Long-term outcomes of otoplasty for correction of prominent ear

Original Article

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ABSTRACT

Objective: To present our own experience in protruding ear correction using a composite technique (combination of sutures and sculpting technique).

Patients and Methods: This retrospective case series study involves 60 patients treated for prominent ear deformity during the period from 2011 to 2022 using a composite technique (combination of sutures and sculpting technique). Long-term follow-up included evaluation of the aesthetic outcomes evaluated as helix-mastoid angle and helix-mastoid distance, patient satisfaction either roughly (as very satisfied, satisfied, or not satisfied); or using the patient outcomes of Surgery-head/neck (POS-head/ neck) questionnaire, and early and late complications.

Results: The current study showed a highly significant improvement in the helix-mastoid angle, helix-mastoid distance, and POS score postoperatively ($p < 0.0001$ for all). The mean operative duration was 100.83 minutes ± 8.93 SD. Forty-two patients (70%) were very satisfied, 17 patients (28.3%) were satisfied, and 1 patient (1.7%) was not satisfied and needed revision surgery. Regarding postoperative complications, only one patient (1.7%) developed early postoperative small hematoma managed by aspiration and tight bandaging of the ear. Late complications included irregularities and a sharp edge in 2(3.3%) patients, ill-defined superior crus in 2 (3.3%) patients, and asymmetry in 4(6.7%) patients.

Conclusion: The used surgical approach in our study utilizing a combination of cartilage cutting, curtilage weakening with a diamond burr, and mattress sutures techniques achieved good cosmetic outcomes with good patient satisfaction and few early and late postoperative complications.

Key Words: Auricular deformity, cartilage cutting technique, otoplasty, prominent ear, weerda technique.

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INTRODUCTION

The most prevalent congenital abnormality, affecting 5% of the population, is prominent ears. The most frequent reasons for auricle protrusion are inadequate antihelix development, excessive concha growth, or a combination of these conditions that results in a cephaloauricular angle greater than 30 degrees[1].

More than 200 different procedures, such as the percutaneous procedure, cartilage sparing, auricular splitting, incision-less, and endoscopic procedures, are used to repair prominent ears. Any surgical intervention aiming to alter the angle only would result in a less natural-looking auricle shape and appearance[2].

The severity of the ear deformity and the unique characteristics of the auricular cartilage determine which surgical treatment is best. Children frequently still have auricular cartilage that is soft, elastic, or easily malleable. In this case, simple suturing methods, like the Mustarde technique[3], are usually sufficient to provide a long-lasting and aesthetically good outcome. The auricular cartilage has already stiffened in adulthood. Therefore, it is typically necessary to use a mix of incision, scoring, and suture procedures. The existence of several ways shows that there isn't a single, universally acclaimed method that is the best [4].

The objectives of prominent ear corrections are to diminish conchal hypertrophy and the conchoscaphal angle, and to define the antihelix. Various procedures have been documented for its correction, therefore the best way is not yet accessible. There are two categories of currently used procedures: cartilage splitting (cutting) and non-cartilage splitting techniques (cartilage sparing)[5].

The attainment of long-lasting cosmetic outcomes is one of the key challenges posed by the otoplasty procedure. In reality, irregularities of the shape and symmetry that result from cartilage release are common[6]. The problem of cartilaginous memory is most prevalent when modifying cartilage using incision, scoring, or abrading methods without the use of sutures. Therefore, the surgical

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procedure should be customized for each patient in order to produce well-shaped, symmetrical, and natural-appearing ears that do not show signs of manipulation[5]. The aim of this study is to present our own experience in protruding ear correction using a composite technique (combination of sutures and cartilage sculpting/ cutting technique.

PATIENTS AND METHODS:

This retrospective case series study involved 60 patients with prominent ears managed during the period from 2011 to 2022. The study was approved by the institutional review board and informed written consent was taken from every patient before the surgical procedure.

Pre-operative evaluation:

During the preoperative evaluation, attention should be paid to the following parameters as described by Farkas[7]: helix-mastoid angle, helix-mastoid distance, cranial helical rim, helical rim at the level of the cavum conchae, hypoplastic antihelix, antithetical folding, conchal hyperplasia, cavum conchae, the position of the lobule, isolated changes at the ear (like coloboma, Darwin tubercle, auricular appendage), cartilage consistency either soft and easily pliable cartilage; or thick, stiff and poorly pliable cartilage. Patients were also assessed for whether that was the first intervention or revision, and the tendency to develop keloids.

Medical history: the doctor-patient discussion was an important precondition for pre-and postoperative compliance. Apart from the patient's past history in general, the question of previous ear surgery or otoplasty should always be addressed. Previous otoplasties are frequently associated with some degree of scarring, which may influence further surgical planning and the postoperative outcome.

Problem analysis:

ENT examination was performed to exclude other potential causes of protruding ears, such as retro auricular space-occupying lesions or traumatic cartilage deformities. Accurate problem analysis of the antihelix fold, helixmastoid angle, helix-head distance, and position of the lobule and of the cavum conchae is crucial. Another aspect with a significant impact on procedure planning was the analysis of the cartilage consistency and here, in particular, the stiffness and thickness of the cartilage. The consistency of the cartilage was typically evaluated by palpitation and cautious, controlled bending. Additional ear abnormalities, such as auricular appendages, Darwin tubercle, etc., could also be excluded in many cases simply by an inspection-based diagnosis. The magnitude of the problem regarding patient satisfaction was measured using an Arabic translation of the Patient Outcomes of Surgery-head/neck (POS-head/ neck), a validated questionnaire for clinical outcome measurements[8] in head and neck surgery (Figure 1).

Occasionally, threshold audiometry with impedance testing may be required to exclude possible conductive or perceptive hearing losses. pre- and postoperative photographic documentation in frontal, lateral, oblique, and dorsal views

Operative technique:

Under general anesthesia (Figure 2-A), the operation started with a dumbbell shape skin incision with the narrow central portion of the incision exactly opposite the external auditory meatus (Figure 2-B, Figure 3- A). The skin was undermined with conchal cartilage exposure (Figure 2-C). Medial rotation of the auricle was done with a conchal cartilage bulge in the external meatus. Two areas of cartilage were resected in all cases: 1-cartilage around the external meatus to avoid bulging of the concha into the external auditory meatus (Figure 2-D, Figure 4-A), 2-Second piece of cartilage to prevent swinging of auricle below the anterior end of inferior crus (Figure 2- E, Figure 4-B). The antihelix was then defined with needles (Figure 2- F). An incision was done along the perichondrium to the cartilage (Figure 2- G), Thinning of the cartilage of the antihelix was done with a diamond burr (Figure 2-H) (Weerda technique[9]). The fixation of the newly formed antihelical fold was finally achieved with mattress suture (Figure 2-I), The lobule should be positioned parallel to the plane of the upper third of the ear (Figure 2- J, K). The retroauricular skin incision (fishtail) (Figure 3-B) could easily be extended to the middle of the lobule, and subsequently, skin excisions could be performed to the extent required in combination with fat resection in the area of the lobule. Adequate dorsal preparation of the retroauricular skin and the connective tissue should be done to prevent narrowing of the external auditory canal by mattress sutures placed too far ventrally (Figure 2-L). Packing of the wound was then done with cotton or straps soaked with an antibiotic.

Post-operative Care:

The first dressing change was usually performed on the 2nd postoperative day to ensure that a possible hematoma was recognized early and drained, if necessary. In addition, peri - and postoperative antibiotic prophylaxis was prescribed over 7 days. On the 7th- 8th postoperative day, the sutures were removed and the dressing was replaced by a headband. The headband should be worn for another 4-6 weeks, at least at night, to prevent accidental kinking of the auricle. At 6 and 12 months after the operation, further photographic documentation was done.

Post-operative evaluation: favorable aesthetic outcomes include a helix mastoid angle of 10-25 degrees, a helical rim that is 1.5 -2 cm from the mastoid, a concho-scaphoid angle of 90 degrees, an antihelix (smooth, rounded, regular curve) with inferior and superior crus and a normally positioned lobule in normal position. Patient satisfaction was assessed one-month postoperative using a rough estimation of either well satisfied, satisfied, or not satisfied. POS-head/ neck questionnaire was used for every patient to be compared with the preoperative questionnaire score. Early complications were evaluated during the first week after surgery including pain, hematoma, postoperative hemorrhage, wound infection, perichondritis, cartilage-skin necrosis, and allergic reaction. Late complications were evaluated three months after surgery including hypertrophic scars, keloids, fistulas, granulomas, hypo and paraesthesia, recurrence, and auricular cartilage deformities.

Statistical Analysis:

Data were collected, tabulated, and statistically analyzed using an IBM personal computer with IBM Statistical Package of Social Science (SPSS) version 23, Armonk, NY, USA. Qualitative data were presented as numbers and percentages, while quantitative data were presented as mean and standard deviation. Data turned up to be non-normally distributed according to the Kolmogorov-Smirnov test. Wilcoxon signed-rank test was used to compare preoperative and postoperative paired quantitiaive data. A two-sided *p-value* of (<0.05) was considered statistically significant, while a *p-value* of (*< 0.001*) was considered highly significant.

During the past 4 weeks, how often has the shape of your ears caused you to feel:

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
Annoyed?	1	2	3	4	5
Unattractive?	1	2	3	4	5
Self-conscious about the shape of your auricles?	1	2	3	4	5
Disgusted with the shape of your auricles?	1	2	3	4	5
Worried?	1	2	3	4	5

During the past 4 weeks, how bothered were you by:

	Not at all	A little	Moder-ately	Quite a bit	Extremely
The appearance of the shape of your auricles	1	2	3	4	5

Fig. 1: The Patient Outcomes of Surgery-head/neck (POS-head/ neck) Questionnaire.

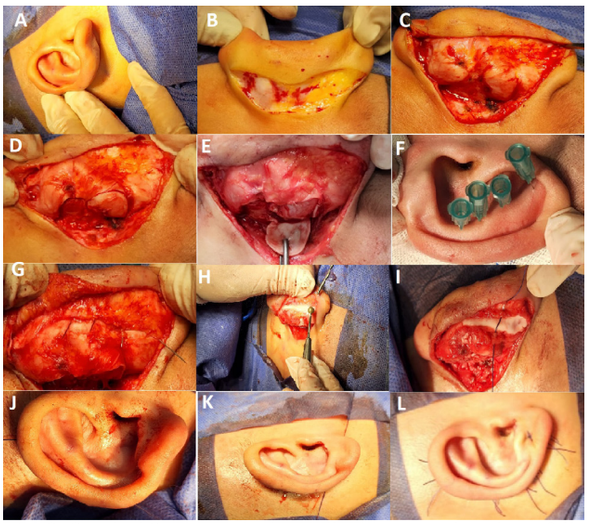

Fig. 2: Surgical Steps: **A:** An immediate preoperative view of the auricle, **B:** A dumbbell shape skin incision with the narrow central portion of the incision opposite the external auditory meatus, **C:** Undermining the skin and exposure of the posterior surface of the auricle, **D:** The first piece of cartilage removed around the external meatus to avoid bulging of the concha into the external auditory meatus, **E:** The second piece of cartilage removed to prevent swinging of auricle below the anterior end of inferior crus, **F:** Defining the antihelix with needles. **G:** Incision of the perichondrium at the posterior surface of the auricular cartilage at the level of needle markings, **H:** Thinning of the cartilage of antihelix with a diamond burr. **I:** Fixation of the newly formed antihelical fold with mattress sutures, **J:** Protrusion of the lobule of the ear after fixation of the new antihelix. **K:** The lobule is positioned parallel to the plane of the upper third of the ear. **L:** Final Shape of the auricle after the reformation of the antihelix and repositioning of the lobule.

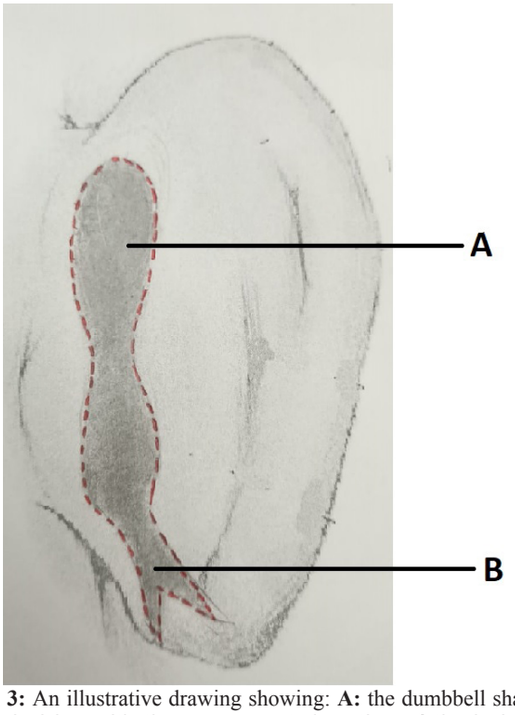

Fig. 3: An illustrative drawing showing: **A:** the dumbbell shape skin incision with the narrow central portion of the incision exactly opposite the external auditory meatus. **B:** The fish-tail extension of the skin incision for repositioning of the ear lobule.

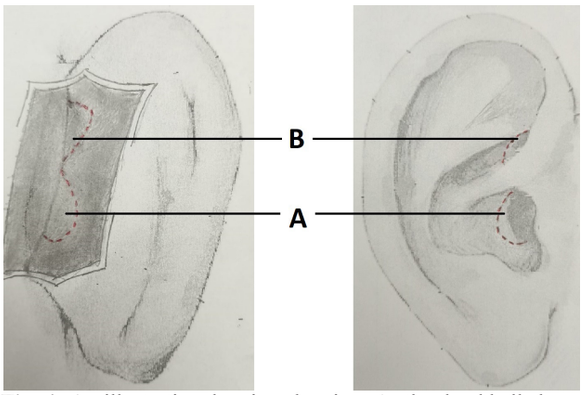

Fig. 4: An illustrative drawing showing: **A:** the dumbbell shape skin incision with the narrow central portion of the incision exactly opposite the external auditory meatus. **B:** The fish-tail extension of the skin incision for repositioning of the ear lobule.

RESULTS:

The current study included sixty patients distributed as 38(63.3%) females and 22(36.7%) males with a mean age of 11.4 years ± 5.73 SD with 48% (80%) under 18 years of age. Out of the included sixty patients, 57 (95%) patients had bilateral protruding ears, and only 3(5%) patients had unilateral protruding ears. The mean helix-mastoid angle of the study patients was 55.2 degrees ± 17.93SD with a mean helix-mastoid distance of 25.08 mm ± 2.78 SD (Table 1).

The current study showed a highly significant improvement in the helix-mastoid angle, helix-mastoid distance (Figures 5, 6, 7, 8, 9, 10), and POS score postoperatively ($p < 0.0001$ for all) (Table 2).

In the present study, the mean operative duration was 100.83 minutes ± 8.93 SD. A rough estimation of patient satisfaction revealed that 42 patients (70%) were very satisfied, 17 patients (28.3%) were satisfied, and 1 patient (1.7%) was not satisfied and needed revision surgery. Regarding postoperative complications, only one patient (1.7%) developed early postoperative small hematoma managed by aspiration and tight bandaging of the ear. Late complications included irregularities and a sharp edge in 2(3.3%) patients, ill-defined superior crus in 2 (3.3%) patients, and asymmetry in 4(6.7%) patients (Table 3).

Table 1: Sociodemographic and preoperative clinical data of the studied group:

Parameter		No	%
Gender	female	38	63.3
	Male	22	36.7
Side	Bilateral	57	95
	Unilateral	3	5
Age	Up to 6 years	16	26.7
	6-18 years	32	53.3
	More than 18 years	12	20
		Mean	SD
Age		11.4	5.73
helix-mastoid angle.		55.2	17.93
helix-mastoid distance.		25.08	2.78

Table 2: Comparison between preoperative and postoperative measurements

Parameter	Preoperative	Postoperative	Wilcoxon Sign Rank test	*p value*
Helix-mastoid angle.	55.2 ± 17.93	14.08 ± 2.4	z =-6.7359.	*< 0.00001*
Helix-mastoid distance.	25.08 ± 2.78	13.5 ± 1.13	z =-6.7359.	*< 0.00001*
POS score	8.93 ± 1.01	25.87± 1.6	z =-6.7359.	*< 0.00001*

POS: Patient Outcomes of Surgery-head/neck (POS-head/ neck)

Table 3: Assessment of operative and postoperative details

Parameter		Mean	SD
Operative Duration		100.83	8.93
		No.	%
Patient Satisfaction	Very satisfied	42	70
	Satisfied	17	28.3
	Not satisfied	1	1.7
Early complication	Hematoma	1	1.7
Late complications	Irregularities and sharp edge	2	3.3
	Ill-defined superior crus	2	3.3
	Asymmetry	4	6.7

Fig. 5: Case 1: **A:** Preoperative frontal view showing bilateral prominent ears with ill-defined antihelix, **B:** Preoperative dorsal view showing bilateral prominent auricles with large helix-mastoid angle and helix-mastoid distance, **C:** Postoperative dorsal view showing good cosmetic results with bilaterally corrected helix-mastoid angle and helix-mastoid distance, **D:** A 12 months postoperative frontal view showing good cosmetic results with no prominent ears deformity.

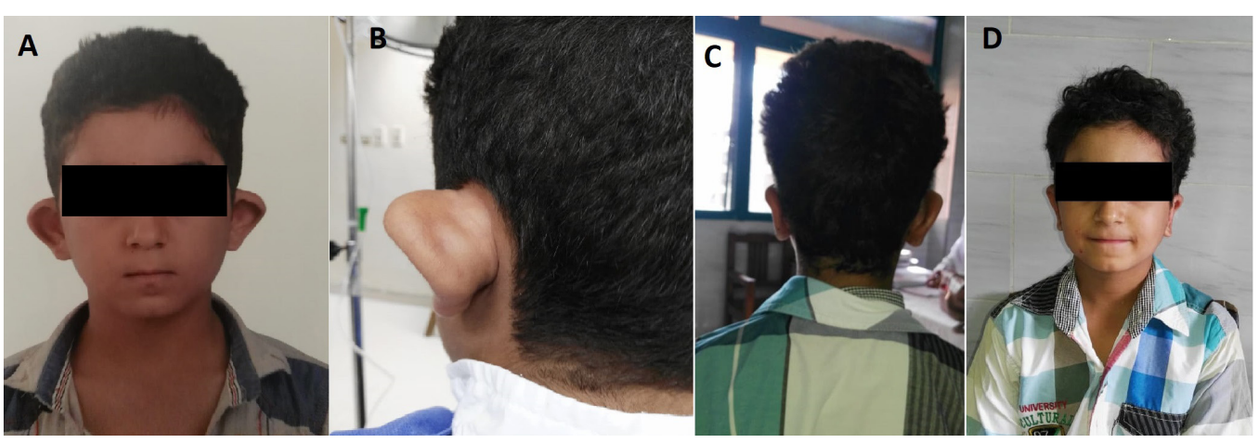

Fig. 6: Case 2: **A:** Preoperative frontal view showing bilateral prominent ears with ill-defined antihelix, **B:** Preoperative dorsal view of the left auricle showing prominent auricle with large helix-mastoid angle and helix-mastoid distance, **C:** Postoperative dorsal view showing good cosmetic results with bilaterally corrected helix-mastoid angle and helix-mastoid distance, **D:** A 6 months postoperative frontal view showing good cosmetic results with no prominent ears deformity.

Fig. 7: Case 3: **A:** Preoperative frontal view showing bilateral prominent ears with ill-defined antihelix, **B:** Preoperative dorsal view showing bilateral prominent auricles with large helix-mastoid angle and helix-mastoid distance, **C:** Postoperative dorsal view showing good cosmetic results with bilaterally corrected helix-mastoid angle and helix-mastoid distance, **D:** A 6 months postoperative frontal view showing good cosmetic results with no prominent ears deformity.

Fig. 8: Case 4: **A:** Preoperative frontal view showing bilateral prominent ears with ill-defined antihelix, **B:** Preoperative dorsal view showing bilateral prominent auricles with large helix-mastoid angle and helix-mastoid distance, **C:** Postoperative dorsal view showing good cosmetic results with bilaterally corrected helix-mastoid angle and helix-mastoid distance, **D:** A 6 months postoperative frontal view showing good cosmetic results with no prominent ears deformity.

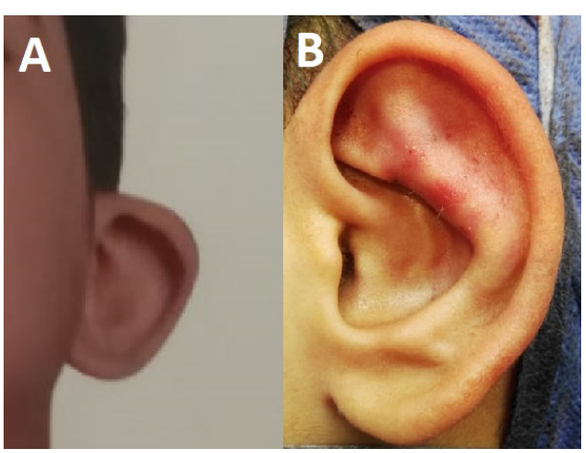

Fig. 9: A: A preoperative frontal view of the left auricle showing severe prominent ear deformity with ill-defined auricular landmarks, **B:** A postoperative lateral view of the left auricle showing corrected prominent ear with well-defined auricular landmarks

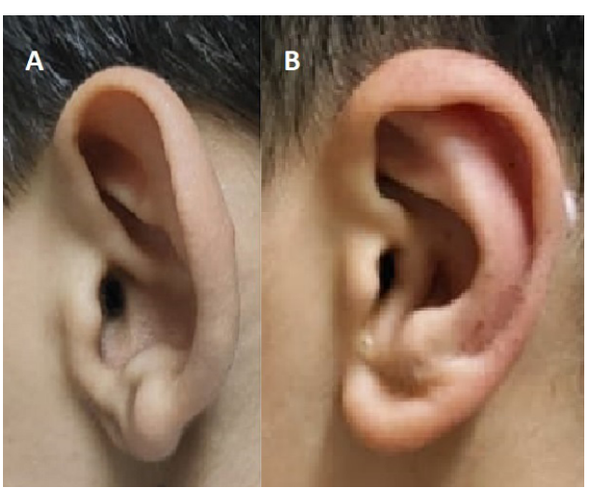

Fig. 10: A: A preoperative lateral view of the left auricle showing prominent ear deformity with ill-defined antihelix, **B:** A postoperative lateral view of the left auricle showing corrected prominent ear with well-defined auricular landmarks

DISCUSSION

Some key guidelines on the objectives and constraints of the surgeon should be discussed prior to surgical repair of prominent ears. McDowell in his Goals of Otoplasty[10] provided some essential advice to remember both before and after the procedure: Correction of the upper third of the protruded ear should be prioritized. The helix should be discernible behind the antihelix when looking anteriorly at the subject. The helix should have a continuous and smooth contour rather than a broken or sharp one (as can occur in the Luckett procedure[11]. The postauricular sulcus shouldn't change shape or significantly shrink. The distance between the mastoid skin and each component of the helix should be between 10 and 12 mm in the upper third of the ear, 16 to 18 mm in the middle third, and 20 to 22 mm in the lower third. The distance from the lateral ear border to the head at any point between the two ears should be within 3 mm of one another.

Regardless of the technique, a thorough preoperative history and physical examination should be done before surgery. Each ear should be examined separately and in relation to the other one, noting any protrusion, proportionality to facial features and the head, angular relationships of the mastoid to the auricle, and any other malformations. Preoperative and postoperative photos are necessary for planning and documentation. It's also crucial to assess the patient (and frequently, the patient's parents). Realistic expectations should be set in this regard, along with a clear grasp of the patient's objectives for the procedure. With the patient and/or parents, complications and how crucial it is to follow postoperative instructions should also be thoroughly explained.[12]

Since the invention of cosmetic otoplasty, hundreds of methods for the correction of protruding ears have been documented. Despite the intense debate, no single method has emerged as the preferred one. The two main categories of otoplasty methods are cartilage cutting and cartilage contouring or sparing, which includes the mere cartilage suturing. The auricular cartilage can be cut using a variety of methods, including scoring, abrading, excising, and full - or partial-thickness incisions. Although it is obvious that there is an increased risk of postoperative cosmetic deformity due to the sharp surfaces created when the cartilage is cut to any degree, these procedures rely on cartilage bending away from the cut side and, typically, have been thought to improve the duration of surgical results. In the exclusive cartilage reshaping/sparing method, the native auricular structure is recreated just by utilizing sutures. Suture-only otoplasty substantially avoids scarring and the aforementioned contour deformities, although there is a larger risk of chronic or recurring auricular abnormality[12]. The most recent developments in otoplasty have focused on improving these methods by making adjustments that address their flaws. Many of the reports under review cover combination strategies and adjustments, highlighting the benefits of each while striving to prevent any potential drawbacks.

In the current study, we presented our own experience in protruding ear correction using a composite technique (combination of sutures and cartilage cutting technique). Two areas of cartilage were resected in all cases: the first piece of cartilage around the external meatus to avoid bulging of the concha into the external auditory meatus, 2- Sand the second piece of cartilage to prevent swinging of auricle below the anterior end of inferior crus. Thinning of the cartilage of the auricle was done using a diamond burr (Weerda technique[9] and the fixation of the newly formed antihelical fold was finally achieved with mattress suture. The study showed a highly significant improvement in the helix-mastoid angle, helix-mastoid distance, and POS score postoperatively. Forty-two patients (70%) were very satisfied, 17 patients (28.3%) were satisfied, and 1 patient (1.7%) was not satisfied and needed a revision surgery Regarding postoperative complications, only one patient (1.7%) developed early postoperative small hematoma managed by aspiration and tight bandaging of the ear. Late complications included irregularities and a sharp edge in 2(3.3%) patients, ill-defined superior crus in 2 (3.3%) patients, and asymmetry in 4(6.7%) patients.

To shape thick, low-elastic auricular cartilage, Weerda's[9] otoplasty approach, which involves cartilage thinning, may be appropriate. Using a retroauricular access and a diamond drill, the auricular cartilage is weakened just above and below the proposed new antihelical fold and the antihelical crus. To protect the skin, caution must be exercised. The cartilage should be gently saucer-shaped and consistently thinned. Drilling should be done in a gradual sweep posteriorly, not superiorly, starting from the concha and moving towards the mastoid. This phase is crucial for aligning the anti-helical fold such that it goes anteriorly rather than superiorly, which avoids an "operated look." To avoid heat-induced chondronecrosis, drilling must be rinsed continuously[5]. The antihelix plasty can be performed on individuals with stiff or thick cartilage using this rather easy and practical technique. However, improper handling of the cartilage still carries a risk of chondronecrosis. A partial or complete recurrence of the initial auricular deformity may happen after the absorbable suture material has completely dissolved and after the auricular cartilage has not been adequately prepared with the drill. The recurrence rate can be reduced by employing nonabsorbable suture material

rather than absorbable suture material, much like in the Mustardé suture technique[5].

In our work, it was simple to manipulate the pinna to create the new anti-helical fold once the cartilage had been thinned posteriorly. After that, mattress sutures made of 5/O prolene are inserted on either side of the thinned cartilage, with the inner and outer cartilage bites being separated by 8–10 mm and 10–12mm, respectively. Using the sutures alone as in the Mustarde technique[3], one of the most widely used methods for reducing the prominence of the ear has the advantages of persistent antihelical fold formation and ease of the procedure. Because it solely corrects the prominence of the upper part of the auricle, the operation is restricted. The Mustarde technique has its share of issues, including poor suture placement that exposes sutures through postauricular skin erosion. Additionally, it's crucial to keep in mind that the Mustarde approach focuses mostly on the superior portion of the ear. For the majority of otoplasties, the Mustarde procedure alone is typically insufficient; additional surgery is typically needed to address the overdeveloped conchal bowl as well.[13]

Therefore, our combination between cartilage sculpting and mattress sutures techniques allowed us to achieve good cosmetic results by minimizing the disadvantage of cartilage cutting techniques caused by sharp cartilage edges and the disadvantage of sole suture techniques in the form of recurrent auricular deformities.

CONCLUSION

The used surgical approach in our study utilizing a combination of cartilage cutting, curtilage weakening with a diamond burr, and mattress sutures techniques achieved good cosmetic outcomes with good patient satisfaction and few early and late postoperative complications.

CONFLICT OF INTEREST

There are no conflicts of interest.

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