Morphometry of The Orbital Region in Dry Skull

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ABSTRACT

Introduction: The bony orbit is important not only for anatomists but also for ophthalmologists, oral and maxillofacial surgeons and forensic experts. This study aimed to assess the orbital index which varies with race, regions, within the same race and periods in evolution. The objectives of the present study are to provide the normal reference orbital parameters for the Nepalese population. **Materials and Method:** The study was done on thirty eight dry skulls irrespective of age, sex and race. The orbital length and breadth were measured by using manual vernier caliper. Orbital index was calculated by using the formula Length /Breadth x 100. To prevent interobserver and intraobserver error two individuals measured the parameters independently with predetermined procedures. All the data obtained were tabulated and analysed statistically by computing descriptive statistics like mean, standard deviation and range. **Results:** The mean orbital length was found to be 34. 44 ±2. 61mm and 33. 79 ±3. 11mm whereas the mean orbital breadth was 38. 08 ±2. 34mm and 37. 00 ±2. 61mm on the right and left sides respectively. By using orbital length and breadth, orbital index was calculated. The mean orbital index was 90. 53 mm and 91. 53 mm on right and left sides respectively based on this the orbital category of the Nepalese is Megaseme. **Conclusion:** Data collected in the present study serve as data base for the quantitative description of human orbital morphology of Nepalese population, which are very important during plastic surgery, maxillofacial and neurosurgeries and also in the forensic research.

Key Words: Dry skull, Orbital dimensions, Orbital index

INTRODUCTION

The two orbital cavities are situated on either side of the sagittal plane of skull between the cranium and the skeleton of the face. 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. [1] Orbital morphometric study will also provide parameters for preoperative planning and prediction of postoperative outcome. [2] It is an important gateway which is connected to central nervous system, nose, paranasal sinuses and face, because of vessels and nerves which pass through its various foramina. [3] It is like a four-sided pyramid comprising medial, lateral, superior, inferior margins with base and apex. [4] Knowledge regarding accurate morphometric measurements of its margins and depth will help in diagnosis and treatment plans of various optic functions. [5] So, surgeons need to have a proper understanding of the human orbital structure, its relationship with both intra and extracranial structures, and associated key surgical and anatomical landmarks. [6] Modern facial surgical techniques require details regarding measurements of various concerned reference points of orbit. It is therefore important to consider the lengths of the superior and inferior orbital depths during deep orbit surgical operations in order not to damage the optic nerve and associated vessels. [7]

Recent studies report that morphometry is a fast and efficient method for the evaluation of morphological characteristics such as ethnicity, gender, age, genetic factors, dietary habits and regional variations which can alter the shape and size of bone structures. These aspects are significantly important in determining the anthropometric changes between different populations and genders. [8] Anthropometric studies are integral part of craniofacial surgery and syndesmology. [9] Most recently, Komar and Buikstra reported that male orbits are ‘‘squared, low’’ and with ‘‘rounded margins,’’ while female orbits are ‘‘rounded, high’’ and with ‘‘sharp margins’’. [10]

This study aimed to assess the orbital index which varies with race, regions, within the same race and periods in evolution. The knowledge of this index is therefore important in various aspects such as in interpretation of fossil records, skull classification in forensic medicine and in exploring the trends in evolutionary and ethnic differences. The documented ranges of this index in different nationalistic groups will assist in skull identification.

The knowledge of the dimensions of the orbital cavity in relation to the skull craniometrycan provide a safer performance of clinical procedures, such as surgeries in the anterior and superior wall of the maxilla.

Taking the orbital index as the standard, three classes of orbit have been described.

1. Megaseme (Large): The orbital index is 89 and over. This type is seen in yellow races (Cassidy, 1913)
2. Mesoseme (Intermediate): The orbital index range between 89 and 83. This type is seen in the white races (Mcgraw Hill, 2003).
3. Microseme (Small): Orbital index 83 or less. This type is characteristics of the black races where the orbital opening is rectangular (Cassidy, 1913).

MATERIALS AND METHOD

For this study thirty eight dry skulls irrespective of age, sex and race with non-pathological bones were included in the study from the Anatomy Department of Institute of Medicine, Maharajgunj, Kathmandu and Universal College of medical sciences, Bhairahawa during the period of January 2018 to March 2018 Measurements of both the right and left orbits were taken with the help of Vernier taken directly using a manual Vernier Caliper calibrated in millimeters.

Fig. 1 Orbital length: This was measured as the maximum distance between the upper and lower margins of the orbital cavity

Fig. 2 Orbital breadth: Distance between the midpoints of the medial margin of the orbit to the midpoint on the lateral margin of the orbit

Orbital index: calculated as Orbital height/ Orbital breadth X 100

The statistical analysis was done using Statistical Package for Social Sciences (SPSS) software version 20. From the measurements, mean and standard deviations were calculated.

RESULTS

The mean orbital length was found to be 34. 44 ±2. 61mm and 33. 79 ±3. 11mm whereas the mean orbital breadth was 38. 08 ±2. 34mm and 37. 00 ±2. 61mm on the right and left sides respectively (Table 1). By using orbital length and breadth, orbital index was calculated. The mean orbital index was 90. 53 mm and 91. 53 mm on right and left sides respectively based on this the orbital category of the Nepalese is Megaseme (Table 2).

Table 1 showing the descriptive statistics of orbital dimensions

	Length of Right	Breadth of right	Length of left	Breadth of left skull
Sample Size	38	38	38	38
Mean	34. 44	38. 08	33. 79	37. 00
Std. Deviation	2. 618	2. 341	3. 112	2. 610
Range	9	11	12	10
Minimum	30	31	28	32
Maximum	39	42	40	42

Table 2 showing the Mean Orbital Index

	orbital index of right orbit	Orbital index of left orbit
Sample Size	38	38
Mean	90. 5332	91. 5345

DISCUSSION

Morphometric parameters of orbit are important in ophthalmology, oral maxillofacial surgery and neurosurgery. Results of the present study are compared to the previous studies. In our present study there was no significant difference between right and left sides of orbital cavity. There is ethnic variation as shown by previous studies.

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. [11]

The orbital index seen in modern man of the Kanto region and Kinki region of Japan were of the microseme range (79. 26-80. 33)[12]and in Perking province of China, studies showed orbital index of microseme category (80. 68)[13] and in our study the mean orbital index was 90.53 mm and 91. 53 mm on right and left sides respectively.

Variation of OI between and within the population could be due to genetic and environmental factors and also different patterns of craniofacial growth mainly resulting from racial and ethnic differences.

From the study conducted in adult Malawians skull radiograph the mean orbital index was found to be 95. 15±4. 56 (90. 63-99. 75)[14] and in our study the mean orbital index was 90. 53 mm and 91.53 mm on the right and left sides respectively. In the study done by SayeeRajangam et al, there was no significant difference in the Height and Breadth of the orbit between the two genders and the values are lower than our present study. [15] Deepak S Howale et al, had studied on Indian population and have reported a slightly lower mean OI (86. 4) compared to our result (91. 02). [16]

The values of orbital indices are important measurements in the evaluation, and diagnosis of craniofacial syndromes and post traumatic deformities, and the knowledge of normal values for a particular region or population can be used to treat abnormalities to produce the best aesthetics and functional result. [17]

The importance of orbital index lies in its use for the interpretation of fossil records, skull classification in forensic medicine and the explanation of trends in evolutionary and ethnic differences. [18]

There is variation in orbital dimensions with age. This suggest either a genetically determined continuously variable like height or may be due to continuous bone resorption and remodelling which according to Parfitt [19] occurred at cortical bone surface every 2-5 years while bone turnover for the whole skeleton is about 10% per years.

CONCLUSION

This present study provides a useful baseline and an anthropometric data that will be of clinical and surgical interest in ophthalmology, oral and maxillofacial surgery and indeed neurosurgery in this part of the world. Many important anatomic landmarks which are short of in our present study need to be measured andevaluated in larger sample for the future research.

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