

# Auricular prominence and otoplasty – An overview

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## Abstract

Auricular prominence is a common cosmetic variation which has significant psychological effects on school-aged children. Though the definition prominence itself is highly subjective, it is well documented that alterations in ear size, shape, position and projection having significant influences on overall individual appearance. It can ultimately lead to poorer educational performance and longer lasting psycho-emotional issues. While moulding techniques are commonplace in the first six months of life, thereafter there needs to be the consideration of potential surgical intervention if required. These can be divided in cartilage-preserving and cartilage-cutting techniques. In this article we give an overview of auricular prominence, ear anatomy, clinical evaluation, historical management, current treatment options, and potential complications.

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## Key words

Otoplasty, Pinnaplasty, Auricular Prominence, Bat Ears, Ear Protrusion

## Introduction

Affecting 5-10% of the population, auricular prominence is a common cosmetic deformity, with ear size, shape, position and projection having significant influences on overall individual appearance.<sup>1,2,3</sup> Though there have no significant associated functional deficits, it has a profound psychological impact, especially in a younger demographic and school-age children.<sup>3,4</sup>

These individuals have been found to have difficulties in social integration, manifesting as behavioural problems and worsening school performance.<sup>3</sup> Being bullied, teased and ostracized eventually leads to feelings of inadequacy, as well as eventual social and economic disadvantages from lack of attendance or engagement with education. Ultimately the backlash from this cosmetic deformity can lead to psycho-emotional issues lasting a lifetime.<sup>5,6,7</sup>

Ear correction surgery is the fourteenth most frequent cosmetic surgery in females, and sixth in males.<sup>8</sup> With evidence highlighting enhanced self-confidence, as well as positive subjective impacts on general health and well-being, in addition to improved school performance, parents often refer their children for surgical opinions. It has been shown that early treatment has greater positive impacts.<sup>1,3,9</sup>

It was for the aforementioned reasons that the National Health Service (NHS) released guidelines for consideration of surgery in those under the age of nineteen years. However, in this economic climate there has been an increased scrutiny regarding most forms of aesthetic surgery including otoplasty.

## Anatomy

The architecture of the auricle primarily involves the helix, antihelix, concha, tragus and lobule. There are also ancillary structures such as the antitragus, intertragal incisures and Darwin's tubercle.<sup>3</sup> While the otic placode presents during the third week of gestation, the external ear continues to grow even after skeletal maturity with ear length increasing for a longer duration than width.<sup>2,10</sup> Even with increasing age, gradual microscopic changes with regards to cartilage cell density and numbers of elastic fibres play important roles when considering intervention, such as decreased skin elasticity and resilience.<sup>11</sup>

With regards to innervation, the auricle receives its supply from the auriculotemporal branch of the trigeminal nerve, facial nerve, glossopharyngeal nerve, Arnold's nerve from the vagus and nerves from the second and third cervical plexus. Vascular supply is typically from the superficial temporal artery, the posterior auricular artery and the lesser occipital arteries.<sup>10</sup>

There have been numerous anthropomorphic studies with regards to defining the ideal ear, finding common distances and angles. The distance between the lateral helix to the scalp should ideally be 20mm, producing an auriculocephalic angle ranging from 20 to 30 degrees. The conchal bowl extends to a depth of 15mm, and produces a conchoscaphal angle which is normally less than 90 degrees.<sup>3,10,12,13</sup>

When considering vertical height and width, the latter should be approximately 55% of the former. If the typical height is approximately 60mm, this would make the width around 35mm. Irrespective of ethnicity, males have been found to have longer and wider ears when compared to females across all age groups.<sup>2,3,14,15</sup>

### Auricular Prominence

In this review we will mainly consider prominauris, the most common indication worldwide when performing otoplasty.<sup>4,10</sup> Though, it must be noted that there are other aetiology resulting in malformation which require surgical intervention.

Prominauris is typically seen when the auriculocephalic angle is greater than 30 degrees or the conchoscaphal angle is equal to or greater than 90 degrees.<sup>4,16,17</sup>

It can be inherited in an autosomal dominant pattern, with questions regarding family history important during consultation. The two main factors resulting in this condition include a poorly developed antihelical fold and a hypertrophied conchal cartilage but it can also include other alterations including a flat scapha or prominent lobule.<sup>4,10,18,19</sup> These irregularities may occur in isolation, but most frequently produce protrusion together in varying degrees.

If considering the mechanism, when the antihelical fold is inadequately curved, there is a prevention of the normal posterior folding of the helical-scaphal unit, which in turn lengthens the distance between the mastoid skin and the helical rim, leading to greater ear prominence. Specifically, this variation leads to prominence of the upper and middle thirds of the ear. In contrast, conchal hypertrophy deepens the bowl and displaces the helical rim, forcing the auricle away from the scalp and brings forward the middle third of the auricle.<sup>20,21</sup>

### Optimal Age of Intervention

It is universally accepted that the ideal time of therapeutic or operative intervention is between the ages of four and six.

Between these ages, the external ear reaches approximately 85% of its maximal width and 50 to 60% of its maximal

height, in addition to having a patient demographic not yet fully subjected to bullying.<sup>3</sup> By the age of six, the ear is technically classified as a mature ear. Cartilage pliability is still malleable enough to contribute to higher rates of success and delaying management to this age has not shown to contribute significantly to psychological morbidity long term, though there are studies showing poorer quality of life leading up to this point from peer ridicule.<sup>6,7,20,21</sup> If the patient is far older, the auricular cartilage becomes more calcified and less malleable, resulting in higher rates of failure.<sup>7</sup>

It is important to note we are considering patients who have grown beyond the age of nonsurgical moulding or splinting techniques. While these are an effective avenue in the first few weeks of life and up to six months, beyond this the rigidity of the cartilage makes it resistant to conventional moulding techniques.<sup>22,23</sup>

### Patient Evaluation and Analysis

There are numerous anatomical variables which are used to evaluate the auricle. When analysing the ear in isolation it is important to consider whether in general it is oval, round, triangular, rectangular or variations and combinations of these shapes. The position and size of the intertragal notch must be noted, with significant variations noted between individuals. With regards to the lobule, it can be attached or free, as well as variable in size and shape.<sup>2</sup>

However, analysing the ear without consideration of the face globally will eventually lead to suboptimal surgical results. The Frankfort horizontal plane is an axis used to gauge spatial relationships between the ear, eyebrow, eyes and nose.<sup>23,24</sup> This passes through the inferior orbital rim to the top of the tragus. Above this, the superior edge of the ear should theoretically be level with the eyebrow and lie parallel to the Frankfort line. Below it, the lobule should lie at the level of the nasal tip, with the overall length of the ear equal to that of the nose, from the nasion to the subnasale.<sup>3,23,24,25</sup>

There is no requirement for pre-operative imaging in patients with normal acoustic function, but pre-operative photographs must be taken anteriorly, posteriorly and laterally.

As mentioned previously, psychological impact of auricular prominence is well noted and must be addressed during the consultation. It is important to manage expectations of surgical outcomes, as well as garnering an insight into the patient's viewpoints and understanding. Self-confidence and social interactions are two topics which should be spoken about individually. There are also calls for psychological evaluation, especially in a paediatric

population pre-operatively, with hopes of engagement in the decision-making process.<sup>3,7,26</sup>

### Aesthetic Goals for Intervention

The primary goal of therapeutic intervention is to restore acceptable auriculocephalic, conchoscaphal and conchomastoidal angles.<sup>18</sup> The results should be reliable, stable and satisfactory for the patient, as well as creating a closely symmetrical result.

More specifically, McDowell has previously listed a set of goals with regards to otoplasty.<sup>27</sup> These included to correct the protrusion of the upper, middle and lower third of the auricle, with protrusion of the upper third the most important. If examining the patient anteriorly, the helix should extend beyond the antihelix, at least up to the mid-ear. The helix should have a smooth regular line. The postauricular sulcus should not be markedly distorted. The ear should not be placed too closely to the head and the positions of the two ears should match closely, ideally within 3mm at any given point.

### Historical Intervention

Dieffenbach reported the first documented technique of otoplasty in 1845, where he described the resection of retro-auricular skin with subsequent conchomastoid fixation.<sup>28</sup> He did this when managing auricular prominence post-traumatically, but it only corrected the cephaloauricular angle and there was significant recurrence.<sup>17</sup> The technique was enhanced in 1881, by Ely who included conchal and triangular fossa cartilage excision as a second-stage procedure.<sup>17</sup> Luckett addressed the antihelical fold and its restoration in 1910, where he added a posterior excision of skin and cartilage along the antihelical fold, but it resulted in an unsightly sharp antihelical border.<sup>29</sup> In 1952, Becker modified the reconstruction with a tubing technique, where he made a cartilaginous tube to accentuate the antihelix, with similar reports elsewhere at the time.<sup>30</sup>

But it was in 1963, when the Mustarde technique was developed that the modern era of otoplasty fully took flight. He advocated the use of mattress sutures without the excision of any cartilage.<sup>31</sup> Furnas, in 1968, elaborated further by introducing a suture technique for the conchal bowl which was widely popularised.<sup>32</sup> Since then, there have been a variety of different techniques using these baseline principles alone, in conjunction or with further modifications.

### Current Surgical Intervention

With over 100 reported procedures in the literature there is likely no gold standard, but we will attempt to give a brief overview of popular management options.<sup>17,33</sup> Techniques

can be subdivided in cartilage-preserving and cartilage-cutting, though most surgeons use a combination of these.

Both techniques require access, using a postauricular incision eventually hidden in the postauricular sulcus. Though skin is excised in some techniques, with adipofascial tissue left behind, others advocate that this is not necessary and may result in hypertrophic scarring. The scaphal region and mastoid fascia are both exposed when raising anterior and posterior skin flaps.

Though some surgeons prefer operating under local anaesthesia in adults, general anaesthesia is commonly required in children.

### Cartilage Preserving

Mustarde's and Furnas's techniques are both cartilage-preserving. Mustarde's technique involves full thickness horizontal mattress suturing through the anterior perichondrium along the posterior cartilage using non-absorbable sutures to re-create the antihelical rim, but not conchal bowl. A cartilage tattoo with methylene blue can be used to mark the locations if required. There are typically three to four sutures required when recreating an antihelical fold placed about 10mm apart.<sup>17,34</sup> The Furnas technique on the other hand focused on the management of excessive conchal cartilage.<sup>32</sup> Four permanent conchomastoid sutures are placed, avoiding the anterior conchal skin and help with relocation.

### Cartilage Splitting

Cartilage-splitting techniques were started by Gibson and Davis, who noticed that when the cartilage was incised it tended to warp to the opposite side.<sup>35</sup> There have been a large number of subsequent modifications involving scoring, scratching, scraping, filing, rasping or abrading.<sup>36,37,38</sup> Criticism of these techniques include the creation of sharp contours, but with modifications, this is gaining greater advocacy when used appropriately.<sup>18</sup>

There has also been the rise of incisionless otoplasty such as transdermal abrasion of the cartilage at the site of the desired fold and percutaneous Mustarde-type sutures, as well as laser-assisted cartilage remodelling, however these are not yet commonly encountered.<sup>39,40,41</sup> It is also important to note that there are non-surgical options becoming available using plastic or metallic splints which remain in place for 2-12 weeks.<sup>3</sup>

### Surgical Complications and Sequelae

These can be divided into early and late complications. The most concerning early complication is haematoma formation leading to cartilage and skin necrosis, ultimately

forming a cauliflower deformity. This can also occur secondary to overtightening of sutures and occasionally excessive pressure from the dressing. Other early complications include bleeding, infections including perichondritis and dehiscence.

Late complications can include excessive scarring and keloid formation, a hidden helix anteriorly, suture extrusion, hypersensitivity and deformities such as a telephone ear deformity, reverse telephone ear or a vertical post deformity. The most common aspect to consider in patients, however, remains dissatisfaction and poor aesthetic outcomes. Residual asymmetry is apparent six months post operatively and loss of correction occurs in 6.5 to 12% of cases, requiring re-operation.<sup>42</sup>

## Conclusion

It is clear that otoplasty is a useful surgical management option for patients with auricular prominence, and can provide a vast improvement in patient quality of life. There are variable management options which must be considered during consultation for optimal outcomes.

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