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Original Article

Auricular Reconstruction Using a Porous Polyethylene Framework

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Abstract Objective To report utility of Medpor frameworks in auricular reconstruction and management of frameworks protrusion. **Methods** Retrorespectively analysis of clinical information in 31 patients who underwent auricular reconstruction from April 2000 to October 2002. **Results** All 31 reconstructed auricles were in good condition at two weeks postoperatively. Framework protrusion occurred later in 11 patients. The framework was retained in 8 of these cases after secondary repair, but had to be removed in 3 patients. In 27 patients, the reconstructed auricle was rated as esthetically succesful. **Conclusion** Medpor framework protrusion is likely to occur when skin tension is high with minimal soft tissue coverage over the framework and can result from impact by strong external force. Despite the concern of protrusion, Medpor frameworks can be used in place of autologous cartilaginous graft in auricular reconstruction.

Key words auricular reconstruction; Medpor; auricular framework

Introduction

High-density porous polyethylene (Medpor), which was first used as implant in human in the 1940's, has been marketed with the promise of better tissue integration and spontaneous healing from vascular ingrowth. The authors performed 31 auricular reconstruction procedures using Medpor frameworks from April 2000 to October 2002. Framework protrusion occurred in 11 patients. The cases were reviewed in this paper.

Material and Method

General information

Thirty-one patients (21 males and 10 females) with unilateral congenital microtia and aural atresia underwent auricular reconstruction procedures using Medpor frameworks. The mean age was 13.6 years (range 7-22 years). All patients had conductive hearing loss with an average air conduction threshold of 63 dB HL. Twenty-seven patients received hearing reconstruction (meato-tympanoplasty) at the same time of auricular reconstruction. One patient with congenital cholesteoma underwent mastoidectomy and tympanoplasty 6 months before auricular reconstruction. In 3 patients, hearing reconstruction was not performed due to poorly developed atrium and tympanum.

Medpor auricular framework

The polyethylene auricular framework (Porex Surgical Inc, College Park, Ga) is composed of a C-shaped component for the helical rim, which pivots around a Y-shaped base component, as shown in Fig 1. The two are joined together with silk sutures to complete the framework at the time of the operation.

The auricular reconstruction procedure was completed in two phases. In phase I, the location and size of the auricle to be reconstructed were determined in accordance to the contralateral ear. The vestigial auricular cartilage was removed while the lobule preserved. A subcutaneous pocket was made for the Medpor framework which was subsequently placed between the superficial and temporoparietal fasciae, secured by 5-0 silk sutures. Suction drainage was maintained to ensure tight enveloping of the framework.

When hearing reconstruction was indicated, meatotympanoplasty was completed via the atrium approach. Meatoplasty was performed without

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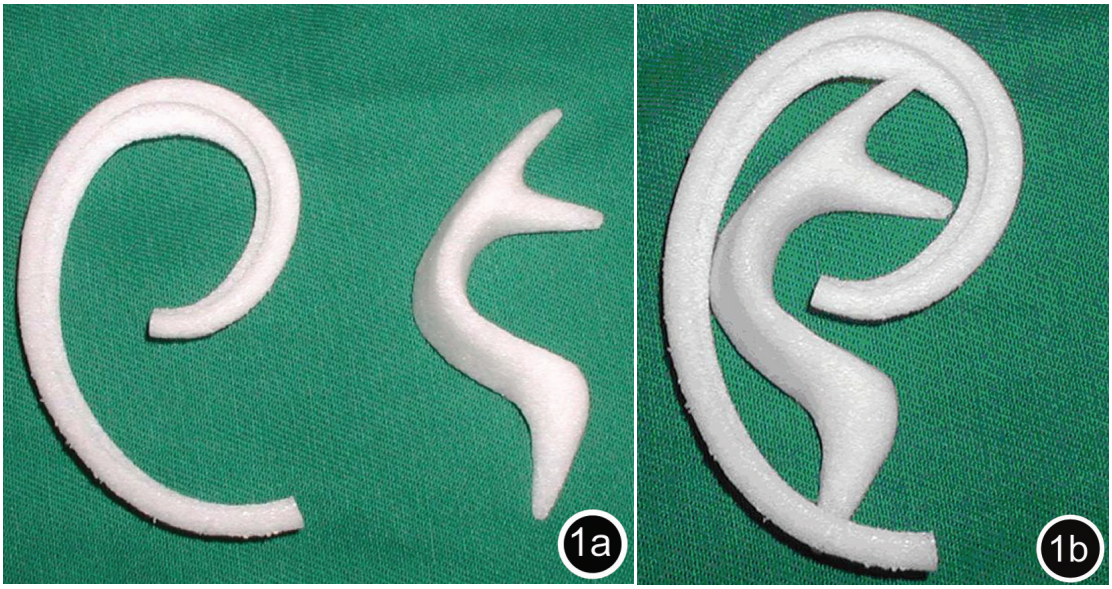

Fig.1 a. The MEDPOR Ear framework components (base and helical rim) b. Assembled MEDPOR Ear framework

tympanoplasty in 3 cases. In 1 case, auricular reconstruction was performed 6 months after mastoidectomy and tympanoplasty.

The phase II procedure took place 3~6 months after phase I. At this time, the framework, with attached soft tissue and skin, was erected to form an auricle with a postauricular sulcus and appropriate projection angle. The posterior surface of the framework was covered with medium-split-thickness skin graft harvested from the abdomen.

Results

Hearing Results

In the 28 patients who received hearing reconstruction, air conduction thresholds at 3 weeks postoperative showed improvement of 20 dB or greater in 26 patients (> 30 dB in 10) and of 15 dB in 2 patients.

Auricular Reconstruction Results

Minimal swelling was noticed following the phase I procedure. Framework contours were acceptable in all 31 cases. All patients were discharged within two weeks. Increased swelling around the new auricle was present after the phase II procedure, which resolved in one month.

Follow–up

The 31 patients were followed for 24 to 54 months. The framework was removed in 3 patients. Twenty seven patients were satisfied with the reconstructed auricle, while results were less than ideal in 1 case due to vague auricular outlines.

Framework protrusion

Framework protrusion occurred in 11 patients during the follow-up period, 9 in less than 6 months after phase I procedure and 2 following phase II procedure. Protrusion took place anterior to the suture line between the ear lobe and auricle(n=2), posterior to this suture line (n=3), through ulceration in the antihelix (n= 3), between the ear lobe and helix(n=1), and behind the helix following phase II procedure(n=1). One protrusion occurred through the anterior surface of the helix 1 year after phase II procedure from auricular trauma and post-trauma infection. The time of protrusion following phase I procedure was between 1 and 2 months in 2 cases, between 2 and 3 months in 6 cases, and between 3 and 5 months in 1 case. Following phase II procedure, protrusion occurred at 6 months in one patient and at 12 months in the other.

Secondary treatments of protrusion

Most post-phase I protrusions(n=7) involved an area less than 5x5 mm. These were covered with local subcutaneous flaps during the phase II surgery, resulting in complete closure. For the two post-phase I protrusions with large tissue defect, the prosthesis had to be removed. Of the two prostheses that protruded following the phase II procedure, one had to be completely removed. In the other case, related to auricular trauma and subsequent infection, only the antihelix part of the prosthesis was removed as part of debridement, which led to complete healing of the wound.

Disscusion

Autogenous costal cartilage is still the gold standard of graft material for auricular reconstruction[1]. However, the complexity of carving techniques and limitations on graft harvesting due to concerns over chest development in young individuals are drawbacks associated with using costal cartilage. Absorption of cartilaginous graft can also occur over time.

The microscopic pores in high-density polyethylene (Medpor) facilitate fibrous tissue ingrowth to form a stable complex with the implant. Medpor is non-absorbable and easy to shape. Its use in auricular reconstruction eliminates donor site morbidities and is a good replacement for autogenous cartilage graft [2-3]. Rapid vascularization with host tissue ingrowth and collagen deposition increases the elasticity of the Medpor implant, while reducing the opportunity of infection. Accurate three-dimensional contouring was achieved in 27 (87.1%) cases in this series..

Porous polyethylene is a non-flexible material which can rupture into particles and cause chronic inflammatory response and skin sloughing. Framework protrusion occurred in 11/31 (35.5%) cases in this group. Of the 9 protruded implants following the phase I procedure, 6 were through the surgical incision at the junction of the implant and the ear lobe. This is believed to be related to local scar tissue contraction that increases the tension of the skin tissue over the junction, where it is the thinnest, leading to ulceration and implant protrusion. Techniques were improved in later cases, in which pedicle fascia flaps were used to cover the tail of the implant before incision closure. No implant protrusion occurred through the incision at the implant-ear lobe junction after this technique was adopted.

The other 3 phase I protrusions occurred in the middle part of the antihelix, where the framework was the most protruding and the skin coverage thin, as showed in Fig 1. Pressure at this point can easily lead to skin ulceration and subsequently implant protrusion. The preventive measure to overcome this problem is to place implant deep in the subcutaneous pocket and to increase the thickness of the overlying tissue.

Some studies suggest that tissue defect in protruded implant can be repaired without removing the implant [2, 4]. However, in 3 cases in our study, the entire framework had to be removed after partial removal failed to result in healing, mostly due to the extent of implant protrusion and local tissue defect.

Implant protrusion was related to trauma in one patient. The helix swelling following trauma was ignored and infection and skin ulceration ensued. The wound was treated by local debridement, and, removal of the Y-shaped base. While the wound healed without incidents in reponse to the treatment, some of the auricular profile was lost.

In conclusion, there is an increased risk of implant protrusion in areas of high skin tension and minimal soft tissue coverage. Exposed porous polyethylene is relatively infection-resistant and can be managed conservatively with local treatment rather than immediate removal. Medpor frameworks are well tolerated as replacements for cartilage graft in auricular reconstruction.

Reference

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