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Correction of Prominent (Bat) Ear by the Use of Y-Shaped Cartilage Strip, Assisted Conchal Reduction Technique

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ABSTRACT

Background/Aim: Multiple techniques have been advocated over the years for the appropriate and natural appearing correction of the prominent ear. The basic techniques used to correct prominent ears with a missing antihelix are based on incision, scoring, bending or reposition of the auricular cartilaginous framework. This study was undertaken to assess the validity of incomplete Y-shaped cartilage strip assisted conchal reduction technique for correction of prominent (bat) ear.

Patient and Methods: This study was carried out on 40 patients in the period between June 2003 and June 2005, thirty one of them were presented with bilateral prominent ears and nine patients were presented with unilateral prominent (bat) ear. This series comprised 30 males and 10 females, twenty eight children and twelve adults. Their ages ranged between 5 to 28 years. In this technique an incomplete Y-shaped cartilage strip was used for the formation of the antihelix the concha was also reduced if needed. No post auricular skin was removed.

Results: Satisfactory results were obtained in 34 patients. Complications occurred in six patients: One over correction, one bleeding, one wound infection, two under correction and one telephone deformity. Patients were followed-up for a period of ranging between 6 and 30 months.

Conclusion: This technique is safe, effective, easy and reliable procedure with few complications. It has a highly acceptable long-term outcome. It can be considered a good surgical option for treating patients with prominent ear at any age and with any severity of deformity.

INTRODUCTION

The external ear is an infinity complex structure with great variation between individuals and between two sides of the same individual. Prominent ear deformity is the most common abnormality of the external ear **[1]**.

While prominent ears are considered as a sign of a good fortune in Far East, Western Society looks upon prominent ears in a far less positive manner. Children with prominent ear are often the subject of verbal and at times physical abuse by their peers, resulting in adverse psychological and social effects **[2,3]**.

Children's families are now fully aware about both bad morphological and psychosocial effects of prominent ears upon their children. Otoplasty is now considered as a procedure with both aesthetic and functional purposes.

Otoplasty is one of the most frequent aesthetic surgical procedures in children and adolescents. Several techniques can give satisfactory results, but few address all the components of the prominent ear deformity **[4]**.

In the long history of otoplasty, the basic techniques used to correct prominent ears with a missing antihelix are based on incision, scoring, bending or reposition of the auricular cartilaginous framework **[5,6]**.

Correction of prominent ears is a common plastic surgery procedure. Otoplasty requires a careful understanding of the discrete elements that compose the normal ear. Careful anatomic analysis to determine the precise cause allows appropriate planning and proper choice of the operative technique with execution of its operative steps in a logical fashion **[7,8]**.

Many researches had been done to determine the anatomical features associated with prominent ear deformity. These features include poor development of the antihelical fold, abnormal conchomastoid angle with large deep conchal bowel, ear lobule abnormalities, inadequate definition of helical rim or combination of all of these **[9]**.

Gomulinski et al. **[10]** stated that the tail of helix is the key to Otoplasty. Through their experience on the study of cartilaginous frame of 244 cases

and 22 anatomical dissections, they recorded hypertrophic part of the helical tail and abnormal conchomastoid angle.

The presence of a well-formed antitragicus muscle exerts an anterior pull on the cauda helicus which contributes to the poor development of the antihelical fold [11].

The prominence of the mastoid process and the protrusion of the lower auricular pole are considered as an additional factors for ear protrusion [12].

The most commonly encountered deformities are lack of antihelical fold and deeply curved conchal bowel [13].

Advances in Otoplasty have made it possible not only to pin back the ears, but also to re-shape them, reduce their size with good symmetry and long term result [2].

Otoplasty is not only the focus of interest for facial plastic reconstructive surgeons, but also it attracts the attention of otorhinolaryngologist. There is a great interesting in integrating facial plastic reconstructive surgery (FPRS)) in the Dutch Otorhinolaryngology Residency Program as it is in the United States [14].

The term otoplastik had been used for the first time for correction of Microtia [15]. However, the first case for correction of congenital prominent ear had been published in 1881 [16]. Many surgeons had contributed different techniques and modifications using the term Otoplasty for solving this heavily debated topic.

The concept of restoration of the antihelical fold for prominent ear deformity was the first introduced by Luckett [17] who resorted to a cartilage breaching technique consisting of cresentic medial skin and cartilage excision along the entire vertical length and the antihelical fold. McColum [18] and Young [19] combined the Luckett technique with earlier trials on conchal reduction.

Multiple parallel antihelical incisions with different modifications had been described by many surgeons [20,21,22]. Parallel antihelical incision held together by permanent sutures was first described in 1952 in an attempt for softening the external ear contour and producing conical antihelical tube. This technique was later refined by Converse, et al. [23] and further elaborated by others [24,25]. Cartilage island flap technique in correction of protruding ear had been described by many authors [26,27].

Chongchet [28] proposed cartilage cutting technique as a reliable method of Otoplasty and popularized later by some authors [29,30]. Numerous modifications had been done upon the open anterior cartilage scoring technique of chongchet, whereas the auricular cartilage had been weakened by different methods [31,32,33].

Minimally invasive Otoplasty is a recent technique that allows correction of most protruding ears with minimal complications and high success rate. However, a very strong cartilage and a very high lateral conchal wall set the limits to such an approach [34].

Debate still present about the proper age of otoplasty and type of anesthesia used during this procedure. The preferred age to correct this deformity is between 4 to 6 years. At that age, the operation is easy, will not affect ear growth and will minimize the associated psychosocial problem. Adults may have less flexibility of the auricular cartilage as well as some degree of calcification which will render it brittle and make the operation more difficult [35].

Otoplasty is typically performed under general anesthesia which is favoured in pediatric population being considered more "humane" than local anaesthesia. However, it is a day case procedure that appears acceptable whether general or local anesthesia is used [36].

When surgery becomes necessary and despite the availability of a wide variety of procedures, the surgeons should be able to select the best features of the most useful technique for correction of this deformity. In this article, a simple and easy approach is presented for correction of this deformity. This approach provides excellent results, a high level of patient satisfaction and minimal complications.

PATIENTS AND METHODS

This study included 40 patients presented with prominent (bat) ears to Plastic and ENT clinics of Tanta University Hospital between June 2003 and June 2005. Thirty patients were males and ten were females. Thirty one patients had bilateral deformity and nine patients had unilateral deformity. Their ages ranged between 5 to 28 years. Each case was subjected per-operatively to full ENT examination especially ears, auricles, external auditory canals and tympanic membranes to exclude other congenital anomalies which may interfere with the surgical correction of the auricles. A detailed analysis of the auricles was done, focusing on the following:

- Extent of development of the antihelical fold and its superior and inferior cruca.
- Size and depth of the conchal bowel.
- Amount of protrusion of the antitragus and ear lobule.
- Degree of mastoid process and lower auricular pole protrusion "prominence".
- Subjective evaluation of the degree of auricular cartilage stiffness by simple finger fold.
- Per and post operative measurements of the cephalo-auricular distance.
- Pre-operative photographic documentation consisted with frontal, back and right and left lateral views.
- The exact same views were taken three months post-operatively.

Operative technique:

The operation was performed under general anesthesia with the patient supine. Four adult males were performed under local anesthesia with sedation. The face and ears are prepared with an aqueous antiseptic solution and draped with both ears exposed. The head was turned so that the ear to be operated on is the uppermost. The ear was held against the head to determine the new antihelix, which is then outlined together with its superior and inferior crura using a marking pen. Usually five to nine straight needles impregnated with methylene blue were passed antero-posteriorly, the first one was used to mark the superior crus, the second one was used for marking the inferior crus, and the remaining needles were used for marking the ant-helix. The ear was then infiltrated using a solution of 1% lidocaine with 1:200.000 epinephrine. Areas of infiltration included the anterior and posterior sides of the auricle in a supra perichondrial plane, the post-auricular sulcus and mastoid region. Time was allowed for the vasoconstrictive effect of the infiltrative solution, the ear is held forward by the surgeon and skin incision was made at the post auricular sulcus, then skin undermining continued on the back of the auricle, stopping 1cm short of the helical rim. Any soft tissue attached to the posterior surface of the auricle was dissected out, leaving the cartilage as clean as possible to facilitate the remainder of the procedure.

The site of the proposed superior crus, inferior crus and anti-helix was identified by the methylene blue marking which was previously described. An incision 3mm anterior to the proposed superior crus and anti-helix and the posterior one were connected together inferiorly. Lastly, a V-shaped incision was made, its anterior limb was 3mm posterior to the proposed superior crus. Thus a Y shaped cartilage strip was incompletely separated at its superior part but completely separated at its inferior part was done. Thinning of this Y shaped cartilage was done by using dermabrasion to allow its easy folding. The anterior and posterior borders of each of the superior crus and antihelix were sutured together using 5/0 prolene sutures forming a tube. Between five and seven non-absorbable "horizontal-mattress-style" sutures were used to maintain the position of the new anti-helical fold, superior and inferior crura. The sutures are passed through the full thickness of cartilage but not the anterior skin. A 4 to 6-mm bite is used which is large enough to avoid cutting through the cartilage but not so large as to cause over correction. Care is taken to bury the knots as in inverted suture so that they do not protrude from the suture line. The remaining cartilage medial and lateral to the tube was brought together behind the tube.

After completing the anti-helix, the degree of ear protrusion was re-evaluated before any conchal setback is attempted. The set back was started by excising a strip of cartilage from the concha stopping away from the external auditory meatus to avoid its obliteration or encroachment on the external auditory canal. Attention now turns to the ear lobule, which if protuberant, required a single non absorbable suture from the dermis on the lateral side of the lobule of the ear to the most inferior portion of the concha. No skin was removed. The post-auricular incision was closed in single layer using subcuticular 4/0 prolene sutures. The second ear was corrected in a similar fashion. Post-operative dressings consisted of antibiotic ointment and xeroform gauze placed over the post-auricular incisions, saline-soaked cotton placed in all anterior services of the ears and gauze fluffs covered by circumferential kerlix and an elastic bandage held in place by woven net dressing. Drains were not used. All patients were given intra-operative and post-operative prophylactic antibiotics. At the second post-operative day, the dressings were changed and replaced after assessment of skin viability, presence of ecchymosis or haematoma. Topical antibiotic ointment was applied on the whole external ear and suture line for one week. At 7th post-operative day, Stitches were removed and head bandage applied for other 2 weeks especially at night. The patients had post-operative follow-up in ENT and plastic surgery visits to evaluate results and exclude deformities or complications such as infection, wound gapping or encroachment on external auditory canal.

Fig. (1-A): Pre operative front view of a boy having bilateral bat ear.

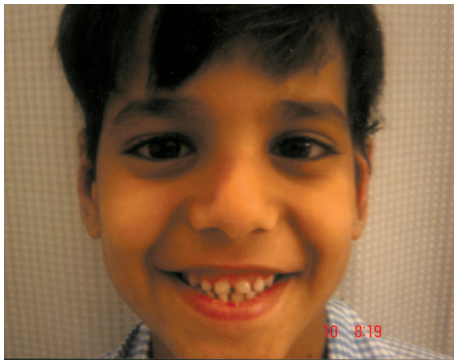

Fig. (1-B): Post-operative front view of a boy having bilateral bat ear.

Fig. (2-A): Pre operative Left lateral view of another boy having bilateral bat ear.

Fig. (2-B): Post operative Left lateral view of the same boy.

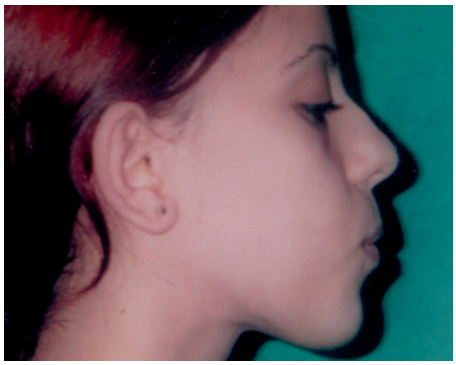

Fig. (3-A): Pre operative Right lateral view of a girl having bilateral bat ear.

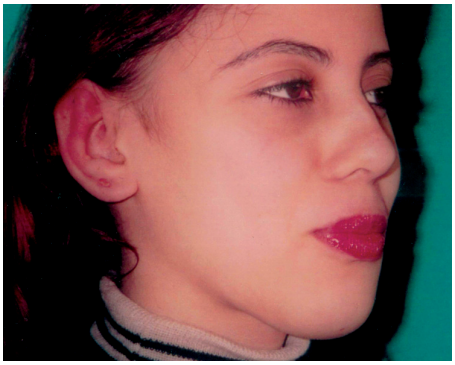

Fig. (3-B): Pre operative Right lateral view of the same girl.

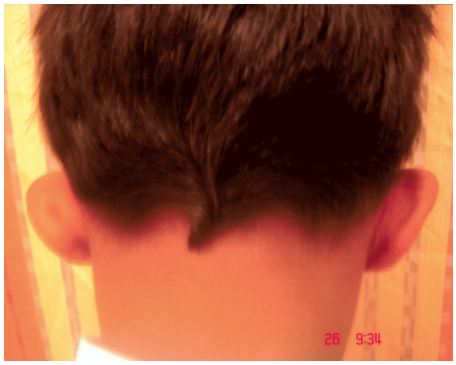

Fig. (4-A): Pre operative Back view of a boy having bilateral bat ear.

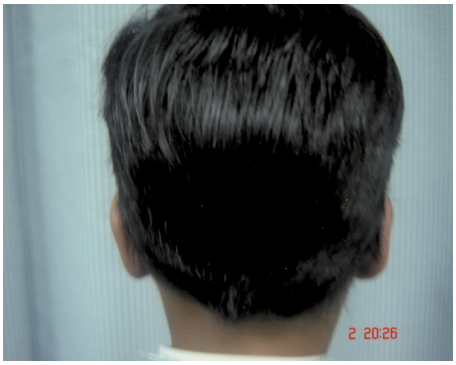

Fig. (4-B): Post operative Back view of a boy having bilateral bat ear.

RESULTS

The incomplete Y shaped cartilage strip assisted conchal reduction technique was used to correct 71 prominent ears in 40 patients in plastic unit and ENT Department, Faculty of Medicine, Tanta University. There were 31 patients with bilateral prominent ears and 9 patients with unilateral prominent ear. The series comprised of 30 males and 10 females, 28 children and 12 adults. The age range was from 5-28 years, with an average of 10 years. Patients were followed-up for a minimum of 6 months and a maximum of 30 months. Thirty-four patients were satisfied with the over-all appearance and symmetry of both ears. However, 6 patients were not fully satisfied. Complications were encountered in six patients. Two patients complained of under correction, one patient had over correction, one case of bleeding; wound infection, and telephone deformity.

Two patients had mild prominence of the lobule in the immediate post-operative period which has been improved after six weeks. None of the patients developed post-operative haematoma, perichondritis, and suture extrusion or incision separation. The results of clinical cases are seen in Figs. (1-4).

DISCUSSION

Multiple techniques have been advocated over the years for appropriate and natural-appearing correction of the prominent ear. Different surgical methods including excision, bending, scoring or reposition of the auricular cartilage have been used. The multitude of different approaches indicate that there is no single technique that can re-create the complex three dimensional nature of the normal human ear **[5,37]**. As in all cosmetic procedures, proper patient selection is imperative **[38]**.

In the present study, we will refer the prominent ear deformity mainly to the lack of formation of the antihelix and/or the presence of an excessively large auricular concha. We made a Y shaped tube of the cartilage which was incomplete at the superior end of the superior as well as the inferior crura.

However, the tube was complete at the lower part; the idea behind this was that in normal subject both the superior crus as well inferior crus are incomplete at their upper end meaning that they end smoothly till their junction with the helix. In normal subjects also, the antihelix is sharp at its lower end that was why we made the cut at the lower end of the cartilage complete, so that we can sharpen the lower end of the tube to simulate normal subjects.

In this study, the age of our patients ranged between 5-28 years. However, in other series, it is ranged between 11 to 22 years **[39]**, a wide range have been reported "3 to 66 years" with mean age of 18 years **[40]**. The majority of plastic surgeons perform otoplasty on the patients who are aged 5 years or older. Recent clinical application reported that otoplasty can be safely performed at age younger than 4 years without interfering with growth of the operated ear **[41]**.

Most of our patients "36 patients" had been operated under general anesthesia. Four adult male patients underwent surgery with local anaesthetic infiltration and sedation. We found that local anasethesia with sedation in an adult mature cooperative patient increase both intra and post-operative comfort and reduces the neuro-endocrine stress. Although, Otoplasty is typically performed under general anaesthesia which is favoured in the paediatric population being considered more "humane" than local anaesthesia. It can be also done via percutaneous infiltration with local anaesthesia with marked reduction in post-operative vomiting without compromising surgical outcome **[36]**. Nowadays, there is a clear trend toward the increasing use of local anaesthesia in cosmetic surgery in the head and neck **[42]**.

In our series, the operative time for Otoplasty ranged between, 1 to 1 1/2 hour for bilateral cases which means that this technique is not time consuming. At the second post-operative day, ear dressing, is changed and new one was replaced after assessment of skin viability, presence of ecchymosis or haematoma. Topical antibiotic ointment was applied on the whole external ear and suture line for one week. The Head bandage was maintained for two weeks after stitch removal especially at bed time.

In their Otoplasty series Mayaleh et al. **[43]**, dressing and head bandage are applied and the child is monitored for 10 days. A head bandage is maintained at night for one month with use of sun screen cream on the scar at day time However, recent trials recorded that it is safe and effective to use head bandage for only 24 hours after otoplasty **[44]**.

Patient were followed-up in our study for a period that ranged between 6 to 30 months which is considered an acceptable period for technique evaluation. Follow-up period ranged between 6 months to 2 years was reported **[39]**.

In a series of 40 patients, the follow-up period was a minimum of 16 months and maximum of 8 years [45]. In another study of 114 consecutive patients underwent to correction of 214 ears, the follow-up period was 9 months to 9 years and 6 months with mean follow-up of 3 years and 11 months [40].

Otoplasty remains a challenging but rewarding operation for surgeons who approach it in a rigorous and exacting manner. Precise adherence to the goals and principals summarized herein will help ensure optimal surgical outcomes and associated patient satisfaction [46].

Numerous techniques and modifications have been tried for solving a prominent ear deformity. Their basic concept originates from Mustard's suture. These are the scoring technique described by Chongchet, Stenstrom, the combined suture and scoring technique described by converse. Techniques for cavum rotation and lobule plasty have also been presented.

Mustarde [47] created antihelical tubing with permanent concho-scaphal mattress sutures of white braided silk. The sutures were found to be particularly successful in treating the pliable cartilage of children and were placed as a full-thickness through cartilage of the concha and scapha in mattress fashion without piercing the lateral skin through a posterior approach. All cartilage tubing techniques depend on scaring to fill the tube and lock the sculpted framework into position. Mustarde [48] had emphasized that a critical point in the success of the suture technique is removal of all soft tissue from the posterior surface of the auricular cartilage in the area to be folded.

Mayaleh et al. [43] modified Mustarde technique by using absorbable sutures, and scoring the auricular cartilage with monopolar diathermy. Minimal, dissection of the edge of the concha and scaphal cartilages and their fixation with horizontal mattress sutures between the two edges were encountered [39]. Recently, combined conchal cartilage resection and mattress suture technique was used with good long term results [49].

Chongchet [28] and Stenstrom [50] have published the cartilage scoring technique which was recently modified by others [51,52]. Anterior auricular cartilage scoring of the upper helical cartilage to correct the helical radix upper prominence is safe, easy and fast technique with good aesthetic result [53]. It is considered a further refinement of Chongchet anterior scoring technique.

Cartilage scoring can be done via both anterior and posterior surfaces by different ways. It started by gauging of the posterior antihelix without damage of the anterior surface [54], using a wire brush [55], using shallow parallel curvilinear incisions along the posterior perichondrium [21], using dermabrasion tool with small spherical metal head [45,56] or using electrocautery [43,57].

In this work, we have used dermabrasion for posterior auricular cartilage scoring with very satisfactory results. It allows easy bending and new smooth curved antihelix.

The greatest area of focus is on the finer nuances between cartilage-sparing and cartilage-transection technique [58]. In their comparative study between cartilage sparing and cartilage transection technique, insignificant degree of patient satisfaction was recorded. However, independent plastic surgeons prefer cartilage-sparing over cartilage cutting technique secondary to smooth natural ear curvature [59,60].

The high criticism of cartilage cutting technique arises from the high unacceptable complication rate especially in training-grade surgeons and secondary sharpe ridging and contour irregularities. In our study of cartilage cutting technique, these problems were not encountered because tubing of the island of cartilage to make the new antihelix then scoring the rest of cartilage behind the tube prevented the risk of formation of sharp ridges of cartilage in the final shape of the antihelix and auricle.

Through their big Otoplasty series and long valid follow-up period, many plastic surgeon reported that cartilage-sparing Otoplasty addresses all component of prominent ear deformity and can go beyond patient satisfaction maximizing outcome in both form and symmetry [1,4].

In their series of incisionless and minimally invasive Otoplasty, combined cartilage scoring and suture technique were applied. The cosmetic results and complication rates match those of open methods. However, very strong cartilage or very high lateral conchal wall set the limits to such an approach [34,61].

Resection of hypertrophic part of the helical tail and its retroposition and fixation on the concha in a good position with ethibond 4/0, correct ear lobule protrusion and form nice antihelical fold [10]. Endoscopic pinnaplasty had been tried but had been found to be technically difficult and time consuming [62].

In this work, single non-absorbable suture from the dermis on the lateral side of the ear lobule to the most inferior portion of the concha had been taken to correct ear lobule protrusion with high satisfactory result.

The following complications were encountered in our study, over correction in single case, under correction in two cases, single case of bleeding, wound infection and telephone deformity. It is important to have a working knowledge of potential complications of otoplasty and their prevention and treatment **[38]**.

Messner and Crysriale **[64]** observing patients treated using the Mustarde technique for at least one year after surgery, found that in up to 40% of eras the final position had returned to within 3mm of the pre-operative state. In our study, the long term follow-up showed long preservation of the early post-operative results.

A retrospective review by Tan **[65]** comparing the Mustarde with Stenstrom technique had illuminated some potential pitfalls. Tan had found that 24% of patient treated by Mustarde technique required re-operation, whereas, 10% of patients treated by Stenstrom technique had required re-operation.

A mild recurrence of the upper antihelical fold was experienced in one case and the patient required further surgery **[39]**.

In their series of 302 otoplasty revision for either a partial recurrence or a still insufficient correction had been recorded in 30 cases 9.9% by Benedict & Pirwitz **[34]**. Noticeable recurrence was noted in one case of twelve patients (8%) **[41]**.

Rubino et al. **[53]** reported no residual ear prominence or upper third prominence "20 surgeries" at one-year follow-up. Revision surgery had been recorded in the two case of under correction and one case of over correction in our cases.

A personal review of 600 ears treated by Mustarde's technique over 20 years had revealed six patients in whom sinus tracts to silk sutures developed and 10 ears that required re-operation for residual deformity **[66]**.

Chao et al. in their study of 13 cases of Otoplasty via modified tube technique and posterior approach, found that suture extrusions developed in two cases **[39]**.

Bulstrode et al. reported no suture extrusion in 114 patients underwent correction of 214 ears **[40]**. In our work, no reported cases of sinus or suture extrusion occurred because the sutures used for the formation of the tube were of the inverted type and were covered by another layer of cartilage. The skin of the back of the ear is thick which added more security.

Some authors reported that a hypertrophic and keloid scar will develop in retro-auricular region which is a very susceptible area for this complication **[67]**.

The incidence of hypertrophic/keloid scars following prominent ear correction was reported to be between 0 and 3.5% (an average of 1.2%) **[56]**. Otoplasty via incisions on the anterior surface increases the risk of hypertrophic scarring and keloid formation on the visible part of the ear **[68,69]**.

Two hypertrophic scars out of 114 consecutive patients had been reported. However, no keloid was encountered **[40]**. Out of 302 cases only one case developed hypertrophic scar in the ear lobule 0.3% **[34]**. In this study of correction of protruding ear lobule, modifications had been performed on skin resection of the posterior ear surface to minimize the risk for relapse and keloid formation **[70]**.

In our work, the skin incisions were located in the post-auricular region and were closed as tension free without skin excision which minimize the risk of both hypertrophic and keloid scar.

In a review of 167 patients who underwent Stenstrom Otoplasty, Heftner **[71]** recorded 14% of patients have sharp cartilage irregularities along the antihelix.

La trenta **[72]** in his study reported secondary sharp-ridging and contour irregularities Rubino et al. **[53]** reported that the upper third of the ear easily maintains the original shape because memory and elasticity are stronger than the middle or lower part of the ear. In other series no visible anterior cartilage irregularities have been recorded among a period of follow-up ranged from 1 to 3 years **[40,53]**.

Visible helical rim deformity had been recorded secondary to excessive resection of post auricular skin during otoplasty **[73]**.

These problems were not encountered in our work because tubing of the island of cartilage to make the new antihelix, then closing the rest of cartilage behind the tube prevented the risk of formation of sharp ridges of cartilage in the final shape of the antihelix and auricle.

A single case of post-operative hemorrhage had been reported out of 214 prominent ears. It required dressing change only **[40]**. In this work moderate postoperative bleeding was encountered in one ear. Conservative treatment by removal of the old dressing, ear wash with saline and re-dressing again was sufficient enough for bleeding control. Ear hematomas or skin necrosis were not encountered in other studies **[34,39,40]**.

Delayed wound healing had been reported secondary to topical application of "superglue" to the post auricular skin in an attempt to pin back prominent ears **[3]**. No wound healing problems were recorded in our study.

Campbell **[37]** stated that plastic surgeon should perform a technique that he feels comfortable with and that can repeatedly provide gratifying results. Ultimately, the simplest technique that can obtain the maximum effect and the minimal complications should be employed. In this work we performed weakening of the posterior surface of the cartilage using dermabrasion. We have found that this method is easy and simple and was not associated with any complications. The long term follow-up did not show any undesirable results.

Conclusion:

- The incomplete Y shaped cartilage strip, assisted conchal reduction technique is versatile and applicable to both children and adults. Though it is technically easier to perform in children, with more pliable cartilage, it can be performed in adults with more resilient cartilage. The operation can be done under local anesthesia with sedation in adult cooperative patients. If the correction is deficient in any way, such as a protruding ear lobule, then this can very easily be corrected during the initial procedure.
- The technique is also technically easy, safe and less time consuming for trainee surgeons. The procedure is less likely to produce unacceptable results in the early stages because it has a rapid learning curve. It gives reproducible and more natural aesthetic results with fewer complications and should be kept in mind during prominent ears evaluation.
- One of the advantages of this technique is that there was no need for removal of the post auricular skin which can be spared to be used for reconstruction later on if needed.

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