SURGICAL TECHNIQUE

Antihelix Plasty Without Modeling Sutures

Hermann Raunig, MD

Many techniques have been described for the surgical correction of protruding ears. A novel modification of a cartilage-sparing otoplastic technique is provided herein. In this modification, a diamond-coated file is used to abrade the anterior surface of the antihelical cartilage to create biomechanical remodeling with resultant formation of a new antihelix. A case series of 302 ears, operated on over a 3½-year period, is presented in support of this technique. This procedure is appropriate for patients having firm or soft auricular cartilage, an underdeveloped antihelical ridge, and a prominent or moderate hypertrophic conchal wall.

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Protuberant ears are not only a problem commonly encountered in the infant or child (**Figure 1**) but also in adults (**Figure 2** and **Figure 3**). Many auricular operations could be avoided if the ear concha of newborns were given more attention.[1] Beyond this window of opportunity, however, surgical correction seems to be the only alternative. A recommendation for permanent flattening of prominent ears to achieve a harmonious facial morphology should be influenced by the patient's perception, the natural range of auricular forms, and the surgeon's knowledge of aesthetics. Although the first surgical methods for the correction of protruding ears were presented in the 19th century,[2] the landmark publications of the scoring technique—described by Weerda[3]—significantly widened the perspectives on auriculoplasty. The article provides a modification of the scoring technique that does not rely on the use of remodeling sutures of skin excision,[4-10] which is usually regarded as the standard technique. This procedure also builds on the significant contributions of Staindl,[4] Ely,[11] Tolhurst,[12] and Nolst Trenité.[13] The principal indication for the use of this particular technique in isolation is hypoplasia or absence of an antihelical ridge in the presence of firm or soft auricular cartilage.

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METHODS

SPECIFIC PHYSIOLOGICAL CONSIDERATIONS

Auricular cartilage consists of highly elastic anterior and posterior layers while intervening cartilage is less elastic. Weakening of the elastic layer on one side can produce a relative imbalance favoring greater tensile stress on the opposing surface. This will result in deformation of the cartilage surface away from the cut side. In ears lacking a developed antihelix, this property can be exploited in efforts to create a new and better-defined antihelix. Initial studies of the scoring technique[3] outlined these elastic properties, while Staindl,[4] Robiony et al,[8] Ely,[11] Tolhurst,[12] Nolst Trenité,[13] A de la Fuente and Santamaria,[14] and Caouette-Laberge et al[15] have provided additional refinements. The elastic properties of rib cartilage were similarly described by Gibson and Davis.[16] In their article, Gibson and Davis delineated the elastic behavior of the layers of rib cartilage used for rhinoplasty. The technique outlined herein has been developed based on the aforementioned reports.

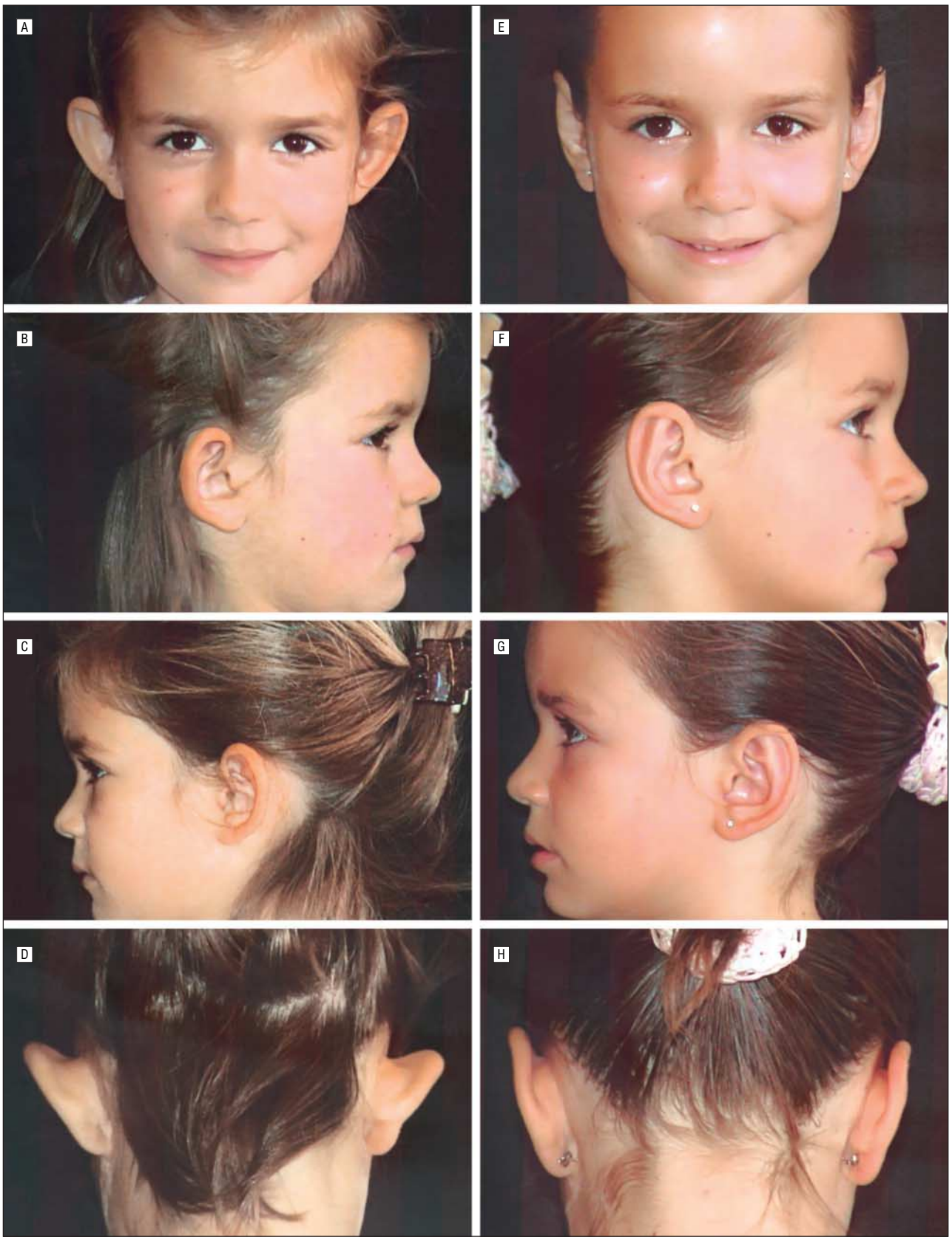


Figure 1. Frontal (A and E), left lateral (B and F), right lateral (C and G), and posterior (D and H) views shown before and 3 years after bilateral antihelix plasty, respectively. Weakening of the cartilage was achieved with the diamond-coated file.

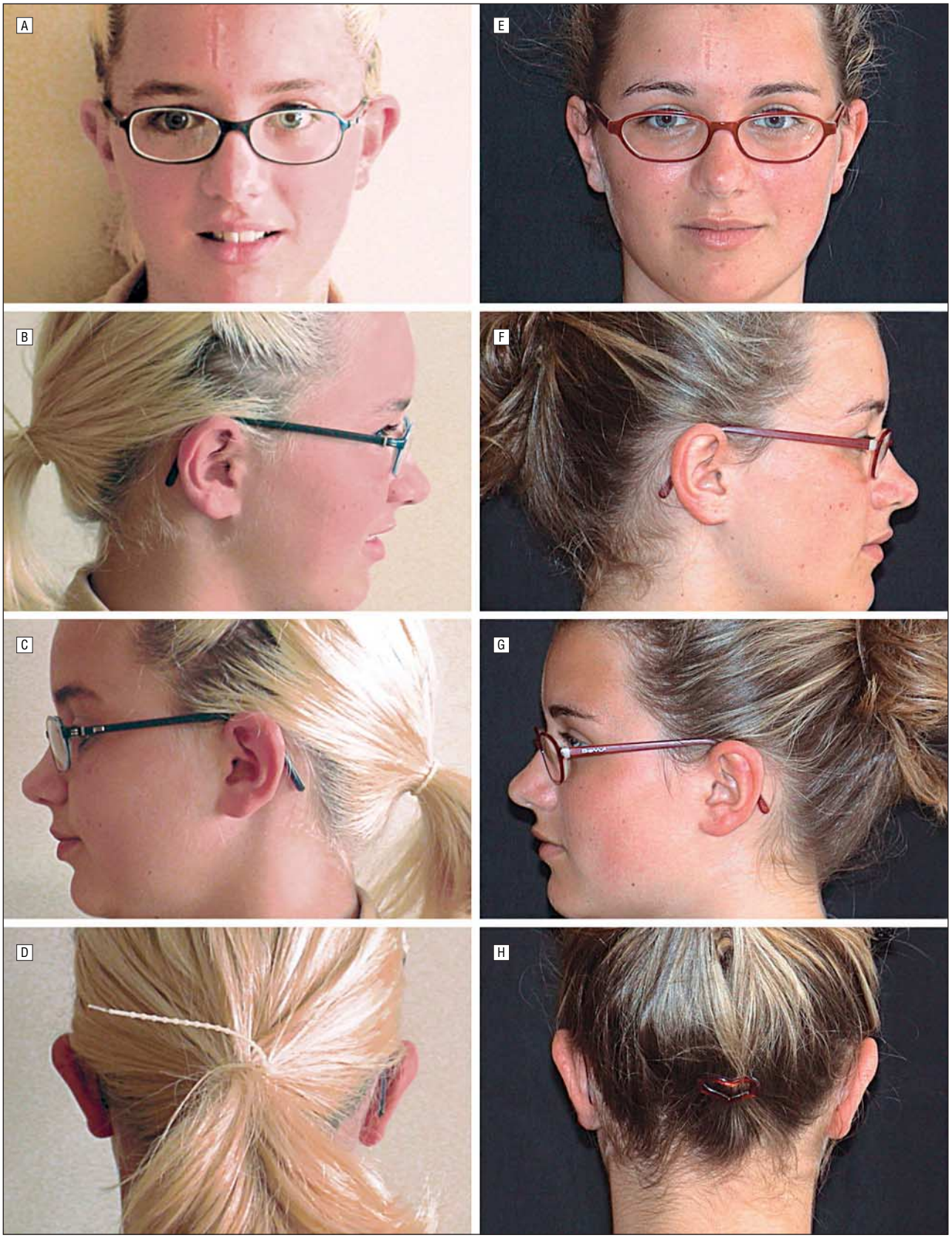


Figure 2. Frontal (A and E), left lateral (B and F), right lateral (C and G), and posterior (D and H) views shown before and 4 years after bilateral antihelix plasty, respectively. Weakening of the cartilage was achieved with a rasp.

Figure 3. Frontal (A and D), right lateral (B and E), and posterior (C and F) views shown before and 3 years after a unilateral right antihelix plasty, respectively. Weakening of the cartilage was achieved with a rasp.

Figure 4. A reference view of the diamond-coated file. Note the flat surface and small size.

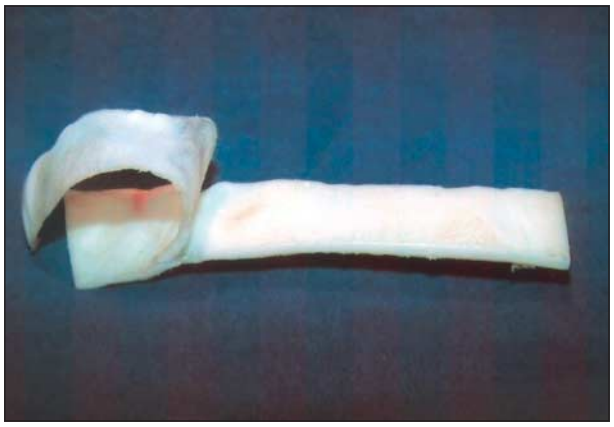


Figure 5. A rectangular piece of porcine ear cartilage used for demonstration of the cartilage thinning obtainable with the diamond-coated file. The peeled-off perichondrium is on the left side.

The concha is modeled only along its anterior aspect in the area of the planned new antihelix. Modeling is accomplished by subperichondrial abrasion using a diamond-coated file to reduce the intracartilaginous tensile forces. According to Weinzweig et al,[17] the contour of the new antihelix, once weakened in its anterior aspect, is fixed by means of a fibrocartilaginous cover on the scored side. While this capsule may be fully developed within 2 to 6 weeks postoperatively, the concha will not yet have achieved its final stability.

SURGICAL INSTRUMENTS

The diamond-coated file (Karl Storz and Stuemer, Tuttlingen, Germany) represents an ideal instrument for the technique described in this article (**Figure 4**). The diamond-coated file alone allows for biomechanical remodeling by means of uniform cartilage thinning through a narrow skin tunnel. I have used a rectangular piece of porcine ear cartilage for demonstration purposes (**Figure 5**). The cartilage was stripped of skin and perichondrium, and it was then modeled by means of a diamond-coated file and scalpel, in a manner analogous to the modeling of the antihelix. Application of a diamond-coated file provides clearly superlative consistency and smoothness compared with scoring or thinning using a scalpel (**Figure 6**). One may observe that filing produces a most aesthetic distortion, and it also provides a balanced and stable curvature toward the opposite side.

SURGICAL TECHNIQUE

Preparation of the ear for surgery begins with taping of the hairline in the periauricular region, followed by dis-

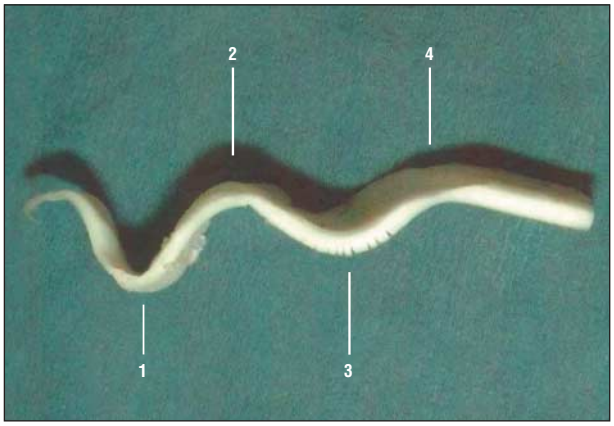
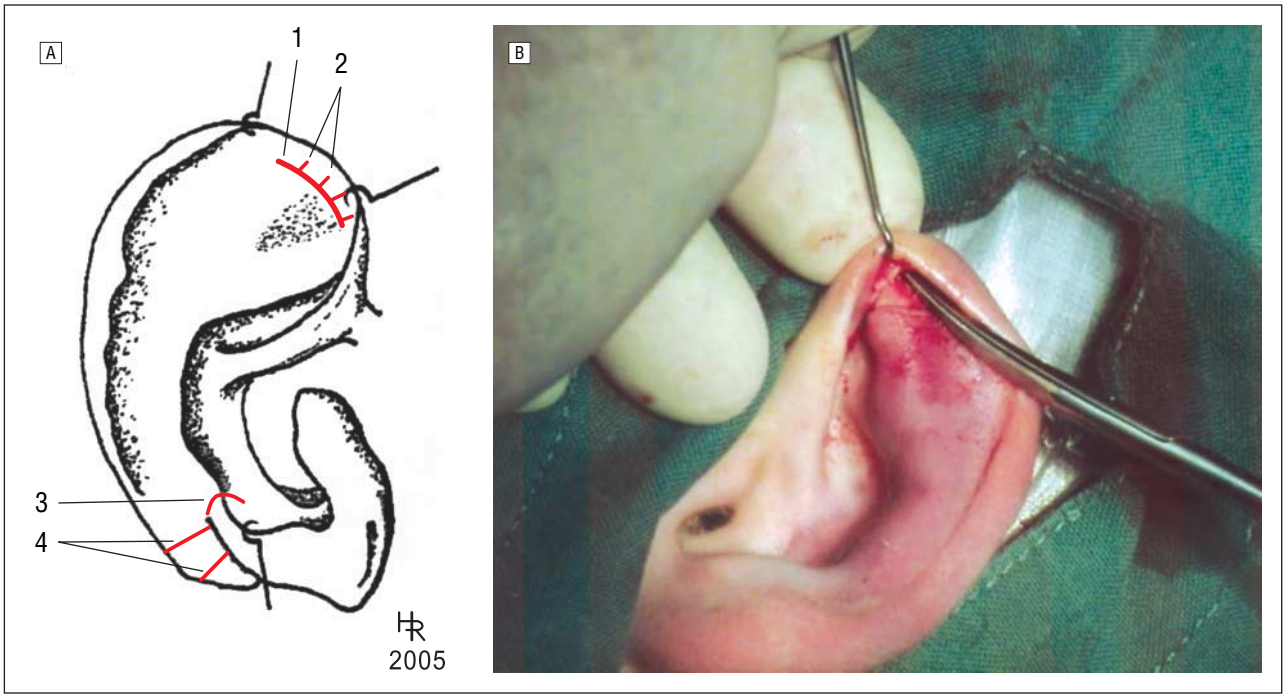


Figure 6. A comparison of the results obtained using various cutting or thinning instruments. Porcine ear cartilage was modeled by filing (1 and 2), scoring with a scalpel (3), and thinning with a scalpel (4). Note the superior contour attained with the file.

Figure 8. Preoperative view of patient in Figures 9 and 10.



Figures 7. Diagram (A) and photograph (B) indicating the anteriorly placed incision within the scapha (1). Small radial incisions in the helical rim may be placed here to reduce tension and allow an alteration in curvature (2). Further incisions at the caudal antihelical margin (3 and 4) will allow for shaping in this area.

infection and infiltration of a local anesthetic with adrenaline in the anterior aspect of the concha along the planned antihelix, and, if deemed necessary, into the tail of the helix. The procedure may be performed under local anesthesia alone or accompanied by a general anesthetic. The patient is draped with an operative foil, followed by careful exposure of the concha and renewed disinfection. A skin incision about 10 mm in length is made in the scapha above the superior crus. This anterior approach is concealed by the overhang of the helical rim. The incision is carried in a transcartilaginous fashion through the underlying cartilage. Cutting the cartilage in this location is advantageous in the setting of a rigid cartilaginous configuration to allow for further reshaping. If the concha is still seen to be protruding along the superior crus, small radial cuts may be made at the helical junction, being cautious not to incise the helical margin (**Figure 7**). A subperichondrial tunnel is then dissected over the anterior aspect of the concha to the antitragus, which can be separated obliquely from the cavity of the concha with scissors. Subperichondrial exposure of the cartilage can be achieved only in flat structures. Care should be taken to elevate the cartilage in a clean plane because residual perichondrium left on the cartilage may cause the diamond-coated file to become blunted. When introducing the file, one must ensure that no epithelial tissue from the helix is introduced and entrapped within the tunnel because this may lead to infection. The surgeon may then proceed with abrasion of the anterior cartilaginous surface. A sign that antiheli-

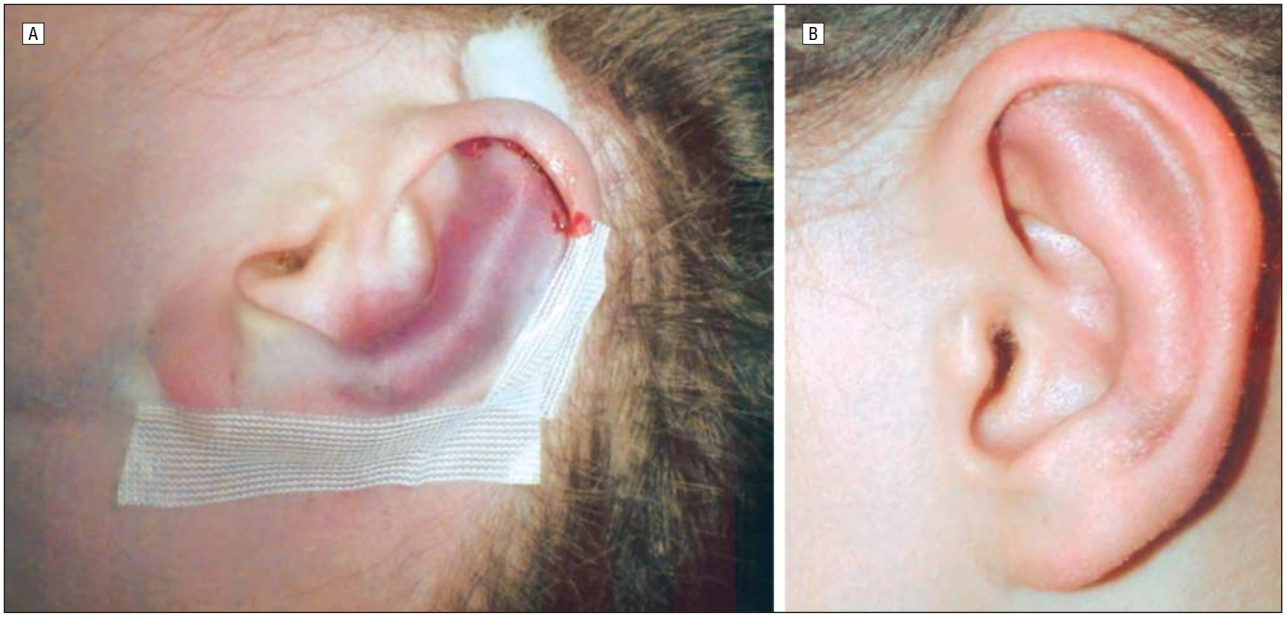


Figure 9. Postoperative views of remodeled ears. A, An immediate postoperative view showing retroauricular fixation of the tension-free concha by wound closure strips (Steristrips; Smith & Nephew Medical Ltd, Hull, England) over rolled cotton wool. B, The postoperative outcome is shown after dressing removal at postoperative day 7. Note minimal swelling and bruising owing to minimal tissue trauma.

cal thinning has progressed is the appearance of only abraded cartilage on the file. The abraded cartilage may be washed out of the skin tunnel. The anterior aspect of the cartilage is filed until a suitable curvature of the antihelix is achieved and the ear concha assumes its new shape without any sign of tension (**Figure 8** and **Figure 9**). Finally, finger massage of the new antihelix is performed.[4] Skin closure is completed using a continuous 4-0 polyglactin suture (Vicryl Rapide; Ethicon Inc, Somerville, NJ). The incision should be closed loosely to allow for drainage of the tunnel.

KEY TECHNICAL ASPECTS

The Helix

The grooved structure of the scapha is important for shaping the superior crus. Depending on its morphology, this part of the helix forms a stiff frame around the cranial half of the ear. To work with the elasticity of the cartilage itself and avoid a "telephone" ear deformity, this structure must be weakened in the region of the superior crus. The residual tension of the helix can be eliminated by making several small radial incisions within it. The distance between the incisions should not be less than 3 mm to avoid sharp bending of the helical rim. However, great care should be taken to ensure that the incisions do not reach the margin of the helix.

The Cavity of the Concha

The caudal portion of the antihelix merges into the cavity of the concha and the antitragus. The proposed curvature of the antihelix is limited by these structures. Therefore, the cavum cartilage must be incised obliquely and mediocaudally from the cephalic end of the antitragus in the direction of the lower margin of the auditory canal over a distance of about 10 mm.

The Antihelix

The thickness of the antihelical cartilage decreases continuously as one proceeds from the tail to the superior crus. Therefore, the cartilaginous zones must be modeled accordingly.

The Protruding Lobule

If a protruding lobule is seen to arise from an anteriorly projecting helical tail, the skin tunnel should be extended from the antihelix to the tail of the helix. Subperichondrial exposure is impossible here. The tail of the helix, which is usually stable, is thinned with the file until the desired shape is achieved. If the caudal helix is too rigid to be shaped by thinning alone, it may be incised in 2 or 3 locations using scissors to weaken it adequately (Figure 7B).

Dressing Technique

The concha is cleaned with hydrogen peroxide and then dried. A dry roll of cotton wool is placed beneath the antihelix, conforming to its newly acquired contour. The helical margin is fixed to the mastoid plane with adhesive tape (Figure 9A). Bepanthen ointment (Bepanthol; Bayer AG, Westhaven, Conn) is applied to the anterior aspect of the concha. Cotton wool dipped in hydrogen peroxide is spread on the cavity of the concha and scapha. The area is covered with dry gauze affixed with adhesive tape. A self-adhesive elastic dressing is then applied. In children, the dressing should be fixed at the chin and the crown of the head (**Figure 10**).

Figure 10. The ear dressing secured at the crown of the head and the chin is especially suitable for children.

Postoperative Care

The dressing is removed routinely on postoperative day 7. In the event of increasing pain, the dressing may be changed at any point, as this symptom may herald the onset of a hematoma, infection, or flap ischemia. Following dressing removal, the desired antihelical shape is maintained by fixation to the mastoid skin with an adhesive strip for about 6 weeks. A headband should then be used only while sleeping.

RESULTS

I performed a total of 302 otoplasties between January 2001 and March 2004. Initially, the retroauricular approach was used for access (86 ears); subsequently, all otoplasties were performed through an anterior approach (216 ears). A cavum resection was performed in 4 ears. On 23 ears sutures were needed. Three operated-on ears sustained a loss of correction and 2 of these required a revision procedure. In the first 108 cases, the elasticity of the cartilage was reduced using a rasp similar to that described by Weerda[3] and Ely.[11] All subsequent operations (194 ears) were performed using only the diamond-coated file, thus simplifying the surgical procedure. Neither operations using the rasp nor the diamond-coated file routinely required remodeling sutures. I used sutures only when filing could not achieve satisfactory contour in an excessively rigid concha. Surgical overcorrection is not required with this technique, as postoperative taping will maintain the desired conchal shape.

Complications related to this otoplasty technique were infrequent.[15,18] In this series, patients have been followed up upwards of 4 years without evidence of serious complication or long-term cartilage irregularities with use of the diamond-coated file. Contour irregularity is a well-recognized complication of other thinning or cutting techniques, such as use of a rasp (**Figure 11**). As with other techniques, complications such as hematoma and infection and recurrence and/or asymmetry may sporadically occur.[16] Necrosis of the skin overlying the antihelix is an exceedingly rare predicament, but may occur for the following reasons: (1) excessive skin tension caused by deflection of the ear by 90° or more, (2) placement of an exceedingly constrictive postoperative dressing leading to pressure necrosis, and (3) use of an overly tight headband beyond the first postoperative week.

Figure 11. Postoperative view of an otoplasty performed using standard cutting or scoring techniques. Note the contour irregularities along the antihelical ridge.

COMMENT

Numerous otoplastic techniques have been described by Weerda.[3] These can largely be categorized as isolated cartilage-sparing suture techniques, isolated cartilage-cutting techniques, or combinations thereof. The technique described in the present study, which does not make use of remodeling or shape-preserving sutures, may be regarded as a distinct procedure. Particularly favorable aspects of this technique deserve to be highlighted. The technique affords more than satisfactory access to the concha through a limited anteriorly based skin tunnel while maintaining excellent vascular supply. Anterior access within the scapha ensures that the postoperative scar in this region is well concealed. The subperichondrial approach described here provides aesthetic results while considering the key aspects of auricular elasticity. Subperichondrial exposure is ideally performed because it separates tissue layers while causing minimal tissue trauma. Thus, when the dressing is removed 1 week after the operation, bruising of the anterior aspect of the concha has already subsided (Figure 9B). Hematomas are not encountered when one uses conscientious dissection in this plane. The limited dissection also ensures that auricular sensation is minimally impaired and returns rapidly to normal function. Stabilizing sutures are required

only when antihelical cartilaginous elasticity cannot be surmounted by thinning alone. If the concha remains free of tension in the desired position, a condition achievable by the described technique, no cartilage sutures will be required. I have also found skin excision to be ineffective in correcting any residual elasticity toward the anterior aspect.[8,9,11,14,15,19,20] In most cases, this straightforward technique will allow reliable correction without an extensive dissection or use of foreign bodies. Other studies have also shown that better wound healing is correlated with lesser wound surfaces and introduction of fewer foreign bodies.[15,20]

This technique is also extraordinarily transparent in its ease of application. While several authors have recommended the use of colored pens or needles for marking, the technique described in this study requires none of these aids because any alteration at every interval can be immediately perceived through the skin. Several surgical instruments have been described in the literature for use in otoplasty, including scalpels, file brushes, bone files, scoring or cutting rasps, and motorized diamond-coated burrs. While appropriate reduction in auricular cartilage elasticity can be achieved within a skin tunnel using the diamond-coated file, scalpels, or motorized diamond-coated burrs can be used only under direct vision. Use of these instruments requires generous exposure of the anterior aspect of the cartilage and are, therefore, unsuitable for the technique described here. Working on cartilage within a skin tunnel by means of scoring or cutting instruments is also problematic as it may lead to crossed incision lines. Shavings of cartilage may cause overlying skin surface irregularities (Figure 11).

ADVANTAGES OF THE PRESENT TECHNIQUE

The reported technique offers several advantages over traditional otoplastic techniques. These include the following: (1) a minimally invasive approach that allows flexible modeling of the auricular cartilage through exploitation of biomechanical flexion forces, (2) a diminutive wound surface, minimizing the risk of hemorrhage, (3) preservation of all auricular structures, (4) the capacity for shaping both the antihelix and the tail of the helix, and (5) a substantial reduction in operating time.

DISADVANTAGES OF THE PRESENT TECHNIQUE

Surgeon-patient teamwork is required because the ears have to be taped for about 6 weeks.[17] When doing this technique on an abnormally high conchal wall, on the anterior view the antihelix is more lateral than the helix. While potent, this technique is serviceable only for the purpose of antihelix and lobular plasty. Concomitant auricular deformities such as an extreme cavum conchal excess or hypertrophy, or an abnormally high conchal wall, with normal developed antihelix will require concurrent procedures such as conchal setback. This approach is limited in such situations, wherein a posterior approach might be more advisable.

CONCLUSIONS

The technique described in this article is minimally invasive, requires few instruments, can be learned easily, and is not time-consuming. A very natural postoperative outcome with no visible scars is achieved (Figure 9B). Therefore, I recommend this technique as the standard procedure for otoplasty in cases of an isolated hypoplastic antihelix as well as a moderately high conchal wall.

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