



Title	Reconstruction of low hairline microtia of Treacher Collins syndrome with a hinged mastoid fascial flap
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Title page

(1) Title of the article:

Reconstruction of low hairline microtia of Treacher Collins syndrome with a hinged
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Abstract

Treacher Collins syndrome (TCS) is a rare genetic disorder leading to congenital craniofacial malformations. Although this syndrome presents with various symptoms, corrective surgery for bilateral microtia with low hairline is one of the most challenging operations given the complex contours of the external ear. In this technical note, we describe a novel, simple procedure for dealing with the low hairline by using a hinged mastoid fascial flap simultaneously with costal cartilage grafting. Previously, several techniques, such as skin graft, skin flap, and tissue expander for reconstruction of low hairline microtia, have been reported, but the high number of repeat operations and residual scars remain problematic. As a simultaneous procedure with framework grafting, the use of a temporoparietal flap with skin grafting is popular; however, its drawbacks include the operative scar, decreased hair growth, and hair thinning. Patients with TCS show anatomical variations of the superficial temporal vessels supplying the temporoparietal flap. In contrast, due to the high vascularity of the mastoid fascia, the mastoid fascial flap can be elevated safely and easily as an anteriorly, posteriorly, superiorly, or inferiorly based flap.

Key words

Low hairline, hinged mastoid fascial flap, microtia, Treacher Collins syndrome

Introduction

Treacher Collins syndrome (TCS) is a rare genetic disorder leading to congenital craniofacial malformations. Typical symptoms of TCS include downslanting palpebral fissures, lower eyelid colobomas, microtia, and malar and mandibular hypoplasia. During the process of treatment, it is very important to reconstruct ears with a refined shape. However, given the complex contours of the external ear, ear reconstruction is a highly challenging operation, requiring almost all the basic techniques of plastic and reconstructive surgery. In addition, the presence of a low hairline in patients with TCS makes ear reconstruction particularly difficult in these individuals.

Aesthetic problems related to hair growth on the reconstructed auricle occur when scalp skin is included in the reconstruction of low hairline microtia (Fig. 1). To resolve these problems associated with the involvement of the hairline, several techniques, such as the use of skin graft, skin flap, and tissue expanders, have been reported. However, a high number of reoperations and residual scars are the drawbacks of these techniques. Here, we present a new technique using a hinged mastoid fascial flap for reconstructive surgery of low hairline microtia. This technique is performed at the same time as costal

cartilage grafting, enabling the reconstruction of the ear in two stages and without leaving residual scars.

Surgical method

A Doppler probe is used to trace the arteries in the temporal region preoperatively. Next, marking of the estimated auricular region is performed, including the hair-bearing skin. The location of the ear is decided according to the total symmetry and balance of the face by using an ear-shaped template. A T-shaped line is marked in the retroauricular mastoid region for elevating the hinged mastoid fascial flap (Fig. 2-a). The length of the T-shaped vertical line is slightly longer than the height of the hair-bearing skin. First, the hair-bearing skin in the marked area is removed and the T-shaped line is incised. Diligent hemostasis is important to delineate the anatomical structure of the fascia. In particular, the preoperatively marked arteries should be dealt with carefully. Skin flaps are elevated under the layer including the hair follicles cranially and caudally (Fig. 2-b). After an anteriorly based mastoid fascial flap is marked with appropriate size to cover

the hair-bearing area, this flap is elevated on the deep temporal fascia. Subsequently, the costal cartilage graft is performed. After harvesting cartilage from the sixth, seventh, and eighth ribs, a three-dimensional frame for ear reconstruction is created. The subcutaneous tissue, including that in the estimated auricular region, is undermined just under the subdermal vascular network. The subcutaneous pedicle is preserved at the estimated auricular concha region, and the lobule is transposed posteriorly. The framework is grafted into a subcutaneous pocket (Fig. 2-c). The mastoid fascial flap is then turned over to cover the exposed framework (Fig. 3) and sutured to the subcutaneous tissue of the estimated auricular region with 5-0 PDS-II. Lastly, a split-thickness skin graft is taken from the temporal region beside the T-shaped line (Fig. 2-d); this is advantageous as it is easily taken in the same operative field and with a better color match as compared with a graft from another site. This graft is applied on the fascial flap (Fig. 2-e). The T-shaped skin incision is sutured with 5-0 nylon, and the skin incision of the estimated auricular region and skin graft are sutured with 6-0 nylon. To prevent subcutaneous hematoma, Penrose drains are placed and tie-over dressing by using traction sutures is applied (Fig. 4).

Discussion

Using scalp skin for the reconstruction of low hairline microtia in patients with TCS leads to aesthetic problems due to hair growth on the reconstructed auricle; to resolve this, several techniques, such as local skin flap, skin graft, tissue expander, and needle/laser hair removal, have been reported¹. The high number of operations, occurrence of graft or skin necrosis, and scalp scars are problems associated with using full-thickness skin grafts and local skin helix flaps, and reoperation is needed when a tissue-expander is used for reconstruction. For children with microtia, the high number of operations can be a psychological burden. Recently, laser hair removal has been used for achieving cosmesis. Brent first reported the use of laser hair removal in the reconstruction of the external ear for microtia in 1999². Since then, laser hair removal has advanced greatly. Laser epilation is considered useful since it is less invasive and safer than other surgical procedures used for reconstructing a non-hair-bearing skin helix. However, the high number of laser epilation cycles required is an issue.

Temporoparietal fascial flap (TPF) combined with skin grafting is commonly performed together with framework grafting³. It is generally recognized that the TPF is mainly supplied by the superficial temporal artery and vein, which promises a highly stable vascular supply. Therefore, for difficult primary or secondary auricular reconstruction, the TPF covers the projected cartilaginous framework with the advantages of being thin, reliable, and a single-stage procedure⁴. However, the TPF donor site leaves a large scar on the side scalp that is prominently visible with shorter hairstyles. Further, decreased hair growth or thinning of hair may occur after raising the fascial flap. In addition, prolonged edema and diminished contour of the reconstructed auricle may sometimes occur. In individuals with hemifacial atrophy or TCS, the anatomy of the vascular supply is complicated by a hypoplastic superficial temporal artery. In their report of a patient with TCS, Tegtmeier and Gooding observed the lack of superficial temporal vessels⁵. Therefore, the TPF may not be suitable for patients with TCS as the first choice of flap.

In 1991, Park et al. first described the possibility of using the mastoid fascia for ear reconstruction using an anatomical cadaver study in the mastoid region⁶. The mastoid

fascia comprises the superficial mastoid fascia and the deep mastoid fascia. These respective layers correspond cephalically to the superficial temporal fascia and the innominate fascia. The superficial temporal fascia has an elastic but not a very fibrous consistency; on the other hand, the superficial mastoid fascia is thick, strong, heavy, and fibrous⁷. The superficial mastoid fascia is supplied by the posterior auricular artery and the posterior branch of the superficial temporal artery or the superficial auricular artery and the occipital artery. Owing to the high vascularity of the fascia, this flap can be elevated safely as an anteriorly, posteriorly, superiorly, or inferiorly based flap. In ear reconstruction, Yoshimura et al. used this flap for covering the supporting cartilage⁸, and Oyama et al. used this flap in a salvage operation after skin necrosis and exposure of the cartilage framework⁹.

With respect to technical skill, one of the most important steps of this procedure is to elevate the skin flap under the layer that includes the hair follicles. Performing this step correctly leads to the absence of a visible scar (Fig. 4); missing this layer can lead to alopecia at the incision site. With careful hemostasis, it is not difficult to ascertain the presence of the hair follicles, elevate the skin flap with the right layer, and to elevate the

mastoid fascial flap. Second, it is important to prevent a hematoma under the skin graft and the estimated auricular region postoperatively. Once necrosis occurs, it is hard to achieve epithelialization on the exposed cartilage. Therefore, tie-over dressing is recommended although intraoperative hemostasis is also essential.

In conclusion, we have demonstrated that a hinged mastoid fascial flap is useful for the reconstruction of bilateral microtia with low hairline in patients with TCS. Further, in patients with TCS, TPF can be preserved for unexpected secondary operations.

Funding

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Competing interests

None.

Ethical approval

Not required.

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Figure legends

Figure 1. Treacher Collins syndrome showing lobule-type microtia with low hairline.

Figure 2. Schematic drawing of the surgical technique of the hinged mastoid fascial flap.

- (a) The skin area of the estimated auricular region and a T-shaped line is marked. (b) The hair-bearing skin is removed and the T-shaped line is incised. (c) The anteriorly

based mastoid fascial flap is elevated. (d) The mastoid fascial flap is turned over to cover the exposed framework. (e) A split-thickness skin graft taken from the temporal region beside the T-shaped line is applied on the fascial flap.

Figure 3. The mastoid fascial flap is turned over to cover the exposed framework. Black arrow, mastoid fascial flap; yellow arrow, skin incision; green arrow, harvest site of skin graft.

Figure 4. Postoperative appearance immediately after the procedure. White arrow, skin graft; yellow arrow, skin incision; green arrow, harvest site of skin graft.

Figure 5. Postoperative appearance at 8 months after the first costal cartilage grafting on the left side.



Fig. I

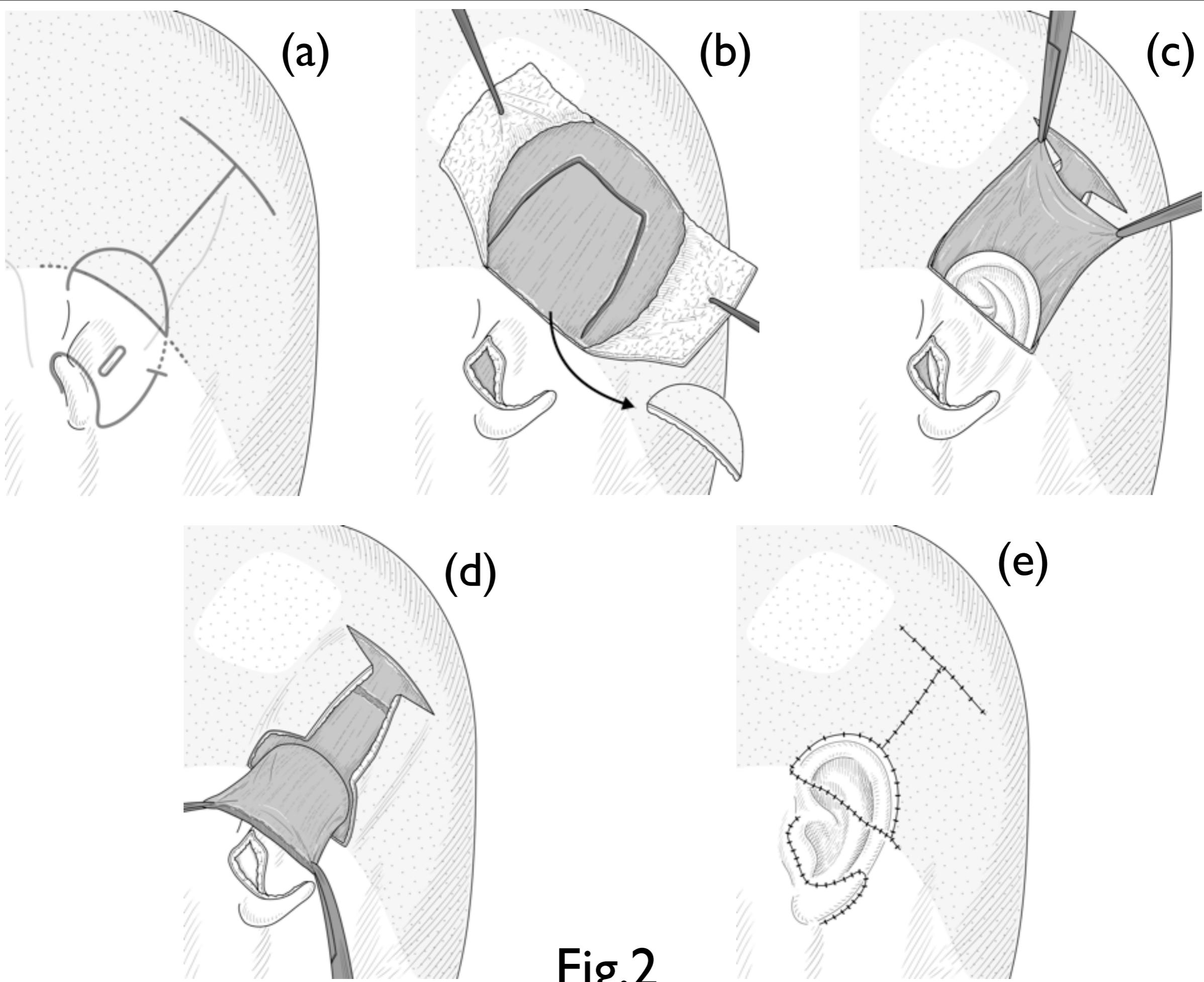


Fig.2



Fig.3



Fig.4



Fig.5