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Alloplastic reconstruction of the microtic ear

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Alloplast microtia repair offers many advantages over autologous costal cartilage as a framework. Advantages include earlier reconstruction, fewer procedures, avoidance of donor site morbidity, shorter surgeon learning curve, and improved consistency in size and contour match. Though multiple implantable materials have been used in microtia reconstruction with variable success, preformed porous polyethylene frameworks combined with advances in soft tissue envelope techniques have significantly improved alloplast outcomes. The authors describe their technique in single-stage microtia reconstruction with the use of porous polyethylene as an alloplast framework.

Introduction

Creation of an external ear remains as one of the most challenging dilemmas for the reconstructive surgeon. Between the thin soft tissue envelope surrounding an intricate, flexible framework projecting off of the mastoid, success in recreating native anatomy depends as much on the patient's soft tissue characteristics as it does surgical technique.

The choice of material used for the framework remains a point of contention and continuous evolution. Staged autologous cartilage reconstruction continues to be the most widely used paradigm in microtia repair,[1] but many surgeons turn to alloplasts to avoid donor site morbidity, hasten timing of reconstruction, improve on the inherent structural limitations of autologous rib, and for individual patient's reconstructive needs.

Alloplasts

The ideal alloplast would be widely available and safely implantable, resistant to infection and repeated trauma, and be able to be easily modeled to match a contralateral native ear.

Since 1891, more than 40 different framework materials have been described in the ear, including alloplasts such as ivory, wire mesh, nylon, and silicone.[2,3] Silicone was initially viewed as a promising prospect, particularly for its ability to mimic the flexibility and structure of native auricular cartilage, but a high extrusion rate when placed under thin skin flaps was ultimately problematic.[4]

First described for partial auricular reconstruction by Berghaus in 1983, porous polyethylene (PPE; Medpor, Stryker, Newnan, GA) has a long record of successful, safe use as an implantable framework. PPE is a modestly flexible, biocompatible material made of high-density polyethylene with interconnected pores (100-200 μm) that demonstrate structural stability and soft tissue ingrowth.[5,6] As a porous material, this facilitates collagen deposition and vascular ingrowth, which in turn prevents extrusion and infection, and allows systemic drug delivery to the implant.[7] Structurally, PPE is robust enough to withstand the repeated microtrauma expected of an ear, yet is easily shapeable with a pair of scissors or knife intraoperatively, and separate pieces may be soldered together with a low-temp cautery.

The most common approach for microtia reconstruction involves the implantation of a fused PPE framework,

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covered with temporoparietal fascia (TPF) and ultimately covered with a mixture of local flaps and full thickness skin grafts. This has been described as both a single- (Reinisch) and multi-stage (Romo, Yang, Constantine) procedure.[3,8-10]

Considerations for porous polyethylene

A primary advantage of alloplast reconstruction is the avoidance of a chest wall donor site. Because of this, patients do not need to wait for chest wall maturity for costal cartilage harvest, and may be implanted at an earlier age. The youngest child implanted in the authors' experience is 4 years old, with preferred timing at age 5 or 6. PPE is available as a preformed 2 piece implant, and a straightforward technique allows for a shorter learning curve for new surgeons. Modern modifications to the procedure have resulted in comparable complication rates to autologous cartilage, and cosmetic outcomes can be excellent in experienced hands.[3,11] Microtia reconstruction with PPE may be performed after or at the same time as a canal atresia surgery if the patient is deemed a suitable candidate for canalplasty. Thus, patients can have their atresia and microtia reconstructions completed in a single stage before entering primary school—an important period of cognitive awareness and self-concept.[12-14]

Although PPE may be used as a salvage repair after failed costal cartilage repair, the reverse is rarely done, and surgeons are encouraged to definitively "pick a horse" when approaching microtia reconstruction. Although salvage surgery using autologous rib with adjunctive procedures has been described,[15,16] it is not common place and the outcomes are widely variable.

Technique

Below, the authors describe their reconstructive approach, adapted from the single-stage technique first described by Reinisch.[3]

Prep

The authors have the family shave the patients head preoperatively. Once in the operating room, the patient is orotracheally intubated and the bed rotated 180°. The patient's eyes, nose, and mouth are covered and kept out of the field with an occlusive transparent dressing. Before the patient is prepped, the superficial temporal artery (STA) is traced out using a vascular Doppler and a permanent skin marker. The anterior and posterior branches of the STA are marked, and if possible, any superior anastomosing branches between the 2 (Figure 1).

It can be helpful to identify the main trunk of the STA as it courses near the auricular remnant. In severe cases of microtia, the vessel can swerve underneath the remnant cartilage putting the vessel in danger during removal of the cartilage remnant.

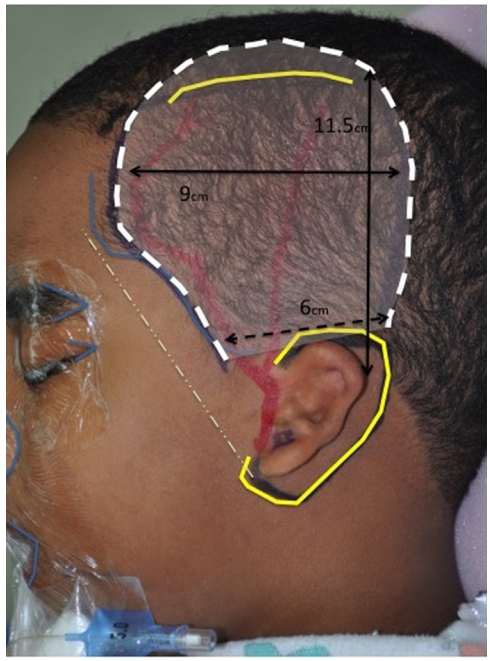

Figure 1 Identification of landmarks and flap design. Yellow lines indicate skin incisions. Vertical dimension of the TPF flap is measured from the proposed superior border of the neo-EAC extending vertically toward the vertex of the scalp. The anterior or posterior dimension is slightly narrower, extending to the temporal hairline to incorporate the anterior branch of the STA (demarcated in red). The base of the TPF flap is kept relatively wide to maintain venous drainage in the mastoid region. EAC, external auditory canal. (Color version of figure is available online.)

The anticipated course of the temporal branch of the facial nerve is also traced out.

Additionally, using a piece of X-ray film, the position and size of the existing ear is marked relative to the oral commissure, nasal alar groove, lateral canthus, and lateral brow. This is sterilized for later use on the field. The dimensions of the new ear are based on the contralateral normal ear, taking in consideration the patient's age at the time of surgery and anticipated future growth. Additionally, notes are taken of specific details and unique feature found on the normal ear that will be customized during the molding and soldering of the implant later in the case.

The head is prepped with betadine solution, and the auricular remnant and scalp is injected with a 1:1 mixture of 1% lidocaine, 0.5% Marcaine, and 1:100,000 parts epinephrine, then diluted in a 1:1 ration with saline to assist with hemostasis, analgesia, and tumescence. Injection is performed widely around the microtic ear, temporoparietal scalp, and contralateral postauricular area.

Incisions remain a point of discussion, with multiple approaches described. The authors favor a curvilinear horizontal incision above the superior portion of the TPF flap, and second incision in the postauricular area of the microtic ear corresponding to the position of the new helical rim. This incision is performed on the postauricular component of the portion of the ear that is present. In patients with low set hairlines, up to a third of this incision