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Original Article

Auricular reconstruction - Our experience at marienhospital stuttgart, Germany

H. Fischer · Wolfgang Gubisch · Vikas Sinha

Abstract The aim of the paper is to report our experience of 60 ear reconstructions to correct the microtia with surgical technique. Autogenous rib cartilage was used to reconstruct the affected ear. Cartilage resorption was found in 10% of the cases, distortion and fusion of pinna in 20% of the cases and infection was found around 8% of the cases. Most of the patients were satisfied with the final result.

Keywords Ear reconstruction · Ear malformation · Microtia · Autogenous rib cartilage

H. Fischer[1] · W. Gubisch[1] · V. Sinha[1, 2]
[1]Department of Facial Plastic Surgery,
Marienhospital, Stuttgart, Germany
[2]Department of ENT,
M.P. Shah Medical College,
Jamnagar, Gujarat, India

H. Fischer (✉)
E-mail: helmutfischer@vinzenz.de

Introduction

To construct an almost normal ear is an open challenge to any surgeon (Fig. 1). The auricular reconstruction can be done either by alloplastic material or by autogenous material like costal cartilage [1]. Various alloplastic materials [2] are used, probably most common one is porous polythelene like Porex, Porex surgical, Newnan, Ga, etc. The advantage of using alloplastic material is that it avoids altogather the procedure of harvesting costal cartilage. Therefore there is less morbidity of the patient, avoidence of additional scar and elimination of technical difficulties of carving the costal cartilage. Beside these when these alloplastic materials are used subcutaneously, there is definite risk of skin breakdown, contamination and eventually the loss of entire reconstructive procedure. To avoid these complications, the extended superficial temporalis flap is raised to cover the whole implant but it has its own drawbacks like leaving behind an area with very little source to deal with in case if gets exposed either spontaneously or by trauma and finally reduces the chance of future autogenous reconstruction. However the autogenous reconstructed ear tolerates minimal to moderate trauma quite well and have withstood over the period of time. It is possible to achieve good results with it although not gaurenteed everytime. Good results can be achieved if favorable conditions are there like availability of the sufficient amount of costal cartilage in the sense that there should be proper thickness for the basic block of the costal cartilage, thin elastic skin without complex chondrocutaneous remnants or associated serious craniofacial malformations. The unsatisfactory results are frequently associated with unfavourable local conditions like thick skin accompanying serious craniofacial deformities and limited amount of costal cartilage.

Principles and method of surgery

The pinna reconstruction is not a one stage surgery and has to be done in different stages. Broadly the different stages

Fig. 1 Deformed ear

Fig. 2 Copy of outlining and position of the left healthy auricle transposed to the affected side

can be grouped as; first stage: Harvesting of costal cartilage, construction of cartilage framework, dissecting skin pocket and frame work insertion. Second stage: Creation of retroauricular sulcus 6 months after the first stage.

Harvesting the costal cartilage

The patient older than 8 years usually have enough cartilage in sixth, seventh, eighth and ninth ribs out of which pinna can be carved. The Surgeon has to assess the width, thickness and the length of the available cartilage (Fig. 2) for the two basic components (pinna reconstruction i.e. basic block of pinna and helix. The natural curvature of the rib is best suited for the carving of pinna (Fig. 3). It is also important to ensure the union between the seventh and eighth rib. Patients aged 12 years and above have adequate good union for harvesting of the main block. The union between the two

Fig. 3 Harvesting rib cartilage and marking with template

cartilages should not be too loose and the ninth rib cartilage has sufficient length to carve out the helix. In case if surgeon finds the costal cartilage insufficient, he must approach the next superior costal level i.e., the junction between the sixth and seventh costal cartilage with preservation of the superior border of the sixth rib [3, 4]. Surgeon must ensure the preservation of the costochondro union to minimise the thoracic scoliosis and chest wall deformity [5, 6].

Construction of cartilage frame work

This step begins with the preparation of main block as well as helix by progressive thinning of the rib's outer perichondrium and cartilage surface. For forming the contour in the main block, cartilage is removed to form the scapha and fossa triangularis with 15 number blade. A flat, smooth rim is prepared along the periphery of the graft, over which the helix can be fixed with 4–0 or 5–0 non-absorbable sutures. For the full extent of root, body and tail of the helix, one should suture the radix helicis to the inferior edge of the anterior border of the antihelix and gently bend and suture the helix over the main block rim. Quite often it is not possible to form two different levels between the antihelix and the scapha, therefore an additional piece of catilage is required to fix a carved antihelix with superior and inferior crura over the main block (Fig. 4) for appropriate projection.

Skin pocket and framework insertion

For this step incision is planned in such a way that there is tension free closure. The skin elevation is done with fine scissor and should extend 1–1.5 cm beyond the outlined ear margins in the superior and middle third. This additional skin elevation allows skin flap to cover the superior and

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Fig. 4 Shaping of rib cartilage

Fig. 5 Placement of shaped rib cartilage underneath skin pocket

most projected portion of the framework without tension. Meticulous hemostasis is mandatory during the entire process.The cartilagenous remnants are carefully resected without perforating the skin. By suction drain, the skin is fixed to the framework (Fig. 5).

The goal of secondary stage is projection of pinna and creation of retroauricular sulcus Figs. (6–12). The additional rib cartilage is required for the concha wall reconstruction. Local soft tissue flap or temporal fascia flap is required for covering the concha: Free skin graft is neccessaryto close the defect after raising the ear. Alternatively the concha graft is covered with a rotation flap from the mastoid area and the residual defect in the retroauricular plane is covered with a skin or split skin graft.

Fig. 6 The reconstructed ear before step 2, the creation of the retroauricular sulcus.

Fig. 7 Raising the rotation flap for covering the additional cartilage graft for protrusion of the auricle

Results

The total 60 cases were operated by the first author in last 10 years. There have been differnt types of ear malfomation requiring ear reconstruction. Some amount of cartilage resorption was found in 6 cases (10%) over the period of time from 6 months to 1 year. Infection of the reconstructed ear at various stages was found in 5 cases (8.3 %) with consecutive some small defects. The infection responded very well with the local and i.v. antibiotics. One case required aditionally split skin graft and did well afterwards. Some distortion of the framework and fusion of the pinna was found in 12 cases (20%) for which no correctice surgery could be offered to

Fig. 8 Additional cartilage graft for auricular protrusion in place (conchal wall reconstruction)

Fig. 9 Flap transposition for coverage of the cochal wall cartilage graft

the patient. About 5% patients felt mildly disturbed and wanted further correction of the deformity after final result of the reconstruction. There was but no further surgery offered to them after last stage of the surgery. The 95% of parents were pleased and found the result from moderately happy to happy and very happy what ever was the end result (Fig. 13–14). They were carrying out normal life without giving the ear a thought.

Discussion

Brent of US [3] and Satoru Nagata of Japan are the two leading surgeons who have contributed lot for the improvement and active reconstruction in microtic ears.

Fig. 10 Early post-operative result (10 days). Rotation flap covers cochal wall cartilage graft. Split thickness scaple skin graft covers the posterior aspect of the elevated auricle beyond the cochal wall graft. Donor site of the skin graft covered with vaseline gauze. Posterior oblique view.

Fig. 11 Lateral view (10 days)

Brent's technique is safe and step-by-step, a four stage reconstruction. It consists of insertion of an autologous cartilagenous framework into a skin pocket, transposition

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Fig. 12 Reconstructed retroauricular sulcus 6 months post-op

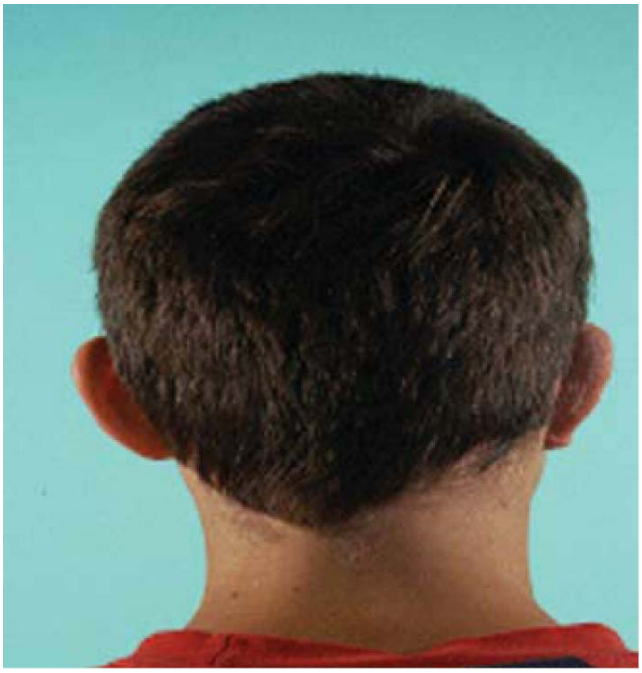

Fig. 13 Back view with good symmetry at 6 months

of the lobule, construction of the tragus and construction of a retroauricular sulcus. Nagata's technique [7–10] is only a two stage technique consisting of transposing the lobule of the auricle during the first stage and reconstruction of the complete framework including the tragus putting it into a skin pocket, and then the lobule was transposed. This stage corresponds to the three first stages of Brent's technique. The second stage is constructing

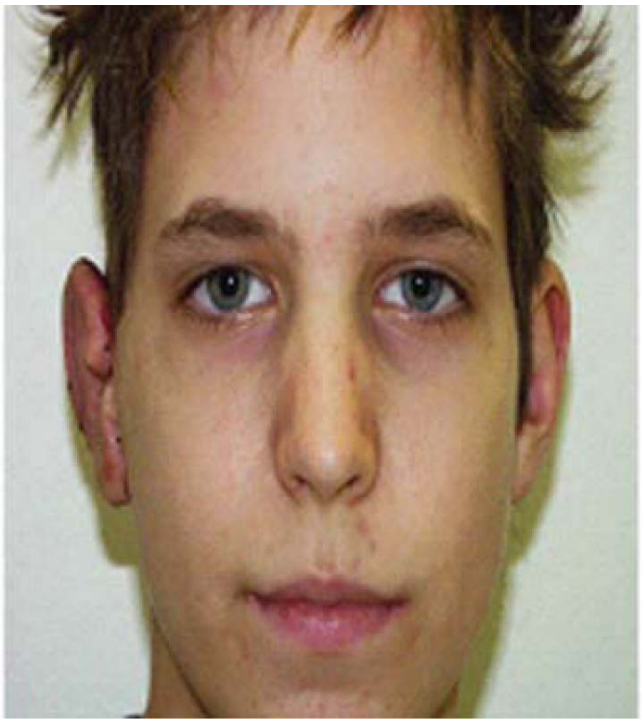

Fig. 14 Frontal view at 6 months

the retroauricular sulcus, means the reconstructed ear is raised and an additional cartilaginous graft is used to increase the projection.

Firmin of France follows Nagata's suggested new principle [11] that the type of microtia is defined by the appropriate incision for the lobular transposition and adaptation to the new framework by a Z plasty, transfixation incision or none of these in anotia. The new principle of Brent's technique [12] that reconstruction must start by placing the cartilagenouss framework on the ideal position under unscarred skin. The lobular remnant can be correctly adapted to the constructed contours [13]. These concepts were different then of Tanzer [14] which advocated that reconstruction should be started by transposition of the lobule.

All the techniques have thier own advantages and disadvantages. Nagata's technique required minimum age of about 10 years for the sufficient cartilage to be harvested. The basement has to be bigger and the helical rim and antihelix is built upon that instead of adaptation of peripherically to the basic block. Training is required to obtain the complete and harmonious framework successfully. It requires a good knowledge of skin flap blood supply to ensure good adaptation of the transposed flap. Nagata reccomended the preservation of the narrow subcutaneous pedicle to avoid the partial necrosis of the posterior flap. However Firmin F found partial necrosis of the posterior flap as specific complication.

It is also important to match the opposite ear during the preoperative planning session as Brent found most of the constructed ears had not only grown very well but even slightly overgrown. Niether of it shrunk, softened or lost its detail. So there is no reason to construct the ear larger. Hence the planning of the new constructed ear should be by tracing a film pattern either by old discarded exposed X-ray film or by any other thing from the opposite normal ear. It is also very important to know that ear at birth is one of the most fully developed organs, its length beeing 66% and its width beeing 76% that of its adult size. An ear reaches approximately 85% of its full size by age of 6 years, 90% by age of 9 years, and 95% by age of 14 years. The sculpted rib cartilage graft's growth generally keeps pace with the growth of the opposite normal ear. Xiogeng et al. [15] from people Republic of China also used autogenous rib cartilage and found satisfactory results. Gabriel Osorno of Columbia [1] in his large series 110 cases of ear malformation found consistingly good results by using the autogenous costal cartilage using Brent's technique and according to him the poor results obtained by the untrained surgeons give reasons to believe that it is better to offer the prosthesis rather than going for this complicated multi stage surgery. The satisfactory results are obtained if ideal conditions are there to reconstruct the aurucle and all the surgeons who frequently get this type of cases should be trained before they operate on such cases. The auricular reconstruction is a challenge surgery to every surgeon who deals with such type of congenital anomalies.

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