Soft-Tissue Reconstruction for Atypical Microtia Malformations and Trauma

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Objective: To provide customized reconstructions of atypical microtia malformations and trauma via 1- or 2-stage procedures.

Design: Case reports.

Setting: Academic otolaryngology specialty hospital.

Patients: Pediatric patients with rare and unique ear malformations.

Interventions: Customized auricular reconstruction using contralateral postauricular donor grafts (skin and cartilage) as well as ipsilateral tissue (flaps and bone).

Main Outcome Measures: Postoperative results.

Results: Surgical procedures were completed in 1 or 2 stages with minimal morbidity. No donor scars were visible, in contrast to traditional reconstructive methods. The completed auricular appearance was realistic.

Conclusion: Selected patients can benefit from soft-tissue reconstruction of the auricle that feels normal to the touch and lacks the morbidity and scarring of traditional reconstructive methods.


Auricular malformation appears as a very visible birth malformation with serious functional concerns for the child and family. Many patients with classic microtia and aural atresia demonstrate a similar appearance. However, the appearance of the congenitally malformed auricle can vary considerably, which implies that traditional reconstruction methods might not be optimal. In addition, trauma can deform a pinna in a unique fashion.

Several successful techniques have been developed for the correction of ear deformities. However, techniques well suited for reconstruction of classic microtia with aural atresia are not always ideal for unique ear malformations. Rib reconstruction involves painful rib removal as well as scarring at both the rib donor site and separate large skin donor site, usually on the abdomen, thigh, or back. The use of a high-density polyethylene implant involves a temporoparietal fascia flap, with occasional scalp scarring and balding, plus a large donor skin graft. Prosthetic ear reconstruction involves placement of titanium posts in the skull, with undesirable scarring at the auricular site as well as a lifetime of hygiene for the scalp and many replacement prostheses. Traditional procedures are multistaged. Importantly, the reconstructed ears do not feel normal to the touch with any of the foregoing methods.

Such trade-offs are worthwhile for classic ear malformations, which require importation of substantial reconstruction material. However, some ear malformations are atypical and can benefit from an individualized surgical approach with reduced morbidity.

To provide a customized reconstruction of individual ears, we describe 1- or 2-stage procedures developed for special types of malformation or traumatic deformation. Morbidity was reduced because large grafts were unnecessary. No donor site scarring was visible, a significant advantage to the patient in later life for intimate situations. In addition, each ear felt normal to the touch, which is unique to this approach.

METHODS

The techniques described in this article are indicated for patients who have an atypical auricular appearance with some anatomic segment that resembles a normal ear. Soft-tissue reconstruction surgery currently is not recommended for patients with classic microtia, anotia, or substantial traumatic auricular loss. Also of note, although some of the auricular mal-
formations might appear to be mild, the condition was often more severe than initially appreciated. For example, aural atresia often coexists with such “atypical” malformations. In addition, the surgical correction can be more challenging than a standardized microtia repair. Preoperatively, parents were informed in general that the auricle was atypical and that a customized procedure, rather than a traditional operation, could be attempted. The projected advantages included reduced morbidity, no donor site scars, and normal tactile sensation. However, because of the unique anatomy, the outcome was unpredictable and limitations to this approach could occur. The limitations included an ear that might not be an exact mirror image of the contralateral ear (also true of rib and high-density polyethylene methods). Also, the vertical height of the pinna might not match that of the contralateral ear, depending on the innate shape and size of the anomalous auricle; width and projection were not as difficult to control.

Although each ear is unique, several general principles for soft-tissue reconstruction can be applied:

- At least one-half to two-thirds of an auricle form should ideally be present before a soft-tissue reconstruction is considered.
- An extremely large segment of imported material (rib or high-density polyethylene) is required to generate an auricle-sized structure, soft-tissue reconstruction is unlikely to be successful.
- Patients with bilateral microtia are less likely to be candidates for soft-tissue reconstruction because the contralateral ear might be required for donor tissue.
- It is useful to recall that an auricle exists as 3-dimensional layers, including skin, elastic ear cartilage, periauricular musculature, and bone, which can be separated and repositioned independently.
- Otoplasty adjunctive techniques frequently can be used.
- As standard operating technique, the surgeon should have a primary plan and a backup plan; however, owing to the unique nature of some of the ear shapes and responses to tissue manipulation, the surgeon must be open to innovation during the procedure.

All procedures were performed by 1 of us (R.D.E.). General anesthesia was required. Surgery was completed in 1 or 2 stages, depending on the patient’s auricular requirements.

Each patient received a customized operation. As a generalized plan, before surgery, each ear was imagined as partially detached from the side of the head with a pedicle for blood supply. Several detachment possibilities were contemplated. The ear was also manipulated in the office and in the operating room preoperatively before an incision was attempted. The manipulation was intended to simulate tissue performance in providing the desired new appearance of the ear. The enhanced ear appearance also was estimated for its potential to increase in size. The auricles were moderately tissue deficient in general, and donor grafting was necessary in most cases.

A relatively common surgical approach used detachment of the helical root, extending caudal to the meatus region, with posterior auricular rotation to expand the width and to simulate internal contours. A Heerman incision was useful at times. As a rule, the deep surface of cartilage required separation from the side of the head to achieve mobility. Some patients, however, did not require such an approach, so the technique cannot be standardized.

Intraoperatively, all patients were administered intravenous antibiotics. Suture material intended for permanent use was 4.0 clear nylon, and skin sutures were dissolvable to avoid the need for office suture removal. Postoperatively, each patient was provided a mastoid-type dressing.

RESULTS

Seven patients whose surgical procedures exemplified soft-tissue reconstructions for ear deformities are described. All ears improved in appearance. No complications, such as infection or necrosis of a graft, occurred in any of the cases, suggesting that the techniques are relatively safe.

PATIENT 1

A 4-year-old girl had a cleft right ear that demonstrated absence of the antihelical fold and a deficient descending helix and adjacent tissue (Figure 1A). A single-stage operation was performed to close the gap in the descending helix and to create a neo-antihelix. The technique involved primary closure of the gap by freshening the tissue at the border of the gap and using permanent perichondrial sutures. The reconstructed ear periphery was shaped naturally, and the midauricle displayed a normal antihelix (Figure 1B).

PATIENT 2

A 6-year-old girl had left aural atresia and atypical microtia. The affected ear showed a hooded helix, lacked a visible antihelix medial to the anomalous helix, and demonstrated deficiency of the helical root (Figure 2A). A single-stage procedure was performed. The helical hooding was trimmed, a Becker suture technique provided the illusion of an antihelix, and a helical root was created by tubing of the native skin with permanent sutures. An earring was placed as well (Figure 2B).

PATIENT 3

A 5-year-old girl had a severely constricted congenital left ear deformity. The anomalous auricle measured only 33 × 20 mm (vertical by horizontal) compared with 49 × 29 mm in the normal contralateral ear (Figure 3A). At the first procedure, the ear was detached at the helical root area and rotated vertically and posteriorly. The resulting bare area was grafted with postauricular skin from the contralateral ear. The newly reconstructed ear…
measured a nearly symmetrical 46 × 30 mm. Three months later, the helical root and ascending helix remained deficient from a 3-dimensional perspective (Figure 3B). During a second procedure, a postauricular bone graft shaped like a curved horn was harvested from the ipsilateral mastoid area for subcutaneous implantation beneath the previously placed skin graft to provide 3-dimensional contours to the now normal-sized ear (Figure 3C and D).

**PATIENT 4**

A 10-year-old girl displayed a unilateral left cup-ear deformity (Figure 4A). During the surgical procedure, the pinna was detached from the meatus cephalad through the helical root with posterior rotation of the auricle, and an antihelical fold was created to match the contralateral ear by means of Mustarde sutures (Figure 4B). The final result in the operated-on ear was similar in contour to the unoperated-on right ear (Figure 4C and D).

**PATIENT 5**

A 5-year-old boy had an atypical microtia of the right ear lacking sufficient size (47 × 22 mm compared with 56 × 34 mm in the normal ear) and definition of the helix, antihelix, and conchal bowl (Figure 5A). In a single stage, the auricle was detached and rotated posteriorly, the helix and antihelix were refined by otoplasty suture methods, and the anterosuperior area was grafted with contralateral postauricular skin. The reconstructed auricular size was 47 × 32 mm (Figure 5B).
PATIENT 6

A 5-year-old girl had atypical microtia and aural atresia in her right ear. The ear lacked a tragus and antihelix and had helical anomalies as well as diminished size compared with the normal ear (50 mm vs 60 mm; Figure 6A). A procedure expanded the auricle and created contouring. The conchal bowl area was detached from the tragal segment through skin and cartilage and maneuvered to attach to the underlying musculature more posteriorly. Therefore, a conchal bowl illusion plus faux antihelix was created and the auricle achieved normal projection. The reconstructed ear displayed a tragus, antitragus, pseudomeatus, and conchal bowl after the initial surgery. During the second stage, an aural atresia repair was performed and the helical rim was refined. The final result (54 mm) is shown in Figure 6B.

PATIENT 7

A 5-year-old girl had sustained a horse-bite avulsion of the descending helix and earlobe below the antitragus on the left side (Figure 7A). The preoperative dimensions of the normal right auricle were 60 mm for the upper auricle and 15 mm for the lobule. The deformed left ear measured 57 mm for the upper auricle and 7 mm for the lobule. The first surgery was directed toward reconstruction of the helix by using postauricular skin and silicone tubing and placement of stacked silicone disks for a staged earlobe repair (Figure 7B and C). During the second stage, a new lobule was created for the affected ear. The virgin upper neck skin was cut to allow rolling of the skin to include subcutaneous tissue and abdominal fat, forming a 3-dimensional earlobe, plus an advancement of upper neck skin to form an earlobe sulcus. The postoperative dimensions of the left ear were 60 mm for the auricle and 16 mm for the lobule (Figure 7D).

COMMENT

All auricular reconstructive techniques have advantages and disadvantages. Tanzer developed the use of autogenous rib cartilage for ear reconstruction in 3 or 4 stages, which was a seminal breakthrough and still serves as the basis for rib reconstruction today. Tanzer’s method has been further refined by others such as Brent, Nagata, Eavey and Ryan, and Walton and Beahm. Basically, the first operation consists of retrieving cartilaginous ribs through an incision in the lower rib region. The ribs are carved into the shape of an ear. The ear framework is implanted under the skin where an ear would normally be located. Subsequent stages involve creating a lobule, separating the reconstructed auricle from the head, and construction of a tragus. The autogenous reconstruction remains a very worthwhile technique for severe auricular malformation. What postoperative ear photographs cannot display, however, is a measurement of the pain of the rib harvest. The donor site chest scar also is invisible under clothing yet obvious when the patient is at the beach. Also unrevealed is the sizable donor site skin graft, which is noticeable whether split or full thickness and whether from the abdomen, thigh, or back. Finally, the new ear does not feel quite normal to the touch; the new rib ear feels much firmer than flexible elastic cartilage.

The use of a high-density polyethylene implant eliminates the problems with rib pain and a chest scar. This technique, also quite worthwhile for severe microtia, was popularized by Reinisch. Because the implant frequently extrudes through the skin unless covered by a tissue envelope, the ear framework must be wrapped in a temporoparietal flap and also requires a separate, large skin graft. The scalp flap frequently can be problematic, however, because at times a very visible scar can appear on the side of the head. At other times the scalp hair can
thin out and bald patches on the side of the head may be visible. As with rib reconstruction, the large donor skin graft still is required, with attendant morbidity and visibility when the patient is disrobed. Again, the ear does not feel normal to the touch.

Another type of reconstruction is to use a prosthetic auricle attached by bone-anchored titanium pins, as pioneered by Tjellström and colleagues. The operation involves little morbidity and the auricular appearance at arm’s length can be quite pleasing. However, the side of the head appears quite unsightly with the pins and scarring revealed when the prosthesis is removed for cleaning. The prosthetic auricle also requires daily hygiene, which is not the case with skin-covered ears. In addition, the ear feels artificial to the touch—the least natural tactile feel of any of the techniques.

Some patients have unusual ear anomalies or traumatic deformity. Such patients can demonstrate a component of the pinna that bears some resemblance to a normal ear. The ears tend to be small, and each can show a component of the pinna that bears some resemblance to a normal ear. The ears tend to be small, and each can show a component of the pinna that bears some resemblance to a normal ear. However, the side of the head occurs. No suction drains are needed postoperatively, as with both rib and high-density polyethylene reconstruction methods, so that postoperative care is simplified and is the same as for a patient who has undergone merely a mastoidectomy or an otoplasty. Of all the reconstructive methods, only soft-tissue reconstruction provides the patient with an ear that feels natural to the touch because the primary tissue and the grafting materials are autogenous elastic cartilage, skin, and mastoid cortex. Some patients do not even require grafting. Should the patient also require an atresia repair, soft-tissue reconstruction is compatible with a 1- or 2-stage repair.

Limitations do exist for soft-tissue reconstruction. First, the ear might not be a completely normal mirror image of the contralateral ear. However, the same is true for rib and high-density polyethylene reconstruction. Only a prosthetic ear provides a near mirror-image result, yet at a cost of artificiality that some patients do not wish to bear. Second, achieving equal vertical height can be a challenge in some patients, although recent bone grafting has enhanced the capacity to achieve adequate vertical dimension. Width and projection are usually obtained successfully. Third, bilateral soft-tissue reconstruction cannot necessarily be accomplished in all patients. Finally, soft-tissue reconstruction must be individualized for each ear, and so the surgeon ideally should be well acquainted with more basic reconstruction techniques from many patients before attempting a novel, virginal reconstruction for 1 patient.

Each child ideally could have an individualized procedure performed for his or her unique malformation. The concept of soft-tissue auricular reconstruction extends the available surgical procedures for special patients.

In conclusion, soft-tissue reconstruction for atypical congenital microtia anomalies and for auricular trauma can provide the patient with a realistic external ear result. Advantages include (1) reduced morbidity, requiring only a 1- or 2-stage operation and a less painful procedure; (2) invisible donor site scar; and (3) an ear that feels normal to the touch.

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