Research Article

Distance of ear with reference to midline landmarks of face

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Abstract

Background: Every individual has different craniofacial anthropometric features because of different biological, geographical, racial, and nutritional environment.

Objective: To prepare database of distance of ear from midline landmarks of face and to find the gender variations of the same in individuals of Gujarat region.

Material and Methods: A total of 500 (250 male and 250 female subjects) living subjects with both parents of Gujarati descent, aged between 17 and 25 years, were measured for the upper naso-aural distance (n-obs), lower naso-aural distance (n-obi), upper subnasale aural (sn-obs), lower subnasale-aural (sn-obi), upper gnathion-aural (gn-obs), and lower gnathion-aural (gn-obi). Vernier caliper was used; measurements were recorded in centimeters and unpaired *t* test was applied to the data using Graph pad prism_5.01.

Results: Mean values of n-obs, n-obi, sn-obs, sn-obi, gn-obs, and gn-obi were 12.2 ± 0.55, 12.48 ± 0.5, 13.47 ± 0.67, 11.78 ± 0.48, 15.04 ± 0.77, and 12.36 ± 0.62, respectively, for male subjects and 11.5 ± 0.58, 11.71 ± 0.48, 12.52 ± 0.53, 10.94 ± 0.44, 13.85 ± 0.61, and 11.41 ± 0.55, respectively, for female subjects. There was significant difference between male and female subjects for each parameter.

Conclusion: The study showed that there is a significant difference between male and female subjects in placement of ear with reference to midline landmarks of face. The data of this study will be useful in anthropological studies, forensic medicine, human genetics, surgical reconstruction of craniofacial anomalies/injuries, and preparation of face mask.

KEY WORDS: Midline of face, cephalometry, ear

Introduction

Cephalometry and craniometry are used frequently to study skull growth in normal and pathological conditions.[1]

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Various races and ethnic groups possess different craniofacial anthropometric features because human body dimensions are affected by ecological, biological, geographical, racial, gender, age, and nutritional factors.

Craniofacial databases are required to treat the congenital or posttraumatic facial disfigurement, for plastic surgeries, for identification in forensic medicine, and so on. Craniofacial anthropometric measurements also changes in certain conditions such as sickle cell disease, microcephaly, gestational age, cleft lip and palate, thalassemia, and Down's syndrome.[2–7]

Many researchers have studied skulls. But, skulls cannot represent a population, and they are largely of persons who are aged and might have suffered from chronic debilitating

diseases; so, we conducted this study in living persons. For this study, "direct measurements" using "sliding calipers" are recorded and analyzed.

Until now, researchers used traditional parameters such as head length, head width, cephalic index, facial index, and so on. So, this study is the first attempt in Gujarat to provide the required normative data on the distance of ear with reference to midline landmarks of face.

Material and Methods

This study was conducted in areas of Gujarat on a total of 500 (250 male and 250 female subjects) living subjects with both parents of Gujarati descent, aged between 17 and 25 years. The subjects without any obvious craniofacial abnormalities such as congenital, developmental, or acquired through any form of trauma and showed no history of plastic or reconstructive surgery were selected. All the measurements were taken in a reasonably well-lit room keeping the subject's head in Frankfurt's horizontal plane. All the measurements were taken at a fixed time to avoid diurnal variations. To avoid interobserver error in methodology, it was measured and recorded only by one person. The protocol was approved by the institutional review board. The informed consent was taken from subject or guardian.

Initially, 20 subjects aged 17–25 years were selected randomly and measured for all the six parameters on both the sides of midline, and there was no significant difference between the right and left sides. So, 500 subjects taken into the study were measured only on the right side of face for the parameters. Using the sliding caliper, the following parameters were recorded[8]: (1) the upper naso-aural distance (n-obs)—between nasion and otobasion superius; (2) the lower naso-aural distance (n-obi)—between nasion and otobasion inferius; (3) the upper subnasale-aural (sn-obs)—between the subnasale and otobasion superius; (4) the lower subnasale-aural (sn-obi)—between the subnasale and otobasion inferius; (5) the upper gnathion-aural (gn-obs)—between the gnathion and otobasion superius; and (6) the lower gnathion-aural (gn-obi)—between the gnathion and otobasion inferius.

Landmarks

1. Nasion (n): It is the point in the midline of both the nasal root and frontonasal suture.
2. Subnasale (sn): It is the midpoint of angle at the columella base were the lower border of nasal septum and the outer surface of upper lip meet.
3. Gnathion (gn): It is the lowest median landmark on the lower border of mandible.
4. Otobasion superius (obs): It is the point of attachment of helix in temporal region.
5. Otobasion inferius (obi): It is the point of attachment of ear lobe to cheek.

Figure 1: Measurements of n-obs and n-obi.

Figure 2: Measurements of sn-obs and sn-obi.

Figure 3: Measurements of gn-obs and gn-obi.

After collecting data, the measurements were tabulated, and the statistical analysis was carried out [Figures 1–3]. The minimum, maximum, and mean and standard deviation were calculated. Unpaired *t* test was applied to the data using Graph pad prism_5.01. Graphs were prepared with the help of Excel worksheet.

Results

Table 1 shows there is no significant difference between the right and left sides of the measurements. Table 2 shows there is significant difference between male and female subjects for the measured parameters.

Table 1: Statistics of 20 subjects taken as a sample

S. No.	Parameter	Side	Minimum	Maximum	Mean	SD	*P*
1	n-obs	Right	10.7	13.1	11.95	0.64	0.96
		Left	10.9	13	11.96	0.60	
2	n-obi	Right	10.9	13.5	12.25	0.72	0.96
		Left	10.9	13.6	12.26	0.72	
3	sn-obs	Right	11.3	14.2	12.91	0.86	0.97
		Left	11.4	14.4	12.9	0.87	
4	sn-obi	Right	10	12.7	11.36	0.73	0.97
		Left	10	12.6	11.35	0.74	
5	gn-obs	Right	12.7	15.7	14.335	0.97	0.99
		Left	12.6	15.7	14.33	0.98	
6	gn-obi	Right	10.7	13.3	11.97	0.84	0.97
		Left	10.8	13.5	11.98	0.83	

If $P < 0.05$, the difference is significant between right and left sides.

Table 2: Statistics of 500 study subjects (250 male and 250 female subjects)

S. No.	Parameter	Gender	Minimum	Maximum	Mean	SD	*P*
1	n-obs	Male	11	13.6	12.2	0.55	<0.0001
		Female	10.1	13.1	11.5	0.58	
2	n-obi	Male	11.4	13.7	12.48	0.5	<0.0001
		Female	10.4	12.9	11.71	0.48	
3	sn-obs	Male	12	15	13.47	0.67	<0.0001
		Female	11.1	13.9	12.52	0.53	
4	sn-obi	Male	10.1	13.2	11.78	0.48	<0.0001
		Female	10	12.2	10.94	0.44	
5	gn-obs	Male	12.2	16.5	15.04	0.77	<0.0001
		Female	12.3	15.3	13.85	0.61	
6	gn-obi	Male	10.4	13.7	12.36	0.62	<0.0001
		Female	10	12.7	11.41	0.55	

If $P < 0.05$, the difference is significant between male and female subjects.

Discussion

Mean values of n-obs, n-obi, sn-obs, sn-obi, gn-obs, and gn-obi were 12.2 ± 0.55, 12.48 ± 0.5, 13.47 ± 0.67, 11.78 ± 0.48, 15.04 ± 0.77, and 12.36 ± 0.62, respectively, for male subjects and 11.5 ± 0.58, 11.71 ± 0.48, 12.52 ± 0.53, 10.94 ± 0.44, 13.85 ± 0.61, and 11.41 ± 0.55, respectively, for female subjects.

When we compare with regard to fat, muscle mass, and bones, men usually have less fat tissue, they have stronger and wider bones, and more muscular mass in comparison with women. In our study, gender significantly contributes to size for all the six parameters.

Akinlolu et al.[1] conducted a study to test the hypothesis that there is no difference in placement of ear between male and female Nigerians in relation to facial midline landmarks. Of the six parameters they used, five showed significant differences, and only one parameter, gn-obs, showed no significant difference. In our study, all the six parameters showed significant difference in the distance of ear between male and female Gujaratis with reference to midline landmarks of face. Figure 4 shows comparison of mean values of all the parameters used in our study with those of the study by Akinlolu et al., which are very similar.

Schafer and Barry[9] and Karaca et al.[10] studied several parameters in their studies. Three of them (nasion-tragion, subnasale-tragion, and gnathion-tragion) were nearly similar to the parameters used in our study. There was a statistically significant difference between the male and female parameters in both the studies [Figure 5].

Shah et al.[11] conducted the study of cephalic index in Gujarat region. The study showed that mean head length and width were higher in male subjects than in female subjects, while mean cephalic index was higher in female subjects than in male subjects. Predominant head type was mesocephalic in both the sexes, and there was no significant gender difference.

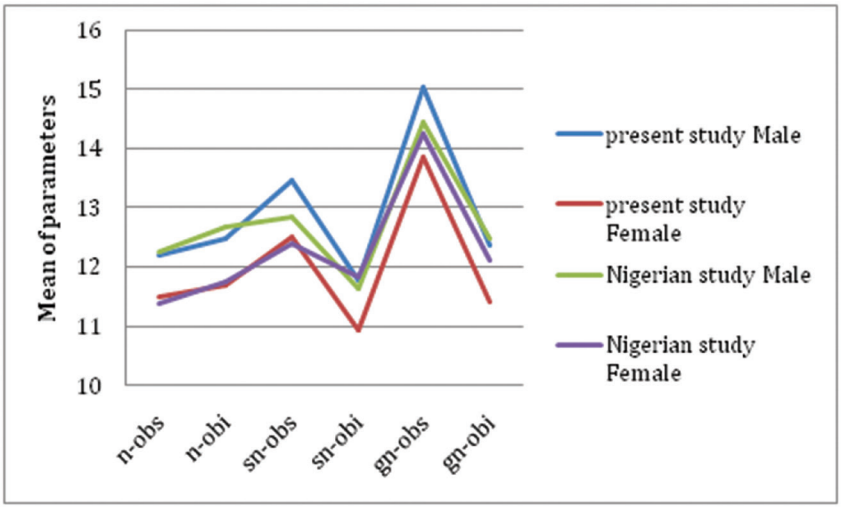

Figure 4: Comparisons of mean values of all parameters used in our study with that of Nigerian study.

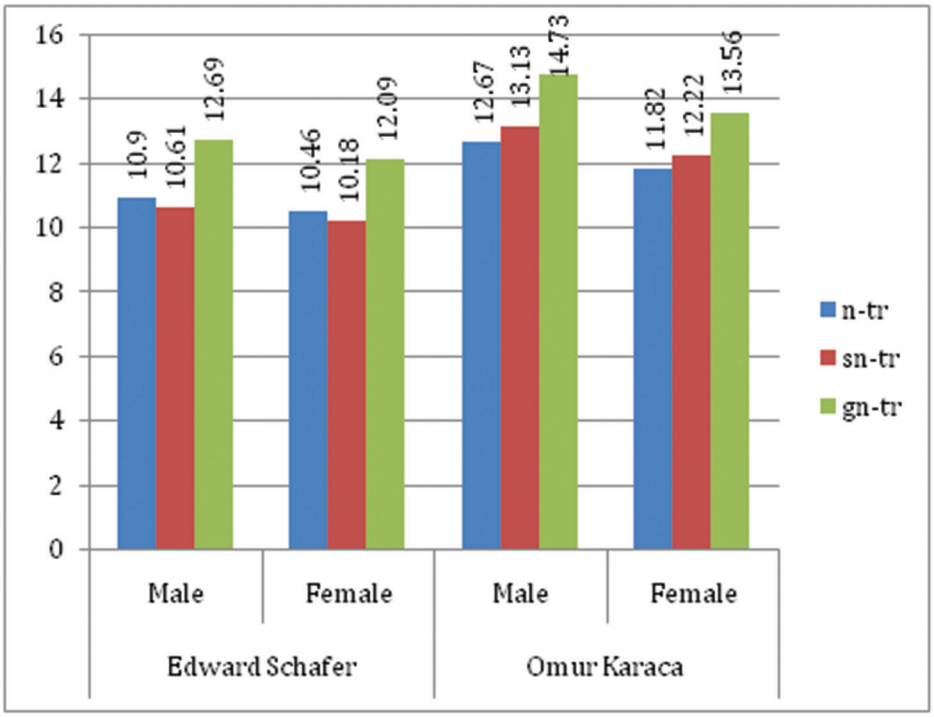

Figure 5: Mean values of the studies that used nearly similar parameters.

Conclusion

The study showed that there is a significant difference in placement of ear between the male and female subjects in relation to midline landmarks of face in Gujarat region, indicating that the male and female populations of Gujarat region are of different morphological patterns with reference to placement of ear in relation to the midline landmarks of face.

The data of this study will be useful in anthropological studies, forensic medicine, human genetics and surgical reconstruction of craniofacial anomalies/injuries, and preparation of face mask. If the same study is conducted on the same

population group after several years, it will help to identify the microevolutionary changes.

To the best of our knowledge, this is the first time that database of distance of ear in male and female Gujaratis with reference to midline landmarks of face have been developed. The values of anthropometric measurements may differ in various sex and ethnic groups because of genetic and environmental factors, suggesting the need for different normograms for each endogenous group.

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