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# Morphometric Study of Different Orbital Dimensions in Dry Skull in Eastern India- A Cross-sectional Study

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## ABSTRACT

**Introduction:** Existing data regarding the relative position of the various bony landmarks of the orbit suggest that the position of these landmarks may vary depending on the racial population studied. The present study will provide useful baseline orbital morphometric data in Eastern Indian population.

**Aim:** To study the morphometric data of the different orbital dimensions, fissures and foramens of dry skulls in Eastern Indian region.

**Materials and Methods:** This cross-sectional study was done in the department of Anatomy, of a Institute of Post Graduate Medical Education and Research, Kolkata, West Bengal, India from January 2016 to June 2020. Total 101 adult dry skulls (71 male and 30 female) collected from the departments of Anatomy of four medical colleges were included in the study. Orbital height, breadth, index, distance between Supraorbital Notch/foramen (SON) to Superior Orbital Fissure distance (SOF), the Anterior Lacrimal Crest (ALC) to Posterior Lacrimal Crest (PLC), ALC to the medial border of the optic canal, orbital floor and lateral wall were measured.

**Results:** Based on Orbital Index (OI) 39.12% skulls were found to be in mesoseme, 50.5% in microseme and 10.4% in megaseme category, both genders taken together. The mean SON to SOF distance was 42.48 mm in males and 41.52 mm in females. Mean Infraorbital Foramen (IF) to Inferior Orbital Fissure (IOF) distance was 22.4 mm in males and 22.26 mm in females. Average Frontozygomatic Suture (FZ) to Inferior Orbital Fissure (IOF) was 24.35 mm whereas it was 32.97 mm for the ALC to Optic canal (OC) distance.

**Conclusion:** Most of the skulls studies belonged to the microseme category. Orbital height and breadth were significantly higher in males compared to females.


**Keywords:** Crest, Fissure, Frontozygomatic, Lacrimal, Optic canal

## INTRODUCTION

The visual apparatus, which are lodged in orbit is important for anatomists, ophthalmologists, oral and maxillofacial surgeons and forensic experts. The bony orbit may be involved in a number of pathological conditions like trauma, tumour, etc. In such circumstances surgeries involving exploration of the bony orbit, orbital decompression or even exenteration of the eyeball may be required [1]. Precise knowledge of the intraorbital structures and their relative position in relation to various bony landmarks is essential in order to prevent serious injuries to the neurovascular structures passing through the orbit.

There are several surgical approaches to the bony orbit each one providing some advantages over the other in terms of the area of exposure while the lateral approach in transorbital procedures is suitable for orbital neoplasms on the lateral wall, the superior approach offers a better access to the optic nerve [2]. With regard to the extra-orbital approaches, the cranio-orbitozygomatic approach provides an access a wide range of pathologies involving the skull base [3]. An important anatomical landmark in these surgeries is the IOF. Anatomical landmark to identify the position of the IOF is important in this regard [4]. A sound knowledge of three-dimensional anatomy of the surrounding structures is therefore essential for craniofacial surgeries.

Earlier studies in West Bengal and other parts of India have shown that, orbital height and breadth are useful for identification and sex determination in anthropological studies [5-9]. OI varies in different races [10] and hence can be used in racial indexation. However, fewer studies are available regarding the position of different foramina, fissures in the orbit and surrounding parts of the skull which can add valuable information to the knowledge of the surgeon for various cranio-orbitozygomatic surgical approaches [11,12].

Besides, the present study will provide useful baseline orbital morphometric data of Eastern Indian population, which are clinically relevant to planning and execution of occuloplastic, maxillofacial and neurosurgeries and also in the design of eye protective equipment and prosthetic implantation of artificial eye [13].

Also, these parameters especially OI might be used during forensic and anthropological investigation in establishing identity based on gender and race of the individual. Hence, present study was conducted to study morphometric data of the different orbital dimensions, fissures and foramens of dry skulls in Eastern Indian region in order to provide a useful baseline and anthropometric data which will be of immense clinical and surgical interest.

## MATERIALS AND METHODS

This cross-sectional study was done in the department of Anatomy, of a premier medical college in Kolkata, West Bengal from January 2016 to June 2020. The study was conducted after obtaining due Institutional Ethics Committee Clearance Certificate (IEC No. Inst/IEC/2016/001).

**Inclusion criteria:** Adult dry skulls collected from the departments of anatomy of four medical colleges were included in the study.

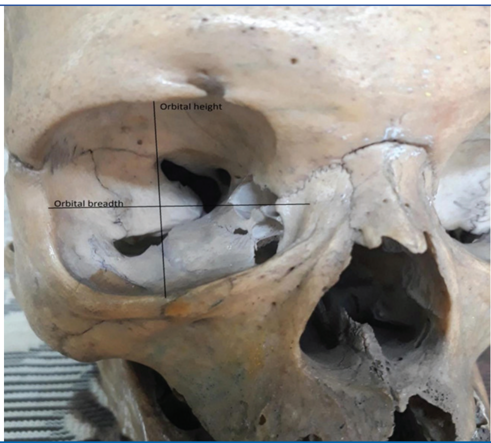
**Exclusion criteria:** Broken, damaged, deformed skulls, particularly in the orbital region, were excluded from the study.

Being a cross-sectional study with the primary goal of defining the dimensions as proposed, no formal sample size calculation was done. However, based on convenience sampling approach 101 adult dry skulls were selected for the study (202 orbits).

## Study Procedure

While selecting the parameters to be studied, we closely followed the parameters studied by Fetouh FA and Mandour DA in their study on dry skulls in Egypt. In present study following parameters were studied [14]:

**1. Orbital length (height):** maximum distance between the midpoint of upper and lower margin of the orbital cavity [Table/Fig-1].




**[Table/Fig-1]:** Orbital breadth and height.

**2. Orbital breadth:** distance between the mid-point of the medial margin of the orbit to the midpoint of the lateral margin of the orbit [Table/Fig-1].

**3. Orbital Index:**

$$\frac{\text{Max Orbital Height}}{\text{Max Orbital Width}} \times 100$$

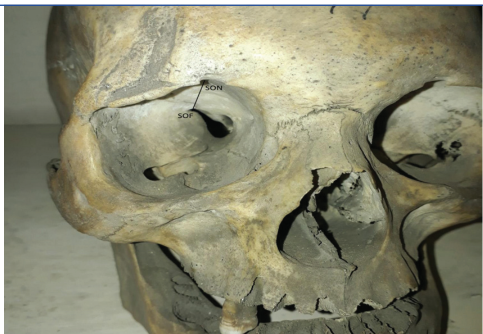
Based on the OI according to Tripathi EB and Webb AAC [15]: Three classes of orbits are recognised as follows: megaseme (OI > 89), mesoseme (OI between 89 and >83) and microseme (OI ≤83).

**4. Measurement of the superior wall or orbital roof [Table/Fig-2]:**

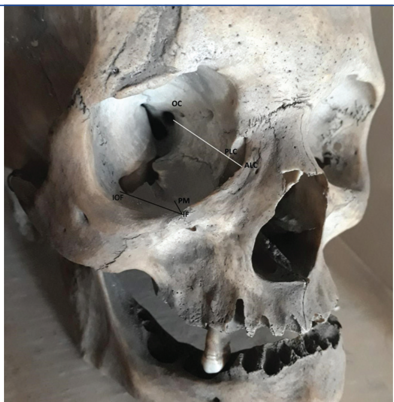
1) Distance between the SON or foramen to the nearest margin of the SOF.

**5. Measurement of the medial wall [Table/Fig-3]:**

1) Distance between the ALC to PLC




**[Table/Fig-2]:** Measurements on superior wall of orbit.




**[Table/Fig-3]:** Measurements on medial wall and floor of orbit.

2) Distance between the ALC to the medial border of the optic canal.

**6. Measurement of the inferior wall or orbital floor:**

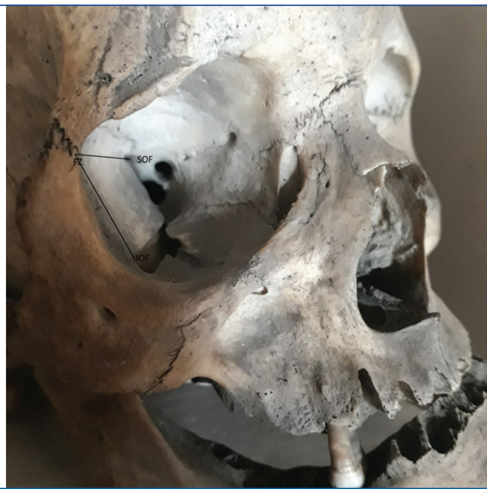
Orbital margin over the IF has been used as a landmark to measure the distance between the following structures:

a) Nearest margin of the IOF; b) Posterior margin (PM) of the roof of the infraorbital canal.

**7. Measurement of the lateral wall [Table/Fig-4]:**

1) Distance between the nearest margin of the FZ to the SOF.

2) Nearest margin of the FZ to the IOF.




**[Table/Fig-4]:** Measurements on lateral wall of orbit.

All measurements were taken in millimeters. After obtaining the dry adult skull bones, the measurements were taken, sex was determined using standard criteria in forensic medicine, including robusticity of the supraorbital, occipital and mastoid regions [16,17]. The linear parameters were measured using a divider with two fine tip ends and then measured with a ruler. Also, a flexible wire and ruler were used wherever bony irregularities obstructed smooth linear measurement. All measurements were taken independently by two of the authors.

## STATISTICAL ANALYSIS

The data were compiled and analysed using IBM SPSS Statistics version 2.0. A descriptive statistical analysis of the pooled data was done measuring central tendency in most of the cases. For analysing the gender variations, unpaired t-test was done with p-value < 0.005 considered to be significant.

## RESULTS

In present study, out of total 101 skulls, 71 were male skulls and 30 were female. The mean orbital height were 32.2±0.17 mm and 32.32±0.19 mm in right and left-sides of male and 31.09±0.1 mm and 30.77±0.12 mm in female skulls, respectively. There was a statistically significant difference in the mean orbital height between male and female specimens (p-value=0.041).

The mean OI was 83.09±0.53 and 83.23±0.65 in right and left-sides of male skulls, respectively. However, in case of females, the index was 83.83±0.56 and 83.85±0.37 in right and left-sides, respectively. There was no statistically significant difference among the OI of the two genders (p=0.4 on right and 0.5 on left side).

The present study showed, maximum orbit; 36 (50.7%) right orbit and 39 (54.9%) left orbit belonged to microseme category in males. In females; maximum 17 (56.7%) of left orbit belonged to mesoseme variety and in right-side 14 (46.7%) orbit, belonged to microseme and mesosme category each respectively [Table/Fig-5].

The mean orbital breadth was significantly higher among males than females.

The study parameters did not vary significantly between right and left-sides of the male skulls, except for one of the measurements

| Orbital Index (OI) | Male skull (71) | | Female skull (30) | |
|---|---|---|---|---|
| | Right | Left | Right | Left |
| <83 (Microseme) | 36 (50.7%) | 39 (54.9%) | 14 (46.7%) | 13 (43.3%) |
| >83 <89 (Mesoseme) | 27 (38%) | 21 (29.6%) | 14 (46.7%) | 17 (56.7%) |
| >89 (Megaseme) | 08 (11.3%) | 11 (15.5%) | 02 (6.7%) | 00 |

**[Table/Fig-5]:** Comparison between male and female skulls based on Orbital Index (OI).

pertaining to the floor and lateral wall of the orbit i.e., the distance from orbital margin over the IF to the posterior margin of the roof of the infra-orbital canal (PM), and the distance between the nearest margins of FZ and SOF (p<0.05) [Table/Fig-6].

| Parameters (Male) | Right | Left | Unpaired t-test (p-value) |
|---|---|---|---|
| Orbital height | 32.2±1.398 | 32.32±1.584 | 0.64 |
| Orbital breadth | 38.9±1.866 | 38.9±1.919 | 1 |
| Orbital index (OI) | 83.09±4.496 | 83.23±5.464 | 0.81 |
| SON-SOF | 42.57±1.719 | 42.38±1.700 | 0.48 |
| IF-IOF | 22.32±1.15 | 22.48±1.21 | 0.39 |
| IF-PM | 11.99±0.71 | 12.24±0.75 | 0.04 |
| ALC-PLC | 8.23±1.05 | 8.26±1.1 | 0.87 |
| ALC-OC | 44.18±1.15 | 43.88±1.23 | 0.14 |
| FZ-SOF | 36.43±0.87 | 35.98±0.83 | 0.002 |
| FZ-IOF | 25.1±1.06 | 24.98±1.15 | 0.52 |

**[Table/Fig-6]:** Chief measurements of the orbit and its walls in males.
SON: Superior orbital notch; SOF: Superior orbital fissure; IF: Inferior orbital foramen; IOF: Inferior orbital fissure; PM: Posterior margin of roof of the infraorbital foramen; ALC: Anterior lacrimal crest; PLC: Posterior lacrimal crest; OC: Optic canal; FZ: Frontozygomatic suture

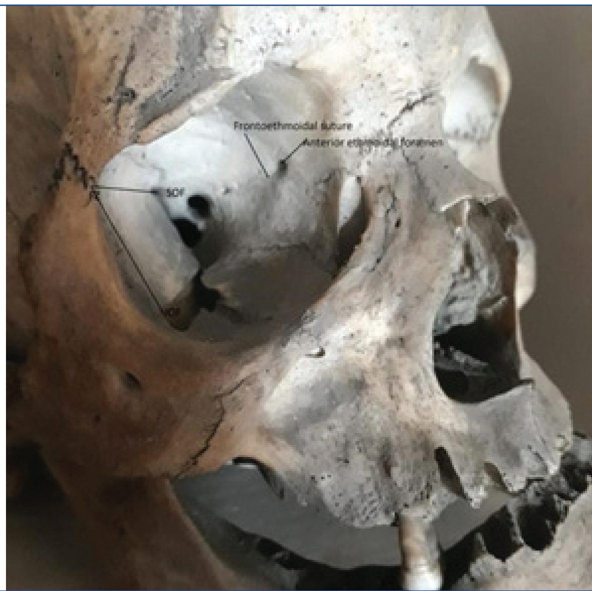
Similarly, in the female skulls, there was significant difference was found among right and left-sides regarding the distance between orbital margin over the IF and nearest margin of the IOF. Also, the orbital height was varying significantly between the two sides of female skull, the measurements being, 31.09±0.09 mm and 30.77±0.12 mm on right and left-sides, respectively [Table/Fig-7].

| Parameters (Female) | Right | Left | Unpaired t-test (p-value) |
|---|---|---|---|
| Orbital height | 31.09±0.55 | 30.77±0.64 | 0.04 |
| Orbital breadth | 37.12±1.3 | 36.71±1.1 | 0.19 |
| Orbital index (OI) | 83.83±3.1 | 83.85±2.05 | 0.98 |
| SON-SOF | 41.66±0.96 | 41.38±1.35 | 0.36 |
| IF-IOF | 22.35±0.31 | 22.16±0.35 | 0.03 |
| IF-PM | 11.73±0.35 | 11.83±0.37 | 0.29 |
| ALC-PLC | 6.44±0.26 | 6.36±0.31 | 0.28 |
| ALC-OC | 41.88±0.79 | 41.93±0.58 | 0.78 |
| FZ-SOF | 33.17±0.9 | 33.1±0.96 | 0.77 |
| FZ-IOF | 23.74±0.54 | 23.58±0.57 | 0.27 |

**[Table/Fig-7]:** Chief measurements of the orbit and its walls in females.
SON: Superior orbital notch; SOF: Superior orbital fissure; IF: Inferior orbital foramen; IOF: Inferior Orbital Fissure; PM: Posterior margin of roof of the infraorbital foramen; ALC: Anterior lacrimal cresto; PLC: Posterior lacrimal crest; OC: Optic canal; FZ: Frontozygomatic suture

Parameters such as orbital height, orbital breadth, lateral orbital wall, and medial orbital wall of both sides (left and right) were significantly higher among males than females. The OI however did not vary significantly between males and females [Table/Fig-8]. The mean SON to SOF distance was 42.48 mm in males and 41.52 mm in females. Mean Infraorbital Foramen (IF) to Inferior Orbital Fissure (IOF) distance was 22.4 mm in males and 22.26 mm in females. Average Frontozygomatic Suture (FZ) to Inferior Orbital Fissure (IOF) was 24.35 mm whereas it was 32.97 mm for the ALC to Optic canal (OC) distance.

The supra-orbital notch and foramen were not co-existent in any of the skulls, be it male or female or left and right-sides. However, in 49 (69%) male and 22 (73%) female skulls the supra-orbital notch was seen while in 22 (31%) male and 8 (27%) female skulls the notch was replaced by supra-orbital foramen. It is worth noting that the Anterior Ethmoidal Foramen (AEF) was found at the fronto-ethmoidal suture in the majority of orbits (95%). In the rest of orbits (5%), this foramen was located superior to the suture with the average distance of 1.0±0.7 mm [Table/Fig-9].




**[Table/Fig-9]:** Important bony landmarks on the medial orbital wall; Anterior Ethmoidal Foramen (AEF) and fronto-ethmoidal suture.

## DISCUSSION

The present study had recorded the variation in the dimensions of various foramina in the skull in each side in both genders.

Comparing the findings of Fetouh FA and Mandour DA in Egyptian skulls, Mekala D et al., (2015) on South Indian skulls and Maharana

| Parameters | | Right (mm) | | | Left (mm) | | p-value (B/w M & F) Unpaired t-test |
|---|---|---|---|---|---|---|---|
| | | Male (N=71) | Female (N=30) | p-value (B/w M & F) | Male (N=71) | Female (N=30) | |
| Orbital Height | | 32.2±1.398 | 31.09±0.55 | <0.0001 | 32.32±1.584 | 30.77±0.64 | <0.0001 |
| Orbital Breadth | | 38.9±1.866 | 37.12±1.3 | <0.0001 | 38.9±1.919 | 36.71±1.1 | <0.0001 |
| Orbital Index (OI) | | 83.09±4.496 | 83.83±3.1 | 0.412 | 83.23±5.464 | 83.85±2.05 | 0.548 |
| Orbital Roof | SON-SOF | 42.57±1.719 | 41.66±0.96 | 0.008 | 42.38±1.700 | 41.38±1.35 | 0.005 |
| Orbital Floor | IF-IOF | 22.32±1.15 | 22.35±0.31 | 0.885 | 22.48±1.21 | 22.16±0.35 | 0.165 |
| | IF-PM | 11.99±0.71 | 11.73±0.35 | 0.06 | 12.24±0.75 | 11.83±0.37 | 0.0047 |
| Medial Orbital Wall | ALC-PLC | 8.23±1.05 | 6.44±0.26 | <0.0001 | 8.26±1.1 | 6.36±0.31 | <0.0001 |
| | ALC-OC | 44.18±1.15 | 41.88±0.79 | <0.0001 | 43.88±1.23 | 41.93±0.58 | <0.0001 |
| Lateral Orbital Wall | FZ-SOF | 36.43±0.87 | 33.17±0.9 | <0.0001 | 35.98±0.83 | 33.1±0.96 | <0.0001 |
| | FZ-IOF | 25.1±1.06 | 23.74±0.54 | <0.0001 | 24.98±1.15 | 23.58±0.57 | <0.0001 |

**[Table/Fig-8]:** Chief measurements of the orbit and its walls.
SON: Superior orbital notch; SOF: Superior orbital fissure; IF: Inferior orbital foramen; IOF: Inferior Orbital Fissure; PM: Posterior margin of roof of the infraorbital foramen; ALC: Anterior lacrimal crest; PLC: Posterior lacrimal crest; OC: Optic canal; FZ: Frontozygomatic suture

SS and Agarwal RK in the skulls of Central Indian population, the mean height of the right orbit was 32.2 mm in males and 31.09 mm in females and 32.32 mm in male, 30.77 in females of the left orbit in the present study [Table/Fig-10a] [14,18,19].

The mean of the orbital breadth in the present study was 38.9 mm in males and 37.12 mm in females on the right-side and 38.9 mm in males and 36.71 mm in females on left-side. These values were not consistent with the measurements that were recorded by other similar studies by Fetouh FA and Mandour DA; Mekala D et al., which is evident from the [Table/Fig-10b] [14,18].

In the present study, the orbits were mostly found in the microseme category in both sexes. Considering the mean orbital breadth, there were no significant difference between the findings of both sides in each sex. The values in the present study almost nearly corroborated with the study done by Fetouh FA and Mandour DA; Mekhala D et al., [Table/Fig-11] [14,18].

| Study | Sample size | Study population | Orbital height (mm) | | | |
|---|---|---|---|---|---|---|
| | | | Right male | Left male | Rt. female | Lt. female |
| Present study | 101 | Eastern India | 32.2±1.398 | 32.32±1.584 | 31.09±0.55 | 30.77±0.64 |
| Fetouh FA and Mandour DA [14] (2014) n=52 | 52 | Egyptian | 35.83±1.23 | 35.27±1.35 | 35.53±0.95 | 34.71±1.12 |
| Mekala D et al., (2015) [18] | 200 | South India | 3.62 cm±0.23 | | 3.45 cm±0.2 | |
| Maharana SS and Agarwal RK (2015) [19] | 100 | Central India | 32.91±2.47 | | 31.83±2.85 | |

**[Table/Fig-10a]:** Showing comparison of orbital height in different studies [14,18,19].

| Study | Sample size | Study population | Orbital breadth (mm) | | | |
|---|---|---|---|---|---|---|
| | | | Right male | Right female | Left male | Left female |
| Present study | 101 | Eastern India | 38.9±1.866 | 37.12±1.3 | 38.9±1.919 | 36.71±1.1 |
| Fetouh FA and Mandour DA [14] | 52 | Egyptian | 43.62±1.13 | 42.75±1.35 | 42.6±0.94 | 42.0±1.37 |
| Mekala D et al., (2015) [18] | 200 | South India | 42.9±0.27 | | 40.5±0.24 | |

**[Table/Fig-10b]:** Showing comparison of orbital breadth in different studies.

| Study | Study population | Orbital Index (OI) | | | |
|---|---|---|---|---|---|
| | | Right male | Right female | Left male | Left female |
| Present study | Eastern India | 83.09±4.496 | 83.83±3.1 | 83.23±5.464 | 83.85±2.05 |
| Fetouh FA and Mandour DA [14] | Egyptian | 82.20±2.97 | 84.13±3.76 | 82.81±3.02 | 82.88±3.31 |
| Mekhala D et al., (2015) [18] | South India | 84.82±7.24 | | 85.22±7.21 | |

**[Table/Fig-11]:** Showing comparison of Orbital Index (OI) in different studies.

The mean distances from the ALC to OC in the present study were consistent with other studies [Table/Fig-12] [20-26]. These measurements are important before planning for surgery of epistaxis. The medial orbital approach is performed in several surgical procedures, including ethmoidal vessel ligation, orbital decompression and exploration for fractures [20]. In the present study, the distances measured from ALC to OC were more than the observation recorded by other research workers except for female orbits which were consistent with the study done by Karakaş P et al., which will permit for more wide dissection during medial wall surgery [21]. The distances from ALC to PLC in present study were not corroborating with the study of Huanmanop T et al., done on Thai orbits except for the female orbits where the findings are close to observation in the present study [22]. These data might help in more generous extension in the medial orbitotomy which is effective in the management of medial orbital tumours, such as cavernous hemangiomas, schwannomas, and isolated neurofibromas [23]. Also, in transnasal endoscopic orbital decompression, the entire medial orbital wall and the medial portion of the orbital floor is removed [24].

From the data of the present study it was obvious that the optic nerve within the OC were present at a distance of 44.18 mm in males, 41.88 mm in females on the right-side and 43.38 mm in males, and 41.93 mm in females on the left-side from the palpable ALC. This should be kept in mind when performing medial wall surgery in Eastern India populations to avoid optic nerve injury. The distance from ALC to PLC has no statistically significant difference between males and females and also between the right and left-sides. Hwang K and Baik SH reported that the distance from the ALC to the AEF varies significantly between the right and left-sides [25]. McQueen CT et al., observed the significant difference between genders in the distance from the PEF to the OC [26]. These findings suggest possible asymmetric anatomy of some foramina in the medial wall of orbit in some racial population.

The SON is constantly found close to the superior orbital rim and hence, can be used as the reference point for the measurements of the superior wall or roof during frontal sinus obliteration, orbital decompression, exploration for fractures and orbital exenteration [27]. Cockerham KP et al., described the sub-brow approach in superior orbitotomy for superior orbital lesions and mentioned that a horizontal extension should be generous (at least 3 cm) [23]. So, the amount of bone removal or the extension needed can be guided by the measured distances in the present study (SON-SOF and SON-OC distances). In addition, the measurements on the roof were statistically were insignificant for each sides and genders. Hwang K and Baik SH reported a significant difference in the distance to the SOF between genders, which was not similar to the present study [25].

The inferior orbital approach is involved in several procedures, including exploration for fracture, decompression, and maxillectomy [28]. The values of IF-IOF distance were found to

| Medial wall | McQueen CT et al., (1995) USA [26] n=54 | Huanmanop T et al., (2007) Thai [22] n=50 | Karakaş P et al., (2002) Male Turkish [21] n=31 | Hwang K and Baik SH (1999) Korean [25] n=41 | Present study | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Rt. male | Lt. male | Rt. female | Lt. female |
| ALC-PLC | | 6.6±1.1 | | | 8.23±1.05 | 8.26±1.1 | 6.44±0.26 | 6.36±0.31 |
| ALC-OC | 43.29 | 42.2 | 41.7 | 40.5 | 44.18±1.15 | 43.88±1.23 | 41.88±0.79 | 41.93±0.58 |

**[Table/Fig-12]:** Comparison of the data of medial wall distances between different studies.
ALC: Anterior lacrimal crest; PLC: Posterior lacrimal crest

be greater than those found in Thai (Huanmanop T et al., 21.7 mm) and Korean (Hwang K and Baik SH i.e., 21.6 mm) [22,25]. On the other hand McQueen CT et al., in US individuals noted much higher value (37.43 mm) [Table/Fig-13] [26].

| Parameter studied (mm) | McQueen CT et al., (1995) USA [26] | Huanmanop T et al., (2007) Thai [22] | Hwang K and Baik SH (1999) Korean [25] | Present study<br>Rt, male: Lt. male<br>Rt. female; Lt. female |
|---|---|---|---|---|
| SON-SOF | 44.34 | 40 | 40 | 42.57;42.38<br>41.66; 41.38 |
| IF-IOF | 37.43 | 21.7 | 21.6 | 22.32±1.15; 22.48±1.21<br>22.35±0.31; 22.16±0.35 |
| IF-PM | 17.08 | 12.3 | | 11.99±0.71; 12.24±0.75<br>11.73±0.35; 12.24±0.75 |
| FZ-SOF | 36.59 | 34.5 | 34.3 | 36.43±0.87; 35.98±0.83<br>33.17±0.9; 33.1±0.96 |
| FZ-IOF | 40.92 | 24 | 24.8 | 25.1±1.06; 24.98±1.15<br>23.74±0.54; 23.58±0.57 |

**[Table/Fig-13]:** Comparison of the data of superior, inferior and lateral wall distances between different studies.
SON: Superior orbital notch; SOF: Superior orbital fissure; IF: Inferior foramen; IOF: Inferior orbital fissure; PM: Posterior margin of roof of the infraorbital foramen; FZ: Frontozygomatic suture

These variations should be considered when dealing with the neurovascular bundle of IOF in subciliary and subtarsal approaches in inferior orbitotomy to reach the orbital floor and orbital rim [29] and in the endoscopic transnasal repair of orbital floor fractures. The values of the present study were not consistent with those measured in US (McQueen CT et al., 17.08 mm) [26]. Our findings corroborate well with the findings of Huanmanop T et al., in Thai individuals [22]. Thus, the Eastern Indian individuals might be considered to have deeper inferior orbital walls in comparison with the caucasians.

These variations in the depth of inferior orbital wall assume great importance especially in procedures to reach the orbital apex. Statistically significant differences were not observed between males and females.

The lateral surgical approach is usually practised in several procedures, including exploration for fractures, decompression, excision of the lacrimal gland, and orbitozygomtic craniotomy [20]. The values of FZ-SOF distance as shown greater than those measured in, Korean (34.3 mm) [25], and Thai individuals (34.5 mm) [22]. Also, the distance from FZ-IOF were not consistent with that measured in Korean (24.8 mm) [25] and more or less consistent to Thai individuals (24 mm) [22] but not consistent with that of US (40.92 mm) [26]. The lateral surgical approach provides enough exposure to remove lesions completely without major complications. No statistically significant differences were observed between the right and left-sides in FZ-SOF distance in females. Also, statistically significant sex differences were observed in FZ-IOF distance. This was not consistent with Huanmanop T et al., who observed significant sex difference in FZ-IOF distance in Thai individuals [22].

## Limitation(s)

Inspite of the measurements being done meticulousy, the major limitation of this study seems to be the inability to pin point the exact lineage of the skull bones. Although all the skull bones have been retrieved from the medical colleges of the Eastern part of India, yet to prove it conclusively, beyond reasonable doubt, that, each and every skull belongs to a subject from eastern India was not been possible.

# CONCLUSION(S)

Most of the skulls in present study belonged to the microseme category. Orbital height and breadth were significantly higher in males compared to females. The supra-orbital notch and foramen were not co-existent in any of the skulls, be it male or female or left and right-sides. The present study points out some significant differences in several anthropometrical measurements as compared to similar findings in other parts of the world and India. As a result, variations in the anatomy of orbital foramina and fissures related to side and gender should be kept in mind when performing the orbital surgery to avoid surgical complications.

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