

SPECIAL TOPIC

Cosmetic Otoplasty

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Introduction: *Protruding ears are a common occurrence and can affect the aesthetics and psychosocial aspects of patients. Hundreds of procedures have been described over the years, but many do not adequately address the specific problem and can prove unstable.*

Materials and Methods: *The author presents a literature review and discusses the demographics, anatomy, and diagnoses related to common protruding ear deformities and describes 2 surgical procedures that have been used to treat more than 100 cases of protruding ears over a 10-year period.*

Results: *The Davis procedure for conchal bowl excess and the Mustardé procedure for reconstructing the antihelical fold, which are most often performed in conjunction, have been used to successfully treat protruding ears.*

Conclusions: *Although numerous procedures exist for the treatment of protruding ears, some do not adequately address the actual anatomic problem at hand. Some surgeons advocate procedures designed to create an antihelix to treat cartilage excess, which can prove unstable. The Davis and Mustardé procedures address the actual anatomic problems and have proven predictable, safe, effective, and stable in the author's cosmetic facial surgery practice.*

Very few cosmetic surgery procedures carry the diversity of thought, diagnosis, and treatment options as does otoplasty. If you do an Internet search on the word "otoplasty," there are as many as 816 000 results. Search the same term in PubMed and there are more than 340 results. There is also an emotional component when surgeons get territorial or argumentative about the "right" way to do the procedure. This procedure is also unique in that for many cosmetic surgeons this is the only procedure they perform on children.

History

Although surgeons were probably operating on protruding ears many years in advance of scientific documentation, a search of PubMed shows that publications about such procedures is relatively recent compared to that for other cosmetic procedures. Numerous seminal articles have been written about this procedure over the past century¹⁻¹² and many articles have been written to refine or define existing procedures.¹³⁻²⁰

Anatomy and Development

The external ear appears only in mammals and functions to direct vibrations to the middle and inner ear. Some of the structures, such as the external auricular muscles, remain vestigial in humans but are active in many other animals, such as dogs, cats, and deer. The anatomy of a clinically normal ear is shown in Figure 1.

The long axis of the ear is approximately 20 degrees from vertical. The average length of the auricle is 63.5 mm in males and 59 mm in females, and the average width is 35.5 mm in males and 32.5 mm in females. The helix should project 2 to 5 mm more laterally than the antihelix on frontal view (Figure 2).

A very important measurement estimate to keep in mind is the distance that the auricle sits from the cranium. This will become paramount when diagnosing, planning, and performing corrective otoplasty. Although it varies from patient to patient, the distance from the outside of the superior helical rim to the temporal skin is about 15 mm, and the distance from the lateral surface of the posterior helical rim to the mastoid skin is about 20 mm (Figure 3).

When the ear is viewed from above, the angulations are a result of a 90° conchomastoid angle and a 90° conchocephalic angle (Figure 4, left image). With protruding ear deformities, the conchomastoid angle may remain at 90° and the conchoscaphalic angle will become obtuse, between 140° and 150° (Figure 4, right image). The auriculocephalic angle measures

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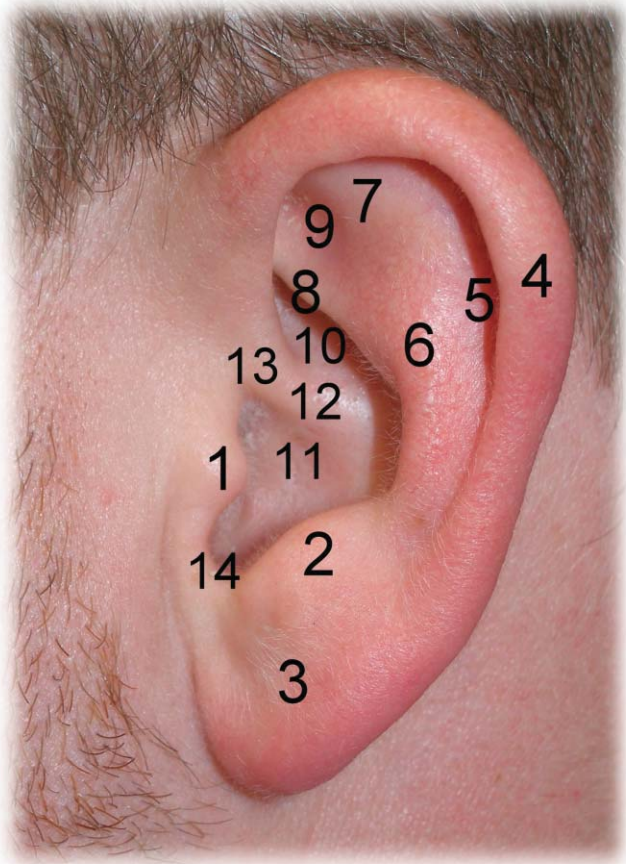


Figure 1. Anatomy of the ear. 1 = tragus, 2 = antitragus, 3 = lobe, 4 = helix, 5 = scapha, 6 = antihelix, 7 = superior crus, 8 = anterior crus, 9 = fossa triangularis, 10 = cymba concha, 11 = cavum concha, 12 = helical eadix, 13 = helical crus, 14 = intertragal incisure. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

how far the pinna sits away from the posterior cranium and should be less than 35°.

Ear Growth and Developmental Abnormalities

Ear growth deformities are estimated to occur in 1 in 12500 births¹³ or 5% of the population.²¹ The ear grows proportionally; 85% of ear development is complete by age 3,^{22,23} and the ear is fully developed at 7 to 8 years of age.^{24,25} Matsuo and colleagues²¹ also observed that the percentage of protruding ears increases from 0.4 percent at birth to 5.5 percent at 1 year of age and concluded that most protruding ears are acquired deformities. Ear width reaches its mature size in boys at 7 years and in girls at 6 years. Ear length matures in boys at 13 years and in girls at 12.25 years. The older the person becomes, the stiffer and more calcified the cartilage. This progression affect the techniques that may be used.^{22,23} Heredity

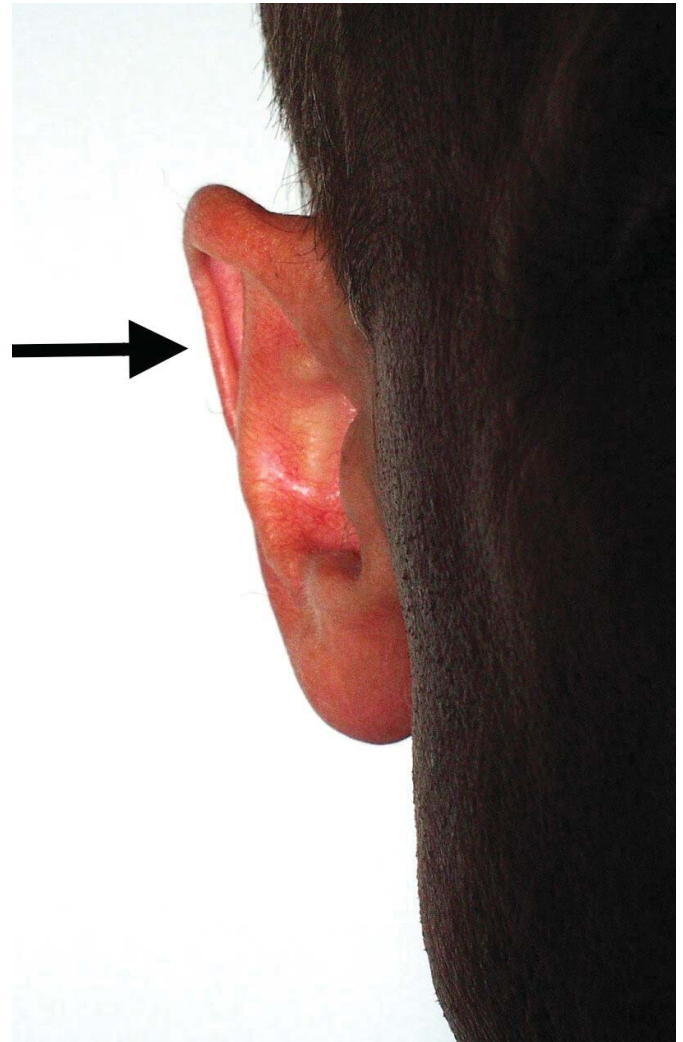


Figure 2. In a clinically normal ear, the antihelix protrudes several millimeters past the antihelix and superior crus. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

plays an obvious part in the birth and development of protruding ears and is an autosomal dominant trait.¹⁶

Lack of Antihelical Fold

The antihelix consists of the superior and anterior crus and forms a curvilinear separation between the conchal bowl and the scaphoid fossa. The region between the crus is the fossa triangularis. In developmental ear deformities, the antihelical fold is often ill defined or absent (Figure 5). This deformity can be bilateral or unilateral.

Conchal Wall or Bowl Hypertrophy

Conchal bowl excess is a common type of ear deformity leading to a protrusive ear. In this deformity,

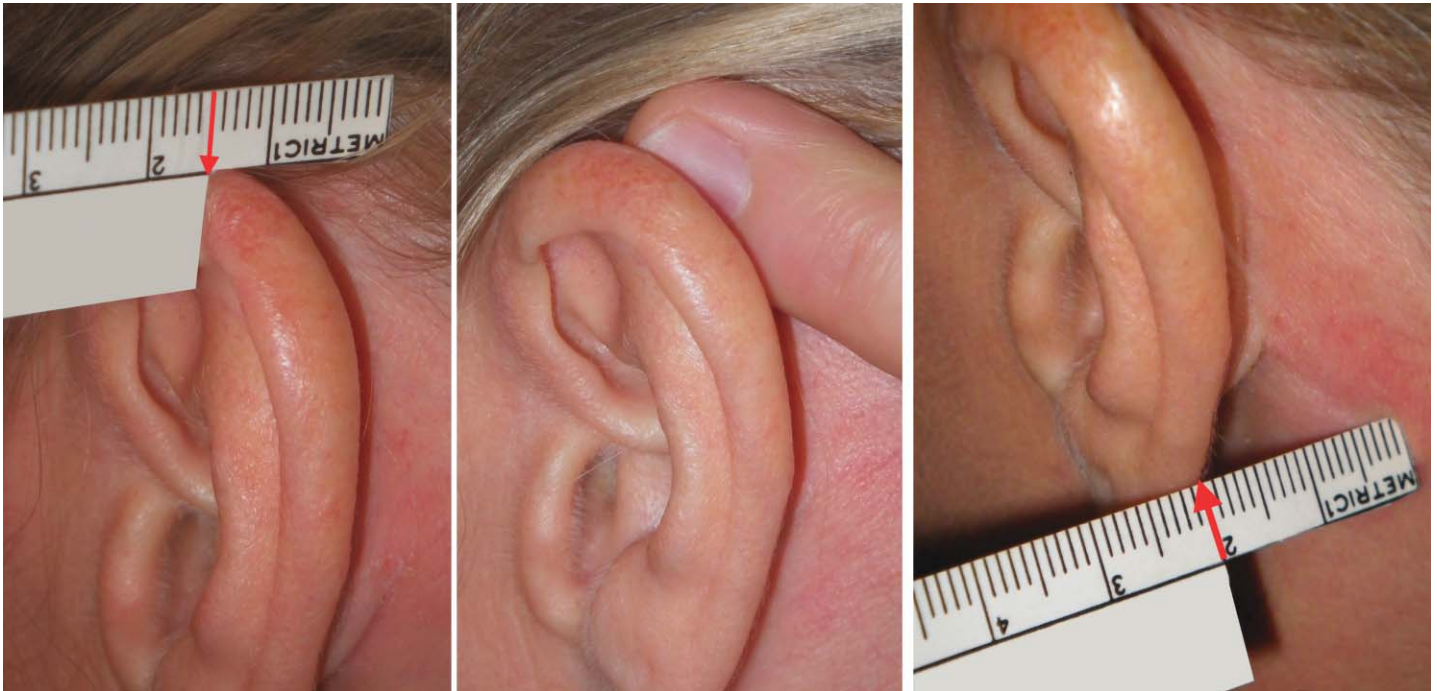


Figure 3. (left image) Average ear measurements include about 15 mm from the temporal skin to the lateral skin surface of the superior pinna. (middle image) The normal ear sits about depth of a sideways adult little finger width. (right image) The lower portion of the pinna sits about 20 mm from the mastoid skin to the lateral skin surface. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

there is excessive growth of the posterior wall of the concha and the chondroplasia can include the entire conchal bowl (Figure 6).

Combination Deformities

In my experience, it is unusual to have a pure antihelical or conchal deformity but rather a combination of the two (Figure 7). Of the surgical corrections I

have performed, 98% included both abnormalities and are treated with separate procedures to address each deformity specifically.

Cosmetic Otoplasty Procedural Timing

One of the most perplexing factors concerning otoplasty is determining the age at which to operate. Although protruding ears are a benign condition,

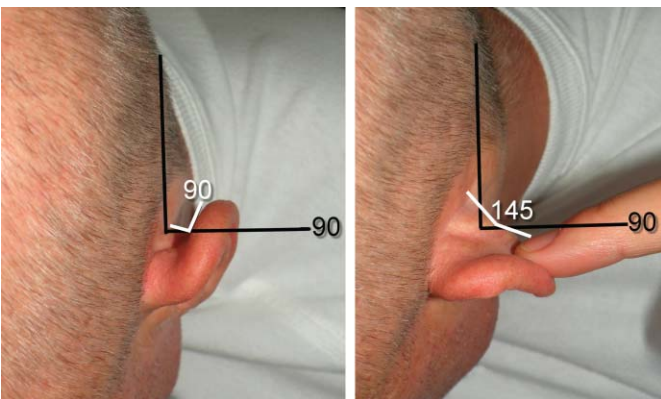


Figure 4. The axial view of the normal ear exhibits a conchomastoid angle of 90° with a conchoscaphalic angle of 90°. Protruding ears can result in conchomastoid angles of 140–150°. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

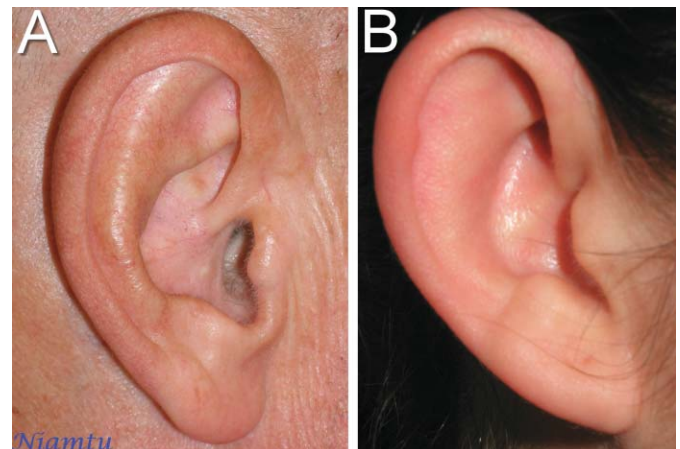


Figure 5. (A) A normal antihelical fold. (B) An ill-defined antihelical fold. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

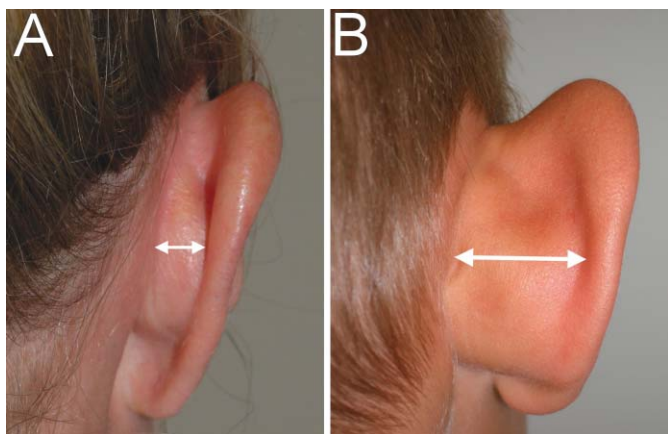


Figure 6. (A) A clinically normal conchal anatomy. (B) A patient with significant conchal wall hypertrophy.

emotional trauma and behavioral problems, lack of self esteem, and a permanent negative body image can be seen with children with protruding ears. These problems constitute the prime motivation for performing this surgery early because of peer ridicule in grade school.²⁶⁻²⁸ Considering the psychological trauma, correcting the deformity before the child starts school is advantageous because 85% of ear development is completed by age 3, and the ear is fully developed at 7 to 8 years of age. I believe there is agreement among most otoplasty surgeons that it is safe and preferable to perform interventional otoplasty on 5- to 7-year-old children before they start school. I have performed this procedure safely and effectively on 4-year-old patients, and others have reported performing the procedure on patients as young as 9 months.²⁸

Surgical Options

As with any surgery, the surgeon must have a distinct set of goals in mind for appropriate surgical outcome. In a 1968 article, McDowell²⁹ outlined the classic goals of otoplasty. They include:

- All upper-third ear protrusion must be corrected.
- The helix of both ears should be seen beyond the antihelix from the front view.
- The helix should have a smooth and regular line throughout.
- The postauricular sulcus should not be markedly decreased or distorted.
- The helix to mastoid distance should fall in the normal range of 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.

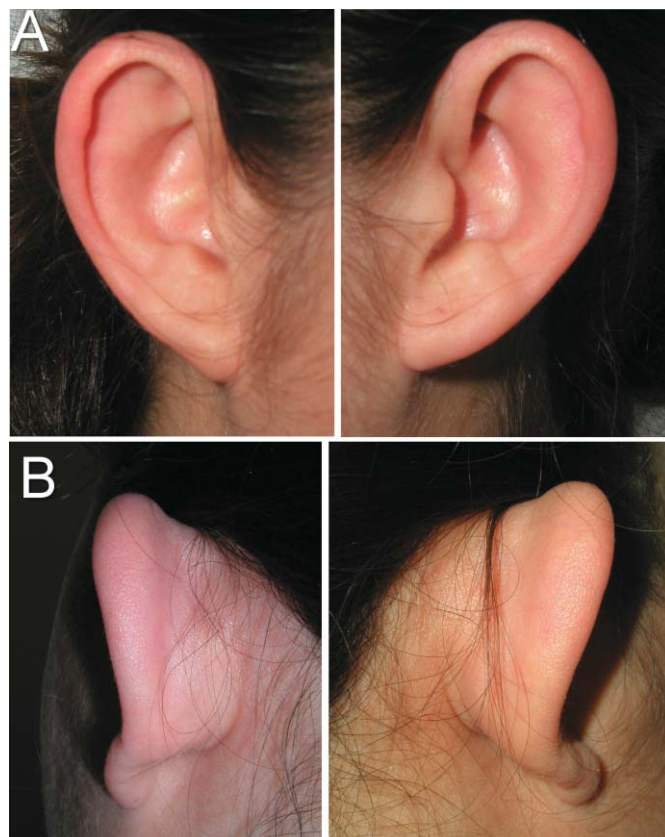


Figure 7. This patient shows both common deformities: (A) lack of a defined antihelical fold and (B) posterior conchal wall excess. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

- The position of the lateral ear border to the head should match within 3 mm at any point between the 2 ears.

The Davis Procedure (Hypertrophic Conchal Bowl Reduction)

It is impossible for a single article to cover all the available methods of protruding ear correction. This article presents the 2 techniques that can be applied to most common ear deformities and that have produced stable and predictable results for many surgeons, including myself. I have experimented with various procedures, such as conchal setback and cartilage splitting, but have not found them to be stable and lasting. Using the Davis and Mustardé techniques in conjunction,¹³ on the other hand, has provided predictable and lasting results.

Otoplasty surgery involves a lot of personal preference. I believe attempting to correct a hypertrophic conchal bowl by merely setting it back with sutures is a mistake as the elastic memory of the cartilage will

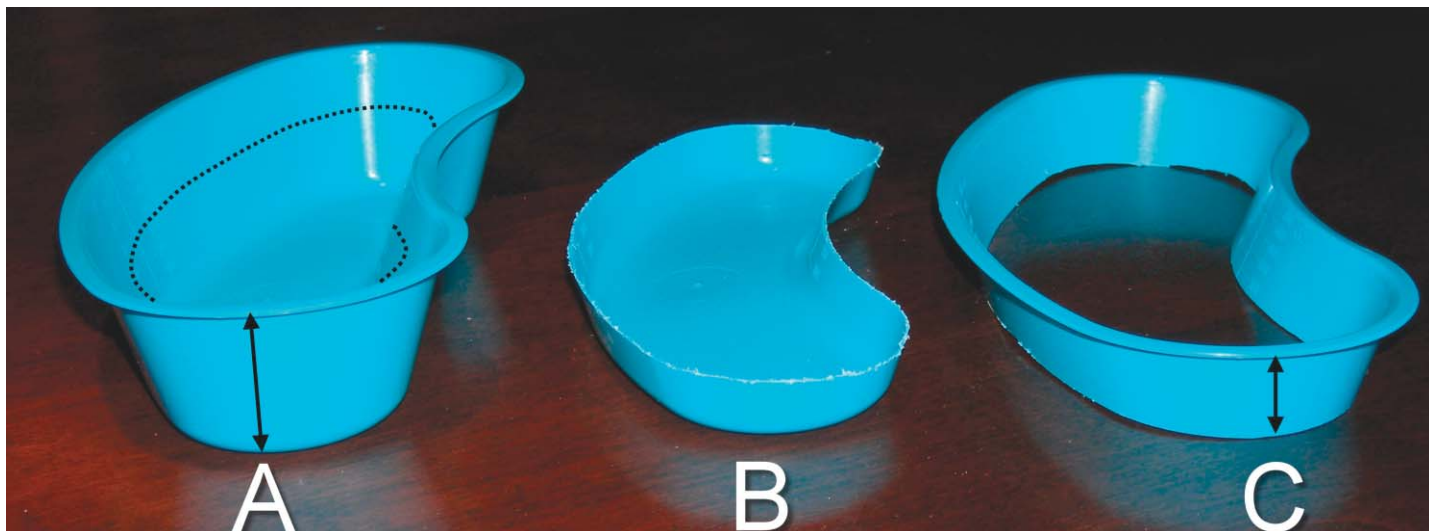


Figure 8. (A) An analogy to removing height from the posterior conchal wall and bowl. (B) The kidney bean-shaped excess excised cartilage. (C) The emesis basin posterior conchal wall and bowl is reduced, thus lowering the height of the basin or protrusion of the ear. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

frequently trump conchal setback sutures and relapse. In situations where the main deformity is conchal excess, it does not make sense to employ a technique designed to create an antihelical fold. Pinning the conchal cartilage to the mastoid fascia with sutures (Furnas procedure) has not proven stable for many surgeons and presents other aesthetic problems, such as constriction of the external auditory canal.

The procedure I prefer for conchal bowl excess was described by Davis^{10,12} and involves removing the excess conchal cartilage to reduce the hyperplastic

posterior wall of the conchal bowl and reduce the bowl itself.

For novice surgeons, the Davis procedure (and the Mustardé procedure) are difficult to conceptualize without actually witnessing the procedure several

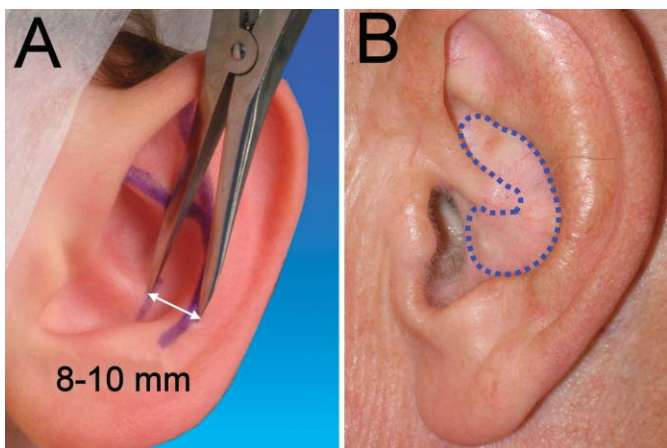


Figure 9. (A) The 8–10 mm marking is made on the posterior conchal wall, and the remainder of the conchal bowl is traced for excision. The tracing includes the entire conchal floor and nears the external auditory canal. (B) A sharp arrowhead is made at the helical radix. All cartilage within the dotted lines will be excised from the other side of the ear.



Figure 10. A skin ellipse is removed from the posterior auricular region. Only enough skin is removed to accommodate the excess from setback. Removing too much skin will produce tension and can scar.

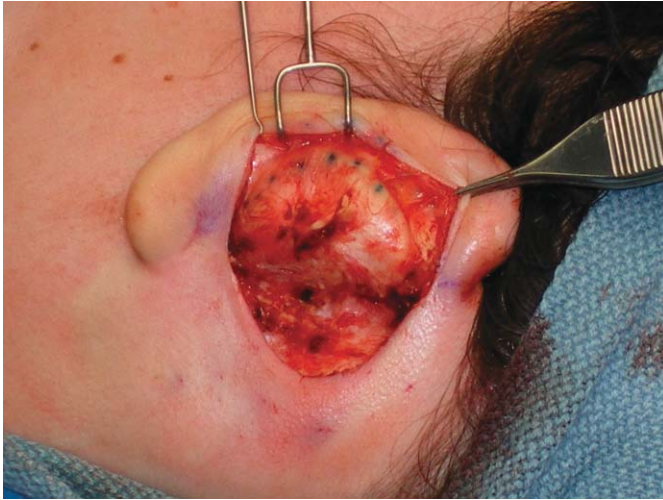


Figure 11. Dissection to the posterior conchal perichondrium and the postauricular excision of all soft tissues to the level of the mastoid fascia.

times. In the Davis procedure, the hypertrophic cartilage of the posterior conchal wall and bowl are excised. It is this excess cartilage that makes the ear protrude, and by resecting the excess, the posterior conchal wall and bowl are reduced, thus allowing the ear to lie in a more normal position. An example of this is shown in Figure 8, using an emesis basin as an example. The kidney bean-shaped emesis basin with its high posterior wall is analogous to the hypertrophic posterior conchal wall. Figure 8 shows the hypertrophic emesis basin “conchal wall and bowl” and its reduction after removing the kidney bean-shaped floor of the basin.

As with many cosmetic procedures, proper marking is integral to success. This procedure is begun by determining the amount of conchal bowl excess to be removed. Generally, this is determined by leaving 8–10 mm of the existing conchal wall intact and removing all remaining conchal wall and bowl cartilage.

The 8–10 mm is a guide and should be adjusted commensurate to the excess. A good guide for novice surgeons is to err on the conservative side (that is, leave 10–12 mm or conchal bowl height). The most common mistake in otoplasty is overcorrection. Index marks are made 8–10 mm inferior to the conchal/scaphal junction, which will be the posterior portion of the conchal wall that remains (Figure 9). By leaving approximately 8–10 mm, the ear will set back to a more normal position in the average person. This marking will include the entire hypertrophic conchal bowl and will result in an excision shaped like a cashew nut or a kidney bean (Figure 9B). The kidney bean shape is marked with a surgical marker. It is imperative to make all markings before injecting local anesthesia as the injections will distort the landmarks and surgical markings.

Although otoplasty can be performed with local anesthesia, intravenous sedation is a more popular option. The surgical field is prepped and draped in the usual manner, and a cotton pledget is placed to prevent blood from entering the ear canal. Local anesthetic is injected subcutaneously in numerous areas for anesthesia, for hemostasis, and to hydrodissect overlying skin. The entire conchal bowl is injected, as is the antihelix (if a Mustardé procedure is simultaneously planned). The entire posterior auricular area is also infiltrated, as is the mastoid region. It is paramount to inject the multiple tissue planes behind the ear to the periosteal level when performing the Davis procedure as significant dissection is required to the level of the mastoid fascia.

The postauricular incision is made as a simple ellipse in the area that would best hide the scar (Figure 10). Aggressive skin removal is not necessary as excess skin removal does not keep the ear posteriorly positioned and can produce tension and scarring.

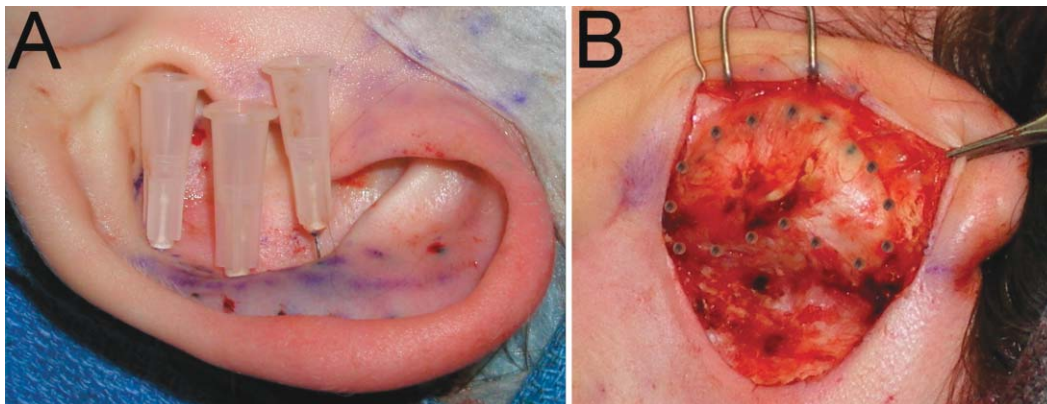


Figure 12. (A) The needle tattooing of the kidney bean-shaped excision. (B) Markings on the posterior conchal region.

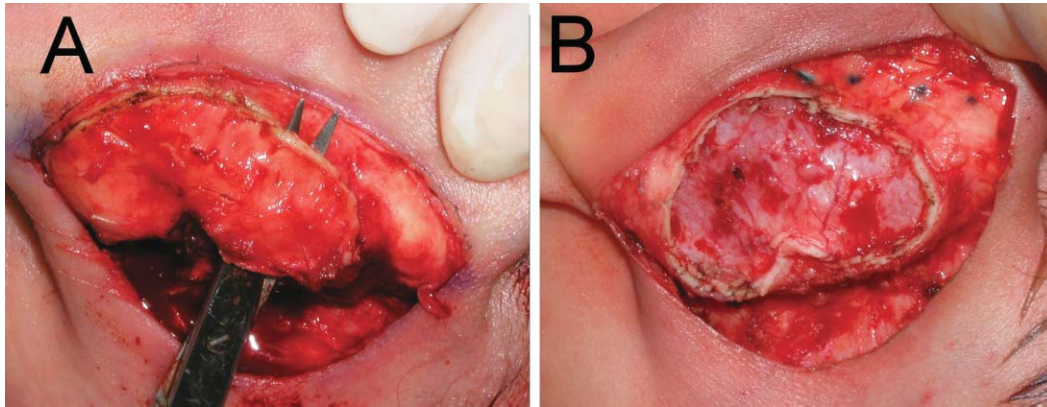


Figure 13. (A) The kidney bean-shaped excess conchal floor is removed with careful undermining. (B) This leaves the dermal surface of the conchal bowl skin intact.

The first step in the Davis procedure is to dissect immediately to the perichondrium of the posterior conchal wall. The second step is to remove all soft tissues in the immediate postauricular region to the level of the mastoid fascia. This includes the vestigial posterior auricular muscles. Tissue removal makes room for the ear to set back and forms the new conchal bowl floor (Figure 11). It is important to have

a smooth surface of the exposed mastoid fascia as it will serve as the new floor of the conchal bowl.

After the posterior soft tissue dissection is completed, methylene blue marking tattoos are made with a needle to outline the region of the conchal bowl floor to be excised. This is done by using the original kidney bean-shaped marking, which leaves a posterior conchal bowl height of 8–10 mm, as shown in Figure 9B.

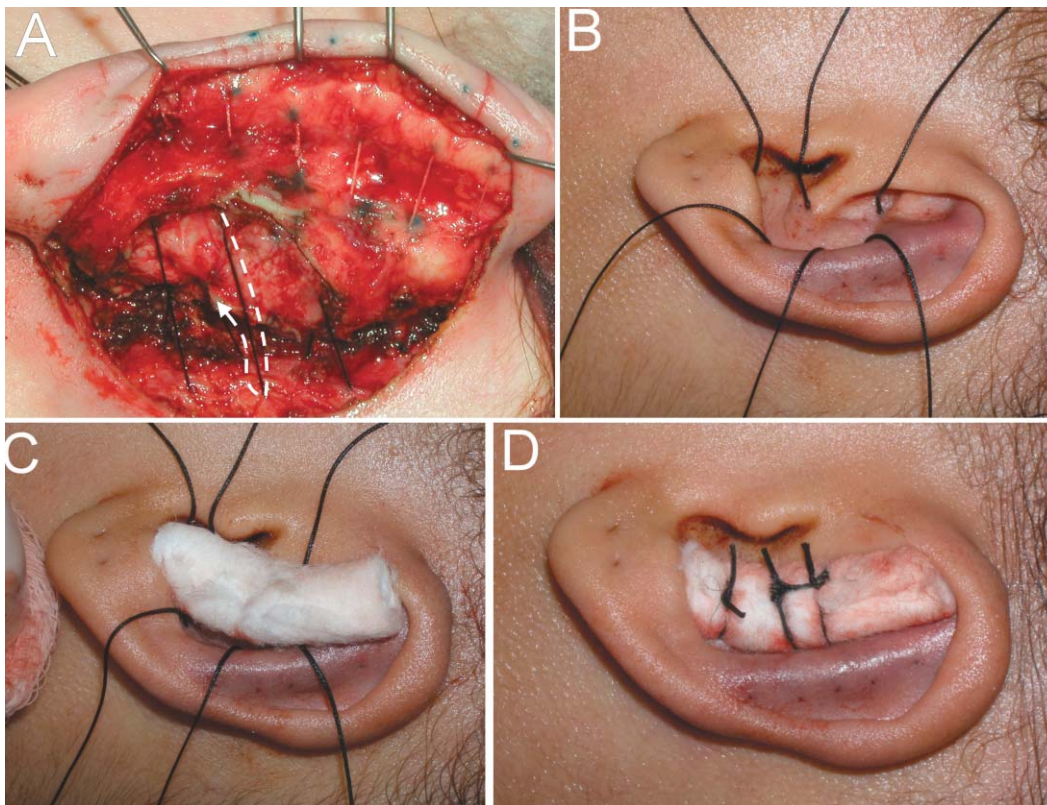


Figure 14. (A) The bolster sutures are placed through the conchal skin, secured to the mastoid fascia, and then returned back through the skin. (B) The sutures in place. (C) The cotton roll bolster in place. (D) The tied bolster sutures at termination.

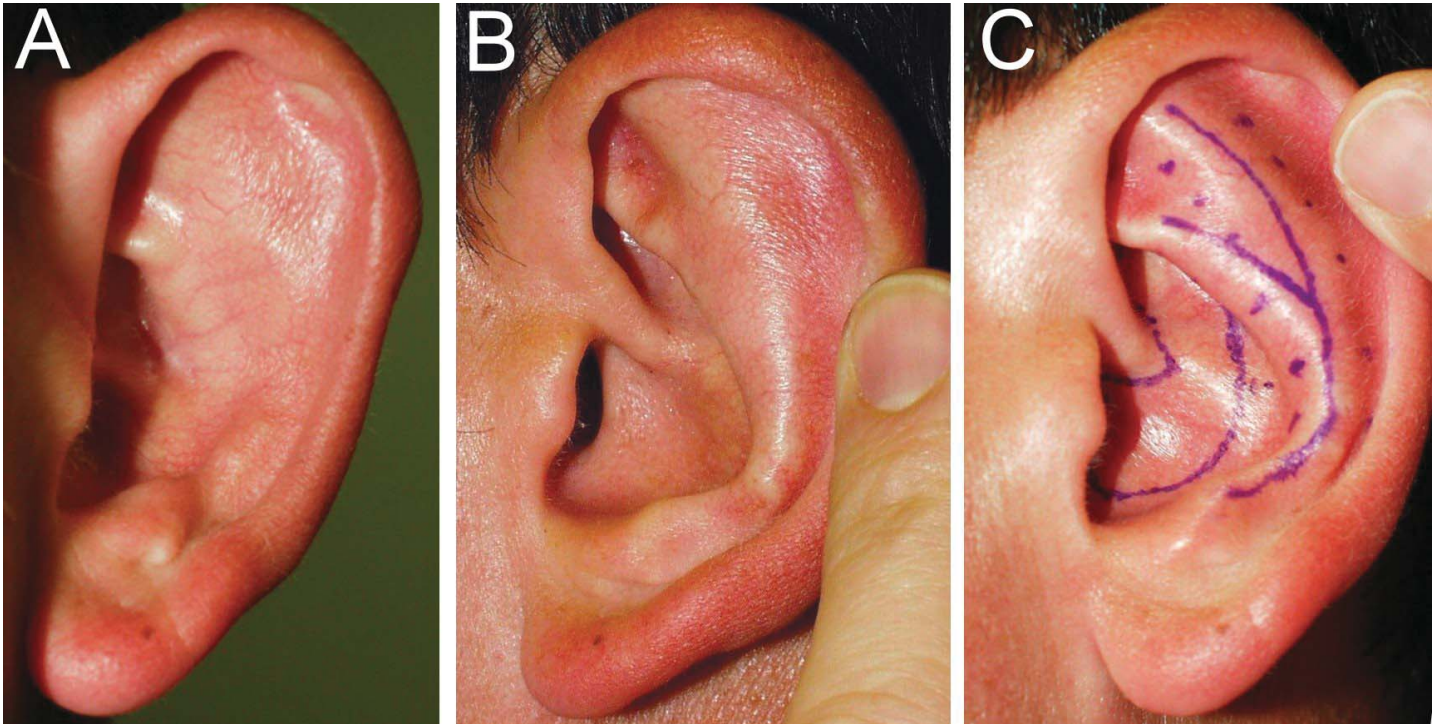


Figure 15. (A) A protruding ear lacking the antihelical fold. (B) The aberrant ear pressed toward the skull to recreate the antihelical fold. (C) The antihelical fold is then marked with prospective Mustardé suture points. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

Figure 12 shows the needle marking technique to identify the excess cartilage to be excised.

The kidney bean-shaped outline of conchal floor is then incised with a scalpel or radiowave microneedle and then dissected from the anterior skin with scissors (Figure 13). Finally, the excess cartilage is removed leaving the anterior auricular skin (Figure 13B).

Although 8–10 mm has been discussed as the average conchal bowl excision, each case is different, and it is

better to err on the conservative side and leave more cartilage intact and to measure the ear position at the superior, middle, and inferior regions. The average distances are 10–12 mm at the superior helix, 16–18 mm at the mid-ear, and 20–22 mm at the inferior portion of the ear. Overcorrection is a common novice mistake. When the ear is placed in the posterior position (after bowl reduction), it should lie passively, and any cartilage that forms a high spot on the excision margin should be reduced so as much surface area of the posterior conchal wall as possible remains in contact with the mastoid fascia.

For patients who only have cartilage excess but have a clinically normal antihelical fold, the Davis procedure is now complete and the final cotton-roll fixation is performed. If the patient requires definition of the antihelix or further set back of the pinna, then a concomitant Mustardé procedure is performed.

The final step in the Davis procedure is to use 3-0 silk place bolster sutures to secure a cotton roll in the revised conchal bowl. The sutures are placed through the skin, securing the mastoid fascia and then are inserted back through the skin again (Figure 14). The bolster serves to eliminate dead space, prevent hematoma, and keep the ear in the desired position during the initial healing. After the bolster sutures are placed,

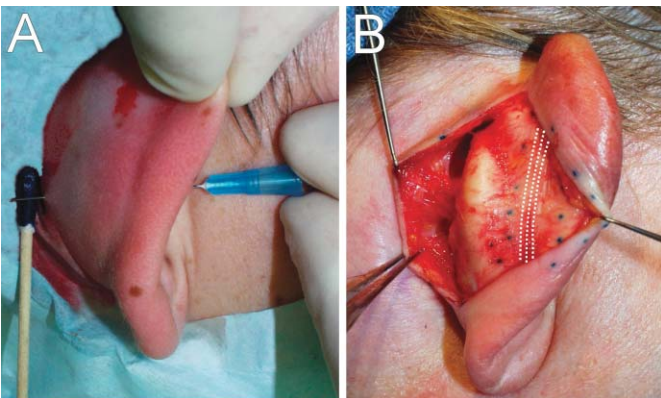


Figure 16. (A) Methylene blue tattooing to create suture placement marks on the posterior pinna (blue dots). (B) The shallow scalpel incision lines (indicated by dotted lines) are made to weaken the cartilage.

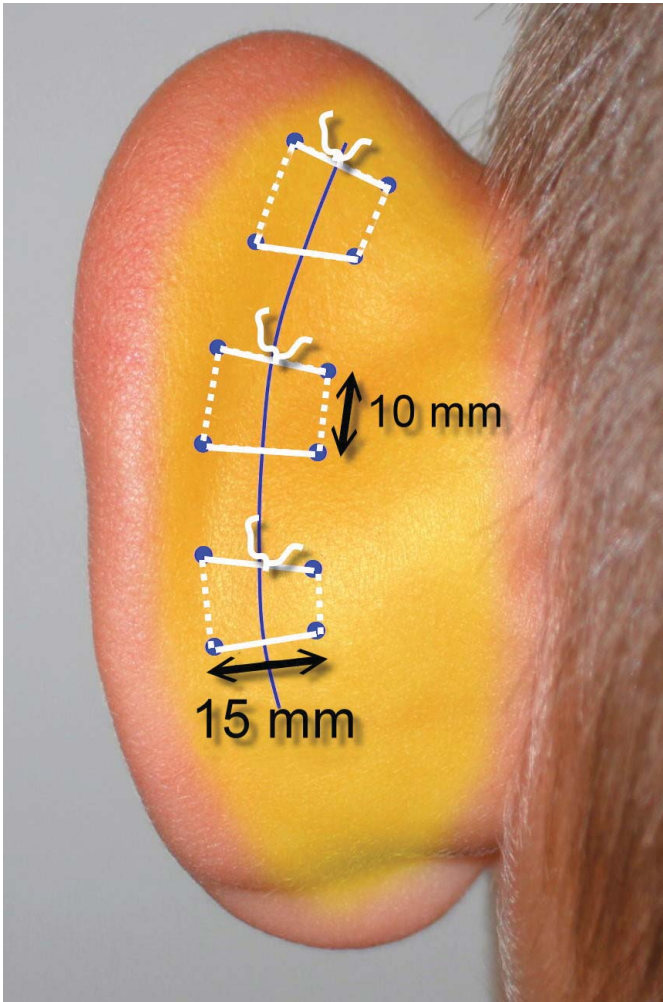


Figure 17. Although complex for the beginner, the Mustardé horizontal mattress suture placement becomes simpler with experience. This image shows a representation of the average suture position to recreate the antihelix and reposition the protruding pinna. (Photo from Niamtu J. *Cosmetic Facial Surgery*. St Louis, Mo: Mosby, 2011.)

a dental cotton roll is saturated with triple antibiotic ointment and tied down gently in the concha. The tip of the cotton roll is placed into the external auditory meatus to prevent stricture. For ease of operation, the posterior auricular incision is closed first (assuming that a Mustardé procedure is not planned), then the bolster sutures are tied (Figure 14C). These sutures are removed 1–2 weeks after surgery. Several millimeters of the inferior portion of the posterior incision is left unsutured for drainage, and a small drain may also be placed overnight.

In lieu of the bolster method, direct sutures can be placed between the posterior conchal wall and the mastoid fascia. Silicone dental impression material

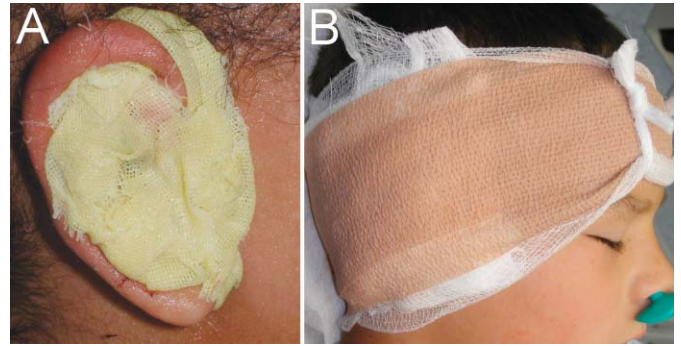


Figure 18. (A) Xeroform gauze dressing in and around the ear and (B) the immediate postoperative dressing, which will stay in place for 24 hours.

can be used to fill the eternal ear and conchal bowl to eliminate dead space.

Mustardé Procedure

The first part of this article described the Davis procedure to set back protruding ears that result from a hypertrophic conchal bowl and posterior conchal wall. If a patient has a protruding ear as a result of cartilage excess but has a normal antihelical anatomy, only the Davis procedure is necessary. If a patient does not have not excess conchal excess with abnormal antihelical anatomy, only a Mustardé procedure may be necessary. If a patient has protrusion resulting from cartilage excess, then attempting to correct this deformity with a procedure designed to create an antihelical fold (that is, the Mustardé procedure) would be inappropriate and could easily relapse. In reality, most patients with protruding ears have a combination deformity of posterior cartilage excess



Figure 19. A 5-year-old girl is shown before and after a Davis and Mustardé otoplasty.

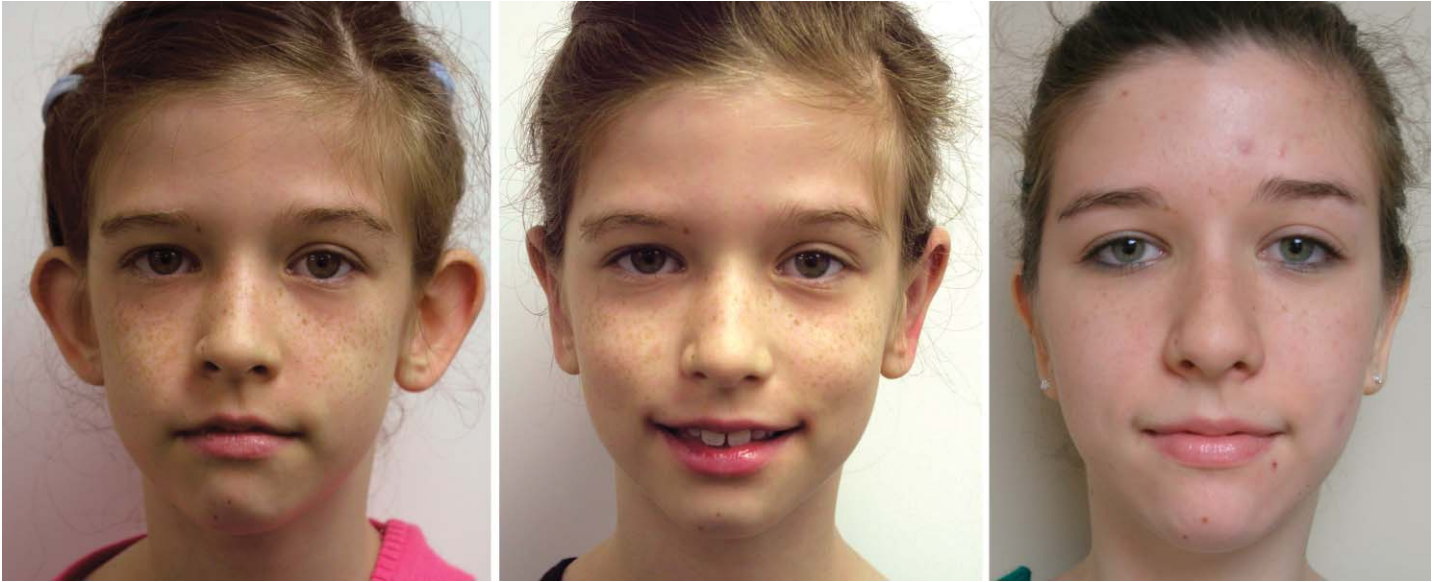


Figure 20. A 7-year-old girl who underwent the Davis and Mustardé procedure is shown 6 weeks and 6 years after the procedure.

and an undefined antihelix. These patients require both procedures.

The Mustardé procedure is begun by marking the antihelix for the precise placement of the horizontal mattress sutures that will reposition the ear and define the helix. The flat pinna with the unfurled antihelix is pressed toward the skull until a prominent antihelical fold is created. At this point the spine of the new antihelix is marked with a vertical line and individual markings are made for at least 3 Mustardé sutures (Figure 15).

If only a Mustardé procedure is being performed, the skin excision and perichondrial dissection are made as described earlier. The same skin ellipse is made, and all the soft tissue is taken off the posterior pinna to the level of the perichondrium within the confines of the ellipse. At this point, methylene blue tattoos are made by placing a 25-gauge needle through the previously marked dots on the lateral skin surface of the ear (Figure 16). Virtually all surgeons use some type of cartilage-weakening method to weaken the depth of the newly created antihelical fold to discourage



Figure 21. An 11-year-old boy is shown before and after a Davis and Mustardé otoplasty.



Figure 22. A 14-year-old boy is shown before and after a Davis and Mustardé otoplasty.

relapse and unfolding. This can be performed by simply creating shallow incisions with a scalpel blade in the depth of the fold (see the white dotted lines in Figure 16). Other scoring techniques include rasps and other cutting instruments that incise the posterior surface. Some techniques score both the anterior and posterior cartilage surfaces. Any incision of this cartilage must be done with care to avoid cartilagenous buckling with distortion of the newly created fold.

Mustardé sutures consist of 4-0 white braided Mersilene suture on a P3 needle (Ethicon, Johnson & Johnson, New Brunswick, NJ). They are placed with a horizontal mattress configuration, and care is made not to include the overlying skin when the sutures are placed through the cartilage. Three sutures are generally placed, and the spacing is approximately 10 mm in the vertical suture throw and 10–15 mm in the horizontal suture throw. The sutures are spaced about 10 mm apart from each other (Figure 17). The crux of this procedure is to properly position the sutures to reposition the various portions of the ear to their



Figure 23. A 23-year-old girl is shown in the posterior view before and after a Davis and Mustardé otoplasty.

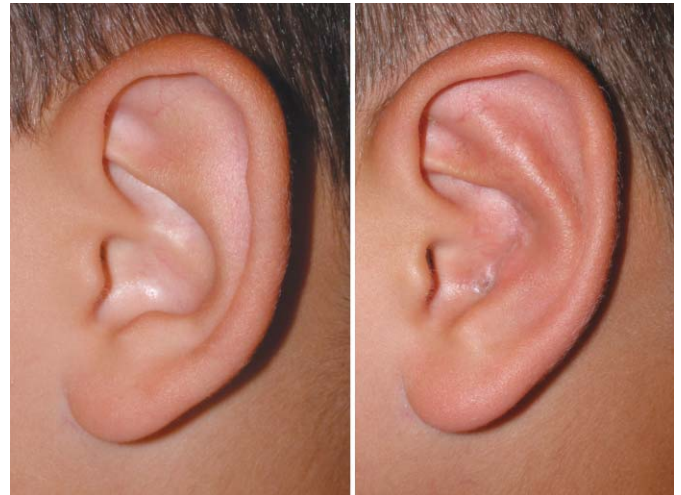


Figure 24. A 10-year-old boy is shown after Mustardé otoplasty to reconstruct the antihelical fold.

normal position and at the same time produce a natural-appearing antihelical fold.

After the ear is inspected for proper position and hemostasis, the incision is closed as detailed earlier. The dressing consists of packing the external pinna with Xeroform gauze (Chesebrough Ponds Inc, Greenwich, Conn) and placing a circumferential gauze wrap around the ear. Gauze fluffs are then used to cover the ear, and a standard mastoid-type dressing is used (Figure 18). The patient is seen the following day for dressing removal and wound inspection. Any collection of blood should be evacuated immediately as hematoma can be very detrimental and deforming. If a Davis procedure is performed, no further dressing is required as the bolster will keep the surgery site stable and the ear in place. If only a Mustardé procedure is performed, a head band or stocking cap is worn 24 hours a day for the first week and during sleep for the second week.

Some cases of ear protrusion may also require earlobe repositioning and the otoplasty surgeon must be adept in these procedures. The description of such is beyond the scope of this article but described in the reference list.³⁰

Figures 19 through 24 show before-and-after images of patients treated with the methods described in this article.

Conclusion

Otoplasty is a unique procedure to aesthetically correct protruding ears. It includes numerous and precise diagnostic and procedural details to obtain predictable and permanent cosmetic results. Although

many permutations of techniques have been described over the past 50 years, I have had superior success with and believe that a combination of the Davis and Mustardé techniques is safe and effective for most patients with protruding ears.

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