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MORPHOMETRIC STUDY OF BONY ORBIT AND ITS SURGICAL IMPLICATIONS

Anatomy

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ABSTRACT

INTRODUCTION: The human orbit is a complex anatomic region. Each of its four bony walls has its own unique features and is perforated by a number of fissures and foramina that carry important nerves and blood vessels. The orbital region plays predominant role in the evaluation of craniofacial complex. Each orbit can be compared to a tiny jewel box that has very precious contents, all carefully wrapped in fat tissue. The two orbital cavities are situated on either side of the sagittal plane of the skull between the cranium and the skeleton of the face. Thus situated, they encroach about equally on these two regions. Each orbital cavity essentially is intended as a socket for eye-ball and also contains associated muscles, vessels, nerves, lacrimal apparatus, fascial strata and soft pad. In a nutshell it lodges the visual apparatus. This is an anatomical region which is of clinical & surgical interest to many disciplines like ophthalmology, oral and maxillofacial surgery and neurosurgery. The bony orbit which lodges the visual apparatus is important not only for anatomists but also for ophthalmologists, oral and maxillofacial surgeons and forensic experts.

AIM AND OBJECTIVE: To do the morphometric study of bony orbit and because knowledge regarding various parameters of orbit are helpful to ophthalmologists, neurosurgeons, maxillofacial surgeons during various surgeries. To prevent injuries to important structures during orbitotomy.

MATERIALS AND METHODS: This study was done on 24 skulls in Department of Anatomy of Osmania medical college, Koti, Hyderabad. The skulls with visible trauma, pathology and fractures were excluded from study. During this study the parameters of orbit which were measured are superior wall length, medial wall length, lateral wall length, Inferior wall length, Intra orbital distance (IOD) and extra orbital distance (EOD) shape and location of inferior orbital foramen was measured. Their relation with optic canal was observed. The distances were measured and photographed. The results were analysed and compared to previous studies.

RESULTS: In present study we observed that both the orbits are symmetrical and its dimensions were arranged in tabular form. From 24 skulls, 48 orbits were analysed. superior wall length of right side was 44.75±3.13 and on the left side was 45.12±3.0.Inferior wall length of right side was 48.29±3.72 and on left side was 47.75±3.65.Medial wall length on right side was 43.95±2.64 and on left side was 42.5±1.86.Lateral wall length on right side was 46.79±2.9 and on left side was 46.33±2.42.various types of inferior orbital fissure was observed ,out of 48 orbits, type 1 was found in 37%,type 2 was found in 16%,type 3 was found in 25%,type 4 was found in 17%,type 5 was found in 5%. Out of which type 1 is most common type. Intra orbital distance was 2.2 cm±0.24. Extra orbital distance was 10.5±0.58. which is helpful in designing various eye equipment.

CONCLUSION: Several Orbit anatomical parameters should be taken into consideration during plastic surgery, maxillofacial surgeries and neurosurgery and ophthalmologist. Accurate measurements of orbital dimensions are very important in designing eye protective equipment.

KEYWORDS

Orbit, Superior Wall Length, Inferior Wall Lenghth, Medial Wall Length, Lateral Wall Length, Infraorbital Foramen, Optic Foramen.

INTRODUCTION:

The human orbit is a complex anatomic region. Each of its four bony walls has its own unique features and is perforated by a number of fissures and foramina that carry important nerves and blood vessels. The orbital region plays predominant role in the evaluation of craniofacial complex. Each orbit can be compared to a tiny jewel box that has very precious contents, all carefully wrapped in fat tissue. The two orbital cavities are situated on either side of the sagittal plane of the skull between the cranium and the skeleton of the face. Thus situated, they encroach about equally on these two regions. Each orbital cavity essentially is intended as a socket for eye-ball and also contains associated muscles, vessels, nerves, lacrimal apparatus, fascial strata and soft pad. The orbit is a bony pyramid with four walls: a roof, lateral wall, floor, and medial wall. The base of the pyramid is the orbital entrance, is roughly rectangular. It measures 4 cm wide by 3.5 cm high and is rotated laterally. The medial orbital walls are parallel, approximately 2.5 cm apart and separated by paired ethmoid sinuses. Each lateral wall forms a 45 degree angle with its respective medial wall, resulting in 90 degree between the two lateral walls. The orbital volume is roughly 30 ml, of which 7 ml is occupied by the globe.

SUPERIOR WALL OR ROOF:

The roof of the orbit is formed principally by the thin orbital plate of the frontal bone. It is gently concave on its orbital aspect, which separates the orbital contents and the brain in the anterior cranial fossa. Anteromedially it contains the frontal sinus and displays a small trochlear fovea, sometimes surmounted by a small spine, where the cartilaginous trochlea (pulley) for superior oblique is attached. Anterolaterally there is a shallow lacrimal fossa which houses the orbital part of the lacrimal gland. The roof slopes significantly towards the apex, joining the lesser wing of the sphenoid, which completes the roof. The optic canal lies between the roots of the lesser wing, and is bounded medially by the body of the sphenoid.

INFERIOR WALL OR FLOOR

The inferior wall or floor of the orbit is mostly formed by the orbital plate of the maxilla which articulates with the zygomatic bone anterolaterally and the small triangular orbital process of the palatine bone posteromedial. The floor is thin and largely roofs the maxillary sinus.

Medial Wall

The medial wall is roughly rectangular and extends from the anterior lacrimal crest (frontal process of the maxilla) to the orbital apex. At its anterior aspect, it contains the lacrimal fossa which is bounded by the anterior and posterior lacrimal crests. The latter is a well-defined ridge on the thin lacrimal bone, which forms part of the lateral wall of the nose and overlies the root of the middle turbinate. The vast majority of the medial wall is comprised of the lamina papyracea.

Lateral Wall:

The lateral wall of the orbit is formed by the orbital surface of the greater wing of the sphenoid posteriorly and the frontal process of the

zygomatic bone anteriorly: the bones meet at the spheno zygomatic suture.

MATERIALS AND METHODS:

This study was done on 24 skulls in Department of Anatomy of Osmania medical college, koti, Hyderabad.The skulls with visible trauma, pathology and fractures were excluded from study.During this study the parameters of orbit which were measured are superior wall length-(from supra orbital notch to superior aspect of orbital opening of optic canal), medial wall length- (midpoint of anterior lacrimal crest (ALC) to medial border of optic canal), lateral wall length- (from frontozygomatic suture to lateral border of optic canal), Inferior wall length- (from directly above infraorbital foramen to inferior aspect of orbital opening of optic canal),Intra orbital distance (IOD)- Mid points of medial margins of two orbits and extra orbital distance(EOD) -Mid points of lateral margins of two orbits. Shape and location and type of inferior orbital fissure was observed . Their relation with optic canal was observed. The distances were measured and photographed. The results were analysed and compared to previous studies.

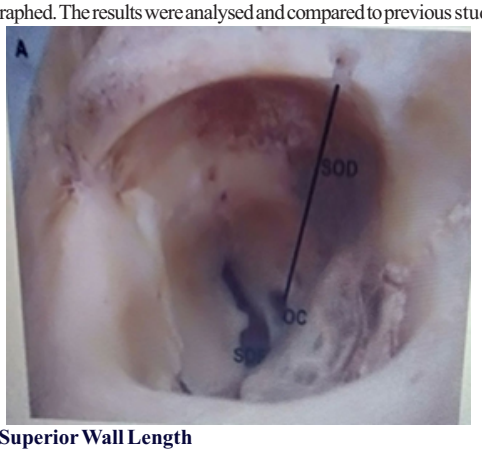


Fig1 - Superior Wall Length

SOD/SL-SUPERIOR WALL, OC-OPTIC CANAL

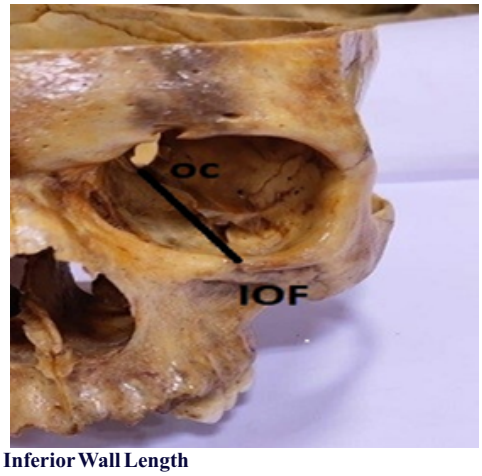


Fig2- Inferior Wall Length

IOF-INFRA ORBITAL FORAMEN, OC-OPTIC CANAL

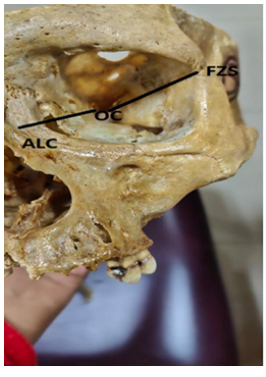
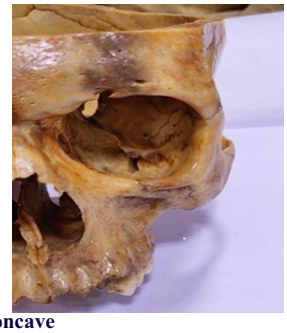


Fig 3- Medal Wall Length And Lateral Wall Length

ALC (ANTERIOR LACRIMAL CREST)
OC -OPTIC CANAL,
FZS-FRONTOZYGOMATIC SUTURE

FIG 4- IOD (INTRA ORBITAL DISTANCE)
EOD (EXTRA ORBITAL DISTANCE)

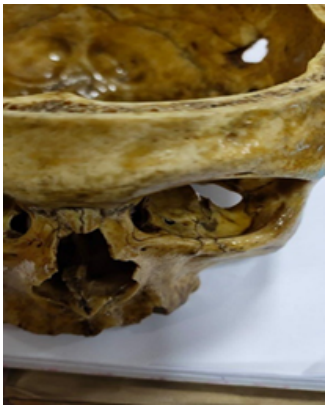
Types Of Inferior Orbital Fissure



Type 1 Wide Concave

Type II Narrow Slit Like

TYPE III Rectangular Type



TYPE IV Triangular Type

RESULT:

In present study we observed that both the orbits are symmetrical and its dimensons were arranged in tabular form. From 24 skulls, 48 orbits were analysed. superior wall length of right side was 44.75±3.13 and on the left side was 45.12±3.0. Inferior wall length of right side was 48.29±3.72 and on left side was 47.75±*3.65*. Medial wall length on right side was 43.95±2.64 and on left side was 42.5±1.86. Lateral wall length on right side was 46.79±2.9 and on left side was 46.33±2.42. various types of inferior orbital fissure was observed , out of 48 orbits, type 1 was found in 37%, type 2 was found in 16%,type 3 was found in 25%, type 4 was found in 17%, type 5 was found in 5%. out of which type 1 is most common type. Intraorbital distance was 2.2 cm±0.24.Extraorbital distance was 10.5±0.58. which is helpful in designing various eye equipments.

DISCUSSION:

Orbit morphometry is an important aspect during surgical procedures, such as reconstruction of face and cranium .These are done to restore lost functional capacity or to improve cosmetic appeareance. periorbital and intraorbital neurovascular structures risk relative damage during these maneuvers.A through understanding of orbital morphology is therefore essential to avoid surgical complications. The ethmoidal canal, the periorbital, muscular cone, optic nerve and the superior orbital fissure are the important structure in topographic arrangement of the orbit.

Measurement Of Orbital Walls Of Dried Skull

MEASUREMENT	RIGHT (n=24) In mm	LEFT (n=24) In mm
SUPERIOR WALL	44.75±3.13	45.12±3.0
INFERIOR WALL	48.29±3.72	47.75±3.65
MEDIAL WALL	43.95±2.64	42.5±1.86
LATERAL WALL	46.79±2.9	46.33±2.42

Inferior Orbital Fissure

TYPE OF FORAMEN	RIGHT (%) n=24	LEFT (%) n=24
TYPE 1 (WIDE CONCAVE)	9 (37%)	9 (37%)
TYPE 2(NARROW SLIT)	4 (16%)	4(16%)
TYPE 3 (RECTANGULAR)	6 (25%)	3(13%)
TYPE 4 (TRIANGULAR)	4(17%)	7(29%)
TYPE 5 (INVERTED)	1 (5%)	1(5%)

IOD (INTRAORBITAL DISTANCE) AND EOD (EXTRA ORBITAL DISTANCE)

PARAMETER (IN CM)	MEAN	STANDARD DEVIATION
IOD	2.2	0.24
EOD	10.5	0.58

CONCLUSION:

SUPERIOR WALL LENGTH:

Superior wall length is required in transcranial approach which targets intra orbital lesions through the roof of orbit and ideally suited for apical lesions and superior orbital fissure lesions.so,the amount of bone removal or extension needed can be guided by distances measured.

Medial Wall Length Of Orbit:

Medial approach is involved in several procedures ,including ethmoidal vessel ligation,orbital decompression and exploration of fracture, helpful in medial orbitomy which is effective in management of medial wall tumors, such as cavernous haemangioma ,schwanomma,isolated neurofibromas.Also in trans nasal endoscopic orbital decompression ,entire medial wall and medial portion of wall is removed.

INFERIOR WALL LENGTH OF ORBIT:

It is useful in various procedures, exploration of fractures, decompression and maxillectomy.it is also helpful in subciliary and subtarsal aaproaches in inferior orbitomy to reach orbital floor and orbital rim. Repair of orbital floor fracture.To reach orbital apex trans nasally for tissue biopsy decompression of orbit and optic nerve.

Lateral Wall Length Of Orbit:

It is required for excision of lacrimal gland, orbitozygomatic craniotomy,useful in retrobulbar lesions and more posterior lesions, exposure can be extended posteriorly all the way to orbital apex.

IOD (INTRAORBITAL DISTANCE) AND EOD(EXTRA ORBITAL DISTANCE)

Intraorbital distance and biorbital distance are important for mantainence of facial symmetry during both reconstructive and cosmetic operations.

Difference between intraorbital and biorbital distance need to be taken into consideration during nasal bridge reconstruction,facial cosmetic surgeries and in the design of spectacle bridges and frames. For designing protective equipment to eyes.

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