Otoplasty for the Protruded Ear

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ABSTRACT

The prominent ear can produce significant social and psychological effects on an individual. Through the last century, many procedures have been described to correct this deformity. In this review, the authors navigate through the history of otoplasty for the protruded ear, and describe some of the breakthroughs in the procedure. Furthermore, they discuss key measurements that must be kept in mind in preoperative and intraoperative settings. They also describe in more detail some of the more common methods for correcting the protruded ear, as well as postoperative management and common complications faced after surgery.

KEYWORDS: Otoplasty, prominent ear, protruded ear, Furnas, Mustarde

Surgical correction of the prominent ear has been reported in the literature as far back as 1845. In the majority of cases, this finding has little relation to other anatomic or physiologic abnormalities. However, the social and psychological manifestations can produce great difficulty and anguish for a majority of patients, which explains the high number of surgical techniques and descriptions that have been presented in the literature for the past two centuries.

Through the years, hundreds of techniques have been described to correct the auricular deformity. Today, this wide variety of options may hinder the surgeon from choosing the correct procedure best suited for a particular patient. This is why a thorough understanding of ear anatomy is one of the most essential steps in the preoperative management of an otoplasty candidate. With the surgeon's objective algorithm toward an auricular deformity, the patient may ultimately enjoy the maximal aesthetic outcome possible for his or her case.

In this review, we will first discuss the normal anatomy of the ear, and devise a simple algorithm to be used in a clinical setting to assess the normal dimensions of the ear. A description of the most common causes for

ear prominence will be presented. A brief history of surgical maneuvers and their evolution through time will also be outlined. Some of the most common methods described in the current literature for correction of the prominent ear will be discussed, followed by postoperative management and common complications.

ANATOMY

The fundamental principles of auricular anatomy will guide the surgeon with not only the approach to a prominent ear, but also toward the principle steps of managing other auricular deformities. With this in mind, a thorough discussion and understanding of normal auricular anatomy is in the surgeon's best interest.

The most common causes for a prominent ear involve an underdeveloped antihelix or an enlarged conchal bowl (Fig. 1). Often these abnormalities can be better appreciated by measuring the discrepancies they manifest on normal auricular measurements. By adulthood, the auricle measures ~5.5 to 6.5 cm in length. A child will reach 85% of this length by 4 to 6 years of age, which also correlates to the appropriate age to begin

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Ear Reconstruction; Guest Editor, Azita Madjidi, M.D., M.S.

Semin Plast Surg 2011;25:288–294. Copyright © 2011 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662.

DOI: <http://dx.doi.org/10.1055/s-0031-1288921>.

ISSN 1535-2188.

Figure 1 A child with protruded ears exhibits the lack of an antihelical fold.

surgical planning. The width of the ear is usually 50 to 60% of the height.¹ In some instances, these dimensions can be important when assessing the symmetry and structure of the ear after otoplasty. At times, despite appropriate correction of the prominent ear, a patient may remain dissatisfied due to asymmetry or size distortion. This is why it is important to address these dimensions during the initial and intraoperative examinations.

When evaluating the ear from the lateral direction, attention should be placed on having the patient in the Frankfort horizontal plane. This is a line parallel to the floor through the inferior orbital rim and intersecting the top of the tragus. From this view, some simple aesthetic features can be drawn (Fig. 2). First, the top of the helical rim should be at the same level as the lateral brow. Second, the vertical axis of the auricle should be inclined 20 degrees posteriorly, which is in some cases similar to the slope of the nasal dorsum.² As mentioned previously, the vertical height of the ear is ~55 to 60 mm and the width is usually 55% of the length.

The normal auricle protrudes 20 to 30 degrees from the skull. When assessing auricular prominence, one of the best objective tools is the helical–scalp distance. The superior point of the helical rim should normally measure 1.0 to 1.2 cm from the scalp, while at midpoint, this distance usually increases to 1.6 to 1.8 cm. At the lobule, the distance grows to 2.0 to 2.2 cm to the mastoid area.¹

In summary, the surgeon should have a systematic approach to the ear, which addresses all the variable

Figure 2 Lateral view. Some common auricular measurements in relation to the Frankfort Horizontal line. Note the vertical axis of the auricle inclining 20 degrees posteriorly.

anatomic indicators for a prominent ear. Special attention should be placed on specific auricular components such as underdeveloped antihelical fold, overdeveloped conchal bowl, abnormal scaphoid fossa, abnormal helical curvature, and abnormal lobule. The angles of auricular positioning, their relation to the nose and brow, as well as the relation to the opposite ear all play a crucial role in surgical planning.

THE EVOLUTION OF OTOPLASTY

There are over 100 reported procedures in the literature that attempt to describe a unique surgical approach to the prominent ear. The first reported technique took place in 1845 when Dieffenbach described a resection of retroauricular skin and conchomastoid fixation to correct a posttraumatic auricular prominence.³ Morestin reported a similar approach in 1903. Problems with this technique included the fact that exclusive resection of postauricular skin only corrected the cephalauricular angle. Furthermore, recurrence of the deformity was more likely because this technique did not address the cartilaginous forces involved in shaping the prominent ear. In 1881, Ely enhanced this procedure with inclusion of a conchal and triangular fossa cartilage excision, which took place as a second-stage procedure.⁴

In 1910, Luckett addressed his technique toward restoring the antihelical fold and widening of the conchoscaphal angle. In his procedure, he added a posterior excision of skin and cartilage along the proposed site of the antihelical fold, followed by closure with mattress

sutures.⁵ Problems with this technique included the sharp antihelical border that resulted after surgery due to the full-thickness cartilage excision.⁴ This problem was addressed in 1952, when Becker modified the antihelical reconstruction with a tubing technique. In his procedure, cartilage incisions and suturing techniques were devised to form a cartilaginous tube to accentuate the antihelix.⁶ Similar reports and modifications were made by Converse in 1955 and Tanzer in 1962.

By 1963, the ever-popularized Mustarde technique was developed to create the antihelical tubing using permanent conchoscaphal mattress sutures without excision of cartilage.⁷ In 1968, Furnas introduced a method in which retroauricular soft tissues, including posterior auricular muscle and ligament, were resected and attached by conchomastoid sutures.⁸ This technique was also widely popularized in the literature as a way to stabilize the cephaloauricular angle.

Weakening of the anterior cartilage is a more recent approach that is utilized in correction of the prominent ear. This can be done in the perichondrium of the antihelix by abrasion or by needle scoring. These anterior approaches should not be performed in conjunction with the posterior techniques as this may lead to extensive interruption of blood circulation to both sides of the ear, leading to necrosis.

CORRECTION OF THE PROMINENT EAR

The variety of techniques, coupled with the broad spectrum of ear projection, provides the surgeon with an almost unlimited arsenal of options. This is why it is important to not only approach the ear with an objective algorithm, but also to pay attention to the patient's or parent's requests. The majority of outcomes are ultimately judged by the patient and family. Hence, realistic goals and expectations should be established in advance. In addition, care must be taken to tend to the patient and view what he or she may expect their ear to look like by adjusting their ear in front of a mirror.

Before surgical correction, some important principles should be reviewed regarding the goals and limitations of the surgeon. Some reliable tips to keep in mind both before and during the procedure were suggested by McDowell in his *Goals of Otoplasty*⁹:

1. Emphasis should be placed on the correction of the upper third of the protruded ear.
2. When viewing the patient anteriorly, the helix should be visible behind the antihelix.
3. The helix should have a smooth and continuous contour, not broken or sharp (as can occur in the Luckett procedure).
4. The postauricular sulcus should not be distorted or markedly decreased in size.

5. Each part of the helix should be at an appropriate distance away from the mastoid skin. This is between 10 to 12 mm in the upper third, 16 to 18 mm in the middle third, and 20 to 22 mm in the lower third of the ear.
6. At any point between the two ears, the position of the lateral ear border to the head should match within 3 mm of each other.

Nonsurgical Techniques

Due to the possible complications of otoplasty, it is important to keep in mind the nonsurgical option when evaluating the prominent ear of an infant. In recent years, splinting has proven to be an alternative option when the prominent ear is detected early after birth.¹⁰ In these cases, correction within the first 96 hours of birth is the most effective. However, the first few weeks of life may still spare the infant from an operative procedure. This time frame correlates to the speed of hardening of cartilage after birth as maternal estrogens dwindle in the infant's system. These estrogens are highest in the first 3 days of birth and decrease to normal levels by 6 weeks of age.¹⁰ For optimal correction, bone wax is a reliable material which is commonly used to shape and splint the ear. Surgical tape can be used to cover and hold this in place, and should remain in place for ~2 weeks.

Operative Procedures

PREPARATION

Before surgery, attention should first be placed on the most-prominent ear. The less-prominent ear can then be corrected to match the surgical changes made on the first ear; this can be done right before skin closure. General anesthesia is usually recommended for the procedure. For teenagers and adults, local anesthesia with sedation can also be an option. Good exposure of the ear and postauricular area should be achieved before starting the procedure.

An appropriate posterior skin incision with corresponding anterior and posterior skin flaps should provide the surgeon with access to the helical rim, scapha, and mastoid fascia. A crescent-shaped or vertical skin incision can be made 2.5 cm lateral to the sulcus. It has been reported that a simple vertical incision may spare the surgeon from excessive skin contraction, possible obliteration of the posterior sulcus, and decreases the possibility of suture granuloma or bow-stringing over the Mustarde sutures.¹ Once this incision is made, anterior and posterior skin flaps should be raised for ~2 cm on each side.

Cartilage Molding Techniques When possible, cartilage molding should be utilized before cartilage-break-

ing techniques. In cartilage molding, the ear structures are shaped and positioned using sutures only, without the need for cartilage excision. Such techniques have been described by Mustarde and Furnas.^{7,8}

FURNAS TECHNIQUE

The simplest initial attempt in correction should be the conchal bowl to mastoid periosteum suture described by Furnas.⁸ This can be the sole procedure required in patients with an overdeveloped conchal bowl and well-formed antihelical fold. It can also be used in conjunction with other procedures such as Mustarde's when the antihelical fold is underdeveloped. The outcome from this procedure will allow permanent retraction of the auricle as it is sutured posteriorly to the mastoid fascia. Once the desired areas are marked, three to four mattress knots using 4-0 nonabsorbable sutures can be placed to set the conchal bowl as far back to the mastoid. It is important to include both the anterior and posterior perichondrium on the conchal sutures, without penetration through the anterior auricular skin (Fig. 3). On the mastoid side, care should be taken to obtain complete bites of the mastoid fascia to minimize the sutures from pulling through and thus reversing the conchomastoid setback. The more-posterior placement of mastoid sutures will also prevent narrowing of the external auditory canal. This complication has been described in the literature and is attributed to anterior placement of mastoid sutures, which leads to forward buckling of the conchal bowl at the os of the external canal.¹¹

MUSTARDE TECHNIQUE

One of the most popular approaches to correcting the prominent ear is the Mustarde technique. The advan-

tages of using sutures alone, permanent creation of a normal-appearing antihelical fold, and the simplicity of the procedure make this a well-sought technique. The procedure is limited in that it only corrects the prominence of the upper third of the auricle. For this approach, mattress sutures are placed along the full thickness of the posterior cartilage all the way through anterior perichondrium and just below the anterior skin (Fig. 4). Before the procedure, it is recommended to plan the desired location of each mattress suture along the anterior helical fold. Three to four 4-0 nylon sutures placed ~4 to 6 mm apart can be used with methylene blue as well to facilitate this (Fig. 5). Once the desired locations have been marked, mattress sutures can be placed and antihelical folding can be achieved quite easily. Some problems faced with the Mustarde technique are incorrect placement of sutures leading to the exposure of sutures by erosion through the postauricular skin. It is also important to remember that the Mustarde technique mainly addresses the superior third of the ear. Simply using the Mustarde technique is not usually sufficient for most otoplasties, and further work is usually required to correct the overdeveloped conchal bowl as well.¹¹

CARTILAGE-BREAKING TECHNIQUES

Cartilage-breaking techniques are usually reserved for the more-experienced surgeon due to their increased complexity. These techniques involve excision of cartilage from the concha. Two of the more familiar techniques in the literature have been described by Converse

Figure 3 Axial view. Furnas conchomastoid horizontal mattress sutures.

Figure 4 Axial view. Mustarde scaphoconchal horizontal mattress sutures to create an antihelical fold.⁷

Figure 5 Posterior view. Marking of antihelical fold with methylene blue and placement of three horizontal mattress sutures.

and Farrior.^{6–10} The converse technique involves excising an island of cartilage that sets anterior to the rest of the conchal cartilage. This island is tubed and creates the antihelical fold. This technique is useful for the more-severe prominent ear deformities. This surgery may also benefit adults with tougher cartilage, and provide more permanent retraction of the auricle and correction of the antihelix. The Farrior technique is also challenging, and involves partial thickness incisions along the conchal rim cartilage. This is followed by removal of longitudinal wedges at the levels of the superior crus and the future antihelical fold.¹¹ In comparison to the Converse technique, the Farrior method produces a more-gentle bend to the antihelix.

POSTOPERATIVE MANAGEMENT AND COMPLICATIONS

After the procedure, care must be taken to prevent any further trauma to the corrected ear and to maintain positioning and correct healing. Cotton should be placed to maintain the contours of the auricle. Mastoid dressing is usually recommended for one week after the procedure. This can be switched to an elastic headband for 1 to 4 weeks after the procedure.

Some complications can be avoided even before surgery. It is essential to ascertain whether the patient has a history or a family history of bleeding, keloid formation, and poor wound healing. Up to 10% of otoplasties can result in complications.¹² This may often not be related to technique. Early complications include hematoma (1 to 3% incidence) and can be treated with

drainage and hemostasis. One of the first signs of this is severe pain. If not corrected in time, it can lead to infection, cartilage necrosis, and auricular deformity. Infection is usually a rare complication, and commonly involves *Staphylococcus*, *Streptococcus*, or *Pseudomonas* species. Treatment involves drainage, cultures, and antibiotics. Failure to treat this may lead to chondritis and cartilage necrosis.

Late complications can result from incorrect suture placement during surgery. This leads to suture extrusion or granuloma formation. Mersilene sutures usually have an 8% incidence of granuloma formation.¹² Treatment usually involves removal of sutures. Keloid formation is also a late complication not necessarily related to technique. Predisposing factors include dark skin, family history, and excessive tension on the skin incision. Treatment for this includes steroid injection, excision of the keloid, and radiation in rare cases.

By far, the most common complaint is the recurrence of the auricular deformity. Care must be taken before and during the procedure to choose the most-suited method of correction for each patient. Also, further care should be taken in technique as described above. The patient should also be aware well in advance of the procedure of the expected outcomes and limitations of otoplasty.

CONCLUSION

Choosing surgery to correct the prominent ear can prove to be more complicated than it looks. Even in the hands of the more-experienced surgeon, delicate discussion, preoperative planning, and intraoperative decision making all play a role in the outcome witnessed by the patient. It is important to take into account the realistic expectations of the patient, and the fact that even the surgeon may find the results not completely satisfying. With this in mind, otoplasty for the prominent ear can offer the patient and the family some significant aesthetic and psychological relief. Here we have described only a handful of techniques that may benefit the patient with prominent ears. Keeping these and other techniques in mind will allow the surgeon to utilize the arsenal of corrective measures best fitted for each individual patient.

REFERENCES

1. Janz BA, Cole P, Hollier LH Jr, Stal S. Treatment of prominent and constricted ear anomalies. *Plast Reconstr Surg* 2009;124(1, Suppl):27e–37e
2. Papell ID. *Facial Plastic and Reconstructive Surgery*. New York: Thieme; 2009
3. Dieffenbach JF. *Die Operative Chirurgie*. Leipzig: F. A. Broekhaus; 1845
4. Brenda E, Marques A, Pereira MD, Zantut PE. Otoplasty and its origins for the correction of prominent ears. *J Craniomaxillofac Surg* 1995;23(2):99–104

5. Luckett WH. A new operation for prominent ears based on the anatomy of the deformity. *Surg Gynecol Obstet* 1910;10: 635–637
6. Becker OJ. Correction of the protruding deformed ear. *Br J Plast Surg* 1952;5(3):187–196
7. Mustarde JC. The correction of prominent ears using simple mattress sutures. *Br J Plast Surg* 1963;16:170–178
8. Furnas DW. Correction of prominent ears by conchamastoid sutures. *Plast Reconstr Surg* 1968;42(3):189–193
9. McDowell AJ. Goals in otoplasty for protruding ears. *Plast Reconstr Surg* 1968;41(1):17–27
10. Gault D. Commentary on: Complications of otoplasty: a literature review. *JPRAS* 2009;62(1):19–27. *J Plast Reconstr Aesthet Surg* 2010;63(2):e235–e237
11. Aguilar EA. Congenital auricular malformation. In: Bailey BJ, ed. *Otolaryngology Head and Neck Surgery*. Lippincott Williams and Wilkins; 2006:2685–2691
12. Limandjaja GC, Breugem CC, Mink van der Molen AB, Kon M. Complications of otoplasty: a literature review. *J Plast Reconstr Aesthet Surg* 2009;62(1):19–27