed to be 7–15 mm (average, 9.3 mm). The projection of the nipple tended to shrink with time (Fig. 4). The average follow-up period was  $25.7 \pm 22.0$  months. Reconstructed nipple projection was maintained at  $4.4 \pm 2.4$  mm (maintenance rate,  $48.4\% \pm 27.0\%$ ). Nipple projection was significantly more preserved with an implant than with autologous breast reconstruction in the present series (Table 1). A 60-year-old woman underwent right nipple reconstruction following chest skin tissue-expanded DIEP flap breast reconstruction, and the projection of the reconstructed nipple was well preserved with follow-up of more than 5 years (Fig. 5).



**Fig. 2.** Two pairs of dermal flaps are sutured to each other on a diagonal line to make an N-shape (A) flaps A and D. (B) flaps B and C. Double-layer dermal flaps sustain the base of the pocket.



**Fig. 3.** (A) Design of the quadruped cage flap. The diameter is 11 mm, and projection is 7 mm. (B) Four fan-shaped flaps are deepithelialized and cut. They are then elevated as dermal flaps, and a cross-type flap is elevated with sufficient subcutaneous fat. (C) The fan-shaped flaps are sutured to each other on a diagonal line in an N-shape using 4-0 nylon thread. Double-layer dermal flaps sustain the base of the pocket. As a result, the cross-flap becomes a birdcage-like tower. (D) Insertion of the rolled auricular cartilage into the pocket. (E) The skin is closed with 5-0 and 6-0 nylon (upper view). (F) The skin is closed (lateral view).



**Fig. 4.** Postoperative nipple projection over time.

### DISCUSSION

Over the past 40 years, many different reconstructive procedures have been described, but postoperative loss of volume occurs commonly in the reconstructed nipple. As well, in many reports, nipple projection tended to shrink with time. For this reason, many authors have advised creating a nipple that is 1.5–2 times the size to take into account this expected loss of volume.<sup>3–5</sup> In our initial case, the initial nipple was too large and needed reduction later. In our technique, we think that reduction of nipple volume is unlikely to occur. The quadruped cage flap consists of a 4 pedicle, random pattern flap, with sufficient subcutaneous fat. If there is a surgical scar on the breast mound, some of the 4 pedicles may be disturbed. By rotating the flap, the number of pedicles that is hindered

is limited. If 3 pedicles are intact, flap blood flow will not be a problem. The reports suggested that thin and expanded skin-subcutaneous tissue flaps can potentially decrease nipple projection,<sup>6</sup> and it is important to place the pedicle on the side opposite the mastectomy scar and avoid undermining the tissue around the pedicle.<sup>7</sup> Tanabe et al.<sup>2</sup> showed that nipple prominence differs greatly due to dermal flap blood flow. They also stated that the dermal bridge worked as an inferior floor. Komiya and Iwahira<sup>7</sup> described new clover-design flaps, which serve as a dermal bridge and simultaneously decrease the retraction force to the areola from the surrounding tissue. We are also aware of the importance of a dermal bridge, and this concept is in common with their technique. Postoperative nipple projection has tended to decrease with time (Fig. 4). Maintaining the projection for a long time depends on how strong the double bottom can be made with 2 pairs of dermal bridge flaps. If the flaps separate, and the cartilage strut collapses into the subcutaneous fat, the nipple projection disappears. We suspect that dermal bridge flaps may have collapsed early in cases where the projection was low in the early postoperative period. Previously, we used absorptive threads to suture the dermal flaps, but we now use nonabsorbable threads.

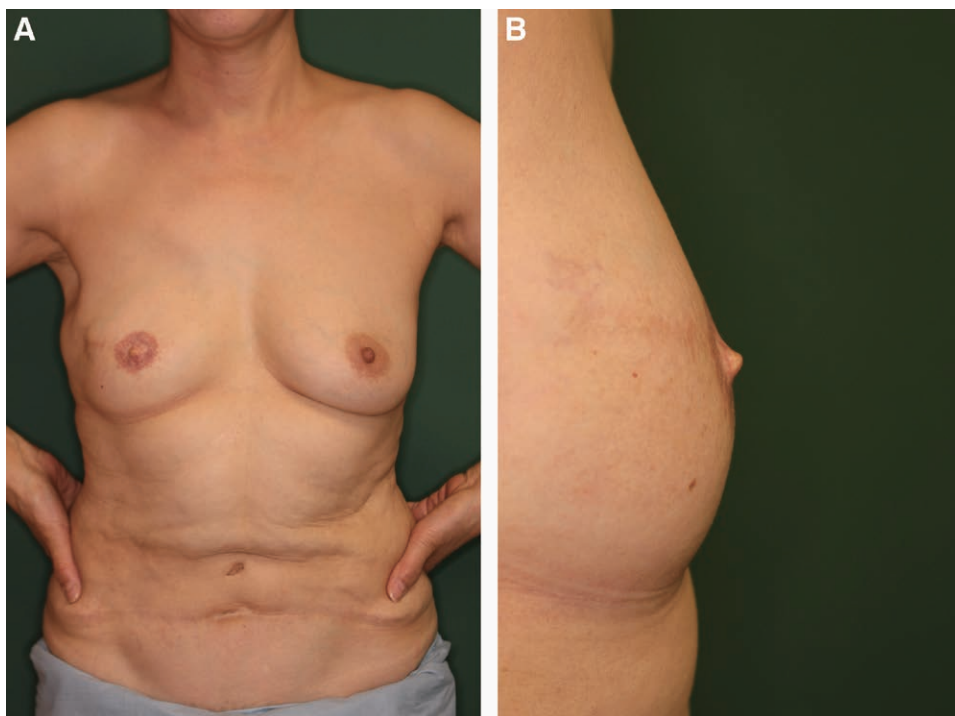
There is a report that projection of the nipple is better preserved with autologous breast reconstruction than with an implant,<sup>4,8</sup> whereas on the other hand, it has also been reported that there is no difference between autologous tissue and an implant.<sup>9</sup> However, there has been no large clinical trial that unified the conditions of the breast mound reconstruction method and local flap techniques. Few et al.<sup>10</sup> reported that the maintenance rate of 93 nipples (implant 44, TRAM flap 49) was 41% for the modified star flap after 24.0 months. Banducci et al.<sup>4</sup> reported

**Table 1. Comparison of the Results of Implant Versus Autologous Mound Reconstruction**

	Implant (n = 14)	TRAM/DIEP (n = 20)	Both (n = 2)	Total (n = 36)	P*
Projection (mm)	5.4±2.3	3.7±2.2	4.0±2.8	4.4±2.4	0.03
Maintenance rate (%)	61.3±26.1	38.8±23.0	52.9±46.5	48.4±27.0	0.01
Follow-up (mo)	17.6±19.5	30.8±21.4	28.0±31.2	25.7±22.0	0.09

The 4 nipples (1 implant and 3 autologous) that dropped out were excluded.

\*Comparison between the Implant and TRAM/DIEP groups using unpaired *t* test.



**Fig. 5.** Right nipple reconstruction following chest skin tissue-expanded DIEP flap breast reconstruction. (A) Postoperative frontal view of the reconstructed nipple at 5 years and 3 months. (B) Postoperative lateral view of the reconstructed nipple at 5 years and 3 months (projection: 6 mm).

that the maintenance rate was 36% after 38.8 months in the autologous group and 23% after 38.5 months in the implant group using a modified Anton-Hartrampf flap. For the implant mound, Rubino et al.<sup>11</sup> reported that the maintenance rate was 49.1% for the arrow flap after 12 months. Valdatta et al.<sup>12</sup> reported that, for their 29 patients with an implant mound, the maintenance rate was 58% for the C-V flap after 12 months. For the extended latissimus dorsi flap mound, Yang et al.<sup>13</sup> reported that the maintenance rate was 56.4% for the Hammond flap after 12 months. Compared with these data reported in the literature, we believe that our novel method is good enough and comparable with the conventional method.

The number of cases with a maintenance rate  $\leq 50\%$  was greater in the autologous group than in the implant group in the present series. We suspected that we treated many TRAM/DIEP patients in the early days when we were not familiar with this novel surgery. In fact, such a trend was seen. The follow-up period of the TRAM/DIEP group was not significantly longer than that of the implant group (Table 1). Before autologous breast reconstruction, the authors expanded the skin of the chest using tissue expander

in most patients. There might be some differences in the postoperative course between patients receiving autologous reconstruction after tissue expansion and patients receiving autologous reconstruction with a skin paddle. We believe that the number of cases is still insufficient to reach a conclusion on this issue.

When performing areola tattooing after nipple reconstruction, it is preferable that the surgical scar fits within the new areola. In the case of a patient with a small diameter contralateral areola, the surgical scar derived from conventional methods<sup>14-17</sup> will tend to protrude from the areola rim. The quadruped flap has a minimal surgical scar, and it does not produce a scar outside the new areola. All the scars are contained within the periareolar region and thus could be completely camouflaged by tattooing. Generally, tattooing is performed 6 months later to complete the nipple reconstruction.

This method can be recommended for patients with bilateral breast cancer, patients whose contralateral nipple is too small for a composite graft, and patients whose contralateral areola is small. Because our method includes cartilage support and sufficient blood flow, it is easy to maintain

protrusion. It should be noted that stiffness and retraction of the skin are caused by radiation therapy. In such cases, it may be difficult to draw the flap on the opposite side. We have not used this method on a mound made with an latissimus dorsi myocutaneous flap; it is thought that it may not be easy to draw the opposite dermal flaps with thick back skin.

### CONCLUSIONS

In summary, we believe that our method represents an advance in terms of plentiful blood flow from 4 pedicles. It allows primary closure of the donor site with a minimal scar and distortion of the breast. The cartilage supported by the double-layered dermal bridge flaps contributes to nipple projection for a long time. We recommend it for patients seeking nipple reconstruction. However, additional studies are needed to further optimize our method.

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