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Original Article

Hyaluronic acid injection in the auricular base for the aesthetic correction of lying ears: A retrospective study

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ABSTRACT

Background: Ears play an important role in facial profiles. Lying ears are not perceived favorably in Asian cultures; therefore, surgical procedures are implemented to adjust this defect. However, surgery has complications and requires recovery time. We introduced a hyaluronic acid (HA) injection technique to aesthetically improve ear prominence.

Methods: This retrospective study examined 25 Chinese patients aged 20–47 years with congenital lying ears who received HA injections in the auricular base at Shanghai Ninth People's Hospital and Hangzhou Yijie Medical Cosmetology Clinic between November 2019 and December 2022. The average injection volume was 6.32 ± 1.22 mL in the auricular base unilaterally, and the follow-up time ranged from 6 to 24 months. Morphological measurement data were recorded. Two-dimensional (2D) and three-dimensional (3D) images were obtained to evaluate the effects.

Results: All patients showed improvements in ear prominence. The cranioauricular angle (CAA) increased from 22.24° ± 4.53° to 65.90° ± 5.38° immediately post-injection and was maintained at 49.18° ± 4.74° 6 months later. The ear projection (EP) increased from 14.75 ± 2.72 mm to 26.26 ± 2.94 mm immediately post-injection and was 22.51 ± 2.68 mm after 6 months. No serious complications were noted.

Conclusion: HA injection in the auricular base effectively corrected the lying ears and aesthetically optimized the facial profile. It also had a face-lift effect that made the face look younger and more compact. The injection procedure was minimally invasive and required no recovery period. The effect was maintained for a long time and was satisfactory.

1. Introduction

The auricles are part of the facial profile and play an important role in aesthetics. Lying ears are the opposite of prominent ears and are defined as an excessive adduction of the antihelix, shallow concha, and a conchoscaphal angle much less than 90°.[1] Due to the excessively acute cranioauricular angle, the auricles are inconspicuous from the front view.

Patients commonly complain about lying ears making their faces look wider and larger. In addition, the zygomatic arch appears particularly pronounced, with inconspicuous auricles, which are not preferred in Asians. In Asian countries, large and thick ears are symbols of wealth and happiness; therefore, patients are more likely to seek more prominent ears.

Different treatments have been reported to rectify lying ears. Lee et al.[2] inserted a silicone implant under the retroauricular periosteum. Kim et al.[1] harvested conchal cartilage, released the postauricular muscle, and performed Z-plasty. Jeong et al.[3] released a fibrous band at the antihelical fold and grafted the cartilage. While these methods effectively correct the acute cranioauricular angle, surgical procedures are traumatic and require time for recovery. Moreover, complications such as prosthesis exposure and infection can occur.

Hyaluronic acid (HA) injection is popular and well-accepted in cosmetic surgery because of its minimal invasiveness and immediate effect; however, few studies have described HA injection on auricles. Herein, we summarize our injection technique for correcting lying ears using HA.

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2. Methods

2.1. Patient information

This retrospective study collected data from patients who received HA injections in the auricular base from November 2019 to December 2022 at Shanghai Ninth People's Hospital and Hangzhou Yijie Medical Cosmetology Clinic. In total, 25 Chinese patients (3 males and 22 females) aged 20–47 years (average age, 30.20 ± 7.35 years) were included. All patients had good physical and mental health. All patients had congenital lying ears and no history of otoplasty. No significant asymmetry was observed in the ears on either side. Because lifting the auricular base requires strong support, HA with high elasticity and viscosity (Hylumatrix, Shanghai Haohai Biological Technology Co., LTD, Shanghai, China) with lidocaine was used.

2.2. Measurement and effect evaluation

Pre-injection, immediately post-injection, and at every follow-up visit, two-dimensional (2D) (iPhone 12 pro, Apple, California, USA) and three-dimensional (3D) photographs (LifeViz, QuantifiCare, Biot, France) were taken. The 3D images of four positions were subsequently reconstructed using a computer.

Additionally, morphological data were also collected. Vernier caliper and protractor (Hengliang, Shanghai Hengliang Measuring Tools Co., LTD, Shanghai, China) were used to perform the following measurements (Fig. 1): (1) total ear height (TEH): distance between the highest point of the auricle and the lowest point of the ear lobe; (2) distance from the tragus to the helix (TH); (3) ear width (EW): distance between the most anterior and posterior points of the ear; (4) lobular height (LH): distance from the intertragic incisure to the caudal point of the lobule; (5) lobular width (LW): horizontal width of the lobule at the midpoint of the lobular height; (6) ear projection (EP): distance from the helix to the processus mastoideus at the tragus level; (7) superior ear projection (SEP): distance from the highest point of the auricle to the temporal bone; (8) cranioauricular angle (CAA): the intersection angle of the line extending from the helical root to the most lateral border of the helix and the plane of the mastoid.

The volume variations of the auricular regions in the 3D figures were calculated using 3D imaging software (LifeViz, QuantifiCare, Biot, France). Because human ears are symmetrical,[4] the value of the unilateral ear was taken and analyzed. The data were analyzed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA), and significance tests of the differences (paired *t*-tests) were performed.

The occurrence of adverse reactions and complications such as edema, hematoma, infection, embolism, and severe pain were also recorded.

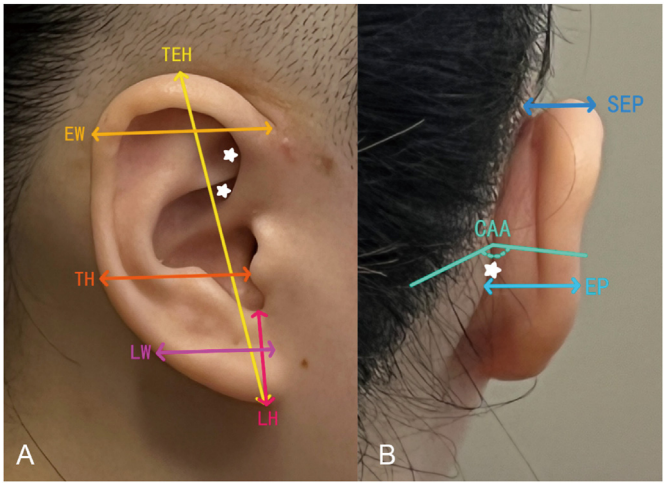

Fig. 1. Morphological measurement of the auricle from the (A) lateral and (B) back sides, including the TEH, EW, TH, LW, LH, EP, SEP, and CAA. The pentacles indicate the insertion points of the injection technique. TEH, total ear height; EW, ear width; TH, distance from the tragus to the helix; LW, lobular width; LH, lobular height; EP, ear width; SEP, superior ear projection; CAA, cranioauricular angle.

2.3. Injection technique

Each patient was placed in the supine position with the head to one side. Every subunit of the concha, the back of the auricle, and the inner side of the hairline was carefully disinfected with indophor to prevent infection. The injection procedure was performed using a 30-G sharp needle, with the insertion points in the following order (Fig. 1).

Postauricle above the mastoid process: The auricle was pinched and pulled up. The needle was tilted 45° to the mastoid plane. The injection layer was subchondral, and 2–3 mL of HA was injected to fill the deep side of the cartilage to shore up the concha auriculae, consequently increasing the CAA and EP.

Preauricle inside the cymba conchae: The needle was tilted almost vertically to the skull in the medial part of the cymba conchae. The injection layer was below the cartilage and supraperiosteal, and 1–2 mL of HA was used. Therefore, the CAA and EP could be further increased.

Preauricle inside the triangular fossa: The needle was tilted to 60°. Then, 1–2 mL of HA was injected to fill below the cartilage of the cranial ear junction to augment the SEP.

The auricular base was then filled. Approximately 0.5–1 mL of HA was injected subcutaneously into the helix and earlobe to embellish the ear shape.

The junction of the auricle and face we defined as the "auricular base". It is located beneath the auricle and surrounded by multiple muscles. The postauricular muscle complex includes the occipitalis, temporalis, trapezius, sternocleidomastoid, posterior auricular muscle, superior auricular muscle, and platysma.[5] Fascial confluence was also observed in these muscles. Moreover, this area lacks blood vessels. HA was injected into this area just beneath the auricular cartilage. Before injection, the needle was aspirated and a subchondral bolus of HA was injected into the fascial confluence. Care was taken to avoid filling the auditory meatus with HA.

Anatomical analysis was performed to verify the injection site. During dissection, HA with methylthionine chloride was injected into the auricular base of a cadaver to reveal the specific site of the filling material (Fig. 2). Most of the HA was located directly beneath the cymba conchae and provided firm support for the elevation of the auricular base.

Moderate overinjection was necessary to leave space for later retraction. If the injection dose was insufficient, the effect was relatively short-term. The patients were instructed not to sleep on a single side for a long time for one week to maintain the shape.

3. Results

3.1. Cases

Case 1. The patient had lying ears, in which the auricles were barely visible from the front view (Fig. 3). The patient's face was large and appeared dispirited. The soft tissues of the malar and cheek regions were loosened. Eight milliliters of HA were injected unilaterally, including 7 mL on the auricular base and 1 mL on the helix and earlobe. After the injection, the prominence of the ear improved significantly. The immediate effect was slightly exaggerated but was natural shortly afterward. Six months later, the shape and prominence remained good. The facial contour was also optimized, with a slimmer and refreshed appearance. A face-lift effect was also observed.

Case 2. The patient had lying ears with acute CAA, as well as a long oval face and sagging cheeks (Fig. 4). The invisible auricle in the front

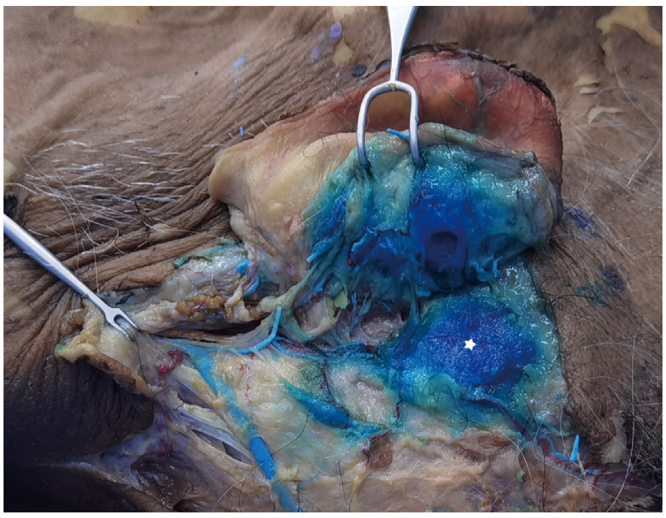

Fig. 2. Hyaluronic acid with methylthionine chloride injected into the auricular base. The pentacle indicates that most of the filling material was located beneath the concha cartilage.

view made her face look longer and appeared to be disproportionate. In this case, 5 mL of HA was unilaterally injected into the auricular base. After the injection, the facial length-to-width ratio decreased and was well balanced. With greater ear prominence, the face profile was shortened and looked younger and more attractive.

Case 3. The patient had a wide zygomatic arch (Fig. 5), which the lying ear made more obvious, as well as making the patient appear older. The patient received an injection of 7.5 mL HA on the auricular base and 0.5 mL on the helix. After the injection, the broad zygomatic arch narrowed. Its appearance appeared to have a higher affinity. The effect remained good after 12 months of follow-up.

3.2. Morphological data

The follow-up duration ranged from 6 to 24 months. The 3D imaging and data measurement follow-up time was 6 months. The average filling dosage was 6.32 ± 1.22 mL. Significant volume changes were observed in the 3D images (Fig. 6). The warm and cold color tones represent volume increases and decreases, respectively. The 3D volume augmentation of the auricular region immediately post-injection was 7.24 ± 1.51 mL. After 6 months, the volume augmentation had decreased to 5.48 ± 1.22 mL. The volume in the peripheral region of the auricle decreased from 4.82 ± 1.73 mL to 1.56 ± 0.55 mL after 6 months (Table 1).

Pre-injection, the morphological measurements were as follows: TEH, 61.12 ± 2.27 mm; TH, 22.23 ± 1.70 mm; EW, 32.02 ± 2.23 mm; LH, 17.28 ± 1.91 mm; LW, 18.14 ± 2.05 mm; EP, 14.75 ± 2.72 mm; SEP, 14.36 ± 2.15 mm; and CAA, 22.24° ± 4.53° (Table 2).

Immediately post-injection, the morphological data were as follows: TEH, 61.78 ± 2.67 mm; TH, 25.17 ± 1.62 mm; EW, 32.49 ± 2.43 mm; LH, 17.77 ± 2.12 mm; LW, 20.33 ± 2.51 mm; EP, 26.26 ± 2.94 mm; SEP, 23.77 ± 2.33 mm; and CAA, 65.90° ± 5.38°. Among these data, TH, LW, EP, SEP, and CAA differed significantly compared to the pre-injection values ($P<0.05$). The increases in EP, SEP, and CAA indicated obvious improvement in the prominence, including both the superior and middle parts of the auricle. Moreover, the increase in TH and LW showed width augmentation of the auricle due to the HA injection holding up the concha auriculae.

Six months later, while the filler was partially absorbed, the effect persisted, with EP, SEP, and CAA values of 22.51 ± 2.68 mm, 20.08 ± 2.19 mm, and 49.18° ± 4.74°, respectively. The prominent auricles had retracted slightly, but still showed significant differences ($P<0.05$) compared to the pre-injection measures.

Among all patients, two cases showed unilateral swelling of the injection area within one month. After oral administration of dexamethasone and antibiotics, the symptoms were relieved and there was no recurrence. Five patients complained of local pain in the injection area during the early stage, which was relieved after oral painkiller administration. No other serious complications were noted.

Fig. 4. Patient images pre-injection (A) and immediately post-injection (B). The excessively long face was shortened visually, resulting in a more coordinated face proportion.

Fig. 3. Patient images pre-injection (A), immediately post-injection (B), and 6 months post-injection (C). The ear projection improved instantly and was maintained well after 6 months. The face also looked fresh and tightened.

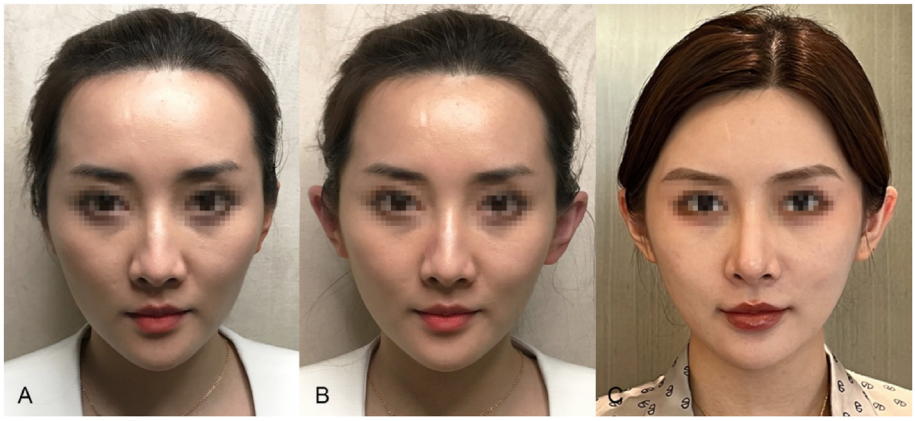

Fig. 5. Patient images pre-injection (A), immediately post-injection (B), and 12 months post-injection (C). The long-term effect was stable. The broad zygomatic arch had narrowed in appearance and the facial profile had improved.

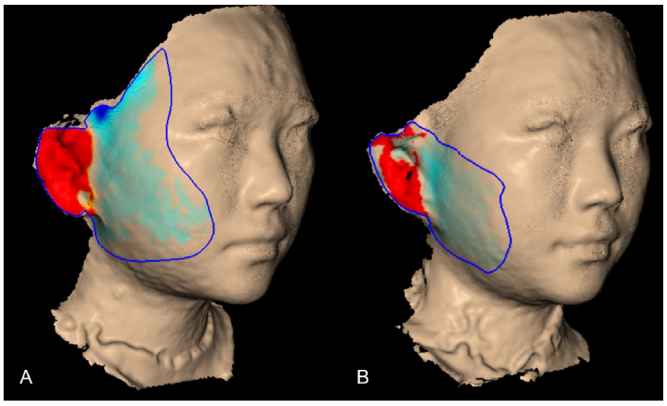

Fig. 6. Three-dimensional images of case 1. (A) Volume change immediately post-injection. (B) volume change 6 months post-injection. Auricular regions in warm and cold tones indicate volume increases and decreases, respectively.

Table 1
Changes in the volumes of the three-dimensional figures.

	Immediately post-injection (mL)	6 months post-injection (mL)
Volume augmentation of the auricular region	7.24 ± 1.51	5.48 ± 1.22
Volume decrease in the peripheral region of the auricle	4.82 ± 1.73	1.56 ± 0.55

4. Discussion

The human ear is a significant characteristic of appearance. Ears with appropriate shapes and prominences make the face appear more attractive. Several studies have investigated the ideal morphology of the external ear. Pausch et al.[6] simulated different degrees of ear protrusion from acute to obtuse. Male evaluators chose 42° (female clone)/52° (male clone) as the transition from attractive to unattractive. Female evaluators chose 36° (female clone) and 48° (male clone). The normal EP of the ear is 1.5–2.0 cm.[7] A distance >2.5 cm was defined as a prominent ear.[8] Freitas et al.[9] reported average cephaloauricular angles of 47.7° in prominent ears and 31.1° in normal ears. Moreover, prominent ears have structural deformities, including underfolding of the antihelix and hypertrophy of the concha.[10]

Lying ears are the opposite of prominent ears. In some cases, the appearance is congenital but can also be caused by the overcorrection of the prominent ears.[11] In Western countries, prominent ears are not well-accepted by society. However, in Eastern countries, many people accept and even favor prominent ears[12] and seek surgical treatment to increase ear prominence. Ears with proper prominence are identified as adorable and youthful.

Table 2
Changes in morphological measurements.

	Pre-injection	Immediately post-injection	6 months post-injection
Total ear height (mm)	61.12 ± 2.27	61.78 ± 2.67	61.64 ± 2.46
Distance from the tragus to the helix (mm)	22.23 ± 1.70	25.17 ± 1.62*	24.02 ± 1.88
Ear width (mm)	32.02 ± 2.23	32.49 ± 2.43	31.74 ± 2.51
Lobular height (mm)	17.28 ± 1.91	17.77 ± 2.12	17.18 ± 2.25
Lobular width (mm)	18.14 ± 2.05	20.33 ± 2.51*	19.43 ± 2.70
Ear projection (mm)	14.75 ± 2.72	26.26 ± 2.94*	22.51 ± 2.68*
Superior ear projection (mm)	14.36 ± 2.15	23.77 ± 2.33*	20.08 ± 2.19*
Cranioauricular angle (°)	22.24 ± 4.53	65.90 ± 5.38*	49.18 ± 4.74*

* Significant difference compared to pre-injection ($P<0.05$).

Ears appear more prominent in children because they grow faster than the head.[13] As people grew older, the ear prominence gradually diminishes. With aging, elastic fibers in the auricular cartilage gradually lose their elasticity, leading to increased ear length and decreased earlobe width.[14,15] Therefore, people with lying ears may be perceived to be more senile.

Following the injection technique, th ear projection and cranioauricular angle increased remarkably. The filing of the auricular base not only improved ear prominence but also supplemented the volume deficit of the posterior temporal region. This restored the youthful structure and smoothened the facial profile. Otherwise, the protrusion of the auricular base transformed the outermost point of the facial contour from the zygomatic arch to the auricle, which increased the width of the outer contour and visually made the face slimmer and smaller. This visual effect also shortened the appearance of long faces.

We also observed an interesting phenomenon in which the elevation of the auricular base not only corrected the lying ear deformity but also made the face appear more juvenile. While ears with appropriate prominence look closer to the ears of a child, the elevation also had a face-lift effect. On 2D images, we observed improved facial contour in the temporomandibular region. On 3D images, the volumes of the preauricular, lateral temporal, and lateral cheek regions decreased. This result indicated tightening of these regions after injection. After the 6-month follow-up, this effect weakened but still existed.

The possible explanations for the lift effect occur include the ligament support provided by the deep filling. The ligaments and fascia around the

ear include the tympanoparotid fascia, platysma auricular ligament, parotid masseteric fascia, and parotid cutaneous ligaments.[16,17] Following injection, loose ligaments were tightened, and the superficial musculoaponeurotic system and subcutaneous layer were pulled up based on the soft-tissue space,[18] resulting in facial rejuvenation.

Compared to the surgical procedure, HA injection had almost no recovery period and little trauma. Another advantage was that when HA is partly absorbed, supplementary injection can be performed to maintain ear prominence and shape. If a patient is dissatisfied with the shape post-injection, hyaluronidase can be used to easily dissolve the HA. Vascular embolism is the most severe complication that might occur and should be considered. The major blood vessels around the ears include the posterior auricular artery, the superficial temporal artery, and their branches.[19] These vessels were distributed in the preauricle, postauricle, and subcutaneously in the auricle. The deep surface of the auricular base lacks vessels and is a relatively safe region for injection. Another complication observed in our study was delayed swelling. This might be related to bacterial biofilm formation. To avoid this problem, thorough disinfection and strict aseptic operations should be performed during the injection process.

This study has some limitations, including the lack of long-term follow-up 3D images and morphological data. Moreover, the detailed mechanism of the face-lift effect of auricular base injection should be further studied through anatomical studies.

5. Conclusion

The ears play an important role in facial profiles. In Asian countries, lying ears are not preferred. Several surgical procedures have been reported to correct lying ears; however, only a few injection methods have been described. The authors recommend the use of an HA injection technique. The ear prominence was obviously increased following the unilateral injection of 4–8 mL of HA in the auricular base and was maintained well after 24 months. The injection procedure was minimally invasive, with little aching and without convalescence. No serious complications occurred after the injection. In addition, the injection also had a face-lift effect, making the face contour appear slimmer and more compact.

Ethics approval and consent to participate

The need for ethical approval and consent to participate was waived due to the retrospective nature of the study.

Consent for publication

Informed consent was obtained from all patients for publication of the data contained within this study.

Authors' contributions

Xiong Z: Writing-Original draft, Writing-Review and Editing, Formal analysis. Jiang Z: Methodology, Project administration. Bai Y: Validation. Liang M: Resources. Jiang W: Visualization. Liu K: Conceptualization, Writing-Review and Editing.

Declaration of competing interests

The authors declare that they have no competing interests.

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