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Case Report

Anatomical external auricular muscle transposition with mini flap transfer for mild cryptotia: A case report

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ABSTRACT

Cryptotia is a congenital ear deformity characterized by the upper helix buried under the skin of the temporal region. Recurrence and inadequate correction of ear position are major complications following auricle reconstruction. Abnormalities of the auricular muscles are closely associated with cryptotia and considered to be the main cause. However, current corrective procedures focus on provision of additional skin and abnormal auricular muscle correction is considered supplementary. We report a surgical approach focused on the anatomical repositioning of the external auricular muscle insertions and skin cover with a mini flap.

Two consecutive patients aged 6 and 14 years with mild cryptotia (minimal auricular cartilage deformity) were treated using this technique with a follow-up duration of 12–25 months. The abnormal insertion of the superior auricular muscle (SAM) to the superior helix was repositioned to its correct anatomical position below the eminence of the triangular fossa, effectively moving the ear posterosuperiorly. No complications occurred postoperatively, the increase in vertical length of the superior helix to the supe-

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rior ear attachment was 7.8 and 7.9 mm at 6months. Both patients could wear facemasks comfortably without them sliding off and were satisfied with the esthetic results. Total follow-up duration was 3 years in Case 1 and 4.4 years in Case 2.

Primary correction of the SAM to its anatomical position may be a useful method for reducing the size of the skin flaps required with minimal donor site morbidity in reconstruction of mild cryptotia.

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Introduction

Cryptotia is an uncommon congenital ear deformity characterized by the upper helix buried under the skin of the temporal region. The global incidence is unknown, but it is believed to be more common in Asians with a reported incidence of 1:400 in Japan.^{1–3} The deformity results in the appearance of an asymmetrically smaller, inferiorly displaced ear, and causes difficulty wearing eyeglasses as well as psychosocial morbidity. Additionally, the emergence of the COVID-19 global pandemic has highlighted the importance of a well-shaped auriculo-cephalic sulcus for face-mask use.

Abnormalities of the external and internal auricular muscles are considered the main cause of cryptotia⁴ with 66.6% of all cases having an abnormal insertion or total absence of the superior auricular muscle (SAM) as the most prominent feature. Surgical treatment is usually considered around 5–6 years old⁵ and in cases where non-surgical management is ineffective.⁶ Current corrective procedures include local flaps, skin grafts, buried sutures and tissue expanders focus on provision of additional skin and correcting the cartilage deformity while the correction of abnormal auricular muscles is considered supplementary.^{2,3} Previous case series have shown that recurrence of the defect, hypertrophic scarring and inadequate correction are major complications following auricle reconstruction.^{7,8} We report a surgical approach for correction of mild cryptotia focused on the anatomical repositioning of the external auricular muscle insertion and skin cover with a mini flap.

Patients

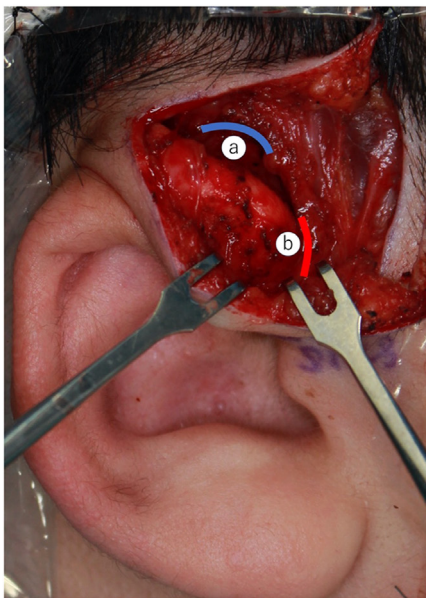
Case 1, a 6-year-old girl (Video1), and Case 2, a 14-year-old boy (Video2) were treated using this technique between 2019 and 2020. In Both cases, 20 mm of SAM attached to the superior edge of the helix and 15 mm AAM attached to the anterior edge of the helix as wide bands of muscle fibers were found. Following repositioning of the SAM the skin defects were covered using mini flaps 11 × 10 mm in Case 1 and 15 × 8 mm in Case 2. No complications such as hematoma, flap necrosis and hypertrophic scarring occurred postoperatively. The increase in vertical length of the superior helix to the superior ear attachment was 7.8 mm in Case 1 and 7.9 mm in Case 2. The patients were satisfied with the esthetic and functional results, and both could wear a facemask comfortably without it sliding off. The total follow-up duration was 3 years in Case 1 and 4.4 years in Case 2.

Methods

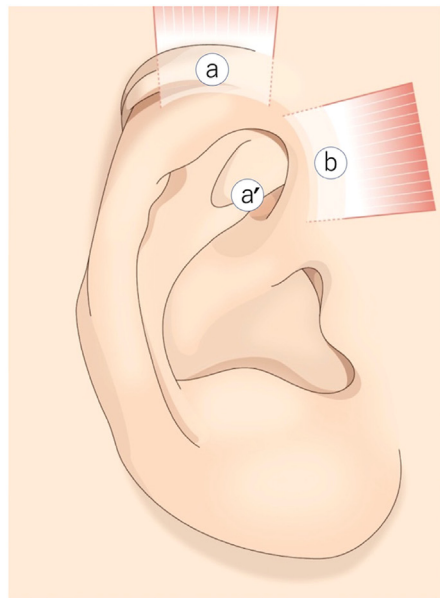
Two consecutive patients with mild cryptotia¹ were included in this report. Preoperatively, the abnormal attachment position of the SAM was identified by ear traction and the mini transposition flap designed to cover the anticipated skin defect (Figure 1, Supplementary Figure 1A). An incision was made on the anterosuperior part of the helix and the anatomy of the ear muscles was examined using the operating microscope. The SAM, anterior auricular muscle (AAM) and auricular transverse muscle (ATM) insertions were then released (Figure 2A) and the SAM repositioned to its correct anatomical



Figure 1. Preoperative photograph of right sided cryptotia in a 14-year-old boy Case 2, showing the design of skin incision at the superior helix and the design of the mini triangular flap (8 × 15 mm).



a



b

Figure 2. (A) Intraoperative photograph showing the superior auricular muscle (SAM) marked *a* and anterior auricular muscle (AAM) marked *b* following release from their abnormal position in the anterior upper helix. (B) Illustration of the showing the abnormal insertion of the SAM marked *a* and the correct anatomical position where the SAM repositioned marked *a'* to below the eminence of the triangular fossa to elevate the ear posterosuperiorly. The abnormal insertion of the AAM on the upper helix is marked *b*.



Figure 3. Postoperative photograph taken 6 months after correction of cryptotia in a 14-year-old boy Case 2, showing the well-defined and elevated superior helix allowing the patient to wear a facemask without it sliding off.

position below the eminence of the triangular fossa with 4–0 nylon. Repositioning of the SAM results in movement of the ear posterosuperiorly (Figure 2B, Supplementary Figure 1B). The mini flap was then transferred into the anterior defect of the cephalo-auricular sulcus to cover the remaining skin defect (Figure 3, Supplementary Figure 1B). Postoperative splinting was not required, and the patients were encouraged to start wearing a facemask one week after operation and continued daily. The increase in vertical length from the superior helix to the superior ear attachment at the crus of the helix (reflecting the depth of the newly formed cephalo-auricular sulcus in the upper ear) was measured at 6 months.

Discussion

Abnormal insertion of the SAM, ATM and auricular oblique muscle (AOM) are strongly associated with cryptotia.^{1,4,8–10} A recent detailed intraoperative anatomical case series study of 77 ears by Yotsuyanagi et al. reported abnormal insertion of the SAM in 54.5% and absence of the SAM in 12.1%, making deformities of the SAM the most common feature in cryptotia.⁴ Other muscle deformities that were commonly observed were shortening of the ATM 51.5% and AOM 45.5%. The study subsequently concluded that SAM deformity is the main cause of cryptotia.⁴ Similarly, an anatomical study by Torikai et al. reported 2 cases with the SAM bundle widely attached to the helix at the back of the scapha in cryptotia.⁹ In our cases, the SAM inserted on the upper helix as a wide muscle bundle. Interestingly, the abnormal superior insertion of the AAM as a wide band of muscle fibers on the anterior helix found in our cases was not previously reported in literature. This may be due to difficulty identifying the muscle with the unaided eye; however, we used the operating microscope and microsurgical dissection techniques making it easier to define the abnormal AAM in all our cases.^{4,6,9}

Several of the current cryptotia correction reports recognize the associated muscle deformities however, conventional techniques advocate that these anomalous muscle attachments should only be released or fixed without tension with the repair more focused on providing skin cover with skin grafts or large flaps 15–20 mm or larger in length.^{2,3,8} A few authors have described heterotopic attachment of SAM as a supplementary part of the procedure.^{3,6,9} However, the main basis for our

procedure which emphasizes correcting the abnormal SAM to its original anatomical position is that we believe this directly addresses the etiology of the deformity and is an essential aspect of creating the cephalo-auricular sulcus and preventing recurrence and mal-positioning. Correction of the abnormal SAM insertion also leads to a desired upwards pulling vector of the auricular helix superiorly and posteriorly and reduces the size of flaps (11–15 mm flaps in our patients) or skin grafts required, resulting in a less invasive repair (Supplementary figure 1). The AAM can also be transferred to the spina of the helix as needed.

Cryptotia encompasses a wide spectrum of severity which may include other different ear anomalies.² Our procedure is best suited to cases of mild cryptotia (as described by Matsuo) without any significant associated ear cartilage defects.¹ The main limitation of this technique is that it may not be indicated in cases of absence on auricular muscles or in severe deformity with multiple tissue deficiencies such as narrowing or loss of scapha and the presence of a third crus of antihelix.

In conclusion, cryptotia reconstruction with primary correction of the SAM to its original anatomical position may be a useful treatment method for mild cryptotia by reducing the size of the flaps required with minimal donor site morbidity. Further study is required to establish the clinical application of this approach.

Prior presentations

None.

Consent and ethical approval

Informed consent was obtained from the patients for publication of this report and the accompanying images. No ethical approval was required for this study.

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Declaration of Competing Interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jptra.2023.09.004](https://doi.org/10.1016/j.jptra.2023.09.004).

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