

Auricular Defects: Autogenous Vs Prosthetic Reconstruction

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Abstract

Introduction: Auricular defects and deformities include not only acquired defects attributable to trauma, burns, tumors, piercing defects, scars, and inflammation/allergies, but also congenital auricular malformations. **Methods:** Alternatives for auricular reconstruction include autologous costal cartilage graft, prosthetic reconstruction with adhesives and osseointegrated implants. **Conclusion:** Total auricular reconstruction in patient with auricular defects is one of the most challenging problems faced by a reconstructive surgeon as it demands precise surgical technique combined with artistic creativity. Ear reconstruction requires carefully planned procedures. The use of autogenous rib cartilage is the gold standard for microtia reconstruction. Overcoming the limitations of surgical procedures prosthetic rehabilitation can be done successfully. The purpose of this article is to compare the two procedures and discuss their advantages and disadvantages.

Keywords: Auricular defects, Microtia, Graft, Prostheses, Implants.

Introduction

An auricular defect generally occurs due to congenital abnormalities, trauma from burns, accidental cases, animal attacks or surgical removal of cutaneous malignancies. Microtia is a birth deformity of one or both ears in which the auricle i.e. outer ear is underdeveloped or absent. Microtia is a congenital malformation of variable severity of the external and middle ear [1]. The microtic auricle consists of a disorganized remnant of cartilage attached to a variable amount of soft tissue lobule, which often is displaced from a position symmetrical with the opposite normal ear. The direction of lobule displacement usually depends on the degree of associated facial hypoplasia. Hearing can be affected in microtia because of involvement of external canal and middle ear [2]. Its appearance causes a psychosocial effect on the affected children and their families. Thalidomide and isotretinoin can cause congenital deformities such as microtia. Microtia occurs as an independent anomaly or in association with other syndromes (Goldenhar syndrome and Treacher Collins syndrome). Weerda's classification [2] for auricular malformations is based on an increasing severity of the malformation (Table 1).

Only two treatment options are available:

1. Autogenous reconstruction and
2. Prosthetic reconstruction

Autogenous Reconstruction: The use of autogenous rib cartilage is the gold standard for microtia reconstruction. The origin of microtia repair had started in 1920, when Gillies buried carved homograft rib cartilage under mastoid skin, then separated it from the head with a flap of neck skin [3]. A major breakthrough came in 1959, when Tanzer [4] used autogenous rib cartilage, which he carved in a solid block. Till date, autogenous cartilage is the most reliable material that produces results with minimal complications. Various donor sites (knee, thighs, ribs) have been used for harvesting the cartilage. Rib cartilage provides a substantial source for fabricating a total ear framework. Building upon Tanzer's

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sound principles, Brent [5] refined and evolved the use of rib cartilage and have created frameworks for years. He was the first to report the successful use of tissue expansion in reconstruction of the microtic ear. Rib cartilage has been studied in various parts of the globe include Firmin, Osorno, Nagata, Weerda and Siegert [6-8]. In 1971, Tanzer [4] described a six-stage procedure, modified by Brent and Nagata to a two-stage technique, which is the basis of most current techniques.

Table 1: Weerda's classification based on an increasing severity of the malformation

Degree of dysplasia	Definition	Subgroup
I: Low-grade malformations	General: most of the structure of a normal auricle are present Surgical: additional skin and cartilage are only occasionally required for reconstruction	(i) Prominent auricle (ii) Macrotia (iii) Cryptotia (pocket ear) (iv) Cleft ear (transverse cleft) (v) Scaphoid ear (vi) Stahl's ear (vii) Satyr ear (viii) Small deformities (ix) Lobule deformities (x) Tanzer's types I, IIA, and IIB cup-ear deformities
II: Grade II microtia; moderate malformations	General: the auricle still displays some structure of a normal auricle Surgical: additional skin and cartilage required for partial reconstruction	(i) Tanzers's type III cup-ear deformity (ii) Miniear
III: Grade III microtia with anotia; severe malformations	General: structures of a normal auricle no longer present Surgical: additional skin and cartilage required for total reconstruction	(i) Unilateral Grade III microtia (ii) Bilateral Grade III microtia (iii) Anotia (iv) Normally congenital aural atresia will be found

The basic principle of current techniques is the harvesting of the costal cartilage as the first step [7-10]. The first stage of the reconstruction surgery is Auricular framework fabrication with help of contra lateral rib cartilage and insertion of cartilage in the skin pocket. Rib cartilages are obtained en bloc from the contra lateral side synchondrosis of 6,7, 8th ribs for natural rib configuration. The helical rim is fashioned separately with cartilage from the 8th rib. Excision of this cartilage facilitates adequate access to the synchondrotic region of ribs 6 & 7 which supplies a sufficient block area to carve the framework body. By preserving even a minimal rim of upper margin of 6th rib cartilage we can decrease chest wall deformities. Care is taken to preserve as much perichondrium on the various surfaces mainly lateral, outer aspect of the framework to facilitate its adherence & subsequent nourishment from surrounding tissues. Acute bending of the helical framework is done and this is sutured to the frame work base with the 3-0 or 4-0 prolene suture material in order to exaggerate the helical rim.

Framework implantation: After the creation of the framework of the auricle during the same procedure, it is positioned underneath the skin on the planum mastoideum. Preoperative marking of site and location with upper, lower & outer limits of snug fit subdermal cavity in right axis is done. By small anterior incision on the auricular vestige with centrifugal skin relaxation, a thin flap is raised by sharp dissection and also by preserving subdermal plexus without making button holes. Native cartilage remnant is excised & discarded. Absolute hemostasis is done in the snug fit cavity and the cartilage framework implanted inside the skin pocket. Intra operatively the donor site as well as the reconstructed site are managed by negative suction drainage which is removed later in post-operative period. This creates a continuous suction and promotes adherence of the adequately nourished skin flap to the cartilage sculpture and prevents disastrous hematomas. The drains are then removed on the fifth postoperative day, when minimal drainage is observed and the skin is well-adhered to the cartilage framework. Sutures are removed from the ear after 5-7 days.

The second stage surgery includes Auricular framework elevation. At an interval of 3 to 6 months, the 3D projection from the mastoid is formed by elevating the neoauricle from the mastoid and creating a posterior auricular sulcus. Posterior auricular margin is defined by separating the ear from the head and covering its undersurface. Incision is made several mm behind the rim, so that the graft will not be seen and care is taken to preserve protective connective tissue layer on cartilage framework. The graft is harvested from thigh and usually partial thickness graft was used to cover the raw area and tie over dressing was done to maintain the proper cephaloauricular angle.

The third stage involves lobule transposition: The rotation or reposition of lobule is essentially done by z-plasty transposition. A third stage is necessary for the fine tailoring of the contours of the auricle.

Prosthetic Reconstruction: The fabrication of auricular prosthesis is considered as one of the most difficult replacements in maxillofacial reconstruction by the prosthodontists. The severe undercuts and pronounced convolutions of the ear's surface pose a challenge to be simulated by a prosthesis [11-13].

Two major problems in making prosthetic ear are reconstructing an exact copy i.e mirror-image prosthetic ear and orientation of the prosthesis in the exact location to the surrounding tissues. These problems can be solved by making a free hand carved pattern of the ear in a modeling wax and simulating it to the natural one not only in form but also texture and orienting it correctly to the surrounding tissues [12,13]. The conventional basic procedure in the fabrication of auricular prosthesis involves the impression of the defect and non-defect ear with irreversible hydrocolloid followed by pouring of impression in high strength dental stone. Wax sculpture of the defective ear is made using modeling wax and trial is done on patient and corrections are done according to the contours, visibility, height, width, and according to patient's expectations. Molds are made to fabricate silicone prosthesis for the patient. These prosthesis can be retained by the use of adhesives, emulsions, spray-ons, tapes but retention was the problem with these adhesive systems. Another adoptable method is attaching prosthesis to spectacles or hair bands, but inadvertent displacement or detachment are disadvantageous in retention of prosthesis.

A breakthrough in the retention of the auricular prosthesis occurred when Branemark in 1980's introduced osseointegrating implants [11]. Implants body or fixtures for ear prosthesis are made of biocompatible titanium metal alloys and placed in the mastoid bone. The implant retained auricular prosthesis system has three parts – The osseointegrated implant, the retention system and the prosthesis. Size of an implant is determined by the thickness of the bone involved. A two-stage surgery is suggested for the osseointegrating implants. As per the accepted protocol, the implants are placed in the mastoid region area 15 mm apart keeping a distance of 20mm from auditory canal opening. After osseointegration verification radiographically (in a period of 3 – 4 months) the second surgery is done to place the abutment. After osseointegration of the implant (3-4 months period), percutaneous abutments are connected which can hold the prosthesis. The prosthesis is mechanically retained either by using embedded clips or magnets. Implant-retained prostheses offer good aesthetics, close fit to the body and the convenience of easy removal and refitting.

Discussion

The choice between the two remaining techniques, autogenous reconstruction and prosthetic reconstruction, depends more critically on the surgeon's skills, training and tradition than on an analysis of which procedure is preferable in a given clinical situation. In the hands of an experienced surgeon, who performs the procedure on a regular basis, autogenous techniques yield consistent results. The indication for reconstruction with autologous rib cartilage depends on the nature, severity and extent of the auricular deformity and on the patient[4]. Starting at the age of 8 to 9 years, it is a good option in children. At this age, enough

cartilage can be compliantly harvested to complete the procedure. Autogenous ear reconstruction has the disadvantage that a suboptimal result might be uncorrectable[10]. Prosthetic reconstruction of the auricle is considered in such patients with congenital deformities for the following indications include failed autogenous reconstruction, severe soft-tissue/skeletal hypoplasia, and/or a low or unfavorable hairline, acquired total or subtotal auricular defect, most often traumatic or ablative in origin, which is usually encountered in adults, patient's preference and cost factor[5-10].

Earlier, ear prostheses were not well tolerated because of the inconvenience and ineffectiveness of chemical adhesives [12,13]. Osseointegration, the direct structural connection between living bone and a implant, has reduced the problems of prosthesis retention and inconvenience[11]. Advantages of autogenous reconstruction over prosthetic rehabilitation are evident. Once an autogenous reconstruction is completed, the patient requires no further treatment. In contrast, prosthetic reconstruction requires replacement of the prosthesis every 2 to 5 years for the life of the patient. Patient with prosthetic ear remains in psychological trauma to wear the prosthesis while autogenously reconstructed auricle can be better accepted. As with any surgical procedure there are risks with autogenous reconstruction which cannot be overlooked. Complications of the procedure can be post-operative infection and cartilage exposure, surgical emphysema leading to donor site complications, hair bearing skin over the auricle can be seen, graft failure, necrosis of graft [4,5]. Prosthetic rehabilitation avoids all these complications [12]. Aesthetics of the rehabilitated auricle depends on skills of the surgeon and prosthodontist. Cost of the prosthetic rehabilitation is far lower than autogenous reconstruction.

Summary and Conclusion

The field of auricular reconstruction remains a great challenge to facial reconstructive surgeons. The method of choice for reconstruction depends not only on the patient's pathology and the state of the local tissue and skin, but also on the preferences of the facial surgeon and the patient. Various possibilities of reconstruction exist, such as autologous rib cartilage or prosthetic restoration. The choice between the two techniques, autogenous reconstruction and prosthetic reconstruction, depends more on the surgeon's training and patient's preference. Recently, interest in the pre-fabrication concept has been developed via modern tissue engineering techniques in which bovine cartilage tissues are grown in the laboratory and seeded upon a synthetic ear from which is then implanted beneath the skin of a mouse[14-16]. The early experimental results are interesting, but, it needs a long time of effort and work before it can be applied to humans.

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