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A Morphometric Study of Auricular Concha in the Population of Young Chinese Adults

Estudio Morfométrico de la Concha Auricular en una Población de Jóvenes Adultos Chinos

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SUMMARY: A detailed data of concha is currently not available. Therefore, the present study aimed to determine twelve morphometric measurements of concha, to investigate its sexual dimorphism and bilateral asymmetry, and to establish basic shapes of concha for both sexes and sides. The study sample comprised of 310 young Chinese aged 18-28 years. 141 left and 141 right ear impressions for females, 169 left and 169 right ear impressions for males were collected and scanned. The 3D coordinates of seven landmarks on each auricular concha were obtained using 3D scanning technology and curvature theory. From the landmarks, twelve morphometric measurements of concha were calculated and analyzed. The conchal morphometry exist significantly sexual dimorphism in this study sample. On average, all measurements were larger in males than in females regardless of the sides. There was significantly bilateral asymmetry among left and right conchae in both sexes. Some measurements were larger in the right sides and some measurements were larger in the left sides, but the bilateral difference in both measurements found to be less than 1mm. Additionally, the basic shapes of concha for both sexes and sides were established on the basis of the mean 3D coordinates of each landmark and the mean value of each measurement. The anthropometric method of this study could overcome the difficulty in locating landmarks of auricle complex structures, and attain a higher level of accuracy in the procedure of measurement. The quantitative description of conchal morphometry will be beneficial for plastic surgeons, and for the ergonomic design of hearing aids.

KEY WORDS: Ear Impression; Anthropometry; Conchal Morphometry; Sexual Dimorphism; Bilateral Asymmetry.

INTRODUCTION

The human auricle is composed of the helix-antihelical complex, the conchal complex and the lobule, which is the most distinctive feature of the human face, and is particularly influential in determining its appearance (Alexander *et al*., 2011; Ahmed & Omer, 2015). It is well-established fact that a detailed knowledge of the morphologic dimensions, location and asymmetry of normal auricle is essential for the diagnosis of congenital abnormalities and syndromes, forensic investigations and for the ergonomic design of hearing aids (Coward *et al*., 2000; Purkait & Singh, 2007; Tatlisumak *et al*., 2015). Therefore, a large number of anthropometric studies of normal auricle have been assessed in various populations, for instance, Koreans (Jung & Jung, 2003; Kang *et al*., 2006), Sudanese Arabs (Ahmed & Omer), Chinese (Liu, 2008; Wang *et al*., 2011) Indians (Purkait & Singh; Sharma *et al*., 2007; Purkait, 2013), Italians (Gualdi-Russo, 1998; Ferrario *et al*., 1999; Sforza *et al*., 2009), Britons (Coward *et al*.; Alexander *et al*.), Turks (Bozkir *et al*., 2006; Barut & Aktunc, 2006), Americans (Brucker *et al*., 2003), Germans (Niemitz *et al*., 2007), and Japanese (Asai *et al*., 1996). The shape, dimension and orientation of each auricle is as individual as a fingerprint (Murgod *et al*., 2013), but it is possible to make some generalisations from the studies mentioned above. (1) The mean dimensions of auricle are larger in males than in females regardless of ethnicity. (2) The dimensions of auricle increase with increasing age. (3) Significant differences in ear dimensions exist among various ethnicities (e.g., Europeans have larger ear dimensions than Asians), suggesting that it is not suitable to use foreign standards of auricle dimensions as a guideline for Chinese.

The previous studies mainly inclined to assess ear length and width, lobule length and width, conchal length and width, and the types of lobule (attached, intermediate, and free types). However, none of the previous studies have

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determined one quite comprehensive introduction to the dimensions and morphology of auricular concha, notwithstanding it is an essential segment of auricle.

Several different methods are used for the anthropometric measurement of auricle. In generally, these can be divide into contactable (Vernier calipers and ruler, etc.) and non-contactable methods (3D scanner, computed tomography, magnetic resonance imaging and photography) (Liu *et al*., 2010). No matter what kinds of methods are used, the location of soft-tissue landmarks of the auricle is the foundation for anthropometry (Wang *et al*.). The previous studies identified the soft-tissue landmarks of auricle primarily helped by ordinary operators, which may prone to inaccuracy because of the uneven experience and the distortion of the soft-tissue landmarks of the auricle.

This study has two innovations. Firstly, the study sought to provide an anthropometric method to extract the anatomical landmarks of concha automatically and accurately. This method combined 3D scanning technology with curvature theory to capture the 3D coordinates of landmarks on each auricular concha, which could overcome the difficulty in locating landmarks and avoid the artificial error in the procedure of anthropometric measurement. Secondly, the current study aimed to determine twelve morphometric measurements of auricular concha for young Chinese adults, to investigate sexual dimorphism and bilateral asymmetry, and to establish basic shapes of auricular concha for both sexes and sides.

MATERIAL AND METHOD

Sample. The study sample composed of 310 healthy young Chinese volunteers (141 females and 169 males) aged 18-28 years. The mean age for females was 21.34 ± 2.62 years and that for males was 20.27 ± 2.01 years. All participants were students in universities located in different provinces of China. All volunteers with a previous history of craniofacial trauma, congenital anomalies, ear surgery were excluded in the sample. 141 left and 141 right ear impressions for females, 169 left and 169 right ear impressions for males were collected and scanned from the participants (Fig. 1) by use of the Einscan-S scanner with an accuracy of 0.1mm and shinning 3D scan software V1.7.1. This study has been approved by the Institutional Ethics Committee.

Extract the 3D coordinates of conchal landmarks. Figure 2a shows the conchal segment of the ear impression. It can be observed that the conchal shapes are primarily effected by seven anatomical landmarks (Figs. 2b and 2c), which are

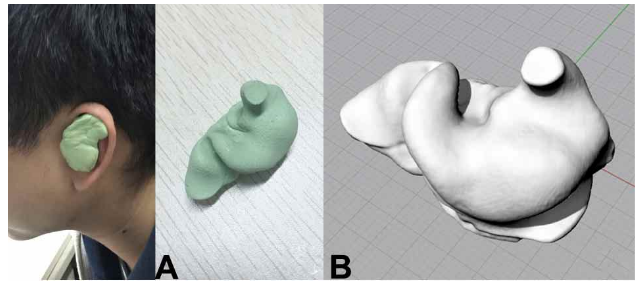

Fig. 1. Collect and scan ear impressions. (a) Collect ear impressions; (b) Scan them into 3D digital models.

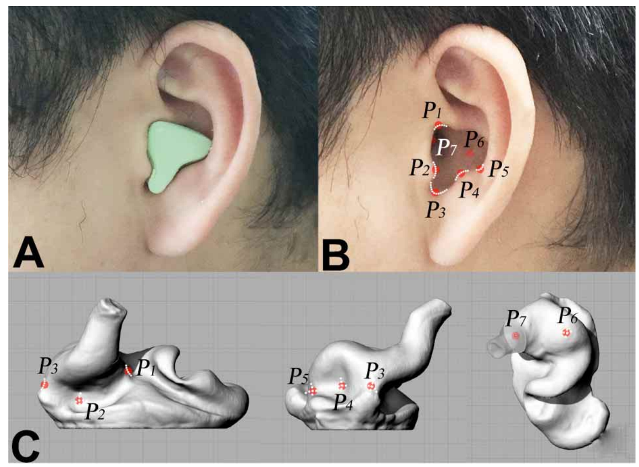

Fig. 2. The anatomical landmarks of auricular concha. (a) The conchal segment of ear impression; (b) and (c) The anatomical landmarks P1, P2, P3, P4, P5, P6, and P7.

(P1) the most posterior point on the edge of the incisura anterior auris; (P2) the bump point of tragus; (P3) the deepest point in the incisura intertragica notch; (P4) the bump point of antitragus; (P5) the strongest antihelical curvature; (P6) the deepest point on the floor of auricular concha; (P7) the central point of the ear canal opening.

Each landmarks of the auricular concha except the central point of ear canal opening (P7) occurs in a local small region of the surface with minimum curvature radius (Figs. 2b and 2c). On the basis of this observation, a RhinoScript code was written to find the maximum curvature point in a local area of 3D digital model. The steps to extract the 3D coordinates of landmarks are follows (Fig. 3 is an example shows the steps to extract 3D coordinates of landmarks P4). (1) Extract the point cloud of a small region around landmarks P4 by use of the plug-in of Rhino-Resurf running in Rhinoceros 4.0 (Robert McNeel & Assoc Inc., USA) (Fig. 3a). (2) Transform the point cloud into an NURBS surface and mesh the surface in Rhinoceros 4.0 (Fig. 3b). (3) Extract all 3D coordinates (x, y, z) of the mesh nodes and their two curvature radius R1 and R2 (U and V direction, respectively) automatically using the written RhinoScript code in

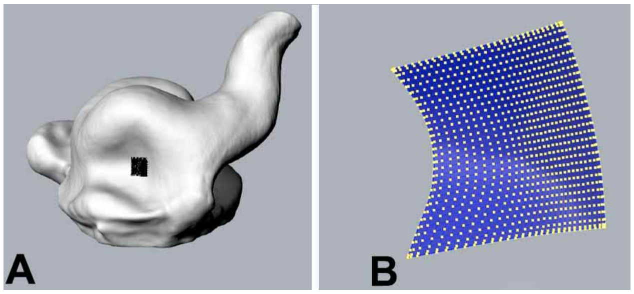

Fig. 3. Extract the 3D coordinates of landmark P4. (a) Extract the point cloud around the landmark P4 from 3D digital model; (b) Convert point cloud into NURBS surface and mesh the surface.

Rhinoceros 4.0. Then, write all the data into a text file. (4) On the basis of the text file, calculate the mean curvature radius R = (R1 + R2)/2 and Gauss curvature radius R' = R1 x R2 in a written Visual Basic code. The point with minimum values of R and R' is considered the landmark P4. Then, record the coordinates (x, y, z) of landmark P4 in a data file. (5) Repeat steps (1) to (4) to obtain the 3D coordinates of other landmarks.

This study utilized another method to extract the 3D coordinates of landmark P7 (the central point of the ear canal opening). The location of the ear canal opening has been determined by previous studies (Alvord & Farmer, 1997; Yu *et al*., 2015). According to these studies, it can be observed that the landmarks G1, G2, and G3 are on the edge of the ear canal opening, which also with the minimum curvature radius in a local small region of 3D digital model (Figs. 4a and 4b). Then, the 3D coordinates of landmarks G1, G2, and G3 were extracted using the method mentioned above. The ear canal opening would be the intersected region between the enlarged plane G1G2G3 and the 3D digital model of ear impression (Fig. 4c). Furthermore, the x, y, z coordinates of landmark P7 was calculated (Fig. 4c).

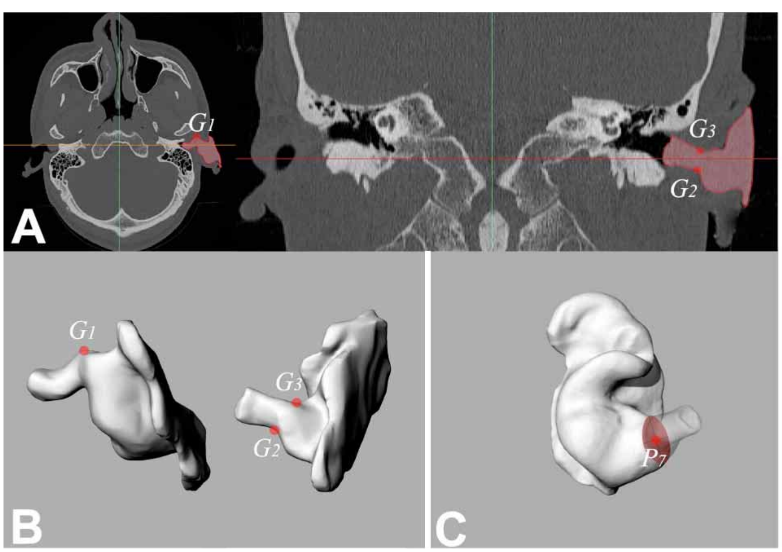

Fig. 4. Calculate the central point of the ear canal opening (P7). (a) and (b) Determine the location of the ear canal opening; (c) Calculate the 3D coordinates of the central point of the ear canal opening (P7).

Data analysis. The x, y, z coordinates of the seven landmarks obtained on each subject were used to calculate the following measurements (Fig. 5):

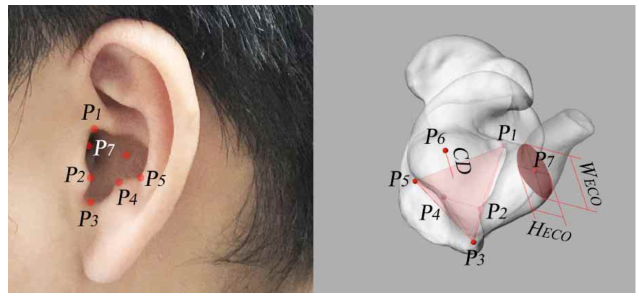

Fig. 5. Twelve measurements of auricular concha.

TL (P1 to P3), the total length of tragus, the linear distance from the most posterior point on the edge of the incisura anterior auris to the deepest point in the incisura intertragic notch.
TL1 (P1 to P2), tragus length 1, the linear distance from the most posterior point on the edge of the incisura anterior auris to the bump point of tragus.
TL2 (P2 to P3), tragus length 2, the linear distance from the bump point of tragus to the deepest point in the incisura intertragic notch.
ATL (P3 to P5), the total length of antitragus, the linear distance from the deepest point in the incisura intertragic notch to the strongest antihelical curvature.
ATL1 (P3 to P4), the antitragus length 1, the linear distance from the deepest point in the incisura intertragic notch and the bump point of antitragus.
ATL2 (P4 to P5), the antitragus length 2, the linear distance from the bump point of antitragus to the strongest antihelical curvature.
CW (P1 to P5), the conchal width, the linear distance from the most posterior point on the edge of the incisura anterior auris to the strongest antihelical curvature.
BD (P2 to P4), the linear distance from the bump point of tragus to the bump point of antitragus.
HECO, The height of the ear canal opening.
WECO, The width of the ear canal opening.
CD (P6 to plane P1P3P5), the conchal depth, the vertical distance from the deepest point of auricular concha to the plane P1P3P5.
$\angle\theta$, The angel between the plane P1P3P5 and the ear canal opening.

The data were analyzed using the SPSS 22.0 software package for Window (SPSS Inc., USA). The descriptive statistics for all measurements (means, standard deviations, maximum and minimum) in both sexes and sides were computed. An independent t-test was used to assess the presence of statistically significant sexual dimorphism between males and females in conchal measurements. Moreover, the paired t-test was used to evaluate the differences between the left and right sides for both sexes. P-values < 0.05 were considered to be statistically significant.

RESULTS

The mean, standard deviation, maximum and minimum of the twelve conchal measurements for both sexes and sides are presented in Table I. The results revealed that the mean values of all measurements were all larger in males than the corresponding ones in females regardless of the side ($p < 0.05$), but the significance value for $\angle\theta$ did not reach the level of statistical significance ($P>0.05$). This result demonstrated the presence of sexual dimorphism in present study sample. The greatest dimorphism were left auricular concha width (CW) followed by the right tragus length 1 (TL1). The least sexual dimorphism was the right antitragus length 2 (ATL2).

Left-right differences in the conchal measurements for both sexes are depicted in Table II. The measurements of TL, ATL, CW, HECO, and WECO were significantly larger on the right side among both sexes while the measurements of CD were significant larger on the left side for both sexes. The measurements of BD and $\angle\theta$ were also larger on the right side among both sexes, but the differences did not reach the level of statistical significance ($P>0.05$). For males, the measurements of TL1 and ATL1 were significant larger on the right side while the measurements of TL2 and ATL2 were significant larger on the left side. On the contrary, the measurements of TL1 and ATL1 for females were significant larger on the left side, while the measurements of TL2 and ATL2 were significant larger on the right side. In worthwhile adding that, the mean difference between sides in both sexes found to be less than 1mm. For males, the maximum bilateral asymmetry was the measurement of ATL1 (the mean left-right difference = -0.587 mm) followed by the measurement of TL1 (the mean left-right difference = -

Table I. Descriptive statistics for conchal measurements in both sexes and sides among young Chinese adults (all measurements in mm with the exception of $\angle\theta$ in degree).

Variable	Males				Females				Independent *t*-test	
	Mean	SD	Min	Max	Mean	SD	Min	Max	*t*-value	*p*-value*
TL(left)	17.55	1.21	14.75	20.60	16.64	1.21	13.93	19.73	6.562	0.000
TL(right)	17.85	0.90	16.69	21.75	17.03	1.22	14.54	20.33	5.837	0.000
TL1(left)	10.44	1.09	7.37	12.93	9.89	1.20	6.90	12.81	4.189	0.000
TL1(right)	10.98	0.97	8.56	12.95	9.74	1.00	7.40	12.32	5.074	0.000
TL2(left)	9.11	1.07	6.37	11.82	8.26	1.15	5.74	11.35	5.808	0.000
TL2(right)	8.78	0.89	6.20	11.55	8.49	1.08	6.01	11.49	6.943	0.005
ATL(left)	16.43	1.41	12.79	19.71	15.35	1.06	12.60	18.31	7.222	0.000
ATL(right)	16.70	1.22	13.92	19.98	15.54	1.24	13.36	19.56	7.876	0.003
ATL1(left)	11.93	1.42	8.58	15.64	11.34	1.21	8.49	14.26	3.322	0.001
ATL1(right)	12.52	1.42	9.08	15.27	11.20	1.17	9.19	13.89	3.775	0.001
ATL2(left)	5.08	1.08	2.22	8.09	4.37	1.17	1.54	7.16	4.410	0.000
ATL2(right)	4.78	1.09	3.28	7.78	4.65	1.04	2.87	7.72	5.353	0.000
CW(left)	17.04	1.34	13.72	20.58	15.69	1.53	12.09	19.00	7.889	0.000
CW(right)	17.26	1.38	14.84	21.65	15.96	1.41	12.98	20.31	7.357	0.000
BD(left)	8.53	1.53	5.55	14.12	7.85	1.50	5.27	12.33	3.326	0.001
BD(right)	8.92	1.99	5.92	14.87	7.98	1.55	4.98	11.83	3.565	0.001
CD(left)	10.19	0.93	7.95	12.67	9.65	0.94	7.35	11.80	5.065	0.002
CD(right)	9.83	0.81	7.51	11.92	9.53	0.98	6.85	11.14	4.871	0.002
H_{ECO}*(left)*	9.82	1.06	5.13	12.12	9.46	0.91	6.84	12.62	3.132	0.002
H_{ECO}*(right)*	9.93	1.13	5.98	12.98	9.71	0.62	6.97	12.80	3.778	0.002
W_{ECO} *(left)*	7.74	1.10	4.35	10.75	7.14	0.86	4.27	9.29	5.336	0.000
W_{ECO} *(right)*	7.98	1.02	5.41	11.01	7.41	0.58	5.32	10.34	4.975	0.002
<θ (left)	41.92	10.76	20.67	71.02	41.03	9.52	21.89	73.35	2.976	0.751
<θ (right)	42.78	9.49	21.57	70.68	42.32	11.16	22.39	71.89	3.774	0.530

*P-value < 0.05 is significant.

Table II. Bilateral differences of conchal measurements within the sexes using paired t-test (all measurements in mm with the exception of ∠θ in degree).

Variable	Males (left-right)				Females (left-right)			
	MD*	SEM*	*t*-value	*p*-value	MD	SEM	*t*-value	*p*-
TL	-0.302	0.208	-3.490	0.000	-0.392	0.150	-4.614	0.000
TL1	-0.542	0.241	-1.750	0.000	0.152	0.152	1.046	0.000
TL2	0.327	0.233	2.661	0.005	-0.231	0.160	-3.884	0.001
ATL	-0.270	0.250	-4.279	0.035	-0.187	0.215	-1.820	0.018
ATL1	-0.587	0.350	-1.679	0.012	0.144	0.263	1.760	0.005
ATL2	0.303	0.278	1.282	0.018	-0.283	0.248	-1.325	0.003
CW	-0.221	0.253	-3.634	0.034	-0.268	0.213	-2.495	0.017
BD	-0.389	0.305	-1.409	0.177	-0.133	0.260	0.361	0.321
CD	0.362	0.177	0.306	0.000	0.121	0.153	0.267	0.000
H_{ECO}	-0.108	0.234	-2.462	0.003	-0.252	0.104	-2.429	0.002
W_{ECO}	-0.240	0.192	-1.302	0.025	-0.272	0.129	-0.842	0.005
<θ	-0.861	2.467	-0.466	0.218	-1.292	2.169	-1.680	0.104

*MD: mean difference; *SEM: std. error mean, *P-value < 0.05 is significant.

0.542 mm). For females, the maximum bilateral asymmetry was the measurement of TL (the mean left-right difference = -0.392 mm) followed by the measurement of ATL2 (the mean left-right difference for females = -0.283 mm).

In addition, a unified coordinate system was established by MATLAB (MathWorks Inc., USA) to describe the distribution of landmarks for all participants. The 3D coordinates of seven landmarks for each 3D digital model were extracted from the individual coordinate system. Therefore, the extracted coordinates of landmarks were transformed by considering P3 as (0, 0, 0), P1 as (0, P1-yi, 0), P5 as (P5-xi, P5-yi, 0), P2 as (P2-xi, P2-yi, P2-zi), P4 as (P4-xi, P4-yi, P4-zi), P6 as (P6-xi, P6-yi, P6-zi) and P7 as (P7-xi, P7-yi, P7-zi) for each sample. Fig. 6 is an example depicts the distribution of seven left conchal landmarks for all 141 females. Furthermore, the basic shapes of auricular concha for both sexes and sides were established on the basis of the mean 3D coordinates of each landmark and the mean value of each measurement (Fig. 7).

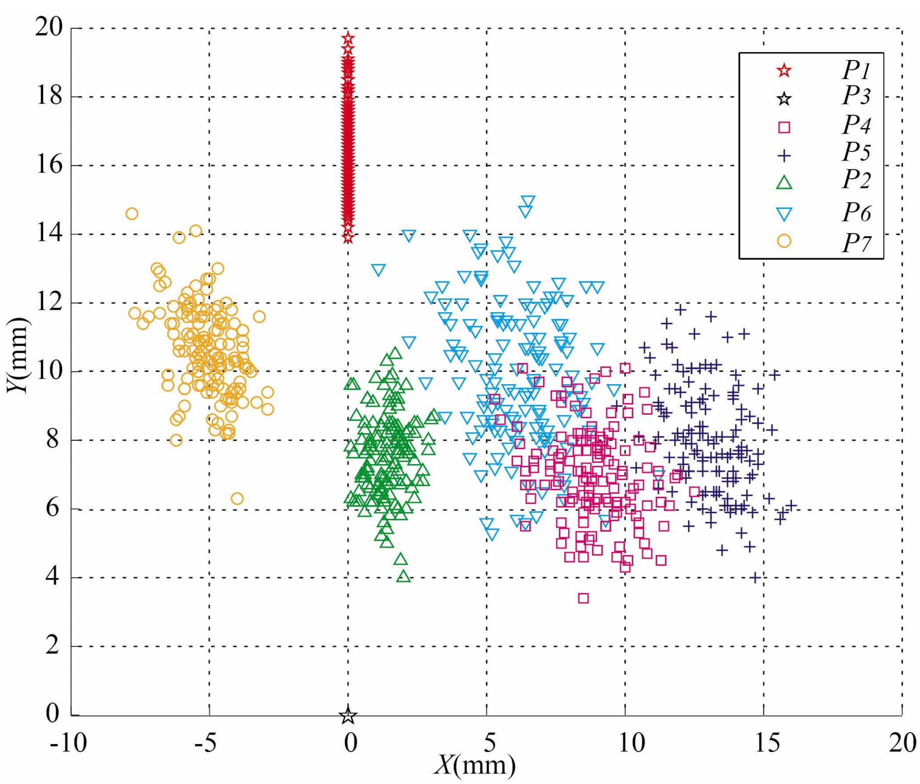

Fig. 6. The distribution of seven landmarks on left auricular concha for all 141 females (From the front view).

DISCUSSION

There are population variations among people from different regions around the world in terms of auricle dimensions, which means it is not suitable to use foreign standards of auricle dimensions as a guideline for Chinese. The auricular concha is an essential segment of auricle, but a comprehensive knowledge

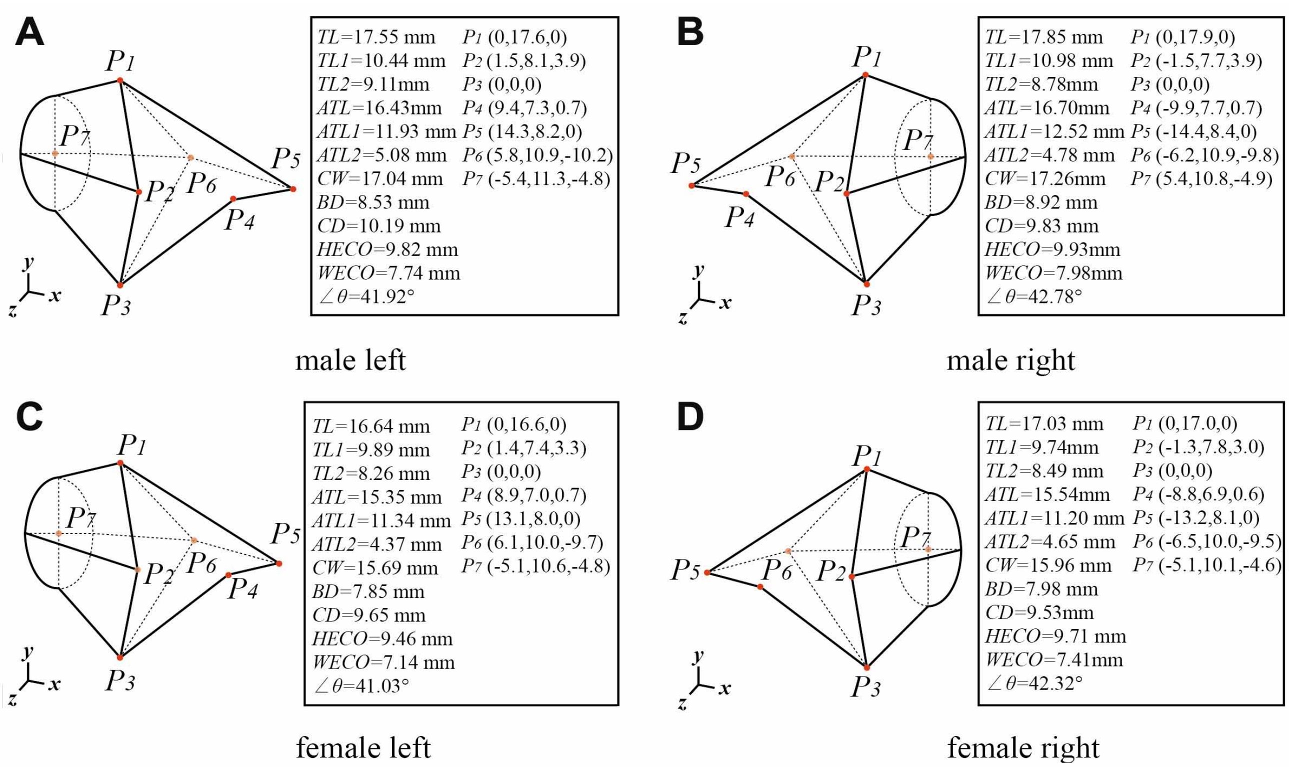

Fig. 7. The basic shapes of auricular concha for both sexes and sides.

concerning morphometric dimensions of normal auricular concha is currently not available. Hence, this study provided a detailed knowledge about the morphometric measurements of normal auricular concha among young Chinese adults (Fig. 7). The results will be essential and beneficial for reconstruction and rectification of a deformed ear, and for the ergonomic design of hearing aid, earphone and earplug.

Previous studies have determined the sexual dimorphism and bilateral asymmetry of auricle using ear lengths and widths, lobule lengths and widths, and the conchal length and width. In a study by Ahmed & Omer reported all measurements showed significantly sexual dimorphism except the lobular lengthsamong Sudanese Arabs. Sforza *et al*. noted ear length and width were significantly sexual dimorphism among Italians, while only ear length was sexual dimorphism among Americans from Rhode Island (Brucker *et al*.,). Murgod *et al*. noted the ear length and width on the right ears and ear length on left ear were sexual dimorphism. For bilateral asymmetry of auricle,

Farkas *et al*., (1992) reported asymmetry between left and right ears in children, but it tended to fade in adulthood. Barut & Aktunc noted significantly larger left ears for all paprameters in children. On the contrary, the studies by Alexander *et al*. and Sforza *et al*. indicated good symmetry between left and right ears. In our study, twelve measurements were utilized to assess sexual dimorphism and bilateral asymmetry of auricular concha. The measurements in current study were different from the studies mentioned above. Therefore, the results of statistical analysis in our study cannot be compared with the study mentioned above.

To the best of our knowledge, a limited number of measurements in our study have been reported by previous studies, which were conchal width and depth, tragus length, and the height and width of ear canal opening.

Ahmed & Omer reported there were significant sexual dimorphisms in conchal widths, and the mean widths of auricular concha were larger in males than females for both sides among Sudanese Arabs in the age range of 18-30 years. This result was coincident with our study. But, in current study the conchal width was significantly larger in the right side than left side for both sexes, which was contrast with Ahmed & Omer (Table III). Additionally, the mean widths for both sexes and sides were all smaller in our study compared with Ahmed & Omer and Purkait & Singh.

Table III. Comparison of conchal measurements in various populations (measurements in mm).

Study	Measurements	Population	Left (M)*	Right (M)*	Left (F)*	Right (F)*
Ahmed & Omer (2015)	*CW*	Sudanese Arabs	18.95±1.87	18.67±2.10	17.96±1.71	17.60±1.69
Purkait & Singh (2007)	*CW*	Central Indians	18.8±2.0	18.7±2.0		
Wang *et al.* (2011)	*CW*	North China	17.9±2.1	17.8±2.0	18.0±2.2	17.9±2.1
Present study	*CW*	Yong Chinese	17.04±1.34	17.26±1.38	15.69±1.53	15.96±1.41
Purkait (2013)	*CD*	Northwest Indians		15.7±0.8		15.7±0.8
Present study	*CD*	Yong Chinese	10.19±0.93	9.83±0.81	9.65±0.94	9.53±0.98
Purkait (2013)	*TL*	North west Indians	16.5±0.9	16.6±1.3		
Present study	*TL*	Yong Chinese	17.55±1.21	17.85±0.90	16.64±1.21	17.03±1.22
Yu *et al.* (2015)	H_{ECO}	Taiwanese	9.6	9.6	9.1	9.2
Present study	H_{ECO}	Yong Chinese	9.82±1.06	9.93±1.13	9.46±0.91	9.71±7.14
Yu *et al.* (2015)	W_{ECO}	Taiwanese	6.8	6.7	6.3	6.3
Present study	W_{ECO}	Yong Chinese	7.74±1.10	7.98±1.02	7.14±0.86	7.41±0.58

*M: male; F: female

Meanwhile, they were also smaller than the population from north China (Wang *et al*.), especially for females (Table III). It revealed that the width of the auricular concha also varied in different geographic regions of China.

Table III indicated the mean depths of right auricular concha for both males and females in our study were much smaller than Purkait. The greater discrepancies may be attributed to without consistent standard for measuring the depth of auricular concha or may represent true differences between Chinese and Indians.

Purkait reported the mean length of right tragus was larger in males than females, which was consistent with current study. Additionally, it could be observed that the mean length of right tragus in young Chinese adults was larger than young India adults, regardless of males and females (Table III).

In a study by Yu *et al*. (2015) indicated that the average height and width of ear canal openings (ECO) for males were greater than those for females, irrespective of left or right side. This result was consistent with our investigation. Furthermore, from Table III, it can be observed that the average heights and widths of both right and left ECO in current study sample were little larger than the young adults from Taiwan, regardless of sex. Moreover, the mean height and width of ECO revealed that the cross-section of ECO was either an inverted pear or ellipse shape (Yu *et al*.). Hence, these finding should be considered in hearing aid manufacturing.

The measurements of TL1,TL2, ATL, ATL1, ATL2, BD, and ∠θ in current study have not been assessed by previous study, but they are essential data for assessing the conchal morphometry. The basic shapes of auricular concha for both sexes and sides were established in this study, and they provided more intuitive data for clinical application and research.

The limitations of this study should not be neglected. The study sample was limited to the young Chinese adults in an age category of 18 - 28 years, but the ear is known to be affected by age. Therefore, the results of the current study may not be representative of the entire Chinese population. In the future studies, the population under the age of 18 years and above the age of 28 years should be measured and analyzed. Moreover, the age difference of the auricular concha should be assessed for Chinese population.

CONCLUSIONS

In conclusion, this study provides detailed information about the morphometric dimensions of normal auricular concha among young Chinese adults in an age group of 18- 28 years. The data generated in the present study could serve as a specific and useful database for the quantitative description of conchal morphometry in young Chinese adults. These intuitive data can be utilized in the diagnosis of congenital anomalies, ear constructive plastic surgeries, and particularly in ergonomic design of hearing aids.

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ZHU, Z.; JI, X.; GAO, Z. & HU, G. A Estudio morfométrico de la concha auricular en una población de jóvenes adultos chinos. *Int. J. Morphol. 35(4)* :1451-1458, 2017.

RESUMEN: Actualmente no existen datos detallados de la concha auricular. Por lo tanto, el presente estudio tuvo como objetivo determinar doce medidas morfométricas de la concha auricular, investigar su dimorfismo sexual y asimetría bilateral, y establecer formas básicas de la concha para ambos sexos y lados. La muestra del estudio estaba compuesta por 310 jóvenes chinos de 18 a 28 años de edad. Se recolectaron y escanearon 141 impresiones de la oreja izquierda y 141 de la oreja derecha en mujeres; 169 impresiones de la oreja izquierda y 169 de la oreja derecha en hombres. Las coordenadas 3D de siete hitos en cada concha auricular se obtuvieron utilizando la tecnología de exploración 3D y la teoría de la curvatura. A partir de los hitos, se calcularon y analizaron doce medidas morfométricas de concha. La morfometría conchal indica la existencia significativa de dimorfismo sexual en esta muestra. En promedio, todas las mediciones fueron mayores en los hombres que en las mujeres, independientemente de los lados. Se observó una asimetría bilateral significativa entre las conchas izquierda y derecha en ambos sexos. Algunas medidas eran mayores en el lado derecho y otras medidas eran mayores en el lado izquierdo, pero la diferencia bilateral en ambas medidas fue menor a 1 mm. Además, las formas básicas de concha para ambos sexos y lados se establecieron sobre la base de las coordenadas 3D medias de cada punto de referencia y el valor medio de cada medición. El método antropométrico de este estudio podría superar la dificultad de localizar los hitos de las estructuras del complejo auricular y lograr un mayor nivel de precisión en el procedimiento de medición. La descripción cuantitativa de la morfometría conchal será util para los cirujanos plásticos y para el diseño ergonómico de audífonos.

PALABRAS CLAVE: Impresión; Antropometría; Morfometría conchal; Dimorfismo sexual Asimetria bilateral.

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