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Correction of Flat Auricular Helix: A Modified Technique

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Abstract

Background: The flat helix, the outermost rim of the ear, is a crucial anatomical feature that contributes to the overall shape of the ear, playing a significant role in sound collection and individual appearance.

Aim: To correct the deformity of the ear's helix, restoring its natural contour and functionality.

Patients and Methods: This retrospective research has been conducted on ten cases with a confirmed diagnosis of flat helix deformity from attendees of plastic surgery clinics of university hospitals.

Results: The mean operative time of the examined group was 47.5±8.89 minutes. The average number of radial incisions in the studied cohort was 3.5±0.71. Ten percent (10%) of the analyzed cohort experienced light hemorrhage post-operation, 10% developed an infection, 50% exhibited mild edema, 50% presented with extreme edema, and 20% encountered partial recurrence. The average follow-up period for the study group was 5.4±1.07 months. Ten percent of the study group were dissatisfied, ten percent were neutral, twenty percent were satisfied, and sixty percent were extremely satisfied.

Conclusion: The procedure enhanced the symmetry, fixed the ear helix deformity, and reduced the chance of recurrence. Eighty percent of patients expressed high levels of satisfaction.

Key Words: *Cartilage – Deformity – Flat helix – Otoplasty.*

Ethical Committee: An official authorization has been received from the Institutional Research Board: Permission by the Institutional Review Board (IRB), Faculty of Medicine, Mansoura University (R.24.12.2929.R2).

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Introduction

The outermost rim of the ear, known as the helix, is a critical anatomical feature both functionally and aesthetically, as it contributes to the overall shape of the ear. Defects or deformations in this area can lead to functional issues such as impaired sound directionality, and aesthetic concerns that may affect an individual's self-esteem and social interactions, so surgical intervention may be necessary if it is damaged **[1]**.

Multiple conditions may affect the shape of the helical rim; These can be categorized into traumatic causes such as lacerations or burns, congenital as Stahl's ear or lop ear deformity, and pathological causes such as skin malignancies or recurrent infection of the ear **[2]**.

Helix restoration aims to rectify aesthetic and functional problems. The operation may be conducted independently or integrated into more intricate ear reconstruction initiatives, especially for patients with significant trauma or congenital anomalies such as microtia **[3]**.

The ear cartilage plays a central role in maintaining the helix's shape and most repairs involve manipulating or reinforcing this cartilage. Various surgical techniques are employed depending on the defect's specific nature. In simpler cases, local flaps or grafts of skin or cartilage may be used to restore a smooth and natural contour to the helix. Complex cases, including congenital malformations or significant injuries, may necessitate cartilage grafting from other body regions, like the ribs, to achieve complete reconstruction of the helix. The choice of technique depends on the surgeon's assessment and the extent of the injury or defect **[4]**.

Postoperative care following flat helix repair is crucial to ensure optimal healing and minimize

complications. The patient's ear must be protected from pressure or injury during the initial healing period, typically through the use of bandages or protective splints [5,6].

Common complications associated with flat helix repair include infection, hematoma formation, or scarring. These complications can generally be managed effectively with appropriate care, but in some cases, secondary procedures may be necessary to address any residual deformities or complications that arise during the healing process [7,8].

This study aims to rectify the flat helix deformity, restoring its normal contour and shape.

Patients and Methods

This study is a retrospective analysis of patients who underwent flat helix repair between 2018 and 2024 at the Plastic Surgery Department of Mansoura and Kafr El-Sheikh University Hospitals. Patients who had insufficient cartilage or other anatomical restrictions, rather than prominent ear, were excluded from the study. An official authorization has been received from the Institutional Research Board: Permission by the Institutional Review Board (IRB), Faculty of Medicine, Mansoura University (R.24.12.2929.R2). All patients provided written informed consent.

Ten patients were included in the study. All patients had corrections of bilateral deformity; so, the number of ears that had been operated upon was 20. Six out of ten patients had bilateral prominent ears that were addressed concurrently with flat helix repair. Preoperatively, a complete physical examination was done, including assessing the degree of helix flattening, ear symmetry, and overall ear anatomy. Standardized pictures of the patients were obtained from various angles for documentation and subsequent comparison.

Surgical procedure:

The posterior auricular approach was conducted under local anesthetic with two percent lidocaine and adrenaline at a dosage of 1:200,000. An incision was made from the upper pole of the ear to the center of the concha (Fig. 1). If prominent ears are accompanied by a flat helix, the incision is extended to the inferior limit of the concha to make the otoplasty surgery easier.

Complete degloving of the skin and subcutaneous tissue enveloping the helix had been carried out until the antihelix was revealed (Fig. 2).

Subsequently, three to five radial incisions, each measuring five to ten millimeters in length and spaced five to ten millimeters apart, were made at the helical rim, directed toward the scapha (Fig. 3). Cartilage has been sectioned obliquely rather than perpendicularly to produce beveled surfaces and avert step-off deformity post-suturing. Attention was made to restrict the incisions to the helix to avoid compromising the scapha or the antihelix.

The free edges of the cartilage were advanced and overlapped to form a small triangular cartilage flap (Fig. 4), which was seamlessly sutured with horizontal mattress sutures of non-absorbable 5/0 Prolene sutures (Ethicon Inc.).

By changing the extent of cartilage overlapping and the length of the incisions, we could accurately calibrate the optimal helical curl. Any abnormality in the freshly constructed helical rim was readily trimmed. The skin flap was then redraped over the cartilage and secured in one layer with 5/0 polyglactin absorbable sutures (Ethicon Inc.) (Fig. 5).

A non-adherent dressing was applied to the posterior suture line and then covered with a gauze pad. The anterior surface of the freshly formed helix was covered with a splint made of fluffed gauze and paraffin oil (Fig. 6), and the dressings were secured in place with a head wrap.

Postoperative complications such as hematoma, infection, excessive edema, and recurrence were recorded for each case. All patients completed a questionnaire regarding their satisfaction level with the operation for 6 months postoperatively (Figs. 7,8).

Data analysis:

The gathered data have been encoded, processed, and analyzed utilizing the SPSS software (Version 25) for Windows. Descriptive statistics have been computed involving standard deviations, means, ranges, medians, and percentages. Independent *t*-tests have been conducted for continuous variables to compare the means of normally distributed data, while Mann-Whitney U tests have been utilized to assess median variations in non-normally distributed data, and chi-square tests have been utilized for categorical data.

Fig. (1): Marking of the incision.

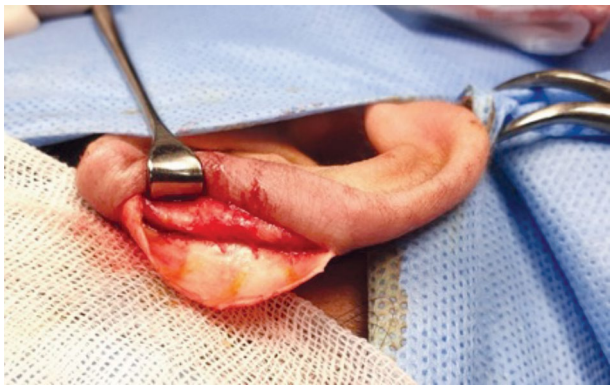


Fig. (2): Exposure of helical rim.

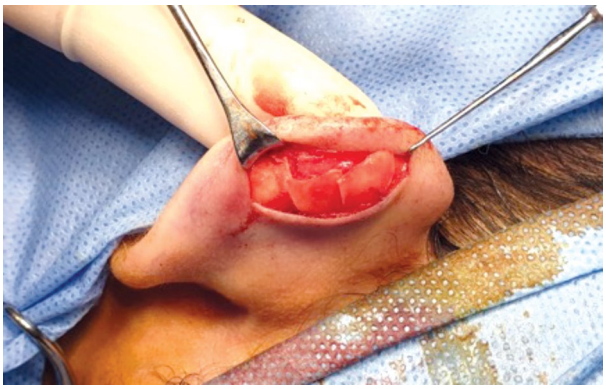
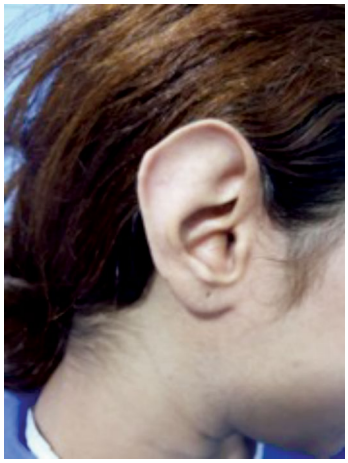
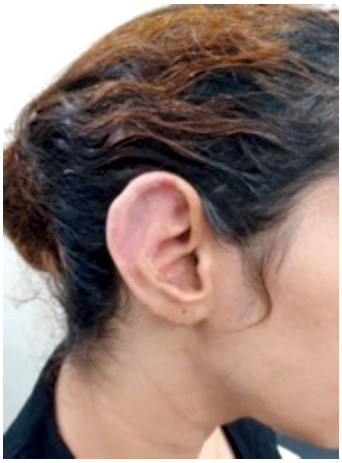
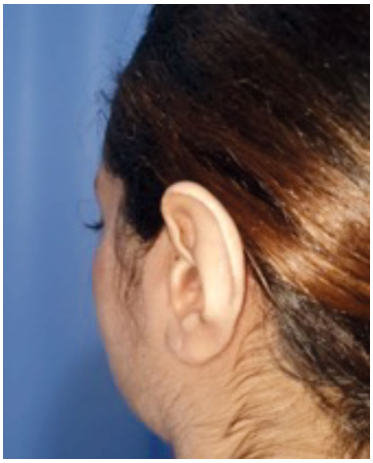


Fig. (3): Radial incisions of the cartilage.

Fig. (4): Molding of helical rim cartilage.

Fig. (5): Intraoperative redraping of skin.

Fig. (6): Splinting of new molded helix.

(A)  (B)  (C) 

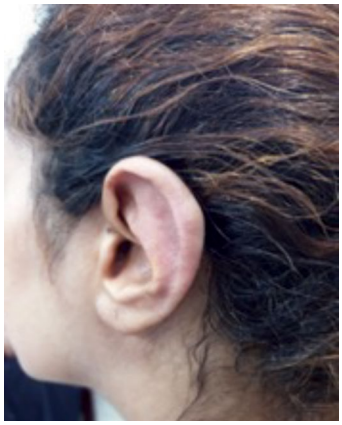
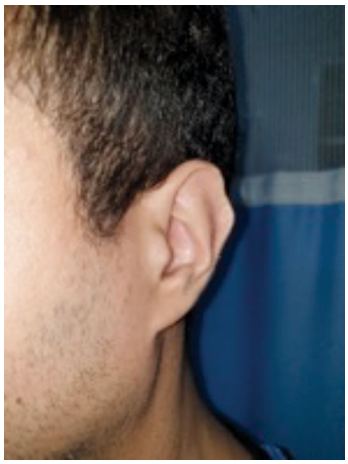
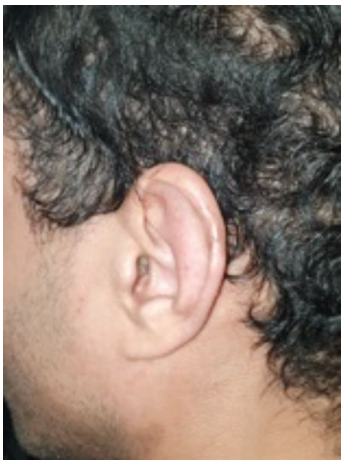
(D) 

Fig. (7): (A, C): Pre-operative. (B, D): Post-operative.

(A)  (B)  (C) 

(D)  (E) 

Fig. (8): (A, B): Pre-operative.
(C): Early post-operative.
(D, E): Post-operative.

Results

The mean age of the studied group was 17.6±6.6 years; 4 of them were males, while 6 of them were females. Six out of ten patients had bilateral concomitant prominent ear anomalies. The mean operative time was 47.5±8.89 minutes (Table 1). The mean number of radial incisions was 3.5±0.71.

Postoperatively one patient had hematoma at one side of the operated ears that was managed successfully operatively by evacuation. Another patient developed an infection on the 5th postoperative day on one side and was managed conservatively with antibiotics (Table 2).

Three patients had excessive edema bilaterally that resolved spontaneously within approximately 2 weeks. Two patients had a partial recurrence on one side along a portion of the corrected helical rim that was corrected at another session.

The mean follow-up duration of the studied group was 9.4±3.7 months (Figs. 7,8). Regarding postoperative satisfaction (Table 3), 10% of patients were unsatisfied, 10% were neutral, 20% were satisfied, and 60% were very satisfied.

Table (1): Operative data in the studied group.

	Studied group
Operative time(min) / Mean ± SD	47.5±8.89
No. of radiating incisions / Mean ± SD	3.5±0.71

Table (2): Postoperative complications in the studied group.

	Studied group (No. of operated ears, N=20)
Hematoma	1 (10%)
Infection	1 (10%)
Edema	6 (30%)
Partial recurrence	2 (10%)

Table (3): Satisfaction in the studied group.

	Studied group (N=10)
Very unsatisfied	0 (0%)
Unsatisfied	1 (10%)
Neutral	1 (10%)
Satisfied	2 (20%)
Very satisfied	6 (60%)

Discussion

The helix is an important anatomical structure to the overall shape of the auricle. Despite that, the literature addressing its deformities is relatively little. Flat helix can exist as an isolated deformity or be associated with other auricular congenital anomalies such as Stahl's ear deformity which is characterized by trifurcation of antihelix and helical rim flattening. However, techniques described in the treatment of the latter anomaly are more complex and exceed the scope of correcting isolated flat helix deformity **[9,10]**.

North JF et al., related the cause of the anatomical feature of the flat helix to the excessive length of the free border of cartilage occupying the rim of the ear which is longer than the line it normally occupies. They illustrated that in a normally shaped helix, the length of the free border of cartilage is shorter than that of the periphery of the pinna. So, they proposed shortening the free border of the cartilage by taking a full-thickness wedge from the helix to shorten it **[11]**. Maurice PF et al advocated the same principle of removing a full-thickness wedge of the helix or multiple wedges if needed, taking care not to violate the scapha **[12]**. Authors believe that this method is a straightforward technique for flat helix correction, but on the other hand, it risks a visible scar at the lateral aspect of the auricle that can be troublesome, especially in dark-skinned populations.

Wilbrand et al, **[13]** described another method for correction of the isolated flat helix deformity in one patient using the Stenstrom scoring principle **[14]**. They advocated scoring of the cartilage via a retro auricular approach so that it warps away from the injured surface **[13]**. But, from authors point of view, this method may be unpredictable, especially in patients with thin cartilage who may have cartilage tear or perforation and subsequently an unnatural result. So, this technique should be further studied to clarify its safety and efficacy.

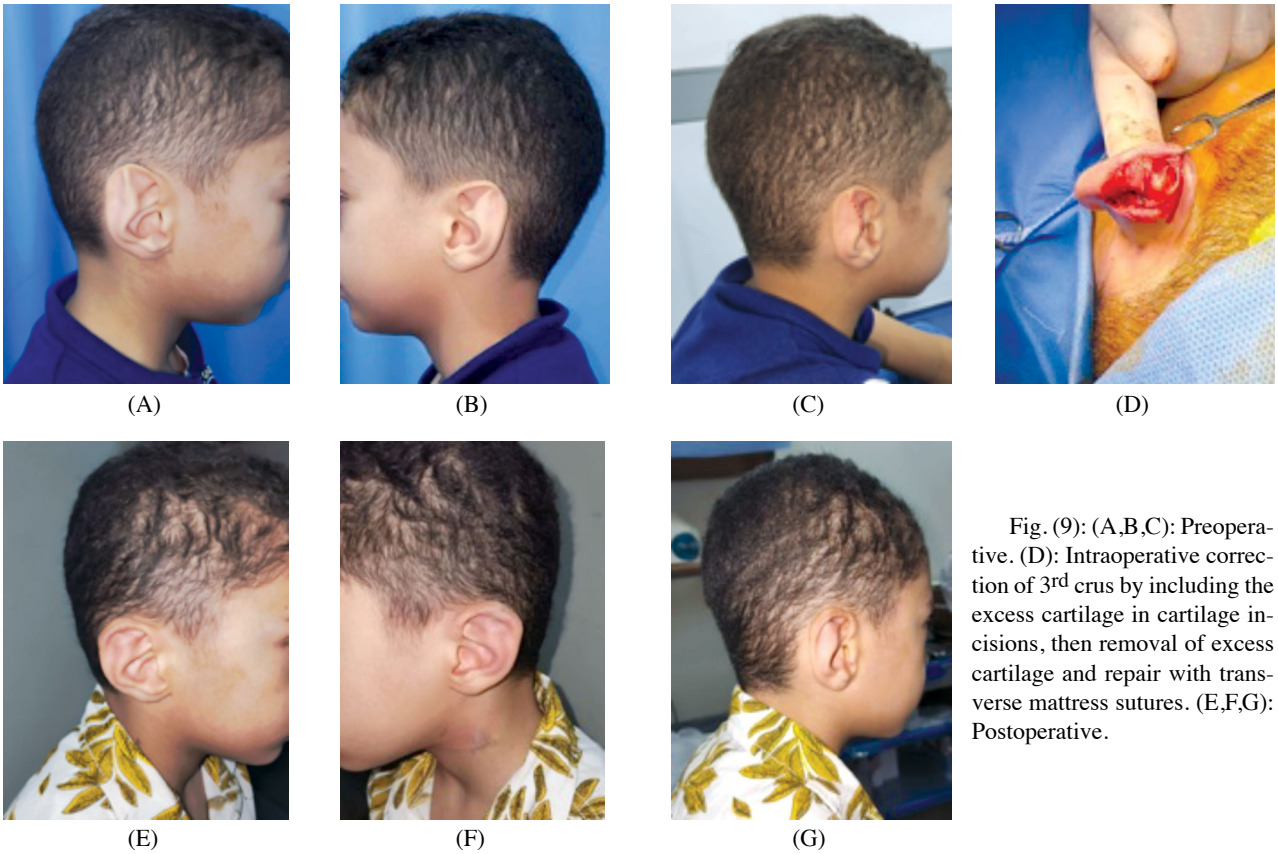
Hasaballah et al., **[15]** addressed the flat helix directly by removing a wedge of skin about 8mm from the free edge of the auricle with a maximum width of about 8-10mm between the root of the helix to the level of the antitragus, subsequently, the underlying cartilage is scored, this is followed by suturing the two edges of the skin without undermining. Although this technique addresses deformity directly, it doesn't take into account the associated prominent ear deformity which would need another retroauricular incision if it coexists.

Lykoudis EG et al., introduced a simple and reliable procedure that allows flat helix correction. Using a retroauricular approach, the helix cartilage is exposed after degloving, then multiple nearby radial incisions are done creating small triangular cartilaginous flaps that are overlapped and secured with sutures **[16]**. This method applies to the same principle advocated by North JF et al., **[11]** by shortening the length of the free border of cartilage through cartilage incision and overlapping via a retroauricular approach.

Authors believe that the technique introduced by Lykoudis EG et al., **[16]** is simple, effective, safe, and predictable. Moreover, it can be combined with an otoplasty procedure for the correction of concomitant prominent ear deformity. We performed this technique in all patients for the correction of flat helix deformity. Using this method, we were able to obtain the desired helical curl by changing the length or number of cartilage incisions and the amount of overlap between the cartilaginous flaps. In current research, the direction of cartilage incision toward the scapha was determined intraoperatively to determine the better direction to create triangular flaps. By cutting rather than removing the cartilage, we can precisely replicate the desired curl, in contrast to other methods **[11,12]** that required wedge excision of skin and cartilage. Therefore, the cartilage was preserved, and if any undesired shape was obtained during surgery, it could be easily reversed.

According to postoperative complications, hematoma occurred only once and was effectively managed with evacuation. Infection happened in one ear on the 5th postoperative day and was managed conservatively using antibiotics. Excessive edema arose in 6 ears and resolved spontaneously within two weeks. All of the previously mentioned complications occurred only in patients who had concurrent prominent ear correction with flat helix repair. Therefore, it is obvious that a combination of flat helix repair with other procedures as otoplasty, might have undoubtedly increased the risk of well-tolerated complications as we mentioned earlier.

Regarding the recurrence of the flat helix deformity; it occurred only in two ears within two months postoperatively and involved a portion of the helix only. It was successfully corrected under local anesthesia at another session, the authors suppose that the radial incisions to be extended until creating overlapping cartilaginous flaps. Considering the postoperative aesthetic outcome, we were able to provide a natural result of the helical curl using this method with no visible scars. Most patients were satisfied with the aesthetic outcome of the newly corrected helix (Fig. 9).



(A) (B) (C) (D)

(E) (F) (G)

Fig. (9): (A,B,C): Preoperative. (D): Intraoperative correction of 3rd crus by including the excess cartilage in cartilage incisions, then removal of excess cartilage and repair with transverse mattress sutures. (E,F,G): Postoperative.

The current study was limited to a small sample size due to the limited number of patients seeking correction of flat helix, hence, more studies with a larger sample size need to be conducted to confirm our results. Future studies should focus on patients with isolated flat helix deformity only with no other additional anomalies, such as prominent ears; consequently, the results would be more valid.

Conclusion:

The technique of cartilage cutting and overlapping provides a predictable, safe and modifiable option for correction of flat helix deformity. Flat helix is often accompanied by prominent ears, which are easily corrected using the same retroauricular incision during the same setting.

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