Microtia and autogenous reconstruction of the ear: an overview and evaluation of 40 cases

Microtia e reconstrução autógena da orelha: uma visão geral e avaliação de 40 casos

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RESUMO

Microtia é uma deformidade congênita da orelha em que a estrutura externa é subdesenvolvida ou completamente ausente. A deformidade pode estar presente em uma ou ambas as orelhas e muitas classificações existem para o tipo de deformidade presente e tipo de reconstrução possível. Reconstrução autógena concentra-se principalmente na concepção e construção de uma estrutura a partir da cartilagem da costela, e posterior colocação desta moldura abaixo da pele sobrejacente da orelha anormal. Neste artigo, é realizado um breve resumo sobre microtia, bem como sobre sua reconstrução autógena. Além disso, em uma tentativa de ter os resultados obtidos pelo autor avaliados por terceiros, os casos operados pelo autor serão apresentados. Restauração de qualquer perda auditiva está fora do escopo deste artigo, e aqui nos concentramos na restauração da aparência visual e forma da orelha.


ABSTRACT

Microtia is a congenital deformity of the ear in which the external framework is either underdeveloped or completely absent. The deformity can be present in one or both ears and many classifications exist for both the kind of deformity present and type of reconstruction possible. Autogenous reconstruction focuses mainly on designing and building an underlying framework from rib cartilage, and subsequent placement of this framework underneath the overlying skin of the abnormal ear. In this article, a brief overview of microtia, as well as autogenous reconstruction, is covered. Furthermore, in an attempt to have the workmanship of the author appraised, third-party evaluation of cases performed by the author will be presented. Restoration of any hearing loss is beyond the scope of this article, and here we focus on restoration of the visual appearance and form of the ear.

Key words: Ear/surgery. Ear, External/abnormalities. Surgery, Plastic/methods.

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INTRODUCTION

Anatomy

Deformities of the ear that exist in cases of microtia are classified mainly on the anatomy of the visible ear vestiges. Brent\(^1,2\) divided microtic remnants into the classical and atypical types.

The classical type remnant presents as a sausage-shaped vestige, frequently appearing as a mal-positioned ear lobule. This type of remnant usually exists without an auditory canal or meatus. Any existing cartilage is amorphous in structure, and the affected ear is usually symmetrical, in terms of anatomic location, to the auricle on the contralateral side.

An atypical type of microtic vestige, however, maintains characteristics of normal ear features such as the concha, tragus, and antihelix, but lacks the upper portion of the normal ear and is relatively asymmetrical anatomically to the contralateral side.

Another classification system was devised by Nagata\(^3,4\) and others\(^5-7\), who separated microtic ear deformities into lobular and conchal-remnant types, corresponding to Brent’s division into classical and atypical types, respectively (Figure 1).

Furthermore, Firmin\(^5\) developed a classification system that categorizes the different types of microtia based on where the incision is made for cartilage framework placement: type 1 – corresponding to lobular type vestige; type 2 – to large conchal type remnant, and type 3 – corresponding to small conchal type and varied atypical vestiges.

Regardless of the classification chosen to describe the microtic remnant, special attention towards the anatomic location of the abnormal ear in relation to the uninvolved side is always warranted. Any displacement must be addressed in order to achieve overall symmetry between the ears. An additional dimension of deformity is apparent when the patient presents with auricular dystopia\(^8,9\), a subdivision of microtia that involves underlying deficiencies of the facial skeleton that result in medial, inferior, and anterior displacement of normal and microtic vestiges of the ear (Figure 1).

Reconstruction

Reconstruction of microtia can be divided into 3 broad categories based on the components used for assembly: autogenous (tissue from other location in the body), alloplastic (composite framework), and prosthetic (artificial extension). This article will focus on autogenous reconstruction.

Regardless of the type and classification of ear deformity, there are two fundamental phases of autogenous reconstruction that are universally applicable. The first is reconstruction of the missing framework from autologous rib cartilage from the contralateral side. The second is placement of the framework under the cutaneous remnant and adjacent skin (Figure 2). The location of incision is chosen based on whether or not any cartilaginous remnant is to be used in the reconstruction. If not, any remnant is excised while retaining any useful tissue for creation of the concha (Figure 3).

In terms of the number of surgeries needed to achieve complete results, the two prevailing approaches are those devised by Brent\(^1,2\) and Nagata\(^3,4\), the former achieving completion in four stages, and the latter achieving similar results in two.

In the Brent technique, the four stages are as follows: first, an underlying framework is constructed from coastal cartilage and subsequently placed in position. Second, the mal-positioned remnant lobule is rotated into place. Third, the reconstructed ear is elevated and a post-auricular sulcus is created. And fourth, the concha is deepened, and a tragus is created.

In the two stages of the Nagata technique, the first involves creation and placement of the underlying framework, construction of the tragus, deepening of the concha, and rotation of the remnant lobule into place (effectively combining Brent’s 1st, 2nd, and 4th stages into one). The second stage, performed approximately four months after the first, involves elevation of the reconstructed ear, and creation of a post-auricular sulcus (Figure 4). Based on experience, the author of the article prefers to perform microtia reconstruction via the 2-stage Nagata technique.
The auricle framework is reconstructed from costal cartilage harvested from either the ipsilateral (Nagata¹,² and Firmin⁵,¹⁰) or contralateral (Brent¹,²,¹¹ and Bauer and Patel¹²,¹³) side. A large piece comprised of costal cartilage from ribs 6, 7, and 8 is removed en bloc, and the ear framework is carved from this piece (Figure 5). The 6th costal cartilage provides the area from which the antihelix and crural complex is to be created, the 7th coastal cartilage for the helical rim, and 8th costal cartilage for added detail, helical crus, and tragus (Figures 5 and 6). Carving of the cartilage is performed via hobby-shop routers or gouges (Figure 7), and satisfactory results are attainable with adequate experience (Figure 8).

Pre-surgical marking for framework placement
Before the first incision is made, careful marking of the location for framework placement is drawn. The exact location for reconstruction is estimated based on the location of the contralateral and normal ear. This is achieved by using an x-ray film template (Figure 9).
**Placement of Framework**

The specific intricacies and techniques regarding the manner in which the framework is inserted into the exact location are beyond the scope of this article, but in general the constructed framework is inserted into a pocket that is created under the skin at a location that corresponds symmetrically to the contralateral ear (Figures 2 and 3). The pocket is constructed in such a manner that leaves an intact and viable pedicle at the caudal end of the flap. Before insertion of the framework, any amorphous remnant cartilage in the microtic ear is removed while carefully preserving the overlying skin. Once positioned within the pocket, the framework may be immobilized via nylon sutures. Two butterfly drains are inserted alongside the framework, the incision sites are thoroughly sutured closed, and the drains are attached to vacutainer tubes with negative pressure in order for the overlying skin to adhere to the underlying framework.

**METHODS**

Between the years of 2003 and 2010, the author (AM) performed microtia reconstruction in 40 patients (38 with unilateral microtia, 2 with bilateral microtia). All cases were congenital in nature, and the average age at time of reconstruction was 9.2 years (range 6-32 years of age). The follow-up period ranged from 6 months to 7 years.

Third party evaluation of the results achieved by the author was conducted by a plastic surgeon with 25 years experience, and two artists, a painter and a sculptor, both with an extensive portfolio in head and face artwork.

Attributes of the reconstructed ear that were addressed were auricular shape, position, prominence, symmetry, anatomic detail, and overall appearance. The individual evaluations were graded on a quantitative scale from 0-100, and subsequently calculated for an overall qualitative score, namely poor, fair, good, and excellent. An overall score of 90 and above was regarded ‘excellent’, a score between 80 and 90 ‘good’, 70 to 80 ‘fair’, and any value below 70 ‘poor’.

**RESULTS**

Of the 40 patients evaluated, each received a numerical score out of a hundred corresponding to the level of success the surgeon achieved within the various categories of assessment (Table 1). Overall, 45% received an evaluation of poor to fair, and 55% received an evaluation of good to excellent. Pictures of selected patients from each qualitative category, along with the constructed cartilaginous framework before placement, are shown below (cases 1-9, Figures 10 to 18). Faces of the patients were covered in order to conceal their identity.

Complications were minimal, among them one patient with rotary subluxation of C1-C2 vertabrae during stage one (Figure 19), one patient with helical exposure (Figure 20), and two patients with exposure of suture wires. All patients with complications were treated accordingly, with no lasting illness or deformity.
DISCUSSION

Reconstruction of the microtic ear is one of the most challenging surgeries for plastic surgeons. Although the surgery is divided into only two to four separate stages – depending on the specific technique chosen – each phase necessitates the highest level of manual dexterity and attention to fine detail. With the right training and practice, one can master the various stages of reconstruction and ultimately reach the proficiency necessary for achieving excellent results.

However, as in any craftsmanship, critical assessment of the artistry of the surgeon is necessary in order to point out flaws and imperfections, maximize the quality of the final result, and, ultimately, increase patient satisfaction. In such an attempt to improve the overall outcome of microtia
reconstruction, cases performed by the author were evaluated by a third party and subsequently graded on a scale from poor to excellent. Thanks to the expertise and honesty of the evaluators, efforts by the author continue to be made in order to further refine the skills necessary to reconstruct the ear with the highest aesthetic results.

REFERENCES