Microtia repair with rib cartilage grafts
A review of personal experience with 1000 cases

Burt Brent, MD*

El Camino Hospital, Mountain View; and Division of Plastic Surgery, Stanford University Medical Center, California, USA

Surgical construction of the auricle with autogenous tissues is a unique marrying of science and art. Although the surgeon’s facility with both sculpture and design is imperative, the surgical result is equally influenced by adherence to sound principles of plastic surgery and tissue transfer.

The material reviewed in this article is derived from clinical experience with congenital microtia: 1094 completed ears in 1000 patients (94 cases were bilateral)(Table 1). This article focuses on total repair of major congenital ear defects, but includes relevant supplementary input from experience gained by managing more than 125 traumatic auricular deformities. All repairs used autogenous rib cartilage grafts.

Initiating the surgery

The age at which one begins surgery is governed both by physical and psychological considerations. It is best to initiate the repair before the child is traumatized by cruel teasing, but the surgeon must not be pressured to begin until rib growth provides substantial cartilage for framework fabrication [28].

In the author’s experience, children become aware that their ears are different between ages 3 and 4, but teasing with psychological overtones does not become manifest until ages 7 to 10. There usually is enough rib cartilage to serve as the sculpting medium by age 6, and at the urging of parents the author often begins at that time. If not pressured by the family, the author’s favored age to begin surgery is between 7 and 8, when the child is more aware of and concerned with the problem, usually wants it resolved as much as the family does, and is helpfully cooperative during the postoperative care phase (Table 2).

Selecting the method of framework fabrication

In contrast to alloplastic frameworks, which often fail [26], and homologous cartilage, which absorbs [25], autogenous cartilage produces favorable results, experiences few complications, and withstands trauma [1,2,9,21,27]. The author has seen silicone ear frameworks lost to even minor trauma up to 12 years after implantation. Despite some investigators’ enthusiasm with Medpore frameworks [12,33,34], these foreign substances seem to encounter the same problems that have plagued silicone. Most recently, a patient consulted the author with an infected sinus tract that had been draining from her Medpore implant for 2 years; another patient presented with three separate exposed areas of Medpore in his reconstructed ear. On the other hand, once safely passing the 10th postoperative day, the author has never lost an autogenous ear framework in a microtia patient; only one framework has been lost in a trauma

* Tel.: +650-851-5300.
patient with poor compliance to postoperative instructions. To date, more than 70 of the author’s reconstructed ears have survived major trauma [9].

For many years, there has been considerable interest in creating a prefabricated framework from autogenous cartilage to circumvent the necessity to sculpt an ear framework during a prolonged reconstructive procedure, or to circumvent the need for artistic ability to create a realistic ear framework from rib cartilage. Back in the 1940s, Young and Peer first conceived the idea of framework prefabrication before the actual auricular reconstruction. This innovative technique was accomplished by means of diced pieces of autogenous rib cartilage, which were placed in a fenestrated two-piece, ear-shaped Vitalium mold that in turn was banked in the patient’s abdominal wall [22,35]. After several months they retrieved the banked mold, opened it, and harvested the framework of cartilage chips, which had united by connective tissue that had grown through the mold’s openings. The results were not consistent, however, perhaps because contraction of the fibrous tissue surrounding the multiple cartilage islands distorted the resulting framework.

Recently, interest in this prefabrication concept has been rekindled by modern tissue engineering techniques in which bovine cartilage cells are grown in the laboratory and seeded on a synthetic, biodegradable ear form, which is then implanted beneath the skin of an immunoincompetent mouse [23]. The early results are interesting, but one should note that the trial work does not take place in conditions comparable with those of a clinical human ear reconstruction: the investigators’ framework is placed under the loose skin of an animal’s back, whereas a surgeon’s framework for ear repair is placed under the tight skin of the ear region.

Although these new laboratory studies are intriguing, unless a very firm, substantial three-dimensional framework can be produced from autogenous tissues, it will likely suffer the same fate the author observed of Young’s and Peer’s prefabricated frameworks (i.e., they flattened from the pressure of the taut, two-dimensional skin envelope under which the framework was placed to complete the ear reconstruction) [22,35]. The other obvious limitation of prefabricated ear frameworks is the difficulty in producing the great variation in size and shape that one must have to match the opposite, normal ear. When sculpting directly from rib cartilage, these limitations do not exist because the surgeon creates the required specific size and shape for each ear reconstruction.

The author has long been intrigued, however, with the concept of creating a prefabricated cartilaginous ear framework. He is working with researchers to explore the possibilities of bioengineering firm, autogenous cartilage frameworks, to see if some of the aforementioned limitations can be overcome [23,31]. This involves growing autogenous costal cartilage in varying-sized molds made from idealized frameworks that the author has sculpted and cast. To fill these molds with chondrocytes obtained by digesting a large volume of rib cartilage, however, would merely reproduce the work of Young and Peer using modern technology [22,35]. The goal is to exploit the technology by using a small piece of cartilage (perhaps obtained by biopsy from the microtia patient at age 3 to 4, when neochondrogenic potential is high), to extract the chondrocytes, to expand them in culture, and then to infuse them into the ideal matrix substrate within the ideal ear framework mold for each specific patient. Once generated to satisfaction, the engineered framework would then be banked under the patient’s hairless periauricular skin as the first reconstructive surgical phase.

For this technique to be successful, the major problems entail replicating sufficient chondrocytes from a small cartilage sample (25 to 50 million cells/mL are needed for neocartilage formation in a construct, and the ear mold volume is about 5 mL); and regenerating firm cartilage matrix from those chondrocytes so that the engineered three-dimensional framework can withstand the pressure caused by the constraints of a taut, inelastic, restrictive two-dimensional skin cover. In the author’s experience, until tissue engineering evolves beyond the aforementioned problems, sculpted autogenous rib cartilage remains the material of choice for surgical repair of the ear.

Preoperative planning

The author initiates the planning by first tracing a film pattern from the opposite normal ear, which is

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**Table 2**

<table>
<thead>
<tr>
<th>Age range (y)</th>
<th>Patients</th>
<th>% of total</th>
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<tbody>
<tr>
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<td>28</td>
<td>2.8</td>
</tr>
<tr>
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<td>0.7</td>
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<tr>
<td>Totals</td>
<td>1000</td>
<td>100</td>
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Author’s series of 1000 microtia patients.
reversed and used to plan the new framework. A new pattern then is made several millimeters smaller in all dimensions to allow for the extra thickness that occurs when the cartilaginous framework is inserted under the skin. The framework’s inferior pole is greatly reduced to accommodate the earlobe on its transposition (Fig. 1). If the patient has no usable earlobe tissue, the framework’s lower end is carved to resemble an earlobe. This is further defined when the ear is separated from the head with a skin graft (Figs. 2 and 3).

The author predetermines the ear’s location in the office by first taping the reversed film pattern to the proposed construction site, and then adjusting its position until it is level to and symmetric with the opposite normal ear. The pattern is traced on the head, noting the ear’s axial relation to the nose, its distance from the lateral canthus, and its lobule’s position, which is usually superiorly displaced. The ear’s new position is straightforward and easy to plan in a pure microtia, but much more difficult when severe hemifacial microsomia exists. Not only are the heights of the facial halves asymmetric, but the anteroposterior dimensions of the affected side are also foreshortened. In these patients, one should plan the new ear’s height by lining it up with the normal ear’s upper pole; it’s distance from the lateral canthus is somewhat arbitrary.

In pure microtia, the vestige-to-canthus distance mirrors the helical root-to-canthus distance of the opposite, normal side. In severe hemifacial microsomia patients, however, the vestige is much closer to the eye. If one places the new ear’s anterior margin at the vestige site, then the ear seems too close to the eye; if one uses the measured distance of the normal side as a guide, then the ear looks too far back on the head. In these patients, it is best to compromise by selecting a point halfway between these two positions [1].

When both auricular construction and bony repairs are planned, then careful integrated timing is essential. Most often the family pushes for the ear repair to begin first, which helpfully ensures the auricular surgeon virginal, unscarred skin. The craniomaxillofacial surgeon argues that by going first, the facial symmetry is corrected, making ear placement easier [17]. The author finds this unnecessary when the previously described guidelines are followed.

If the bony work is done first, it is imperative that scars be peripheral to the proposed auricular site. When a coronal incision is used to approach the upper face or to harvest cranial bone grafts, special care must be taken that the scar does not precariously lie over the future region of the upper helix.

**Surgical staging**

Because a well-sculpted cartilage framework is the foundation of the repair, it must be created under ideal conditions. This is accomplished as the first surgical stage where one usually finds scar-free skin with

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**Fig. 1. Framework fabrication in the young patient.** (A) To optimize natural configuration, rib cartilage is harvested from the chest opposite to the side of the ear defect. (B) The framework is sculpted in two pieces: the ear’s main body is carved from synchondrotic cartilage block, and the helix is created by thinning the floating cartilage on the outer, convex surface to warp it into a favorable curve. (C) The completed framework; the helix has been affixed to the main block with 4-5 sutures of 4-0 clear nylon, with the knots placed on the frame’s undersurface.
optimal circulation and elasticity. Secondary procedures, such as repositioning the earlobe and creating the auriculocephalic sulcus, take place only after sound healing of the grafted cartilage framework foundation. Combining procedures to reduce surgical stages [24] must be done with caution to prevent complications [3] and to ensure predictability of the repair. One is not thanked by a patient for taking shortcuts, but instead suffers with the family during management of a complication that arises from so doing.

The first surgical stage

Harvesting the rib cartilage

To avoid deforming the thorax, certain precautions must be followed to obtain the ideal sculpting material. In a survey addressing the author’s first 500 microtia patients, it was learned that 35.2% rated the scar or chest contour as “noticeable, but worth the tradeoff [1].” One only has to observe a surgically deformed thorax to realize the importance of harvesting only what is needed to create the framework, preserving maximum integrity of the chest wall. The author finds that one can significantly decrease obvious chest deformities by preserving even a minimal rim of the upper margin of the sixth rib cartilage from which one obtains the basic ear shape of the framework (Fig. 4) [9,20,30]. This precautionary measure retains a tether to the sternum so that the rib does not flare outward, distorting the chest as the child grows. If the synchondrotic region seems inadequate in width, one can compensate for framework width by bowing the helix away from the framework body (the expansile design) [5], rather
than violating the sixth rib margin and sacrificing chest wall integrity. To acquire cartilage of appropriate configuration, the author prefers to use the contralateral chest (see Fig. 1).

**Fabricating the framework**

The framework must be treated as a living sculpture. During fabrication, the author avoids the use of power tools by carving the tissue with scalpels and chisels [10]; the cartilage is intermittently bathed in saline to prevent desiccation. Muscle and connective tissue scraps are removed from the cartilage graft before carving, but perichondrium is preserved when possible to facilitate adherence to and subsequent nourishment from the skin cover. On forming the basic shape of the ear, the helix is created by thinning the floating rib cartilage [16]. To decrease the amount of

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Fig. 3. Managing the earlobe in microtia. Top, Lobe transposition secondary to cartilage framework stage. Middle, Lobe transposition combined with elevation procedure. This was safe because the skin-bridge above the short lobule carries circulation across to the auricle. Bottom, Microtia with absent lobule vestige. The lobe is created by first defining it in the rib carving, then further delineating it when the ear is elevated with skin graft. (*From* Brent B: Technical advances in ear reconstruction with autogenous rib cartilage grafts: Personal experience with 1200 cases. Plast Reconstr Surg 1999;104:319, with permission.)
foreign bodies, the helix is wrapped around the ear silhouette with a minimal number of 4-0 and 5-0 clear nylon sutures (see Fig. 1). The knots are placed on the framework’s undersurface. The author finds that nylon causes far less problems than wire sutures, which commonly extrude from reconstructed ears [4,29].

Framework modifications in older patients

In adult patients, the author usually finds that basic differences in rib cartilage quality and configuration require modification of the framework fabrication. Adult rib cartilages often are fused into a solid block (see Fig. 2), which invites one to sculpt the framework as one piece, not unlike a wood carving (see Fig. 2). In the author’s experience, this is particularly advantageous because adult cartilage is often calcified; it is difficult, if not impossible, to create a separate helix that bends without breaking [9]. If a one-piece carving produces insufficient helical projection, one can detach the helix and slide it up the framework body to augment the rim’s protrusion (Fig. 5). This improved contour is maintained by reattaching the helix to the framework with several permanent sutures (see Fig. 5).

The Cutaneous cover

After completing the carved cartilage framework, meticulous technique is used to create a skin pocket
in the proposed auricular region, which provides a nourishing, protective covering for the newly introduced ear framework. As time elapses during the rib harvest and framework fabrication, contamination risk is minimized by preparing and scrubbing the ear region just before beginning the skin dissection. Using the film template and preoperatively determined measurements, the ear’s position is marked and a small incision is made along the backside of the ear vestige. After dissecting out and removing the gnarled cartilage remnant beneath the skin, fine dissection scissors are used to develop a thin skin pocket, taking great care not to damage the small blood vessel network that nourishes the skin. To furnish sufficient tension-free skin coverage, the dissection is carried well beyond the marked ear outline. After securing hemostasis, two small silicone drains are inserted beneath and behind the framework (see Fig. 4), which are attached to vacuum test tubes. This creates a continuous suction, which promotes adherence of the nourishing skin flap to the cartilage sculpture and prevents disastrous hematomas (Fig. 6).

Postoperative course

The convolutions of the constructed ear are packed with Vaseline gauze and a bulky, noncompressive dressing is applied. Because the vacuum system provides both skin adherence and hemostasis, pressure is unnecessary and contraindicated. The first day, the tubes are changed frequently. The patient leaves the hospital in 24 to 48 hours, after which time the parents are taught to change the tubes several times daily.
times daily. The drains are removed on the fifth postoperative day, when drainage is minimal and the skin is well-adhered to the cartilage framework.

The first day following surgery, the patient often experiences chest discomfort from the rib surgery and nausea from the anesthesia. Both of these are controlled easily with medications. Most patients do not experience significant ear discomfort.

Most patients run a fever the day after surgery, because they are splinting the chest and trapping lung secretions. To prevent this atelectasis, the patient is encouraged to breathe deeply, aided by a tri-flow respirometer and by blowing up balloons.

Sutures are removed from the ear after 1 week, and bandages are discontinued after about 12 days. The patient is permitted to resume school 2 weeks after surgery.

Activities and sports

Children are restricted from sports for 4 to 5 weeks, and teenagers and adults for 6 weeks. This regime protects the ear, but more importantly the chest wound, which is much more significant. Once back to sports, the patient is allowed to play baseball and other sports with no special protection; he or she can carry on like anyone else in most activities. Because the reconstructed ear is made from the patient’s own living tissues, it grows, heals, and can tolerate as much bumping and trauma as a normal ear. Unusually traumatic activities, such as boxing, are discouraged. If the patient chooses to wear a helmet (for motorcycling or football), it is suggested that it be modified to accommodate the new ear to avoid scraping inside the helmet. An area should be cut out and lined with soft foam rubber.

In the past, the author preferred that patients avoid sleeping on their surgically constructed ears because it was believed that continually doing so might flatten out helix details. This problem has rarely been seen, however, during 25 years of practice. Because we all turn in our sleep, it is impossible to keep from rolling over on a reconstructed ear. Patients with bilateral microtia who have had two ears surgically repaired...
find it impossible to avoid lying on their ears. The author recommends vigilant protection for a month and encourages patients to use very soft pillows (preferably feather down) so the reconstructed ear is protected from firm pressure. One month after the surgery, sleeping on the ear is no longer an issue.

Fig. 7. Utilizing vestiges. Row 1, Seven-year-old boy with grade II microtia (left and left center). Native auricular cartilage shelled out from skin envelope and replaced with sculpted rib cartilage graft (right center). Note that to avoid closing incision under tension, it was repaired with a full-thickness skin graft. Result achieved (right). Row 2, Fourteen-year-old patient with unusual, convoluted microtia vestige (left). Primary rib cartilage graft with partial vestige excision (left center). Earlobe transposition and further excision vestigial tissues (right center). Continued repair (right). Further vestige excision planned. Row 3, Twenty-year-old patient with traumatic ear loss from a human bite (left). Placement of rib cartilage graft, immediately postoperative (left center). Note site through which skin pocket was developed; inferior portion of dissection accomplished through small incision on backside of earlobe vestige. Inset of lobule (right center). Final result (right). Row 4, Six-year-old girl with conchal-form microtia (left). First stage repair with rib cartilage graft (left center). Second stage splice of remnant into repair (right center). Final result, 2 years postoperatively (right). (From Brent B: Technical advances in ear reconstruction with autogenous rib cartilage grafts: Personal experience with 1200 cases. Plast Reconstr Surg 1999;104:319, with permission.)
Other stages of the ear repair

Earlobe transposition

Although it is possible to transpose the earlobe at the same time one inserts the cartilaginous framework, the author finds it safer and aesthetically better to do this as a secondary procedure. Nagata and Firmin transpose the earlobe and use skin from the lobule’s posterior surface to line the framework’s tragal strut during the first-stage surgery [15,18]. Although this does produce an excellent tragal appearance, the price paid is an earlobe that is at times compromised in appearance and often unable to accommodate an earring. This latter problem is no small issue for young female patients, who often submit to surgery with eventual earlobe piercing as their highest priority (Fig. 7). If the lobe vestige is short so that a substantial skin-bridge above can be preserved during its transposition, then one can move the earlobe safely while simultaneously separating the auricle from the head to create the auriculocephalic sulcus and preserve sufficient posterior earlobe skin to permit the use of earrings (Figs. 3 and 8).

Lifting the ear

Separating the ear from the head with a skin graft defines the ear’s posterior margin and creates an auriculocephalic sulcus. The author makes the incision several millimeters peripheral to the embedded framework, then sharply lifts the ear from its fascial bed while carefully preserving the framework’s connective tissue on its undersurface, which serves as a nourishing bed for the graft. A medium split-thickness skin graft is harvested from a hidden region (usually underneath the bathing suit area) and sutured to the wound with the sutures left long; these

Fig. 8. Augmenting ear projection with scalp-banked rib cartilage graft and fascial flap; simultaneous earlobe transposition. Top left, Healed first-stage repair of microtic ear. Note banked rib cartilage behind ear framework (arrow). Top left center, Stage 2: Retroauricular scalp undermined to retrieve banked cartilage; earlobe transposition begun. Top right center, Banked cartilage wedged behind elevated ear to augment its projection; lobule suspended on inferior pedicle. Top right, Retroauricular fascial flap raised; earlobe transposition complete. Bottom left, Fascial flap turned over cartilage wedge to provide nourishing cover for skin graft. Bottom left center, Complete skin graft “take” on elevated ear. Bottom right center, Preoperative view of the patient. Bottom right, Healed postoperative appearance. (From Brent B: Technical advances in ear reconstruction with autogenous rib cartilage grafts: Personal experience with 1200 cases. Plast Reconstr Surg 1999;104:319, with permission.)
are tied over a bolster to tamponade the graft to the recipient bed.

One can get greater projection of the auricle by placing a wedge of rib cartilage behind the elevated ear, but this must be covered with a tissue flap for the skin graft to take over the cartilage. Nagata [18] accomplishes this with an axial flap of temporoparietal fascia. Use of that fascial flap, however, invites a certain morbidity [1]. The author believes that this fascia should be reserved for significant traumatic and secondary ear reconstruction cases where one relies on a fascial flap for their salvage and repair [11]. Like Firmin and Weerda, the author prefers to cover the cartilage wedge with a turnover “book flap” of occipitalis fascia from behind the ear (Figs. 8 and 9) [6,9,14,32]. When one uses this cartilage-wedging technique, there is no need to subject the patient to a second uncomfortable chest operation by harvesting rib cartilage anew, as does Nagata [19]. Instead, an extra piece of cartilage can be banked underneath the chest incision during the initial first-stage procedure. When the wedge is needed during the elevation procedure, it can be retrieved easily by incising through the original chest scar. Alternatively, the author also banks this cartilage wedge underneath the scalp, just posterior to the main pocket where the completed ear framework is placed (see Figs. 4 and 8). This site is particularly advantageous in that one can retrieve the nearby banked cartilage more conveniently when later lifting the new ear from the head (see Fig. 8) [9]. Furthermore, this scalp site seemingly provides better nourishment for the banked cartilage than does the subcutaneous chest region.

**Tragus construction**

In a single procedure, the author forms the tragus, excavates the concha, and mimics a canal by inserting a special, arched composite graft through a J-shaped incision in the conchal region [8]. The main limb of the “J” is placed at the proposed posterior tragal margin; the crook of the “J” represents the intertragal notch (Fig. 10). Extraneous soft tissues are excised

![Fig. 9. Augmenting ear projection with cartilage graft and retroauricular turnover fascial flap. Scheme of separating surgically constructed ear from head; placing the projection-maintaining cartilage wedge and covering it with turnover flap of retroauricular fascia; then applying split-skin graft.](image)

![Fig. 10. Tragus construction, conchal excavation, and canal mimicry. Top left, Chondrocutaneous composite graft harvested from contralateral ear. To avoid setting this particular ear too close to the head by the usual direct closure of defect, the concha is repaired with small skin graft harvested just anterior to the hairline behind the ear. Top center and bottom left, Composite graft applied beneath tragal flap developed by a J-shaped incision placed at the proposed location of posterior tragal margin and intertragal notch. Top right, Excision of excess soft tissues accentuates conchal depth. Bottom center, Composite graft pulled under tragal flap with bolster suture; conchal floor surfaced with full-thickness skin graft, harvested from behind contralateral earlobe. Bottom right, Result 2 years postoperatively. Shadow cast beneath the constructed tragus mimics a canal opening. (From Brent B: Auricular repair with autogenous rib cartilage grafts: Two decades of experience with 600 cases. Plast Reconstr Surg 1992;90:355, with permission.)](image)
beneath the tragal flap to deepen the conchal floor (see Fig. 10). This excavated region looks quite like a meatus when the newly constructed tragus casts a shadow on it (see Fig. 10).

To create a realistic tragus with the best curvature, the composite graft is harvested from the anterolateral conchal surface of the normal ear. This technique is particularly ideal when a prominent concha exists, because the donor site closure facilitates an otoplasty, which often is needed to attain frontal symmetry.

If the concha is not prominent or the projection of both ears is already equal before tragus construction, then the donor concha is grafted (see Fig. 10). This is easily accomplished by harvesting a small ellipse of skin from just in front of the retroauricular hairline.

The author also uses an alternative method of creating the tragus as an integral strut of the original framework during its initial fabrication [9]. This is achieved with a small piece of rib cartilage that is first fastened to the frame so as to create the antitragal eminence (Fig. 11). The strut is thinned on one side, then curved around and affixed by its distal tip with a clear nylon suture that stretches across to the frame’s crus helix. The final result is a delicate tragus that flows naturally from the main framework by an arched intertragal notch (see Fig. 10). Like the original expansile framework principle [5], this new method of tragus construction uses cartilage more efficiently so that one needs only a minimal extra strut of rib tissue (see Figs. 4 and 11). Such considerations are pre-eminent in preserving chest wall integrity and contour. This method of tragus construction is particularly advantageous in bilateral microtia where there is no source for special composite tissue grafts.

Utilizing vestiges

When one is dealing with the classic grade III, sausage-shaped microtic remnant, the surgical plan is

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Fig. 11. Ear framework fabrication with integral tragal strut. (A) Construction of frame. The floating cartilage creates helix, and second strut is arched around to form antitragus, intertragal notch and tragus. This arch is completed when the tip of the strut is affixed to the crus helix of the main frame with a horizontal mattress suture of clear nylon. (B) and (C) Actual framework fabrication with patient’s rib cartilage. (From Brent B: Technical advances in ear reconstruction with autogenous rib cartilage grafts: Personal experience with 1200 cases. Plast Reconstr Surg 1999;104:319, with permission.)
always quite clear (Figs. 3 and 12). Using remnants is far more challenging when more ear exists (see Fig. 3). In grade II, conchal-form microtia, one must decide whether to expand the existing remnant (see Fig. 3); build on it (see Fig. 3); or leave it alone and merely reduce the size of the opposite, normal ear.

**Variations in total ear reconstruction technique**

Numerous variations in technique have evolved and continue to emerge. One of the current popular variations is the Nagata technique in which the ear reconstruction is accomplished in two stages [18,19]. In this method, the cartilage framework implantation, tragus construction, and lobule transposition are all performed in the first stage; the ear is separated from the head at the second stage with a block of cartilage (harvested by entering the chest for a second time), which is covered by a fascial flap and skin graft.

Although this eliminates several stages of surgery, all the soft tissue manipulation in the initial stage dramatically increases the risk of tissue necrosis; complication rate with this procedure has been reported as high as 14% (Walton R, personal communication, 2000). By contrast, the author’s technique has experienced less than a 0.25% complication rate during the past 1000 cases [9]. This combination

Fig. 12. Long-term stability of ears constructed with autogenous rib cartilage grafts. Row 1, Eight-year-old girl with microtia, shown preoperatively; then at 1, 4, and 12 years postoperatively. Row 2, Thirteen-year-old patient, shown preoperatively; at 1 year; and at 10 years postoperatively, comparing both ears. Row 3, Six-year-old girl, shown preoperatively; then at 1 year and at 8 years postoperatively. Ear growth is particularly obvious in this patient. Row 4, Eight-year-old boy shown preoperatively and immediately after cartilage grafting; then at 2 and 8 years postoperatively. Row 5, Six-year-old girl, shown preoperatively; at 1 year; and at 12 years postoperatively, comparing both ears. (From Brent B: Auricular repair with autogenous rib cartilage grafts: Two decades of experience with 600 cases. Plast Reconstr Surg 1992:90:355, with permission.)
of procedures also sacrifices the earlobe quality by lining the tragus with the lobe’s valuable backside skin. In the author’s opinion, the final appearance and quality of the earlobe are far more important than creating a tragus during the initial first stage.

Because the Nagata technique produces the anti-helical complex by wiring an extra piece of cartilage to the base block, the ears produced are thick and more rib cartilage is needed and excised from the chest with attendant chest wall donor deformity [18,19,20,30]. The numerous wire sutures used to apply these two pieces together (and to attach the helix) are placed on the lateral cartilage surfaces and lie precariously under the thin auricular integument; they bear great risk of frequent extrusion through the skin [4]. Tanzer reported wire extrusions in 20 of 44 cases, and used a fraction of the sutures per ear as does Nagata [18,19,29].

To achieve ear projection, the Nagata technique uses the superficial temporal vessel-containing fascial flap in every case, with its attendant scalp scar and its risk of hair thinning in the donor site [1,18,19]. Because Nagata enters the chest again (to obtain the cartilage wedge) during this procedure, the patient is subjected to a second uncomfortable operation [18,19].

Finally, the Nagata technique does not address frontal symmetry of the two ears, and for the technique to deal with this and to be complete, a third stage is required [4,18,19]. In the author’s technique, the symmetry is dealt with during the tragus construction when the grafts for the tragus are harvested from the opposite ear (see Fig. 8). This allows one to adjust the donor ear to the reconstructed ear and achieve frontal symmetry; by doing this as the final stage, the healed final position of the elevated ear has occurred so one knows were to set the opposite ear during the tragus construction so that symmetry can be accomplished.

The Nagata technique has produced some interesting and useful variations in ear reconstruction and continues to evolve [14,15,18,19]. Other variations will emerge as the quest for improved ear reconstruction continues.

Long-term results of microtia repair

As with the first 500 microtia patients, a questionnaire survey was sent to the last 500 to evaluate the benefits of auricular repair on 1000 surgically repaired microtia patients. Although many of the author’s patients come from a distance and are difficult to follow, a 50.8% response was obtained. This volume (508 respondents) has provided enough data to present valid information regarding a long-term outcome of ear repair. Follow-up ranged from 1 to 18 years, with an average of 7.7 years. The following was provided through survey data.

Durability of constructed auricle

Ears constructed from autogenous tissues withstand trauma remarkably well. Despite more than 70 cases of major trauma to surgically constructed ears, all healed without incidence. These traumatic episodes included severe blows during contact sports, abrasive injuries from wrestling and football scuffles, insect bites and bee stings, and a human and dog bite.

These ears also retain their form over the years. The survey showed no instances of softening or shrinkage of the cartilaginous frameworks. As reported previously, ears constructed from autogenous cartilage in younger patients probably can be expected to grow (see Fig. 12) [1].

Psychological and emotional benefits

As one would expect, the survey again demonstrated that the impact of an unrepaired microtic deformity becomes greater to patient and family as the child enters school and approaches adolescence. As before, the greater the emotional impact of the deformity, the greater the relief by its repair. A detailed analysis of the long-term emotional benefits of microtia repair has been reported elsewhere [7].

References

[7] Brent B. The pediatrician’s role in caring for patients


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