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Prosthodontic Implications of Macrotia and Relative Oto-aesthetics

Khurshid A Mattoo*

Department of Prosthetic dental sciences, College of Dentistry, Jazan University, Jazan 45142, KSA
*Corresponding author: drkamattoo@rediffmail.com

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Abstract The term "Oto-aesthetics" is term that highlights the role of the external ear in the overall facial aesthetics of the human face. Feasibly, its aesthetic significance is valued by those who suffer from conditions like Macrotia and Prominauris. A seventy-two-year-old patient reported for complete denture rehabilitation. The most prominent feature of his face was Macrotia (average length – 83.2 mm and average width – 44.2 mm) and prominauris. Since the size of the ear was rare and unique, a review of literature was conducted, and evidence-based facts of Oto-aesthetics were compiled. Measurements of both ears were recorded clinically as well as on a model of both ears that was prepared after making impressions of both ears. The aesthetic value of the human ear has been discussed in terms of its size, position, projection from the cranium, color, orientation, and relations between surface anatomy landmarks. A complete denture prosthesis was prepared using conventional dental procedures.

Keywords: *ear auricles, ear pinna, dental esthetic, dental prostheses, esthetic surgical procedures*

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1. Introduction

The external division of the human ear (Pinna) is composed of a bony and a cartilaginous skeleton that are lined by skin. It is an organ which disrupts the skull outline, yet it adds to facial aesthetics through its mere position and orientation within the lateral surface of the skull. It is also perhaps the only portion of the human face that doesn't possess the value of expression, although its elusive surface features convey signs of gender and age. [1] The auricle develops from the first and second branchial arches prenatally, while 85 percent of postnatal development is completed by 3 years and complete development by 7 to 8 years of age. [2] Although maturity of its height is reached by 13 years in males and 12 years in females, [3] there are studies which conclude an increase in height (mainly lobular height) in relation to age. [4,5] Historically, the external ear has been subjected to adorning, through procedures like piercing, stretching, cuffing, and flaring across various cultures as body modification to enhance perceived aesthetics across various times. [6] Anatomically the external ear is composed of a helix - antihelical complex, the Conchal complex and the label. [7] Functionally, the external ear acts as a funnel in sound collection and has also been used as a tool for establishment of personal identity. [8] Although there is no ear that can be designated as a standard, the external ear influences facial aesthetics [9], especially in terms of its size, orientation, and the anatomic relation to the skull. Macrotia is a clinical condition where the external ear is larger than would be expected in a particular population, whereas prominauris (protruding ears) is defined as the lateralization of the helix of the ear.[10] Prominauris besides being most common congenital deformity of the head also happens to be most common congenital deformity of the external ear transmitted as an autosomal dominant fashion with variable penetrance. [10] In young children and adolescents, prominauris influences children self - image, socializing ability and influences negative psychosocial impact (intimidation, mocking) that leads to increased anxiety which in turn lead to behavior modification including depression. [11].

There has been renewed interest in plastic surgical procedures with the advent of microsurgical procedures. Development of cosmetic and corrective surgical procedures have been shown to change the anomalies of the face to a large extent with desired patient satisfaction. [12] Human facial expressions are dependent on many factors (facial composition and symmetry, phonetics, presence, or absence of teeth). [13,14] With the advent of plastic surgeries involving the ear, there has been a better understanding of the anatomical aspect of the ear in terms of their aesthetic contribution to facial esthetics. In maxillofacial prosthodontics, such applications have not yet been explored. This article presents a case report of a macrotia with prominauris of a 70-year-old male patient, the uniqueness of which is the size, a negative family history and despite having both conditions the external ear had a very well-developed superior and anterior crus. The primary aim of this article is to review the aesthetic aspects of the external ear that have been addressed in the

plastic surgery literature and apply them to the field of maxillofacial prosthodontics for future investigations.

2. Case Report

An elderly male patient aged seventy-two years reported to the department of Prosthodontics for seeking complete denture prosthesis, since he was completely edentulous and was facing difficulties in mastication of food. Medical, drug, social and family history were non-contributory while dental history disclosed loss of natural teeth largely due to caries while few of them were extracted due to mobility. Extra oral examination revealed wheatish (brown) complexion, a droopy nose, long maxillary lip, dark brown eyes, and significantly large external ears that were projecting laterally from the side of the skull. Palpation of lymph nodes and temporomandibular joint did not reveal any abnormality. Intra oral examination showed normal mucosa, class 1 soft palate, well-formed maxillary, and mandibular completely edentulous residual alveolar ridges and macroglossia that was due to development of overgrowth of musculature and not secondary to any systemic disorder. Treatment plans presented to the patient ranged from implant supported fully bone anchored prosthesis to conventional complete denture prosthesis. The patient was educated about the impact of his existing large and protruding ear on overall facial aesthetics as well as on the complete denture aesthetics. Patient gave a written consent to the conventional complete denture prosthesis. Since the patient presented a rare and unique size of the ear, various measurements of the ear were recorded directly on/from various anatomical landmarks of the external ear (Figure 1). The average length of the ear was measured along plane L (highest point on the helix to the lowest point on the tragus) while average width was measured along plane P (base of the tragus to the outermost portion of the helix) (Figure 2 A). The diameter of the tragus was calculated by measuring the distances from same point on the base of the tragus at various degrees (15º, 30º, 45º and 60º) (Figure 2 B). Prominauris was established by measuring recommended dimensions as presented in medical scientific literature between external ear and the lateral surface landmarks of the cranium (Figure 2 C) (Table 1).

Table 1. Components of Oto-aesthetics

	Average dimensions	Reported dimensions
Size	• Average length – Males (60 to 65 mm), Females (55 to 60 mm) • Average breadth – Males (30 to 35 mm), Females (25 to 30 mm) (55% of its length) • Average earlobe size – 15 to 20 mm (Lobular elongation contributes the most to overall increase in ear length)	• Length – 83.2 mm • Width – 44.2 mm • Lobe -27 mm high/ 7 mm wide
Projection from cranium	• Distance from temporal to lateral skin of helical rim – 10 to 12 mm • Distance from high mastoid region to mid helix region – 16 to 18mm • Distance from low mastoid region to lower helical rim – 18 to 22 mm	• 27 mm • 32 mm • 30mm
Position	• Ear occupies a region between the superciliary arch superiorly to the base of the columella inferiorly. • Base of the tragus at one ear width lateral to the lateral canthus. • The cranio-caudal dimension of the ear should nearly parallel the orientation of the dorsum of the nose. • Lobule present in a straight line with helix cartilage thus occupying a position in that does not project laterally to the upper two thirds of the ear (same vertical plane as that of the helix)	
Color	• Same as that of skin, uniformly distributed unaffected by ageing, facial expression or facial make up (beard, moustache, spectacles). • Only hair length and ear ornaments can obscure its visibility	
Orientation	• Depends on three different angles (Figure 3) • Auriculo-Cephalic angle: Measures ear projection at helical root thus defining how far pinna sits away from posterior cranium. This angle is formed by a line extending from helical root to most lateral border of the helix and the plane of mastoid. The normal range is 25 to 35 degrees. (40 degrees or more in prominauris) • Concho-Mastoid angle: Angle at which concha bowl rises away from mastoid. (Between 45 to 90 degrees) • Concho-Scaphal angle: Defines the antihelix (normal approximately 90 degrees or less). More obtuse (140 to 150 degrees) in prominauris cases.	
Surface anatomy relations	• Both ears should be symmetrical in contour, size, and projection. • The helix should be several millimeters past (lateral) the antihelix and the superior crus. • Longest axis of the ear reclines posteriorly by 15 to 30 degrees to the vertical (ideal axis being 20 degrees from vertical axis of skull) • The helix should be thick, tapering and curved from top to bottom. • The post auricular sulcus should not be distorted (normal projection values) • The asymmetry of any ear should be within 3mm of the contralateral ear. • Distance from tragus to helix (25mm average). • Distance from tragus to antihelix (18 mm average). • Distances from tragus to helix and antihelix should be proportionate. • Vertical height of the concha wall (average concha bowl depth 12- 13 mm). • Helical rim should be furled. • Surface involutions are visible. • An altered helix or concha influences overall aesthetics more than tragus. • A prominent antihelix has been considered aesthetically appealing. • Poorly projecting ears are less aesthetic.	

Measurements of ear lobe were also recorded in terms of length and width. In relation to the frontal part of the face, the position of the external ear was determined by measuring distance between eyebrows superiorly to the base of columella inferiorly in frontal plane. The lateral position was determined by measuring the distance of the ear to the lateral canthus of eye. A calibrated (zero to zero) digital caliper (Precise) measured distances between various anatomical landmarks directly on the patient, followed by confirmation of measurements on a plaster cast (Elite Model; Zhermack, Badia Polesine, Rovigo, Italy) which was fabricated from impression of both ears using irreversible hydrocolloid (Thixotropic, Zhermach, Italy) impression material. All measurements recorded and presented in this paper are average between the dimensions of right and left ear and between live measurements and measurements on the cast. For complete denture prosthesis, routine clinical and laboratory procedures were performed for fabrication of the complete denture with balanced occlusion. The patient was extremely satisfied with the masticatory function of the prosthesis, which was his primary concern.

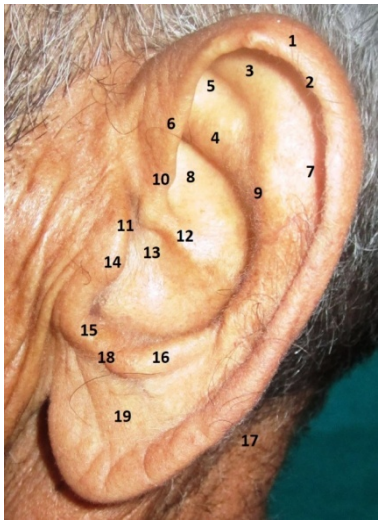

Figure 1. Anatomical landmarks of the external ear - 1. Helix 2. Darwin's Tubercle 3. Antihelix crus Superior 4. Antihelix crus (Anterior) 5. Fossa Triangularis 6. Roof of helix 7. Scaphoid fossa 8. Cymba conchae 9. Antihelix 10. Helical crus 11. Tuberculum supratragicum 12. Helical radix 13. Cavum conchae 14. Tragus 15. Intertragical notch 16. Anti tragus 17. Auricular sulcus 18. Posterior auricular sulcus 19. Auricular Lobule

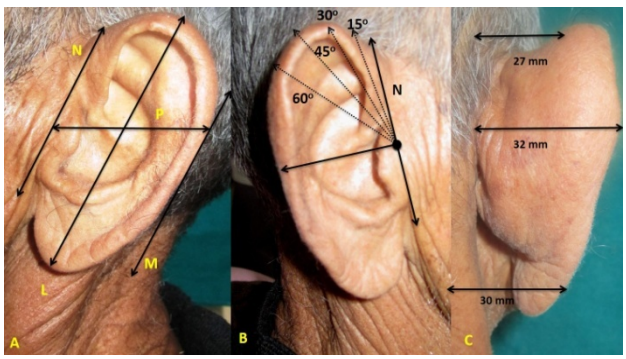

Figure 2. Baselines for dimensions: A- Plane L (ear length) (83.2mm), plane P (ear width) (44.2mm), B – Tragus diameter at various distances depending upon degrees (15° - 40.1mm, 30° - 43.2mm, 45° - 46.7mm, 60° – 42.9mm), C - Distance of most prominent part of pinna from the cranium – 32mm.

3. Discussion

The incidence of prominent auricles ranges from 0.5% to 15%, with a 5% incidence in Caucasians. [15] Two thirds of the patients have demonstrated a positive family history, the case we report presented with no family history. Diagnosis of prominauris is based on knowledge of surface anatomy, relationship to the skull, comparison between the ears and size and shape of its components.[3], [5,10,12] Although photogrammetry is commonly used to measure the human ear, [16] we used the 'direct' ear measurements from the patient since only one case needed to be measured. However, to verify our results we made an impression of the ear on both sides following which we poured the impression with plaster casts and then verified the clinical measurements with the measurements on the cast. Wherever discrepancy existed, the lower measurement was recorded to remove bias.

Components of "Oto-aesthetics" (Table 1): The term Oto-aesthetics in this article is referred to as the aesthetic contribution of human ear on overall facial aesthetics. The ear influences facial aesthetics by its size, color, projection, orientation, position, relation of various components of its surface anatomy and relation of the vertical axis of the ear with the various vertical axis of the organs of the face. [1,3,7,16,17] Immediate negative impact on facial aesthetics is mainly due to the size and position as was observed in the present case. The average length of the ear in this case was 83.2 mm along plane L while average width was 44.2 mm along plane P. However, in this case the proportion distribution between height and width was normal (55% of its length). The diameter of the tragus varied at different angles with more variations in the length than width. The proportion between the length and the width of the external ear tends to remain same unless there is some developmental deformity that results in disproportionate growth between different areas that originate different embryologically. [18] The size of the ear lobule also influences facial aesthetics. According to Mowlavi et al, the most esthetic lobule has been found to be 5 mm in width and a minimum of 20 mm in height. [19] The average length of the ear lobules in our reported case was 27 mm height and 7 mm width. The overall average dimensions of this reported case present a rough idea about the degree of the lateral projection of the external ear from the cranium. The diagnosis of prominauris was established by measurement of dimensions between external ear and cranial landmarks as shown in Figure 2C. As can be seen, distances at various recommended points were markedly greater than normal (almost doubled) thus giving rise to an increase in the depth and width of the post auricular sulcus. The aesthetic position of the ear within the skull has been found by Kelley, [10] to be a region between eyebrows superiorly to base of columella inferiorly in frontal plane. On lateral view, the aesthetic position of the ear is a region that is approximately one ear width lateral to the lateral canthus of eye. The relation between craniocaudal dimensions of the ear and the dorsum of the nose have been investigated by Mobley,[20] who concluded that it should be nearly parallel. Such reference point/plane has applications if a nasal prosthesis is being fabricated. The position of ear

lobule in relation to the ear itself is aesthetic when the lobule is present in a straight line with the helix cartilage so that they occupy a position that does not project laterally beyond upper two thirds of the external ear. [21] Three angular relations namely Auriculo-Cephalic, Concho-Mastoid and Concho-Scaphal angles are used to determine the orientation of the external ear in relation to the skull (Figure 3). Their normal ranges are mentioned in Table 1.

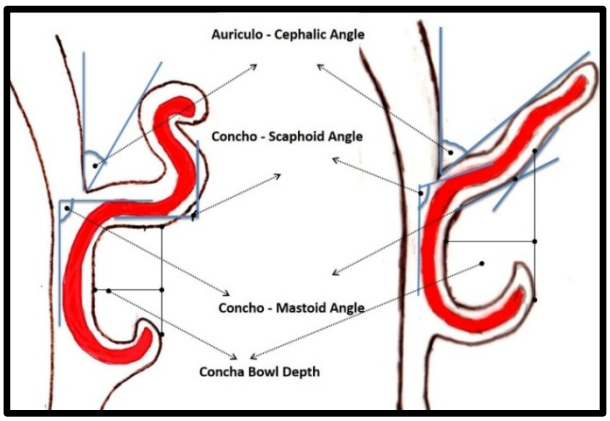

Figure 3. Anatomical determination and relations of three angles (Auriculo-Cephalic, Concho-Mastoid and Concho-Scaphal) used to analyze orientation of external ear to the cranium.

4. Conclusion

A distinctive feature of the external ear in the present case was distinctive details of surface anatomical features (Figure 1). Within the surface details of the external ear, the ideal aesthetic relations were not within norms in the present case. Among them included asymmetric projection and contour, helix far lateral to antihelix, increased reclination of vertical axis of pinna, over tapered helix, increased distance from tragus to helix, tragus to antihelix, disproportionate sizes of surface landmarks, increased concha bowl depth and poorly projecting ears from the skull. Variations in distances and/or angulations between these landmarks have been negatively associated with esthetics. [22,23].

Macrotia and prominauris are correctable through otoplasty which can be safely performed as early as 9 months of age up to 4 years and is based on sound and correct diagnosis. Prominent ears do not signify anything but do affect overall facial aesthetics. A significant part of facial aesthetics is dependent on the natural dentition and smile. However, there are no studies that have been directed to determine the aesthetic relation between the ear and natural dentition.

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