



MORPHOMETRIC ANALYSIS OF ORBITAL MARGINS WITH REFERENCE TO BONY LANDMARKS

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ABSTRACT **Background :** Analysis of the morphometric features of orbit is of great importance to anatomists, radiologists and medicolegal experts. Orbit morphometric study also provides parameters for preoperative planning & prediction of postoperative outcome. Morphologically, an orbit is a four sided pyramid with an apex, a base and four walls. **Objective :** To measure the distances between walls of the orbit to different foramina & fissures present in the orbit. **Material & Methods:** The study was conducted on completely ossified 75 intact dry skulls (150 Orbits-75 Right, 75 Left). Skulls of unknown sex will be studied in the Department of Anatomy, Mahatma Gandhi Medical College & Hospital, Jaipur (Rajasthan). The distances from the constant landmarks to the foramina in the superior and inferior walls were measured. **Results:** The distance of SF to SOF, OC and LF, mean value of superior wall of total mean value was 42.96mm, 45.97mm and 32.74mm respectively. The distance of IF to IOF and OC, mean value of inferior wall of total mean value was 22.88mm and 47.61mm respectively. **Conclusion:** This is an anatomical region which is of clinical & surgical interest to many disciplines like ophthalmology, oral and maxillofacial surgery and neurosurgery. There were non significant differences in all parameters between the right and left side orbits.

KEYWORDS : Orbit, walls of the orbit, foramina & fissure

INTRODUCTION

The two orbital cavities are situated on either side of the sagittal plan of skull between cranium and skeleton of face. The orbit is very complex structure. Morphologically, an orbit is a four sided pyramid with an apex, a base and four walls. Bony orbit is made of seven bones namely maxilla, palatine, frontal, zygomatic, sphenoid, ethmoid and lacrimal. It protects the delicate eyeballs. All orbital openings are arranged around base or apex or around the walls. Apex is situated posteriorly and base anteriorly. The walls of the orbit namely superior, medial, inferior, and lateral are of distinctive clinical importance. In forensic anthropology, sex estimation is extremely important to identify decedents. The skull is second best part of skeleton for determining sex after pelvis^[1,2].

Superior wall / Roof of the orbit is formed by the frontal bone and lesser wing of sphenoid bone. It is markedly concave anteriorly and more or less flat posteriorly.

Inferior wall / Floor is formed by the orbital plate of the maxilla, the anterolateral part by the orbital surface of zygomatic bone and the small area behind the maxilla is formed by orbital process of palatine bone.^[3,4]

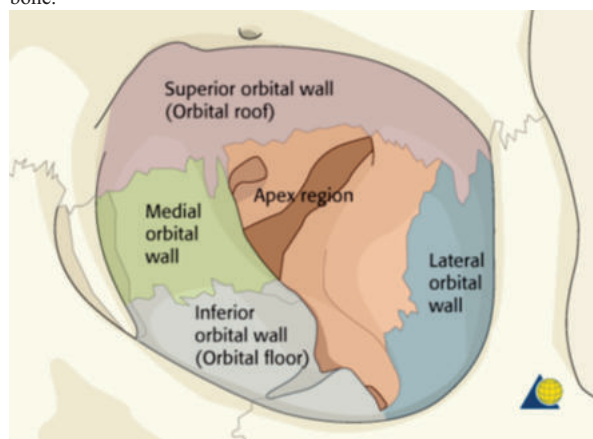


Figure 1. Walls Of The Orbit

Fissures & Canals Between Walls Of Orbit:

(a) Superior Orbital Fissure: It is the gap between lesser and greater wings of sphenoid closed laterally by frontal bone. It lies between roof and lateral wall of the orbit.

(b) Inferior Orbital Fissure: It lies between the lateral wall and floor

of the orbit. Through it, the orbit communicates with the pterygopalatine and infratemporal fossa.

(c) The Ethmoidal Foramina: It lies between the roof and medial wall of the orbit either in the frontoethmoidal suture or actually in the frontal bone. They are the openings of canals which are formed in greater part by the frontal but completed by the ethmoid.

(d) Optic Canal Or Foramen: The optic canal, leads from the middle cranial fossa to the apex of the orbit, and it is formed by the two roots of the lesser wing of the sphenoid. Optic canal is formed medially by the body and laterally by the lesser wing of the sphenoid bone.^[5,6]

The human skull and cranium are essential segments of the skeleton that have received significant attention in forensic research especially in the analysis of ethno-racial relationship. And the features within it may give further insight into the understanding of craniofacial anthropometry.

The stereo-structure of the orbit is affected by several orbital diseases. The main goals of plastic surgery for orbital hypoplasia and orbital fracture are to repair the stereo-structure of the orbit and to reestablish the symmetric relationship between the two orbits. Orbit morphometric study will also provide parameters for preoperative planning and prediction of postoperative outcome.^[7]

Aims & Objectives

To measure the distances between walls of the orbit to different foramina & fissures present in the orbit and to provide a data base of the orbital parameters for the Rajasthan population.

MATERIAL & METHODS

The study was conducted on completely ossified 75 intact dry skulls (150 Orbits-75 Right, 75 Left). Skulls of unknown sex will be studied in the Department of Anatomy, Mahatma Gandhi Medical College & Hospital, Jaipur (Rajasthan). The measurements of right and left orbits will be recorded.

Parameters regarding the distances between easily palpable points (landmarks) on the two orbital margin and the different foramina and fissures in the orbital walls.

- (A) Superior Wall / Roof= 1. SF – OC
2. SF – SOF
3. SF – LF

The digital vernier caliper (accurate up to 0.01mm) will be used to measure various distances. All the measurements will be recorded in mm (millimeter).

- (B) Inferior Wall / Floor= 1. IF – IO
2. IF – OC

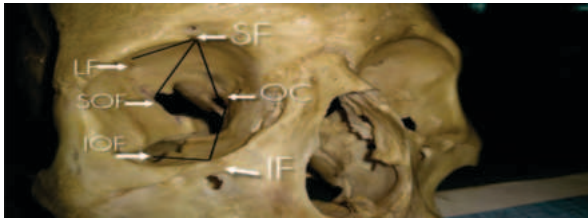


Figure 2. Showing landmarks used for various parameters on superior and inferior orbital wall; SF- supraorbital foramen, OC- Optic canal, SOF – superior orbital fissure, LF- lacrimal foramen, IF – infraorbital foramen,

OBSERVATIONS

The observations that were made as per the parameters are listed in the tables below and the measurements of the right and left orbits (75Right, 75Left) of the individual skull bones.

Table 1-the Distance Measured In The Superior Wall /Roof Of The Orbit

Parameters	Right Orbits		Left Orbits		Total mean±SD	TotalRange (min.-max.)	p-value
	Mean± SD	Range (min.max.)	Mean± SD	Range (min.max.)			
SF-SOF	43.13± 2.28	39.05- 46.98	42.79± 3.47	38.97- 47.67	42.96± 2.87	38.97- 47.67	0.4793
SF-OC	46.19± 6.01	40.09- 50.43	45.75± 3.75	39.71- 51.02	45.97± 4.88	39.71- 51.02	0.5914
SF-LF	32.76± 2.10	30.11- 43.43	32.73± 0.60	29.23- 37.76	32.74± 1.35	29.23- 43.43	0.9055

The data regarding the measured distance between the defined landmarks of the orbit for the right and left sides.

In the superior wall , the total mean distance between SF to the SOF was 42.96mm with total range from 38.97 - 47.67(min - max). The total mean distance between SF to the OC was 45.97mm with total

range from 39.71 - 51.02(min - max). The total mean distance between SF to the LF was 32.74mm with total range from 29.23 - 43.43(min - max)

When all the difference in measured parameters between the right and left orbital cavities were statistically insignificant.

Table 2- The Distance Measured In The Inferior Wall Of The Orbit

Parameters	Right Orbits		Left Orbits		Total mean±SD	TotalRange (min.-max.)	p-value
	Mean±SD	Range (min.max.)	Mean±SD	Range (min.max.)			
IF-IOF	23.02±2.14	20.02-26.05	22.74±0.23	19.64-26.54	22.88±1.18	19.64-26.54	0.2617
IF-OC	47.63±5.92	42.07-54.43	47.59±5.88	41.02-53.55	47.61±5.9	41.02-54.43	0.9669

The data regarding the measured distance between the defined landmarks of the orbit for the right and left sides.

In the inferior wall , the total mean distance between IF to the IOF was 22.88mm with total range from 19.64 - 26.54(min - max). The total mean distance between IF to the OC was 47.61mm with total range

from 41.02 - 54.43(min - max)

When all the difference in measured parameters between the right and left orbital cavities were statistically insignificant.

DISCUSSION

Table 3. Comparison Of Important Distances In Superior Wall Of The Orbit Among The Studies.

Authors	Year	Population	Sample size	Measured distances (mm)		
				SF-SOF	SF-OC	SF-LF
Rontal et al	1979	Indian	48	40	45	32
Mc Queen et al	1995	USA	54	44.34±3.97	48.65±3.21	38.99±4.55
Hwang et al	1999	Korean	82	40.0±2.5	44.9±2.0	-
Karakas et al	2002	Turkish	62	-	45.3±3.2	-
Huanmanop et al	2007	Thai	100	40.0±2.4	44.7±2.3	33.6±3.5
Gosavi et al	2014	Indian	68	40.37±3.2	45.11±3.4	32.6±5.3
Present study	2020	Rajasthan	75	42.96±2.87	45.97±4.88	32.74±1.35

The mean measured distances between SF to SOF were found 42.96±2.87 mm. The distances from SF to SOF are approximately similar to Rontal et al , Mc Queen et al , Hwang et al , Huanmanop et al , Gosavi et al.

The mean measured distances between SF to LF were found 32.74±1.35 mm.

The distances from SF to LF are approximately similar to Rontal et al , Gosavi et al.

The mean measured distances between SF to OC were found 45.97±4.88 mm. The distances from SF to OC are approximately similar to Rontal et al , Gosavi et al.

Regarding the comparison between sides , the distance from the SF to the SOF , OC , LF was non significant.

Table 4. Comparison Of Important Distances In Inferior Wall Of The Orbit Among The Studies.

Authors	Year	Population	Sample size	Measured distances (mm)	
				IF-IOF	IF -OC
Rontal et al	1979	Indian	48	24	48
Mc Queen et al	1995	USA	54	37.43±4.13	49.73±2.71
Hwang et al	1999	Korean	82	21.6±1.8	45.5±2.5
Huanmanop et al	2007	Thai	100	21.7±2.0	46.2±2.8
Abed et al	2011	British Caucasian	47	25.40±2.70	43.23±3.4
Gosavi et al	2014	Indian	68	21.51±2.5	48.32±2.8
Present study	2020	Rajasthan	75	22.88±1.18	47.61±5.9

The mean measured distances between IF to IOF were found 22.88±1.18 mm. The distances from IF to IOF are approximately similar to Hwang et al , Huanmanop et al , Gosavi et al.

during plastic surgery, maxillofacial and neurosurgeries and also in the design of eye protective equipment. Also these can be used during forensic and anthropological investigation of unknown individuals for determining gender, ethnicity, etc.

The mean measured distances between IF to OC were found 47.61±5.9 mm. The distances from IF to OC are approximately similar to Rontal et al , Huanmanop et al , Gosavi et al.

The distance of SF to SOF , OC and LF , mean value of superior wall of total mean value was 42.96mm , 45.97mm and 32.74mm respectively.

Regarding the comparison between sides , the distance from the IF to the IOF , OC was non significant.

The distance of IF to IOF and OC , mean value of inferior wall of total mean value was 22.88mm and 47.61mm respectively.

CONCLUSION

Accurate measurements of orbital dimensions are very important

There were non significant differences in all parameters between the right and left side orbits, which demonstrated the symmetry of the two

orbits in the same individual.

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