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Original Research Article

MORPHOMETRY OF ORBIT FROM ADULT DRY SKULL OF CENTRAL INDIAN POPULATION

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ABSTRACT

Background: The human orbits are complex anatomical structure which contains visual apparatus along with its neurovascular structures. Morphometric analysis of orbit is of great significance to anthropologists, anatomists, forensic experts, maxillofacial and plastic surgeons. Orbital dimensions vary with the periods of evolution, development, sex, race, and regions within the same race as pointed out in previous studies. The objective of the present study is to provide the baseline reference data for the central Indian population.

Material and Methods: Orbital dimensions of 50 dry skulls, collected from the department of anatomy and forensic Pt. J.N.M.Medical College, Raipur were measured by digital vernier calipers with 0.01mm accuracy. Orbital height (OH) and orbital breadth (OB) of both sides were measured and orbital index (OI) calculated by applying formula OI = OH/OB X 100.All the data obtained were statistically analysed and tabulated.

Result: The mean orbital height for the right and left side were 33.46 ± 3.12 mm and 33.79 ± 3.46 mm while their breadth were 39.79 ± 4.12 and 39.23 ± 34 mm respectively. The mean orbital index calculated was 86.19 ± 5.12 on right and 84.57 ± 5.12 on left side. Maximum orbits measured were of mesosome category. There was no significant difference between right and left side of the orbital parameters.

Conclusion: The orbital dimensions measured in the present study provides baseline data for ophthalmological, maxillary and facial reconstructive cosmetic surgeries and also helpful in classify the skulls for forensic experts in central India. The values shows the diversity of orbital morphology in different geographical areas and also useful in better treatment of orbital pathologies.

KEY WORDS: Orbital morphometry, Central India, Orbital index, Mesoseme, Vernier caliper.

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INTRODUCTION

The orbits are craniofacial structures situated on either side of sagittal plane within the skull that encroaches equally upon the cranial and facial regions [1]. Each orbital cavity is essentially intended as a socket for the eyeball and also contains associated muscles, nerves, vessels and in essence lodges the visual apparatus [2]. Orbits allow the accurate positioning of the visual axis which is essential for the binocular vision [3]. Understanding structures proportion and mechanical function of the human body and racial variation in ocular anatomy is vital to clinical assessment and treatment

of patients [4].It is aided by the advances in medical imaging techniques such as radiography, ultrasonography, MRI, CT Scan etc. Also anthropometry, which equally aids the understanding of anatomical structures, constitutes the technique of expressing quantitatively the form of the human body and skeleton. Anthropometric studies are integral part of craniofacial surgery and syndromology [5]. For these reasons standards based on ethnic and racial data are desirable because these standards reflect the potentially different patterns of craniofacial growth resulting from racial, ethnic and sexual differences [6].

To treat congenital and post traumatic facial disfigurements successfully surgeons require access to craniofacial database based on accurate anthropological measurements [7] Orbital dimensions vary among individuals of different age, sex and ethnicity. Patnaik [8] stated that in each orbital cavity, the width is usually greater than the height; the relation between the two is given by the orbital index which is nothing but the ratio of orbital height to orbital breadth multiplied by100. Based on orbital index orbits are categorized as Megaseme (large) Orbital Index is 89 are more. These type is seen in yellow races[9]. Mesoseme(Intermediate) the Orbital Index ranges between 83-to .89,these type is seen in the white races[10]. Microseme (small) Orbital Index is 83 or less, this type is characteristics of black races where the orbital opening is rectangular [9].Moreover, the orbit seems to be an important factor during ultrasound evaluation to diagnose diseases such as Down syndrome [11].

MATERIALS AND METHODS

Adult skulls of unknown sex were collected from department of anatomy and forensic Pt. J.N.M. Medical College Raipur. Morphometry done in 50 skulls i.e.100 orbits were measured using digital vernier calliper with 0.01 mm accuracy of both right and left side. Fetal skulls, and skulls fractured at the areas of orbit were excluded from the study. Orbital height was measured as the distance between the superior and inferior orbital margins. Orbital width was the distance between the medial and lateral walls of the orbits and then the orbital index was calculated as Orbital Hight/Orbital Breadth multiplied by100.The results were tabulated mean and standard deviation calculated .A comparision of the mean values between two sides were performed using the independent 't' test, p-value<0.05 was considered statistically significant.

RESULTS

The range of orbital height varied from 27.29 mm to 38.62 mm on the right side and from 27.58 mm to 41.22 on left side respectively. The range of orbital width varied from 31.11 mm to 49.25 mm on the right and 31.78 mm to 49.38 mm on the left side respectively .By using orbital Height and Breadth, Orbital Index was calculated. In right side it was 84.39 and left side 84.57.The mean and standard deviation values of various parameters on each side is shown in the following table.

Table 1: Showing Orbital Dimensions.

Parameters	Right Side		Left Side	
	Mean ± SD	Left Side	Mean ± SD	Left Side
Orbital Height	33.25 ± 3.25	27.29 – 38.62	23.58 ± 3.84	27.6 – 41.22
Orbital Breadth	39.53 ± 4.25	31.11 – 49.25	39.26 ± 4.41	31.78 – 49.38
Orbital Index	84.39 ± 5.74	68.23 – 94.25	84.57 ± 5.49	70.8 – 94.25

Values of all parameters showed no significant differences between right and left side as p value is >0.05. Considering all the orbits that were measured the mean orbital height was 33.41 mm, mean orbital breadth was 39.64 mm and the mean orbital index to be 84.48.

Table 2: Comparison of orbital index with some of the previous studies.

S.No.	Authors	N	Race/Regions	Mean Oi	Category
1	Ukoha et.al. (2011)[12]	70	Nigerians	89.21	Megaseme
2	Jaswinder Kour et al.(2012)[13]	30	North Indian	81.65	Microseme
3	Deepak howale et[14] al.(2012)	75	Maharashstra	86.4	Megaseme
4	Munguti et al.(2013)[15]	150	Black Kenyan	83.03	Mesoseme
5	Gosavi et al.(2014)[16]	64	Maharashtra	81.88	Microseme
6	Patil et al.(2014)[17]	200	South Indian	81.23	Microseme
7	Kumar et al.(2014)[18]	68	Indian	80.07	Microseme
8	Fetouh &Mandour et al.(2014 [19]	52	Egyptian	82.89	Microseme
9	Mekala D et al.(2015)[20]	200	South Indian	85.04	Mesoseme
10	Maharana & Agrawal et al2015)[21]	100	North Indian	81.66	Microseme
11	Narsinga & Pramila et al.(2015)[22]	50	South Indian	88.41	Mesoseme
12	Navneet et al.(2016)[23]	50	Shrilanka	81.29	Microseme
13	Nagraj S. et al.(2017).[24]	100	Telangana	87.39	Mesoseme
14	Present study	50	Central Indian	84.48	Mesoseme

Table 3: Catagories of orbits.

Category	Right	Left
Microseme (<83)	30%	30%
Mesoseme (83-89)	52%	58%
Megaseme (>89)	18%	12%

It is observed that the majority of the orbits belonged to mesoseme category whether right (52%) or left (58%).

DISCUSSION

Orbital dimensions of a particular person depend predominantly on genetic constitution, influenced by environmental and nutritional habits.

In a study done by Gosavi et al. [16] from central India the mean height of the orbit was observed as 32.31 ±2.52 mm, Kour et al. [13] observed it as 32.05 ± 2 mm in north Indian skulls, Mekala D et al. [22] found 32.42 mm in south Indian skulls. In present study it was 33.41 mm.

The mean orbital breadth in the present study was 39.64 mm, Jaswinder singh et al.[13] found it to be 39.25 mm in north Indian, Gosavi et al [16] found it 39.46 mm in central Indian skulls, Mekala D et al.[22] from south Indian skull the value was higher 41.7 mm. Ukoha et al. (2011) [12] found it was 35.5 mm in Nigerian skull .

The differences noticed could be due to racial differences, variations in the sample size, geographical, environmental and genetic variations. It may be due to different technique or type of instruments used for measurements.

In the present study the mean orbital index was 84.48 and falls into mesoseme category, it is consistent with Mekala D et al [21] in south Indian skulls 85.05,Narsiga and Pramila et al.[22] found it 88.41 and Nagraj S et al. [24] calculated the index 87.39 of mesoseme variety. However the values are higher than present study. While Ukoha calculated the orbital index of megaseme type and the value was 89.2 from Nigerian skulls. Other authors reported the skulls of microseme type, the value were less than 83. Variations may be a product of environmental trends, invented by the influence of time, on the people involved in the study. Many factors have been implicated in the transformation of the facial skeleton into the adult form. Although the basic structure is determined in accordance with genetically regulated blueprints while in utero, that is modified pre and postnatally through functional matrices responding to environmental and epigenetic influence such as climate, activity patterns and masticatory functions. The orbital index which determines the shape of the face differs in different population groups. This means that the orbits with larger widths than height will have smaller orbital indices while those with larger orbital indices will have narrow faces. This index varies with race, regions within the same race and periods in evolution.

The slight difference observed between the right and left side, though not significant, could be attributed to the differential growth of the two sides of the brain and in this case, the left side has shown dominance; A factor that must be considered in the surgical correction of the bony orbit to ensure an efficient structural disposition of the visual apparatus Individually, the left and right orbital heights and breadths were not significantly different, suggesting left and right symmetry. However the differences found between the left and right side orbital height and width were not large enough to be detected by our statistical tests. Left-right asymmetry in orbital height or breadth was previously reported in Egyptian[19] and Nigerian[12] populations;

CONCLUSION

The orbital measurements are helpful not only for surgical accuracy but also for preparation of ocular prosthesis. More such morphometric studies in India should be conducted even by employing radiological methods for better diagnosis and treatment as well as racial characterisation. Thus based on the present study, Indian skulls can be placed mesoseme type and THE study is useful in surgical aspects of oromaxillary surgery, orbital surgeries, and cosmetic surgeries and in medico-legal aspects of forensic medicine.

Conflicts of Interests: **None**

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