The Aesthetic Outcome of a Combined Otoplasty Technique in Children with Prominent Ears; a Prospective Clinical Study

Thesis

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ABSTRACT

Background: The external ear is a defining feature of the face. It helps make one have the “normal” look with an aesthetically fine appearance. Prominent ear is the commonest congenital deformity of the external ear. This deformity has profound psychosocial effects on the bearer. Prominent ear interferes with the bearer's social and sometimes even mental wellness. The well being of patients is the ultimate goal of every medical practitioner, thus it is the surgeon's responsibility to bring back “normalcy” in individuals with deformities such as prominent ears.

Objective: The aim of this work is to assess the aesthetic outcome of a combined technique of otoplasty in correction of combined auricular deformities in children and to evaluate the effect of cartilage scoring in newly created antihelical fold.

Methods: The study is a clinical trial in which 30 cases of prominent ears are divided into two groups. The study was done at Plastic, Burn and Maxillofacial surgery department, Demerdash hospital, Ain Shams university in the period from 1/1/2018 to 31/12/2018. Group A (15 cases) performed otoplasty using the combined approach of otoplasty including: conchal excision, anterior cartilage scoring, conchoscaphal sutures and conchomastoid sutures. Group B (15 cases) performed otoplasty using the same technique omitting the scoring step. The comparison between the two groups was based on 3 aspects: Auricular anthropometric measurements measured preoperative, one month and three months postoperative, patient satisfaction using a questionnaire form and the occurrence of complications whether early or late.

Results: In our study, we assessed the combined technique of otoplasty, merging cartilage scoring with Mustardé sutures and Furnas sutures (Group A) and compared the results of this technique with the results omitting the cartilage scoring step (Group B) regarding surgical outcomes in the form of pre and post operative anthropometric measurements, patients' satisfaction in the form of postoperative questionnaire and safety of the technique in the form of the rate of postoperative complications. The surgical outcomes of patients of group A and B were good with no major difference. The patients' satisfaction of group A was slightly more than group B but still insignificant. Hematoma formation was more in group A than group B.

Conclusion: Combined technique of otoplasty is an effective and aesthetically pleasant technique for management of prominent auricles with high patient satisfaction and low complication rate. However, the surgeon should tailor his techniques individually for each patient based on the preoperative analysis of the cause of prominence.

INTRODUCTION

The auricle is a defining feature of the face. Its shape and size is influenced by age, sex and ethnic origin. Ear appearance and symmetry contribute to facial aesthetics. The shape, size and orientation of each auricle is as individual as a fingerprint but it is possible to make some generalizations; men have larger ears than women, ears increase in both length and width with increasing age, and overall ear size differs according to ethnic group ***(Alexander et al., 2011).***

The vertical height of the ear is 5-6 cm and should approximately match the distance between the orbital rim and the helical root. The width is approximately 55% of the vertical length. The vertical axis of the ear is inclined by 15-20˚ posteriorly. The auriculocephalic angle, defined as the protrusion of the auricle off of the scalp, should range between 25-35˚. Prominent ear is the most common congenital auricular deformity and typically occurs bilaterally. Approximately 5% of the population suffers from some degree of ear prominence. ***Farkas*** defined ear prominence as a auriculocephalic angle ›40˚ ***(Banks and Cheney, 2017).***

The most common causes of protrusion of the external ear are underdeveloped flat antihelix or an overdeveloped deep concha. In reality, most patients have a combination deformity of posterior cartilage excess and an undefined antihelix. Contributing features which may accentuate auricular prominence are protrusion of the mastoid process, prominence of the lower auricular pole (cauda helicis, lobule and cavum concha) or a prominent tipped upper auricular pole ***(Koul and Patil, 2011).***

The protruding ear can be managed through a multitude of approaches, both surgical and nonsurgical. Molding techniques are frequently successful in infants with protruding or deformed ears. Another management option is the Laser-assisted cartilage remodeling (LACR) which is based on the temperature-dependent characteristics of cartilage. It provides a smoother, more natural curvature than conventional techniques but without the incisions and subsequent scarring. However, surgery continues to be the main therapy to correct the protruding ear ***(Byrd et al., 2010).***

Otoplasty is a description of surgical procedures designed to give the deformed auricle a more natural and anatomic appearance. Children and adults with auricular deformities may suffer significant social and psychological trauma. Dramatic psychosocial improvements after otoplasty are well-documented. The appropriate time for corrective surgery should balance auricular growth, cartilage pliability, psychological burden secondary to the auricular deformity and patient maturity level. In the golden window between ages 4 and 6, these elements align, thereby allowing optimal execution of reconstructive techniques to improve the cosmesis of the ear ***(Ali et al., 2017).***

Surgical management of protruding ear has evolved over time to include countless innovative techniques. Not earlier than in the end of the 19th century, reports on surgical techniques used to pin down protruding ears for cosmetic reasons were published. ***Dieffenbach*** was among the first when, in 1845, he described his technique of otoplasty to correct a post-traumatic prominent auricle in a patient. He excised retroauricular skin and used a conchomastoid suture for the fixation of the ear. Following his approach, ***Ely*** described in 1881 a continous, crescentic resection of a strip of cartilage in combination with conchomastoid fixation suture. In 1910, ***Luckett*** combined a skin-cartilage excision along the antihelical fold with horizontal mattress sutures to achieve a better formation of the scapha ***(Dieffenbach, 1845) (Ely, 1968).***

Gibson and ***Davis*** could show the cartilage incised on one side has the ability to wrap to the opposite side leading to weakening the depth of the newly created antihelical fold to discourage relapse and unfolding. The knowledge of this phenomenon became ultimately the starting point for numerous modifications of incision-scoring techniques in the area of anti-helix, which was described by ***Converse*** (1955). ***Converse*** performed incomplete cartilage incision from posterior in combination with fixation sutures, ***Chongchet*** and ***Crikelair*** scored the anterior cartilage of the lateral scapha with a scalpel to form the antihelix using a posterior access, while ***Stenström*** used a rasp to shape the anterior cartilage via a small posterior access ***(Gibson and Davis, 1958; Converse, 1963; Chongchet, 1963; Stenström, 1963; Crikelair, 1964).***

In contrast to the incision-scoring techniques mentioned above, ***Mustardé*** described in 1963 and 1967 a technique to create a new antihelical fold that was only based on sutures made of non-absorbable suture material. He used a posterior access to place several individual cartilage mattress sutures to bring the antihelix into the desired. Apart from the cavum rotation technique, ***Furnas (1968)*** and ***Spira (1969)*** described a concho-mastoid fixation suture technique intended to reduce the helix-mastoid distance, which was used in combination with antihelix plasty ***(Mustardé, 1963) (Furnas, 1968).***

Since then more than 170 techniques have been described for correction of prominent ears varying between incisions, excision, scoring and suturing techniques indicating that there is no single widely accepted procedure that has been adopted by most surgeons ***(Ali et al., 2017).***

AIM OF THE WORK

The aim of this work is to assess the aesthetic outcome of a combined technique of otoplasty in correction of combined auricular deformities in children and to evaluate the effect of cartilage scoring in newly created antihelical fold.

Chapter 1
EMBRYOLOGY OF THE AURICLE

The embryonic pharyngeal arch apparatus provides the structural foundation for formation of the external ear. The pharyngeal arches are conspicuous external features of the human embryo and are significantly involved in various aspects of head and neck development. The arches are obliquely oriented, rounded ridges separated by prominent grooves or clefts (Fig1.1). The clefts come into close relationship with outpocketings of the pharynx known as the pharyngeal pouches. In fact, it is the first of these pouches that eventually elongates to form the tubotympanic recess, from which the Eustachian tube and middle ear cavity develop. ***(Wright, 1997)***

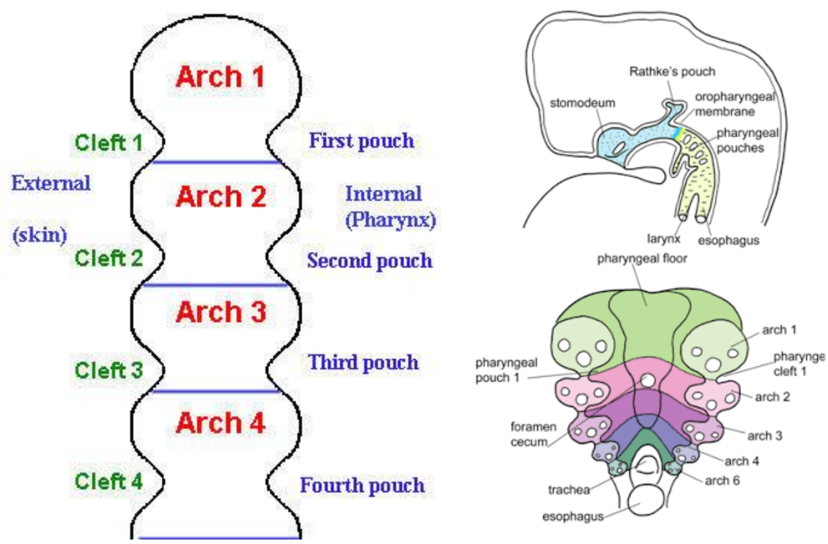

Fig. (1-1): Cross sectional view of the pharyngeal arch apparatus ***(Keibel and Mall, 2008).***

By the end of the fourth week of gestation, four well-defined pairs of pharyngeal arches are externally visible in the neck region of the human embryo (Fig 1.2). The first two of these, the mandibular and hyoid arches, are important contributors to external ear development ***(Wright, 1997).***

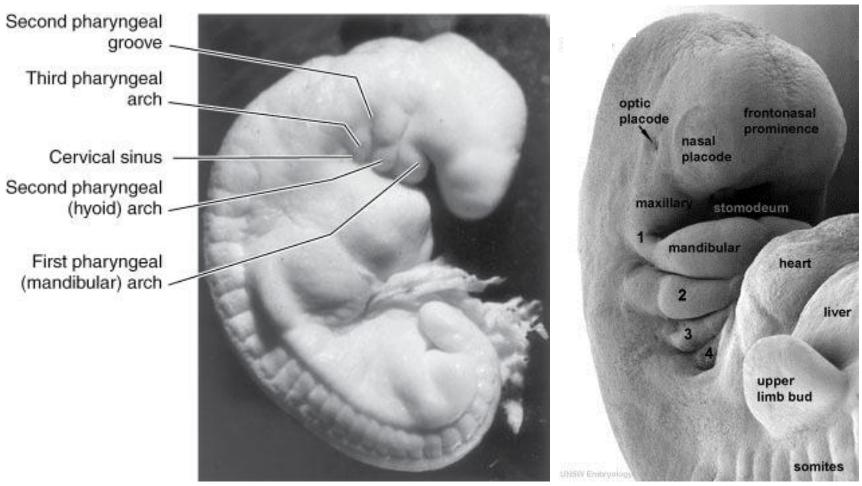

Fig. (1-2): 3D model of the pharyngeal arches in the neck
(Keibel and Mall, 2008).

The structures of the external and middle ear are made up of endodermal, mesodermal and ectodermal elements of the first and second branchial arches. The development of the external ear is generally complete by 20 weeks' gestation. Through childhood, the external ear and EAC will grow in size but in relative proportion to the scale present at birth. In contrast, the middle and inner ears are fully formed and of adult size at birth and do not grow significantly with the child ***(Tracy et al., 2013).***

During the fifth gestational week, nodular swellings of tissue known as the hillocks of His appear on the first and second pharyngeal arches. Six such hillocks, three on either side of the pharyngeal cleft, can be distinguished. Most investigators believe that the auricle is formed by growth, differentiation and fusion of these six tissue condensations. There is some disagreement, however, as to the exact adult structures that form from the auricular hillocks ***(Keibel and Mall, 2008).***

However, it is generally accepted that hillocks 1-3 develop from first branchial arch mesoderm (rostral to the first branchial cleft) and hillock 4-6 develop from the second branchial arch, just caudal to the cleft. As development proceeds, the relative contribution of cells from the first arch decreases, such that second branchial arch derivatives contribute about 85% of the mature external ear ***(Tracy et al., 2013).***

The hillocks of His achieve maximal prominence by the end of week 6. In the seventh week of fetal development, the hillocks undergo directional growth such that they fuse and begin to form the shape of the auricle. Hillock 1 gives rise to the tragus. Hillock 2 and 3 form the crus of the helix and helix proper. Cells of hillock 4 and 5 constitute the anti-helix; and the anti-tragus and lobule are formed from hillock 6 (Fig. 1.3). These assignments are general and there almost certainly is overlap in terms of the primordial contributions to the developed ear ***(Tracy et al., 2013).***

During the initial stages of its development, the auricle is located in the general area of the neck, behind the lower jaw, but by the 20th week of gestation it has moved upward to attain its adult location and overall configuration. In a 4- to 5-year-old child, the auricle is about 80 percent adult size. It reaches full adult size by approximately 9 years of age ***(Wright, 1997).***

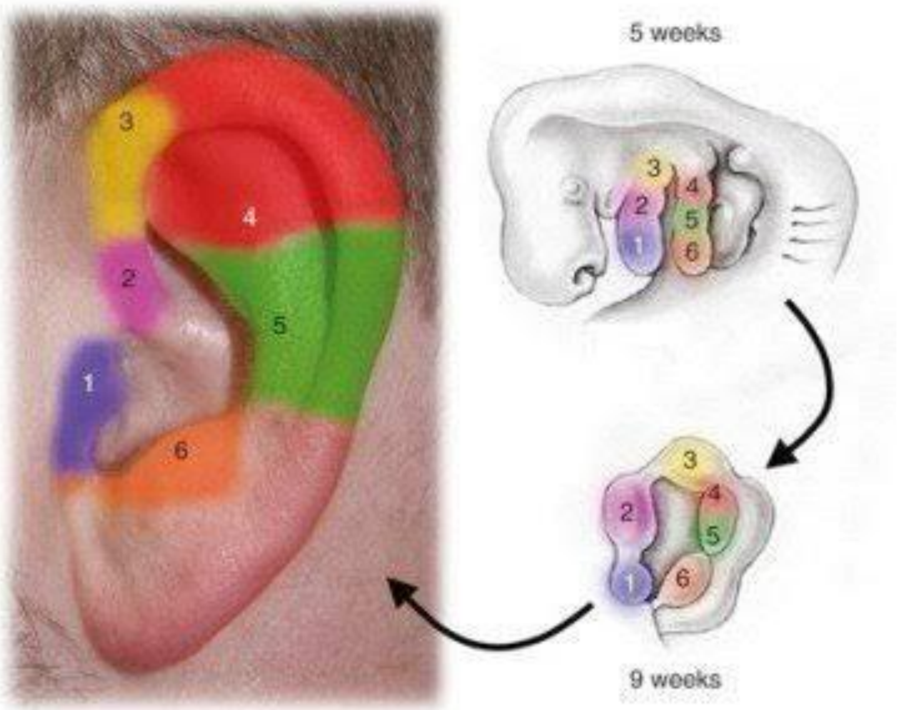

Fig. (1-3): The six hillocks of His ***(Keibel and Mall, 2008).***

Dysmorphogenesis of the auricle

Congenital deformities of the ear may be secondary to genetic abnormalities or through sporadic developmental anomalies. The second category is believed to be the more common cause, although twin studies have indicated that genetic contributions are important as well. Further, it is estimated that about 50% of external ear anomalies are associated with other congenital abnormalities. Sporadic anomalies are most commonly assumed to be related to fetal malposition or vascular insults in development ***(Artunduaga et al., 2009).***

Dysmorphogenesis has been broadly classified as agenesis, hyperplasia, dysplasia, heterotopia or duplication. In the case of the auricle, the terms anotia, microtia and macrotia are used. The development of the ear allows for a broad range of different anomalies and classification can be a challenge. Further, as noted above the auricle, canal and middle ear all develop concurrently and from tissues of the first and second branchial arches. Therefore, congenital anomalies frequently involve more than one part of the ear. Anomalies of the external ear will be categorized based on clinical appearance. The anomalies of the external ear include: auricular pits, cysts and sinuses, microtia, anomalies of the antihelical cartilage, protruding ears, cryptotia and anomalies of the external auditory canal ***(Alasti and Van Camp, 2009).***

As regards protruding ears, a variety of anomalies may lead to its appearance. The majority of such cases are the result of abnormal position of the ear or auricular subunits. Dysplasia of the helix or antihelix may cause the appearance of protruding ears especially loss of the normal antihelical roll. Often the cause is related to the size and shape of the conchal cartilage and its position relative to the mastoid and other auricular subunits ***(Alexander et al., 2011).***

Chapter 2
ANATOMY OF THE AURICLE

It is well known that the aesthetic otoplasty techniques are elegant and often intricate and rely on a complete understanding of the anatomy as well as knowing the muscles, nerves and vessels supplying the auricle. Every groove, fold, concavity of the ear should be clearly imprinted in the mind of any surgeon embarking on aesthetic otoplasty and reconstruction of the auricle ***(Prendergast, 2013).***

The ear can be split into three parts; external, middle and inner ear (Fig. 2.1). The external ear is divided broadly into the auricle, cartilaginous external auditory canal (EAC) and bony EAC. The auricle is the irregularly shaped part of the external ear that protrudes from the face at the level of the temporal bone. Its shape is very similar to a question mark, as described by ***Gillies and Millard (1957)***. It consists of an elastic, convoluted cartilaginous plate covered in skin. The auricular cartilage framework consists of three tiers of delicately convoluted cartilage: the conchal complex, the antihelix-antitragus complex, and the helix-lobule complex. The ear still presents some characteristics and functions that are not well-known; however its major function is to capture and direct sound waves into the ear canal. It also helps localize the direction of sounds ***(Avelar, 2013).***

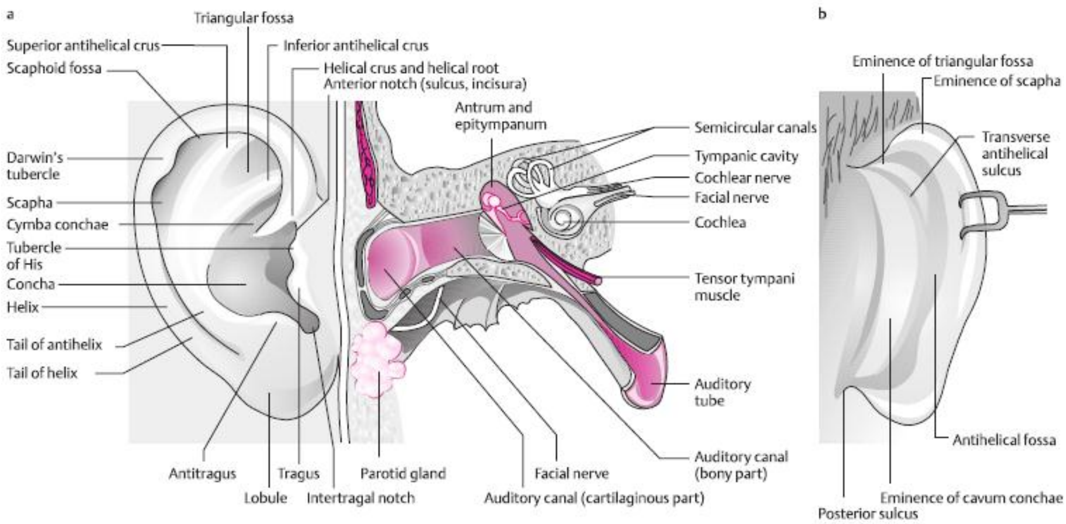

Fig. (2-1): Anatomy of the ear ***(Weerda, 2007).***

There are two surfaces on the human ear. The anterolateral surface shows its peculiar organization with reliefs and folds. The posterior surface is quite hidden from view (Fig.2.2). The organ is completely covered by thin skin, with special characteristics of texture, histology, elasticity, color, and thickness. The anatomical structures of the ear include: (1) the auricular skeleton; (2) the cutaneous covering; (3) the muscles; (4) the arterial and venous vascularization; and (5) the innervations ***(Avelar, 2013).***