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ORIGINAL ARTICLE

Helix free otoplasty for correction of prominent ear

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Summary *Background:* Prominent or bat ear is not uncommon deformity as it affecting 5% of population. Plenty of procedures were reported for its correction. Being plenty means it is still a subject of research. The current procedures could be summarized as cartilage sparing and cartilage splitting ones.
Methods: During a period of 35 months a total of 31 patients were presented with bilateral prominent ears so the included a total of 62 ears. Their average age was 8 years (ranging from five to 18 years). All deformities were corrected using helix free otoplasty technique which included skin paddle excision, separation of helical cartilage (hence the name helix free), anterior scoring, backward folding, mattress and simple suturing of the folded cartilage, proper definition of antitragus and earlobe and concha-mastoid sutures. Outcomes including patient's and/or guardians' satisfaction were determined.
Results: The postoperative period was uneventful except two cases that developed early postoperative hematomas, one case shows late postoperative antihelical fold irregularity in one ear and other case developed ill defined superior helix in one ear. The average follow up period of two years shows no recurrences. Almost all patients (96.85%) and their guardians were satisfied with the aesthetic results while only one (3.2%) was dissatisfied.
Conclusion: Helical free otoplasty technique addresses the deformity through a posterior approach with under vision correction. It has very low incidence of complications, high patient's satisfactions, no visible scars and no recurrences. It is a simple, short duration procedure, reliable and good option for correction of prominent ear.

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1. Introduction

Prominent ear deformity is affecting 5% of population.[1] Prominent ear anatomically means absence of antihelical folding, flat scapha and conchal hypertrophy. By anthropometric measurements it is defined as; conchoscaphal angle equal to or more than 90°, auriculocephalic angle greater than 30°, increasing of distances of height (normal 5—7 cm) and width (normally 50—60% of height) and increased helical rim distances from scalp (normally 10—12 mm superiorly, 16—18 mm at its middle and 20—22 at the lobule).[2,3] The goals of prominent ear correction are defining the antihelix and reduce both the conchoscaphal angle and conchal hypertrophy.[3—5] Various methods have been reported for its correction which mean that the ideal technique is not yet available.[6] The currently available methods can be divided into cartilage splitting (cutting) and non cartilage splitting techniques (cartilage sparing).

Non cartilage splitting techniques include cartilage molding only, skin excision, cartilage suturing, cartilage scoring and cartilage fixation (step back) or their combinations.[7—9] However these techniques are criticized by their temporary results, high rates of recurrences and the likelihood of suture extrusion.[6]

Cartilage cutting techniques were formerly started by Ely, 1881 who described a resection of skin and conchal cartilage followed by skin closure only.[10] In 1910 Luckett did the same but he added horizontal mattress cartilagenous sutures for better definition of antihelix.[11] In 1964 Crikelair and Cosman performed skin excision, cartilage cutting and anterior scoring using a scalpel.[12] Others performed two parallel cartilaginous incisions for designing cartilage tubing to create the antihelical folding.[5,13—15] Also these methods have the problem of creating a sharp antihelical fold, deep concha, prominent lobule and also have high recurrence rates as it sometimes did not address the cartilage tendency to recoil to its old shape.

In this study we presented a method of helical free otoplasty for correction of prominent ear after precise revision of pros and cons of previous studies. It could be considered a novel technique.

2. Methods

The study was performed in plastic surgery unit, surgery department, Zagazig University, Egypt and completed in KSA (Kingdom of Saudi Arabia). During a period of 35 months (from July 2015 to May 2018) a total of 31 patients (of them 19 were male and 12 were females) were presented complaining from prominent ear deformities. Their average age was eight years (ranging from five to 18 years). All deformities were bilateral so the study included a total of 62 prominent ears. All patients' and/or their guardians were formally consented after acceptance of the procedure from the university ethical committee.

All patients were operated up on using the helix free otoplasty technique. Both ears were corrected in the same operative sitting. First dressing was done after 24 hours at which time if any heamatoma noticed, it could be aspirated under aseptic technique then the bandage reapplied continuously for 10 days. The sutures were removed on 10th postoperative day and a head bandage was applied day and night for a period of four weeks then at night only for another two weeks. The patients were followed up after four weeks, two months, six months, one year and two years for detection of any complication, and for assessment of patient's satisfaction.

Patient's satisfaction was assessed using modified **Laberge et al 2000**[16] scoring system. It is a questionnaire study for patients or their guardians performed at least six months post surgery with exception of last case in the study which was assessed after two months. Its items as follow;

1 Pain when the ear is touched.
2 Sensation of the ear.
3 Presence of skin irritation (wound).
4 Symmetrical ear positions.
5 Ear shape.

Each item has four responses from one to four. The summation of the points dichotomize the result into four groups; we consider 20 response as very satisfied, 12—19 response is considered to be satisfied and eight to 11 response means dissatisfied while a response less than eight is considered to be very dissatisfied.

2.1. Surgical technique

All operative procedures were done under general anesthesia. All patients received a prophylactic antibiotic in the form of a single dose of cefuroxime IV at time of induction. Both ears and periauricular regions were cleansed using povidone iodine solution after application of eye ointment and small piece of gauze in both external meatal openings. Draping was applied so both ears could be seen in the operative field for easily intraoperative assessment of symmetry. The position of the antihelix was first determined and its site was marked. Skin marking was drawn posterior in the shape of fish tail with its bifurcation placed at the lobule and its concavity toward and two to three mm lateral to the posterior auricular sulcus(Fig. 1). A solution of

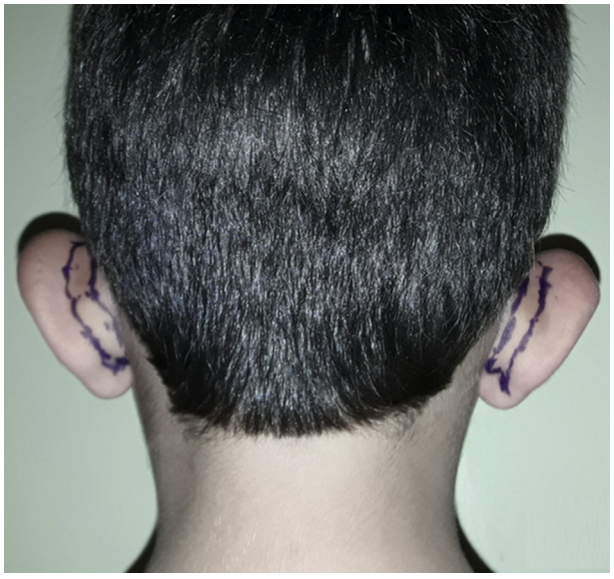

Figure 1 Posterior view shows preoperative fish tail marking.

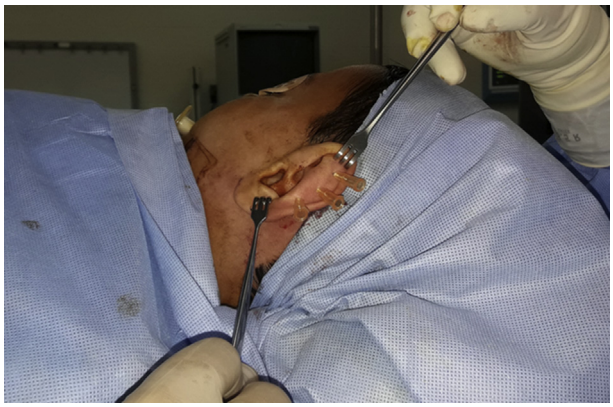

Figure 2 Three insulin needles where inserted from front to back and used as land mark for future antihelix and superior crus definitions.

1/200000 adrenaline in normal saline was injected through the whole posterior marking and also anteriorly along the site of future antihelix to help bloodless hydro dissection. The skin paddle was excised down to the perichondrium which was left intact. Dissection of the posterior auricular surface was performed anteriorly till the scapha, posteriorly till the mastoid periosteum, upwards till the helical spine (rim) and downwards to helical tail. The proper site of the antihelix and its upper crus were then determined by the help of insulin needles (two to three in number) pushed anteroposteriorly from scapha to concha and from scapha to triangular fossa(Fig. 2).

The auricular cartilage was then divided along the posterior exit of the transpiercing insulin needles extending from helical rim to tail to achieve a near total separation of the helix (hence the name helix free)(Fig. 3). Dissection of cartilage from anterior skin was then carried out in the subperichondrial plane. Anterior superficial longitudinal scoring was then performed using number 15 scalpel utilizing **Stenstroem** technique.[17] (Fig. 4) The conchal cartilage was then folded backward up on itself to form a smooth antihelical fold and its upper crus. The folded edge was then fixed in mattress and simple sutures to the concha using a non absorbable polypropylene (Prolene®) 4/0 suture material(Fig. 5). Cauda helix was then manipulated and sutured to concha for proper definition of the antitragus and the lobule using same previously mentioned suture material. Dissection was then directed posterior toward the mastoid area where a strip of posterior auricular muscle was excised. Two conchomastoid **Fernas** sutures were then performed and considered as integral part of our procedure.[9] (Fig. 6) The skin was then closed using a subcuticular 5/0 polypropolyne suture material. Dressing was then applied keeping the anatomical structures in place using fluffy cotton, gauze and a head bandage.

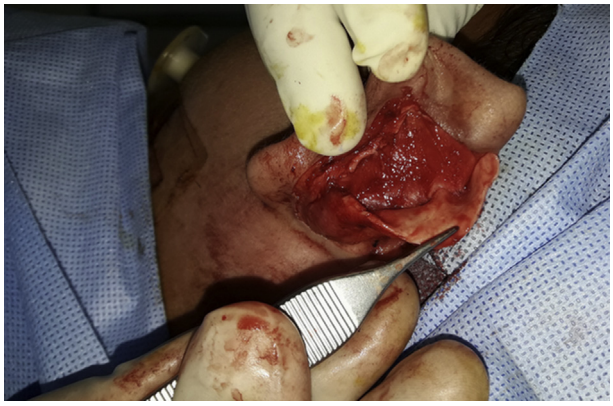

Figure 3 Separation of the helix and anterior perichondrial dissection of conchal cartilage with preservation of perichondrium posteriorly.

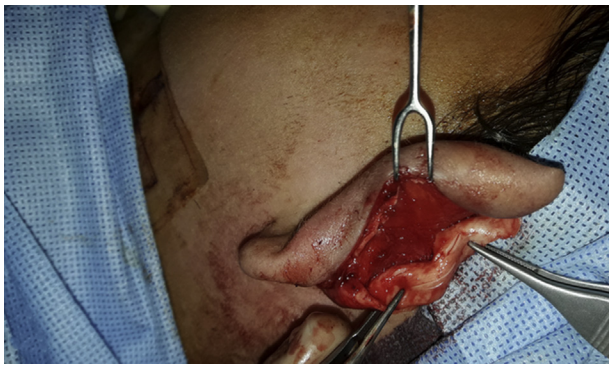

Figure 4 Anterior scoring and posterior wrapping of conchal cartilage.

3. Results

The patients were followed through a mean period of 24 months (ranged from two to 30 months). The mean operative time was 90 minutes (ranged from 85 to 120 minutes).

The early postoperative course was uneventful with exception of two ears in two patients 2/31 (6.4%). They developed auricular heamatomas which were managed by aspiration under aseptic precautions and pressure bandages. There was no reported complications of bleeding, skin necrosis or wound infections.

Late complications were documented in two patients 2/31 (6.4%). The first case developed an irregularities of one antihelix with sharp edges that was caused by excessive

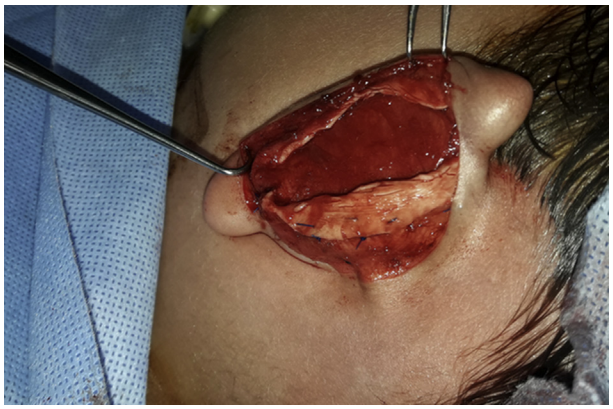

Figure 5 Fixation of wrapped cartilage to cavum concha using polypropylene sutures.

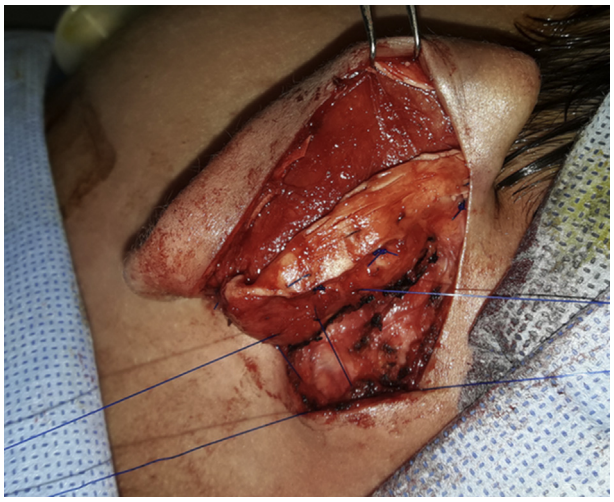

Figure 6 Two conchomastoid sutures to treat the deep concha.

anterior scoring. It was re-operated up on through posterior approach where the sharp edges were rasped, trimmed and contour was corrected using permanent sutures. The other case developed ill defined superior crus in one ear. The case managed by excision of a posterior skin ellipse, small cartilage incision, posterior cartilage wrapping, minimal anterior scoring and permanent suture fixation between scapha and triangular fossa (Table 1).

There were no other late complications as; recurrences, loss of sensations, affection on hearing (as there was no external meatus narrowing), telephone ear deformity, suture extrusions, keloids and hypertrophic scars.

Results of patient's satisfaction are summarized in (Table 2). We are proud to report that 96.8% of our patients and/or their guardians were satisfied by the results. Only one patient (3.2%) was dissatisfied by the result and this was the patient who developed antihelix irregularities and his operation was repeated after that he becomes satisfied (Figs. 7 a,b and 8a,b,c, 9a,b,c and 10a,b,c).

4. Discussion

Prominent ear deformity is not only causing aesthetic problem but also leads to considerable social and emotional impact.[6]

The currently available techniques for its correction could be divided into cartilage sparing and cartilage cutting

Table 1 Complications.

Complication	Number of patients	Percentage (%)
Early:		
Heamatoma	2	6.4
Late:		
Anti helix irrigularities	1	3.2
Ill defined superior crus	1	3.2
Total	4	12.8

Table 2 Patient's satisfaction.

Total	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Degree of satisfaction
31	0	1/3.2	2/6.5	28/90.3	Number/%

ones.[7] The cartilage-sparing techniques have shown unacceptable high recurrence rates compared with the cartilage-cutting techniques due to the tension applied on the sutures.[2] In spite of multiple trails to cover it like using postauricular fascial or adepodermal fat flaps, suture extrusion is still being one of its drawbacks.[1] Beside the great risk of recurrence and less durability of repair after cartilage sparing technique, chronic postoperative pain related to the embedded sutures is also noted as an additional problem.[6,7,18]

Cartilage cutting technique is more preferred due to its durability of corrections.[3]

In all patients of this study we have conducted a prominent ear deformity correction using our helix free otoplasty technique. It is considered as a progress in cartilage cutting technique. We have noticed that the new antihelix was looked normal in shape and smooth in contour.

The idea of breaking the cartilaginous framework of the ear was started in 1881 by Ely[10] who did a cartilaginous incision at site of future antihelix then skin closure. Thereafter multiple trials and modifications have been reported in order to make a more natural appearing antihelix. Luckett in 1910[11] added horizontal mattress sutures to the previous Ely's cartilaginous incision. However both methods have been leaded to a very sharp antihelix and also skin necrosis.

Converse and Wood 1964[13] performed two parallel cartilaginous incisions then to make an island of cartilage which was tubed to create anihelix. In 1987 Pitanguy et al[14] created an antihelix via separating a simple ellipse of island cartilage that pushed anteriorly then the cut edges sutured together behind it. In 2003 Cho et al[5] performed two parallel cartilaginous incisions without separation then they applied horizontal mattress sutures to create antihelical fold. All previous trials have drawbacks of creating a sharp antihelical fold, reposted high recurrence rates as they either use nonpermanent sutures and/or not doing anterior scoring and also they did not address the lobule protrusion problem. Being two incisions so if recurrence will occur, it will be difficult to manage.

In this study only single cartilagenous incision was done which extended from the cauda helix to its rim so nearly separate the helix from the concha to break the framework. The skin incision we performed was a fish tail for better control of lobule protrusion.[19] So if recurrences occur which we did not notice in our study, it can be managed easily in the future.

Anterior scoring which was done only partial using scalpel has two benefits; the first one it inhibits the cartilaginous memory and secondly it resulted in smooth antihelical folding, both leaded to low incidence of recurrences and good aesthetic antihelix contour.

In 2010 Valente[4] has performed a procedure of separating the helix from antihelix via cartilage cutting however he did not performed anterior scoring. He depended only on

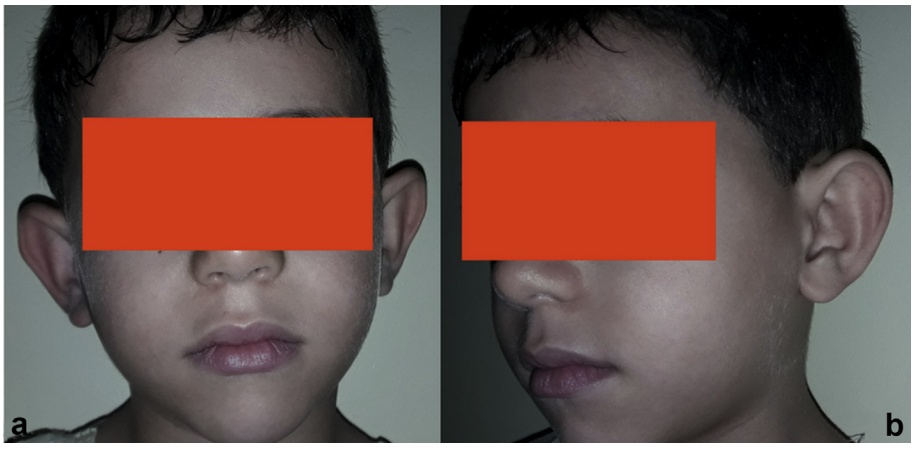

Figure 7 a:preoperative anterior view. b:preoperative left lateral view showing the deformity.

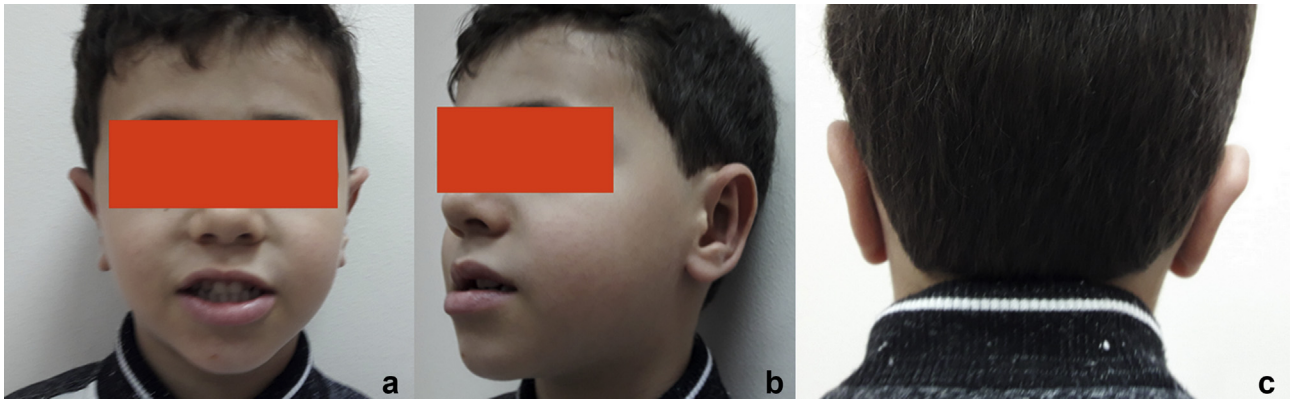

Figure 8 Six months postoperative shows a:anterior view with absence of deformity. b:lateral view a well defined antihelix, superior crus and anterior ear lobule in normal place. c: posterior view with complete disappearance of the deformity.

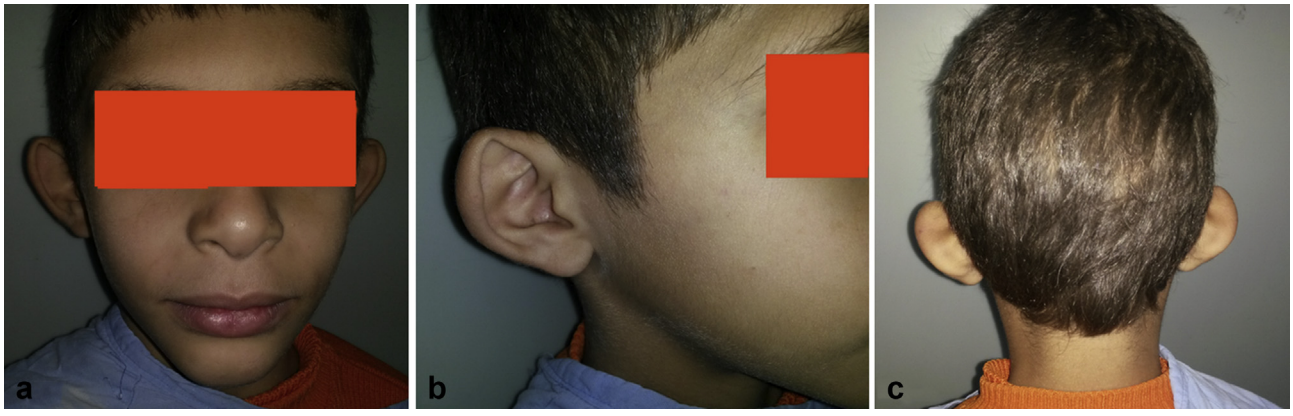

Figure 9 Preoperative a:anterior view b:lateral view with absent both antihelical fold, superior crus and deep concha c:posterior view shows wide cephalo auricular dimension.

the strength of the absorbable sutures which he used. Because of these he reported recurrences in his study.

In this study we used permanent polypropylene sutures to fix the folded scored cartilage to the concha. It is believed to be one of the responsible factors for preventing recurrences of prominent ear.[5,9]

In a trial to decrease the incidence of recurrence Gualdi et al, 2018[6] excised two triangular cartilaginous segments and sutured the skin only. However the resulted antihelix was sharp and not natural and they did not address the ear lobule protrusion also if their patients have a deep concha their procedure will not be sufficient.

In our study we used conchomastoid sutures with excision of a posterior auricular muscle strip. These maneuvers lead to achievement of better contouring (as all cases of the study were having hypertrophied concha). This noted in

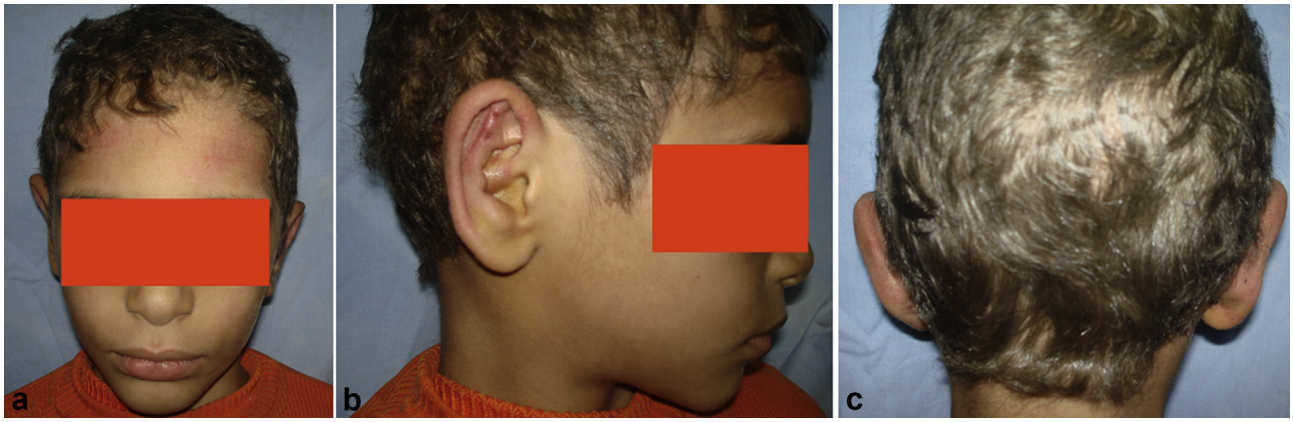

Figure 10 Two months postoperative a:lateral view shows well defined antihelix, superior crus and ear lobule normal contour and place. c:posterior view shows complete disappearance of deformity.

most series that the most common variety of ear prominence include both ill defined antihelix and conchal hypertrophy.[20,21]

Conchomastoid sutures in this study was done routinely as an integral part of our procedure and this also explained by other studies who found that dealing with conchal hypertrophy produces a constant and acceptable aesthetic result.[21,22] We removed a strip of posterior auricular muscle and this also proved by Choi et al 2017[23] to help to create a space for redistribution of the ear.

Preventing lobular prominence is dependent on proper cauda helix reposition or resection reposition and/or lobular suture techniques.[5,8]

In this study we do not notice lobule prominence during our follow up due to not only proper closure of fish tail incision but also due to cauda helix modification.

Our technique demonstrated minimal complication rates which are lower than reported in the literature. We registered lowest incidence of complications 4/31 (12.8%) as follow; two hematomas (2/32), one irregular anti helix and one ill defined superior crus. Two patients (6.4%) were re-operated up on only. There were no cases developed hypertrophic scars because of the reduced tension on the ear and the absence of dead space obtained through the use of the proper compressive dressing. Also no cases developed recurrences, helical buckling, telephone ear, antitragal prominence or lobule prominence. Extrusion of sutures was not observed in any of the patients of the study.

Smittenberg et al, 2018 reported higher rates of complications; 20%, and 21% in cartilage sparing and cartilage cutting respectively.[24] Of them 6% and 7% respectively required reoperations. Maricevitch et al, 2011[25] on their experience on Pitanguy technique developed nearly similar incidence of complications (12.8%) to our study but with some differences of their natures and most of them required reoperations. In a study conducted by Valentines, 2010[4] he reported a 10% early complications of them 3.3% auricular hematomas and a 10% late complications in the form of recurrences of the superior poles and almost all were corrected with reoperations.

Regarding patient's satisfaction with the procedure in this study; 28 (90.3%) of our patients were very satisfied, two (6.5%) were satisfied and only one (3.2%) was dissatisfied. It is considered higher satisfaction rates than those reported by other studies. Valenties, 2010[4] reported incidences of 83% very satisfied, 15% satisfied and 2% dissatisfied respectively. Petersson and Friedman reported 64% very satisfied, 21%satisfied, 11% dissatisfied and 4% very dissatisfied.[7] Lee and Bluestone reported 86.7 very satisfied and satisfied while 13.3% are unsatisfied.[26]

5. Conclusion

Helical free otoplasty technique addresses the deformity through a posterior approach with under vision correction. It has very low incidence of complications, no visible scars and no recurrences. It is a simple, short duration procedure, reliable, good option for correction of prominent ear with very low morbidity and high incidence patient's satisfaction.

Conflicts of interest

None declared.

Funding

None.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.asjsur.2018.08.005.

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