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Case Study

Minimally Invasive Suture Otoplasty: A Large Consecutive Case Series

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Abstract

Background: Protruding ear correction was first reported 150 years ago [6]. There are several surgical methods to correct the anomaly. This study aimed to investigate the utility of a incisionless otoplasty correction in terms of efficacy, safety, replicability, postoperative complications and patient satisfaction.

Objectives: To determine whether incisionless otoplasty is a reliable and replicable technique and assess patients' satisfaction and complication rates.

Methods: 779 patients underwent incisionless otoplasty procedure between August 2009 and April 2014 were analysed prospectively. Three measurements obtained preoperatively, immediately postoperatively and 12 weeks after the procedure were compared. The measurements were obtained based on Frankfort's line. A questionnaire including 12 questions was given to each patient 12 weeks after the operation to assess their satisfaction with the procedure.

Results: Bilateral correction was performed in 737 patients and 42 patients underwent unilateral correction. The total number of ears corrected was 1516. The procedure was performed under local anesthesia. 233 patients were male (29.9%) and 546 patients female (70.1%). The number of ears that had a revision procedure were 83 (5.4%). The infection complication rate was found as 0.5%. Mean medialisation distance was 12.1 mm just after the procedure and 10.9 mm 12 weeks after the procedure.

Conclusion: The aesthetic results achieved with this technique, the low complication rate and the high patient satisfaction rate proves that this technique can be offered as a surgical option to patients wishing to undergo otoplasty.

Keywords: Protruding Ears; Deformity

Introduction

Protruding ears is one of the most common deformity of the auricle [1]. Although there is an autosomal genetic predisposition for developing protruding ear; environmental factors could also play a role [2]. This deformity may result from conchal hypertrophy, underdevelopment of antihelix structure, prominent lobule or a combination of these abormalities [3,4]. A detailed examination of the external ear must be performed prior to any surgical correction procedure. Since a facial disfirgument may lead to a low self-esteem, anxiety and psychological disorders especially in children; protruding ear deformity, must be corrected [5]. Protruding ear correction was first reported 150 years ago [6]. There are several

methods developed in order to correct the protruding ear anomaly. Anterior scoring methods of Stenström and Chongchet and the posterior suturing technique of Mustarde are the most common ones [7-13]. Otoplasty methods can be classified as the ones that need incision and the ones that can be performed without incision; "incisionless otoplasty". This study aimed to investigate the utility of incisionless otoplasty in prominent ear anomaly correction in terms of efficacy, safety, replicability, postoperative complications and patient satisfaction.

Materials and Methods

A total of 779 patients (1516 ears) aged between 7 and 52 (average 24) were admitted to our Department between August 2009 and April 2014 in order to have a protruding ear anomaly correction procedure. Inclusion criteria were no excessive conchal hypertrophy, underdevelopment of the anti helix fold and presence of no additional ear pathology. Patients are not specifically intended to be women. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. All patients were operated under local anesthesia and in some cases also sedation. Bilateral correction was performed to 737 and unilateral correction was performed in 42 patients. The data of these patients were investigated prospectively with retrospective analyses.

Demographic data was collected and analyzed. Written informed consent was obtained from each patient. The data were analyzed with SPSS 14.0 program and $p < 0.5$ was determined as statistically significant.

Incisionless otoplasty was performed on patients who were deemed appropriate for the operation. Patients without preoperative and postoperative measurements and patients who did not attend to follow-up visits and did not fill the postoperative satisfaction questionnaire were excluded from the study. Open approach method was recommended for patients with severe protruding ear deformity.

In a study of Schaverien., *et al*. a Frankfort's horizontal line based measurement method has been used [14]. Frankfort's horizontal line is an imaginary line connecting infraorbital rim and superior aspect of the auditory meatus [12,15]. There are 2 points defined in order to make the measurements and the points were as follows; the projection points of Frankfort line on the helical rim and the mastoid process. The perpendicular distance from mastoid to the helical rim was measured at the level of Frankfort line before, right after and 12 weeks after the procedure (Figure 1). The difference between two measurements was termed as change in medialisation. A written questionnaire was given to each patient 12 weeks after the operation in order to assess the patient satisfaction rate. The questionnaire consists of 12 questions, 10 multiple choice questions and 2 yes/no questions (Figure 2). Score of each question was ranging from 1 (very negative) to 5 (very positive) and the total score of the questionnaire was ranging from 10 to 50. The last 2 yes/no questions were prepared in order to assess whether a relapse occurred in any of ears and the patient would choose our clinic for any kind of treatment or not. The anonymous questionnaire was applied by surgical residents and was completed under supervision of the parent in pediatric patients.

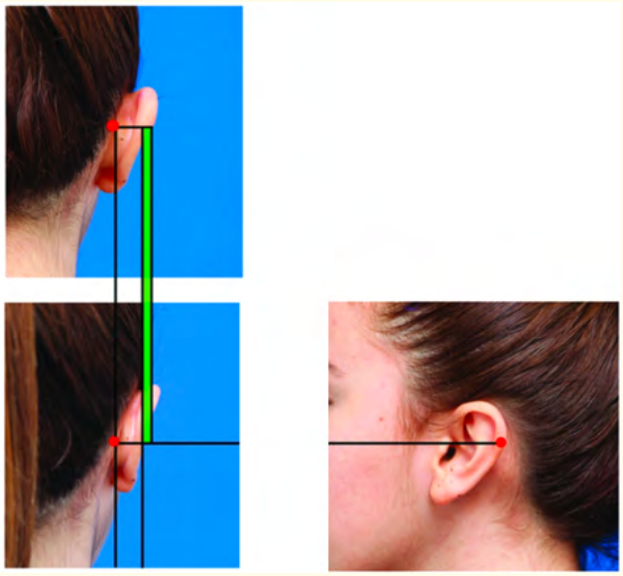


Figure 1: Preoperative and postoperative measurements of the perpendicular distance from mastoid to the helical rim was measured at the level of Frankfort line.

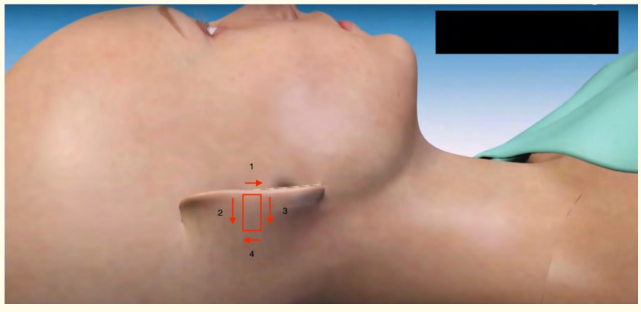


Figure 2A: shows the sutures placement in a shape of rectangle with numeric indication of the order of the placement.

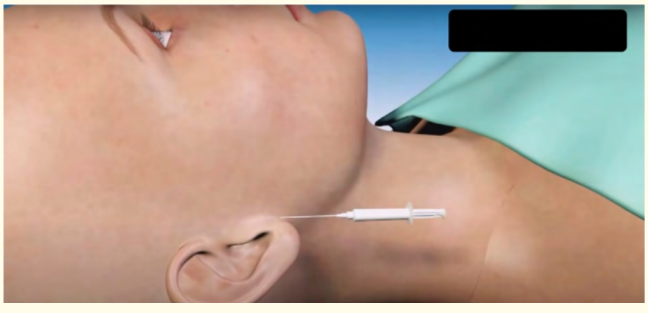


Figure 2B: shows the anesthesia technique.

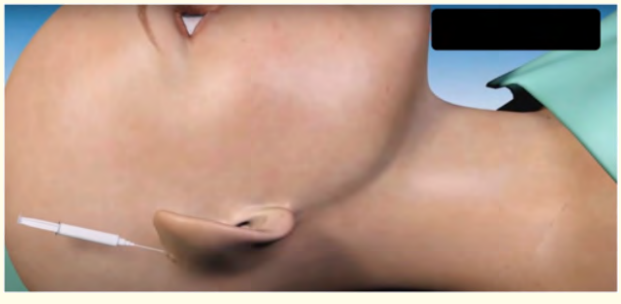


Figure 2C: shows the anesthesia technique.

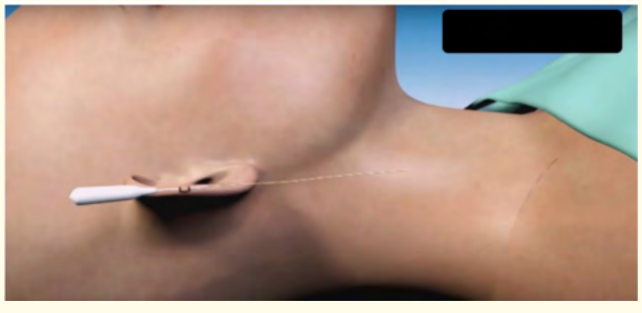


Figure 2D: shows the insertion of the thread on side 1.

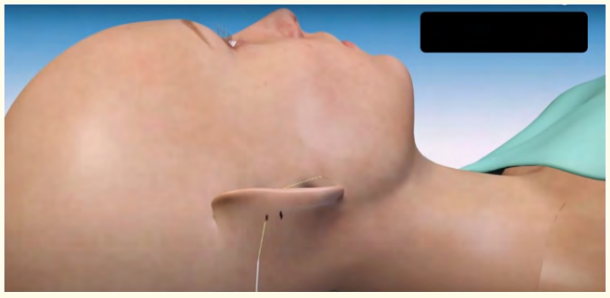


Figure 2E: shows the thread being pulled from side number one to side number 2.

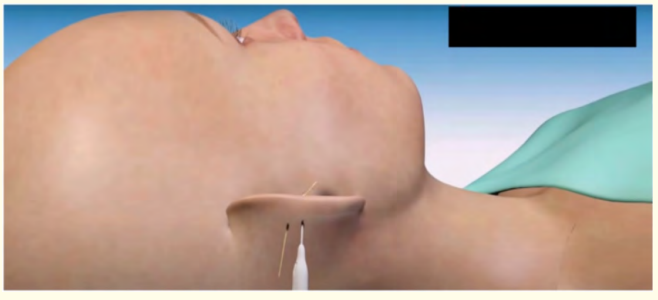


Figure 2F: shows the thread being pulled from side 2 to side 3.

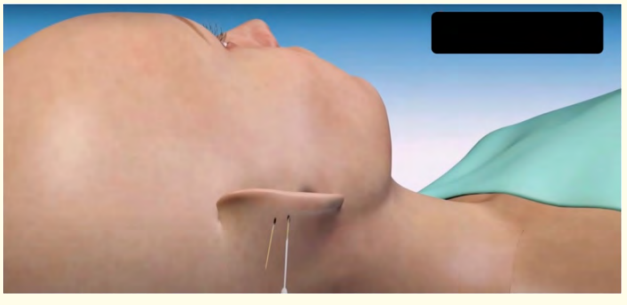


Figure 2G: shows the positions of the 2 ends of the thread after being pulled .

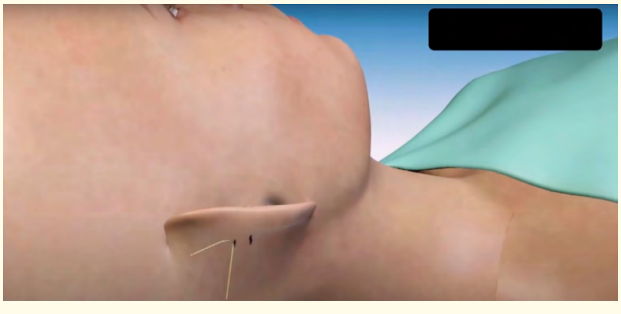


Figure 2H: shows the caudal end of the thread being pulled from side 3 to side 2 in order to be fixed with a knot.

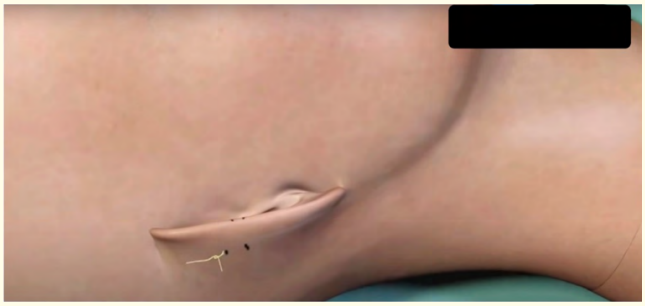


Figure 2I: shows the fixating knot placement.

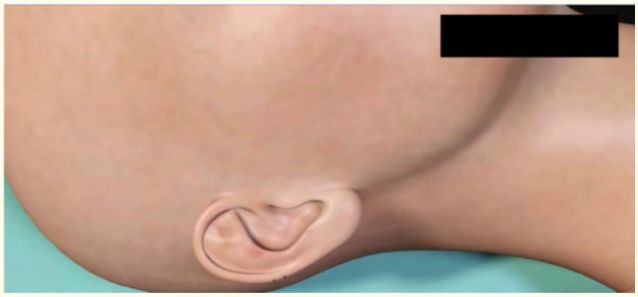


Figure 2J: shows the fixated ear result after the procedure.

Figure 2A - 2L: Diagram of surgical technique (2A and B anesthesia; 2C sutures placement; 2D -2L step by step technique).

Photographs were also obtained from every patient. A follow up visit at 6th and 12th weeks was scheduled for all patients. This study was conducted according to the standards of good medical practice (ICH-E6) and the principles of the Declaration of Helsinki. All the patients taking part in the study signed a detailed consent form.

Surgical technique

Local anesthesia, xylocaine 2% (figure 3A and 3B), is applied to the periauricular region and a 3/0 transparent prolene, non-absorbable suture is used. The entry, exit and fixation points of the sutures are determined during the clinical examination of the auricle. Using a forceps the points that cause the least tension are determined as the entry points. The schematic diagram on figure 3C, shows the suture placement in the shape of a rectangle with a numeric indication of the order of such placement.

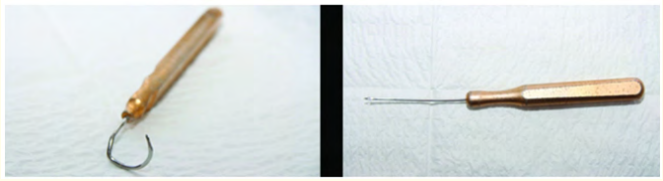
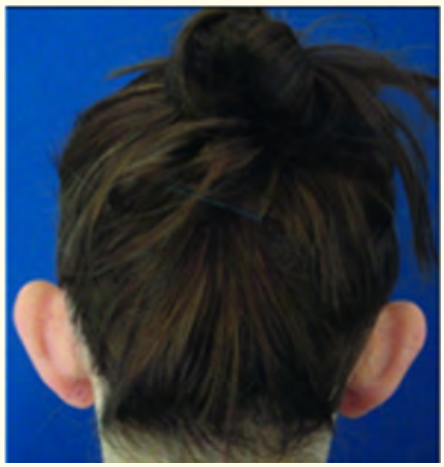


Figure 3: The special surgical instruments used in the incisionless otoplasty.

Two or three sutures (rectangles) are performed according to necessity and severity of the deformity. The entry and the exit points of the sutures on each side of the rectangle are shown by the direction of the red arrows on figure 4, having the end of the arrows as the entry points and the head of the arrows as the exit points. The entry point of side number 1 is the same as the exit point of side number 2, the exit point of side number 1 is the same as the exit point of side number 3, the entry point of side number 3 is the same as the entry point of side number 4 and the entry point of side number 2 is the same as the exit point of side number 4 and this same point is also the fixation point. Sutures are passed through the cartilage from the entry point to the exit point and fixed under the posterior sulcus of the auricle which is between the temporal bone and auricle, as shown on figures 3D, 3E, 3F, 3G, 3H, 3I, 3J and 3K. Fixation point must be under the posterior sulcus of the auricle through the periosteum of the temporal bone (figure 3L), in order to prevent the tension and skin necrosis. The surgeon must fix the knot to the periosteum in order to maintain a strong fixation.



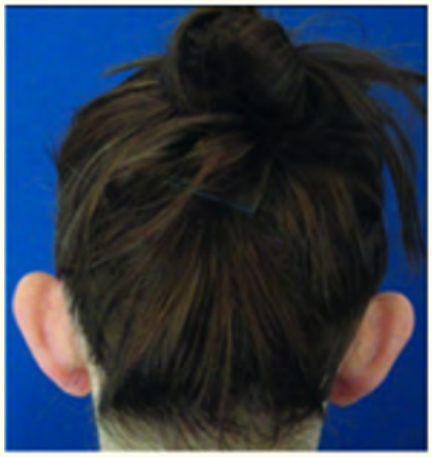
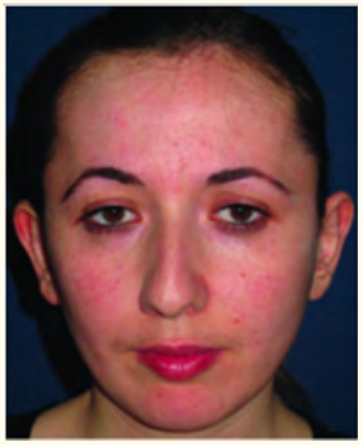
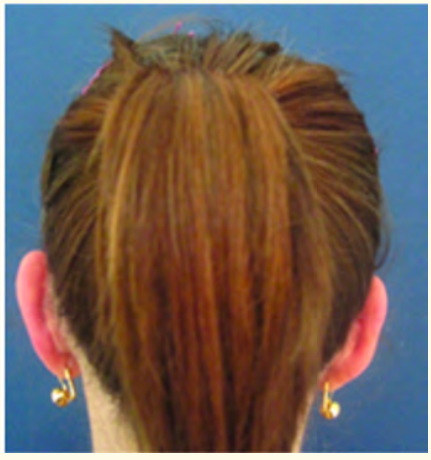
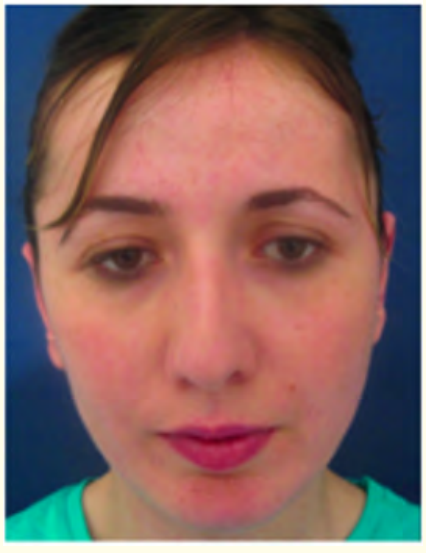


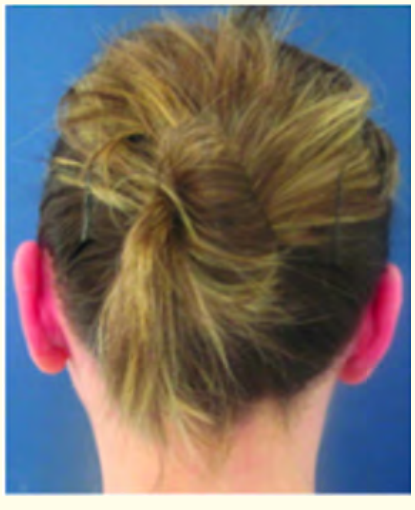
Figure 4: A and B Preoperative photos of a 21 year old female requesting correction of her protruding ears, frontal and back view. C Postoperative photos of a 21 year old female 12 weeks after undergoing incisionless otoplasty, frontal view.

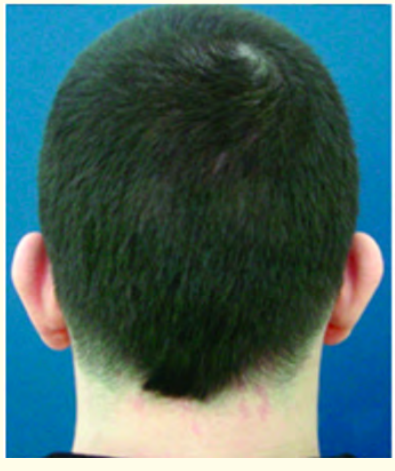
Special surgical instruments, one in shape of a hook and the other one a straight blunt needle with a hole at the distal end for passing the suture need to be used in order to perform this technique (Figure 4). The hook shaped tool having the 3/0 prolene non-absorbable suture is used to create a canal under the skin, inside the cartilage tissue to pass the sutures and retract the ear. Although different suture materials are used in otoplasty surgeries, non-absorbable, monofilament, surgical suture is mostly preferred in surgeries. Strychowsky., *et al*. are used 4/0 mersilene sutures for otoplasty procedure [16]. The important facts that should be taken into consideration during this procedure are, creating a natural appearing auricle, maintaining the angle between mastoid plane and upper helical rim less than 40 degrees and a distance from helical rim to skull of 15-20 mm [17]. Patients are asked to take ciprofloxacine (500 mg/2 times a day, adult dose and 15 mg/kg 2 times a day pediatric dose) for 7 days to prevent infection and biofilm layer related to the foreign body placed as it covers staphylococcus aureus and gram negatives, and analgesic treatment (Paracetamol every 8 hours) for 3 days after the procedure. An elastic head bandage covering the ears needs to be applied to patients in order to reduce the tension on the sutures. Patients are advised to wear this bandage for 3 weeks all day long and continue to use the bandage for 3 weeks more only at nights. A follow up visit at 2nd, 6th and 12th weeks was scheduled for all patients.











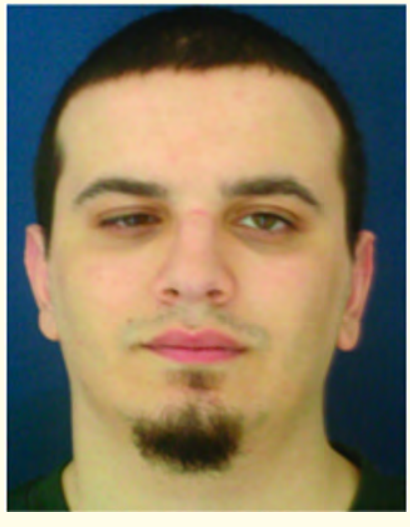


Figure 5: A and B Preoperative photos of a 36 year old female requesting correction of her protruding ears, frontal and back view. C and D Postoperative photos of a 36 year old female 12 weeks after undergoing incisionless otoplasty, frontal and back view.

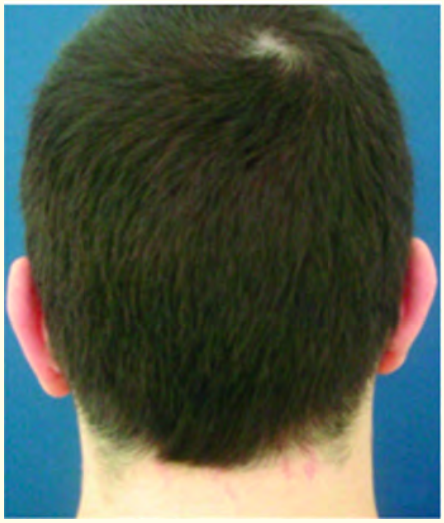


Figure 6: A and B Preoperative photos of a 29 year old male requesting correction of his protruding ears, frontal and back view. C and D Postoperative photos of a 29 year old male 12 weeks after undergoing incisionless otoplasty, frontal and back view.

Are you satisfied with the new shape of your auricle?	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied
Are you satisfied with the level of correction the was performed to your auricle?	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied
Are you satisfied with the symmetry of your auricle?	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied
What type of comments did you received about your operation by your friends and relatives?	Very negative	Negative	Neutral	Positive	Very positive
What is the pain level that you have experienced following your operation?	Intolerable	High	Moderate	Minor	No pain
How do you feel about yourself after the operation?	Very unhappy	Unhappy	Same as before	Happy	Very happy
Is your life changed after the operation in a positive or negative way?	Very negative	Negative	Same as before	Positive	Very positive
Do you feel more hopeful about the future after your operation?	Much more hopeless	Hopeless	Same as before	Hopefull	Much more hopefull
Do you feel more confident after the operation?	Much more unconfident	Unconfident	Same as before	Confident	Much more confident
Do you recommend this operation to people around you who have similar deformity?	I definitely do not recommend	I don't recommend	Neutral	I recommend	I definitely recommend
Would you choose our clinic for any kind of treatment after this operation?	Yes				No
Is there a relapse in any of your ears after this operation?	Yes				No

Appendix 1: Patient satisfaction questionnaire.

Results

A total of 779 patients underwent minimally invasive otopasty procedure between August 2009 and April 2014 and were included in this study.

Bilateral correction was performed in 737 patients while the remaining 42 patients underwent unilateral correction. The total number of ears that were submitted to the correction procedure was 1516.

Mean age was 24 (ranged between 7 and 52). 84 (10.78%) of these patients were pediatric (under 18 years old). Mean age was 24 (ranged between 7 and 52). 84 (10.78%) of these patients were pediatric (under 18 years old). 233 patients were male (29.9%) and 546 patients were female (70.1%). Patients were called for a control visit at the 2nd postoperative week and at 12th weeks after the procedure. In 76 patients (9.75%) a revision operation was performed to one ear only. Analysing this numbers we can observe that in a total of 1516 ears the need for a revision surgery was encountered in 83 ears making a revision surgery rate of 5.4%. The correction procedure was performed with incisionless otoplasty method in 69 patients and the remaining 7 patients underwent revision surgery via open approach for correction. Revision procedure was performed at the 12th week visit if necessary. Complications seen in our patients included suture rupture in 76 patients (9.75% of patients) at 2nd postoperative weeks in 4 patients and at 12th postoperative week in 72 patients) and local abscess in 4 patients (0.51%). Early and late suture rupture was accompanied by recurrence and 69 patients were corrected with the same technique due to rupture in one ear, while 7 patients were corrected with open otoplasty technique. We consider suture removal and repositioning from the old entry point is not a difficult procedure as the entry points are minimal. A transparent prolene was used as suture passing the dermis superficially to prevent shrinkage while suturing and none of the patients developed keloid or similar scar problems.

Success rate was assessed based on change in medialisation. The changes between the first, second and third measurements were calculated. Mean change in medialisation just after the procedure was 12.1 mm. This change is expected to decrease over time since the tissues that hold the sutures get narrower due to the extraction force derived from the suture. The change in medialisation was calculated at the 12th week follow up visit again and the mean medialisation was decreased to 10.9 mm.

Mean sum of the multiple choice part of questionnaire was 43.82 points meaning, mean question score was 4.38. This result can be interpreted as that patients were happy and very happy in average. Since 3 points was corresponding to neutral in the questionnaire a total score of below 30 points can be termed as negative result. Total score was found as below 30 points in 91 patients (11.68%). 83 of these 91 patients were the patients who needed to undergo revision surgery.

Discussion

The first publications about correction of protruding ear deformity with non-surgical methods were published in 1980s [17-22]. In these studies it was stated that forcing the auricle into a proper position and maintaining for a several weeks may result in permanent correction. The success of this procedure is related with the elasticity of the cartilage, the underlying deformity and the age of the patient. In a systematic review about correcting the protruding ear without any intervention but only using external forces; it was stated that excellent results were achieved with the technique but the results were correlated with the method used and the experience of the physician [23]. However these procedures called as splinting techniques are effective only in newborns and children. These methods are off our scope since it comprises only newborns and small children.

Aesthetic surgeries help to increase patient's life quality by improving patient's overall appearance and self-esteem [24]. The underdevelopment of antihelix structure is the most common reason of protruding ear. The ideal ear protrusion is generally accepted as 15-20 mm from the skull of helical rim and we also aim to correct the protruding ear to this distance interval in our patients. It is a well-known fact that psychological disorders are related with childhood traumas closely. Protruding ears may be a reason for embarrassing and bullying by other children in childhood period and this can lead to psychological traumas. Therefore, we believe that this deformity should be corrected between the ages of 5-7 years old in order to avoid school bullying, avoid lowering self-esteem as this age is prior to the age of self consciousness and to wait the complete cartilage and ear development.

The incisionless otoplasty method was first described by Fritsch in 1995 with the goal of limiting the complications seen in open surgical approach. Fritsch has refined the originally described technique in 2004 and 2009.

[25] Parents of children with protruding ear may wait, and this may affect children's social life and psychology in a negative way. However with the incisionless otoplasty method the patient does not undergo a general anesthesia and this procedure requires short operation duration around 15 minutes. The main goal of the protruding ear operation is the correction of ear naturally and symmetrically without causing any complication and recurrence. However there is a recurrence rate in all otoplasty techniques and long term outcome results are not well documented [11,12,26,27]. In our study; incisionless otoplasty technique was found to have a relatively low reoccurrence rate per ear as 5.4%.

Common complications seen in surgical approaches are infection, pain, asymmetry, suture extrusion and anterior skin or cartilage necrosis. The minimal invasive otoplasty technique is an effective method for correcting the antihelix structure with minimal surgical incision. In our study infection rate was found to be 0.5%. Infection complication rate was reported as 3.5% in study assessing the results of surgical approach [28].

The minimal invasive otoplasty technique is also superior to surgical techniques in terms of anterior necrosis complication since there is no cutting and no new edge formation that can cause increase in the skin pressure and lead to necrosis. The cartilage necrosis complication also was not present in our minimal otoplasty technique because the vascularization of the cartilage is not compromised. The minimal invasive otoplasty technique is an ideal method for preventing the asymmetry complication since the position of the auricle is provided via sutures and the asymmetry can be easily corrected with a second procedure, if needed. The rate of need for the revision surgery has been reported as 8-16% in previous studies conducted on open approach otoplasty performed patients. This rate was found as 9.75% in our study. However a great number of correction patients underwent a correction procedure only in one auricle.

The revision surgery rate per ear in our study was 5.4%. The revision rate obtained with incisionless otoplasty method is low specially when compared to other methods. As we have also mentioned above the mean medialisation was calculated as 12.1 mm just after the procedure and 10.9 mm 12 weeks after the procedure. This decrease in medialisation is normal because the tissues that hold the sutures get narrower due to physical forces. Therefore a decrease in change in medialisation around 10% is expected after the procedure and it is acceptable. Since a decrease in medialisation is expected we correct the auricle more than the desired shape. The auricle gets its last form after the holding tissues gets their final position.

The results of the satisfaction questionnaire was below 30 points (equal to neutral) in 91 patients and 83 of these patients were the

ones who needed a revision procedure. Mean of the questionnaire was 43.82 and this result can be interpreted as patients were very happy with the results of the operation. Nonetheless, this technique, rather than a "one-size-fits-all" technique that correct all types of prominence, seems to be better suited to certain forms of prominence and likely to be applied to selected patients with insufficient anti-helix folds and no additional ear deformities (cup ear). In addition, although majority of our study population was composed of children under the age of 18, it should be noted that a longer-term follow up in older patients is necessary, given the risk of stiff and calcified cartilage in older age groups which may cause the suture to cut the cartilage and cause the ear to return pre-operative position. Certain limitations to this study should be considered. First, generation of the patient reported outcomes data via a non-validated instrument rather than valid instruments such as FACE-Q is major limitation of the current study in terms of the scientific value of the data. Lack of data on a longer-term follow up and the difficulty in accessing all patients are other limitations of the study, whereas we expect the rate of rupture and recurrence to be similar to normal open otoplasty techniques with additional follow-up.

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Conclusion

The incisionless otoplasty is a safe technique, that does not require general anesthesia, with low complication rate and high patient satisfaction. To the best of our knowledge this study has the largest patient population among other studies conducted on incisionless otoplasty.

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