A 2-Stage Ear Reconstruction for Microtia

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Objective: To introduce our 2-stage reconstruction of microtia method, which results in a natural-looking contour of the reconstructed ears, one of the most demanding challenges in facial plastic surgery.

Methods: In the first stage, the 3-dimensional cartilage framework is fabricated. The skin flap and retroauricular fascial flap are elevated in the mastoid area. Then the framework is wrapped by the fascial flap from behind and covered by the skin flap from front. In the second stage the crus, the tragus, and the conchal cavity are reconstructed. So almost all of the fine structures of ear are reconstructed.

Results: Sixty-eight patients ranging in age from 5 to 17 years had their ears reconstructed using our 2-stage method from January 1, 2006, to December 31, 2008. Forty-eight patients were boys, and 20 were girls. Unilateral microtia was present in 66 patients and bilateral microtia was present in 2 patients. The reconstructed ears had a 3-dimensional configuration, and the cranioauricular angle of the reconstructed ears was similar to that of the contralateral ear.

Conclusions: Two-stage ear reconstruction is a simple and promising method for microtia. Furthermore, the complications are rare.

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RECONSTRUCTION OF MICROtia represents one of the most demanding challenges in facial plastic surgery. A variety of surgical strategies have been devised for the reconstruction of the external ear. There has been considerable acceptance of the multistage methods of Tanzer and Brent. However, the lack of ear definition and excessive operating stages detract from the final result. We used a 2-stage ear reconstruction method from 2006 to 2008 for 68 patients. Most of the reconstructed ears had a 3-dimensional and natural-looking contour. Herein, we describe our 2-stage technique: in the first stage, 2 flaps are created, and cartilage is fabricated; in the second stage, the tragus, crus, and conchal cavity are reconstructed.

METHODS

STAGE 1

In the first stage of our reconstruction procedure, the right costal cartilages are harvested, usually the sixth, seventh, and eighth cartilages, individually, in children. A 10 × 3-cm skin excision outline is then made on the center of the seventh cartilage. The skin is excised and trimmed into a skin graft of intermediate thickness. The costal cartilage is harvested separately, and the costochondral junction is dissected. The perichondrium is incised parallel to the margin of the costal cartilage. The length between the incision and the margin of the costal cartilage is usually about 2 to 3 mm. Most of the perichondrium is left intact except for the perichondrium on the surface of the costal cartilage.

The framework has 3 main parts: the helix, the base, and the pad, and these 3 parts are of different heights. The helix and partial crus helics, which are formed from the eighth rib, are at the top of the level. The base is the most complex part and is fabricated mainly from the seventh cartilage. The scapha can be carved directly from a piece of crescent-shaped cartilage. This crescent-shaped cartilage is turned over and anchored on the interior side of the scapha to form the antihelix and superior crus (Figure 1). The inferior crus is constructed by introducing a small fragment of cartilage into the seventh cartilage. The triangular fossa is formed by the concavity between the superior and inferior crura. The helical cartilage is attached anterior to the base of framework. The pad is formed by the sixth cartilage and anchored beneath the base to enhance projection of the framework (Figure 2).

The superior and posterior parts of the skin flap are designed along the hairline. The inferior part of the skin flap runs parallel to the transposition incision of the remnant ear (Figure 3). The skin flap is elevated in the layer of subcu-
taneous tissue. An additional 3.5- to 4.0-cm incision behind the hairline is made to form the C-shaped retroauricular fascial flap. The superior part is elevated on the surface of temporal fascia; the posterior part is on the periosteum; and the inferior part is on the musculi sternocleidomastoideus (Figure 4). Then, a retroauricular fascial flap measuring 7 to 8 × 4 to 5 cm is prepared and wrapped. The flap is based on the posterior auricular muscle and local fascia. The main vascular supply to this area is derived from the posterior auricular artery and innervated by the lesser occipital nerves.

The cartilage framework is positioned between the skin flap and the fascial flap. The rear of the framework reaches to the pedicle of the remnant ear. The retroauricular fascial flap wraps the framework from the back and anchors it to the helix (Figure 5). The skin flap covers the whole anterior surface and part of the posterior surface of the cartilage framework. The remainder of the posterior surface of the cartilage framework is covered by the fascial flap. A small suction catheter is inserted between the framework and the skin flap. The fascial flap and the subsequent wound surface are then covered with the skin graft made from the patient’s chest skin. A tie-over dressing is applied to the skin graft. Suction drain is applied until the fifth postoperative day, and on the tenth postoperative day, the dressing is removed altogether from the reconstructed ear.

**STAGE 2**

A V-shaped flap, the crus flap, is formed in the superior part of the remnant ear. A C-shaped flap with a radius of 1 cm, the tragus flap, is designed in the conchal area. After the 2 flaps are elevated, the remnant ear cartilage is exposed and divided into 2 parts. The superior part is carved into a cone shape and connected to the helix. The inferior part is trimmed into a semicircular slice to form the lining of the tragus, which is then wrapped by the tragus flap doubled on itself. The redundant skin is excised to form the tragus. Then the extraneous rem-

![Figure 1](image1.png)

Figure 1. Construction of the ear framework. A, The scapha is designed on the cartilage. B, A piece of crescent-shaped cartilage is carved. C, The crescent-shaped cartilage is turned over and anchored on the interior side of the scapha to form the antihelix and superior crus. D, The instruments used in our method: the straight needles, blade, and steel wire.

![Figure 2](image2.png)

Figure 2. The constructed ear framework. A, Front view. B, Posterior view. C, Lateral view.

![Figure 3](image3.png)

Figure 3. The earlobe is transposed with the formation of the skin flap and fascial flap.
nant cartilage tissue is excised to the mastoid periosteum to deepen the conchal floor. The cavity is lined with a full-thickness skin graft from the opposite retroauricular area or from the chest where the scar is obvious and repair needed (Figure 6).

RESULTS

Sixty-eight patients, ages ranging from 5 to 17 years, were treated using the 2-stage method from January 1, 2006, to December 31, 2008 (48 boys and 20 girls). Unilateral microtia was present in 66 patients, and bilateral microtia in 2.

Follow-up ranged from 1 to 3 years (Figures 7, 8, and 9). In 66 cases, the reconstructed ears had 3-dimensional configurations and cranioauricular angles similar to those of the contralateral control ears. There were 5 cases of conspicuous hair growth in the helix, which were treated by 3 to 5 applications of laser therapy. No absorption or distortion of cartilage framework was observed.

COMMENT

The remnant ear is a key factor in reconstructing the inferior structure of the ear. The transposition of the remnant ear is the classical technique in microtia reconstruction. However, the timing of the transposition has always been controversial. Tanzer believes that the transposition should be the first part of the reconstruction procedure. If the frame is inserted during the second stage, it is difficult to obtain a good match with the already transposed lobule. In contrast, Brent proposes that the reconstruction should be started by placing the cartilaginous frame in the ideal position. Then lobule transposition can be correctly adapted to the already constructed contours during the second stage. We perform earlobe transposition and implantation of cartilage framework in a single stage. Thus the operation times can be reduced.

We also practice several other innovations, based on the fabrication technique devised by Brent. We usually harvest cartilage from the right side of the chest. We are aware that the trend among most other practitioners is moving in the opposite direction, but we believe that the
Figure 7. Postoperative view after completion of stage 1 ear reconstruction in a 16-year-old patient. A, Frontal view. B, The reconstructed ear has a 3-dimensional contour, and the definition is clear. C, The contralateral normal ear.

Figure 8. Postoperative view after completion of stage 2 ear reconstruction in a 10-year-old patient. A, Frontal view. B, The crus, tragus, and conchal cavity are formed. C, The contralateral normal ear.

Figure 9. Preoperative (A) and postoperative (B and C) views of an 8-year-old boy who underwent 2-stage ear reconstruction. B, Two months after completion of stage 1. C, One year after completion of stage 2.
heart is well protected by the integrity of the left thorax. Furthermore we do not find using the cartilage in this way to be inconvenient. In the process of cartilage fabrication, we use the cartilage cut from the scaphoid to produce as much contour definition of the antihelix and inferior crus as is required. Projection is the main factor in 3-dimensional contour. In Brent’s\textsuperscript{5} third stage, a block of cartilage is inserted beneath the framework to lift the reconstructed ear. In our method, we use 3-layer framework, and there is no need to enhance the projection of the ear in another procedure.

Since local skin and fascial flaps were introduced in single-stage ear reconstruction, the 2-flap technique has been widely used.\textsuperscript{8} In elevating the retroauricular fascial flap, 3 key factors must be kept in mind. First, in the superior part, the principle is that the superficial temporal fascia and loose areolar layer are all raised when separated from the temporal fascia. Second, in the posterior part, careful hemostasis should be maintained if there is an emissary vein in the mastoid area. Third, in the inferior part, the parotid gland may be abnormally positioned, especially in patients with dysplasia of mandible. Do not accidentally injure the parotid gland when dissecting the fascial flap.

Temporoparietal fascial flap is another widely used fascial flap in ear reconstruction. It has many advantages. These include pliability, good vascularity, and easy translocation. However this type of flap leaves a conspicuous scar in the temporal region. We usually use the temporoparietal fascial flap as a rescue to repair exposure of cartilage framework.

The remnant ear cartilage is in the conchal region. It is usually excised and discarded to deepen the conchal cavity. We use partial remnant ear cartilage to reconstruct the helix crus and tragus. Thus the requirement for cartilage framework is reduced. This method is especially practical in young patients whose rib cartilage is insufficient.

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