ISSN: 2278-5213

RESEARCH ARTICLE

Orbital dimensions– A direct measurement study using dry skulls

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Abstract

Assessment of orbital dimensions is important for a good knowledge of the anatomical disposition of orbital structures and surgical management of orbital pathologies. Orbital dimensions of thirty (30) dry skulls of adult were measured by direct measurement technique with Vernier Caliper. The mean orbital height for the right and left sides were 31.9 ± 2.2 and 32.2 ± 1.8 mm while, their orbital breadth were 39.7 ± 2.2 and 38.8 ± 3.1 mm respectively. The mean orbital index was 81.65. The north population belongs to the Microseme category and this study will serve as a guide to surgical management of orbital pathologies as it relates to our environment.

Keywords: Orbital dimensions, anatomical disposition, Vernier Caliper, orbital index, Microseme category.

Introduction

The two orbital cavities are situated on either side of the saggital plane of skull between the cranium and the skeleton of the face. Thus situated, they encroach about equally on these two regions (Last, 1968). Understanding anatomical structure, proportion and mechanical function of the human body and racial variations in ocular anatomy is vital to clinical assessment and treatment of patients (Fawehinmi *et al.,* 2008). Anthropometry aids the understanding of anatomical structures, constitutes the technique of expressing quantitatively the form of human body and skeleton. It is a basic tool of biological anthropology and has been of immense help in the development of forensic sciences in general and forensic medicine in particular. Anthropometric studies are an integral part of craniofacial surgery and syndromology (Novit, 2006). For these reasons, standards based on ethnic or racial data are desirable because these standards reflect the potentially different patterns of craniofacial growth resulting from racial, ethnic and sexual differences (Everekliogl u *et al.,* 2002). The orbital cavities, which form the subject of this work, are situated on either side of the saggital plane of the skull between the cranium and the skeleton of the face (Patniak *et al.,* 2001). 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 (Soames, 1999). Patniak *et al.* (2001) 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 varies in different races (Orbital Index= Orbital Height/Orbital Breadth).
Taking the orbital index as the standard, three classes of orbit have been described.

1. Megaseme (Large): The orbital index is 89 or 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).

This anthropometric study employs the use of direct measurements on dry skulls as it will present a different and a more natural perspective in assessing the orbital cavities. Also, this study will provide a deeper insight in the morphological disposition of anatomic relationships of the orbit and also a guiding principle for the surgeons who are involved in the reconstructive management of fractures due to traumas and different orbital pathologies.

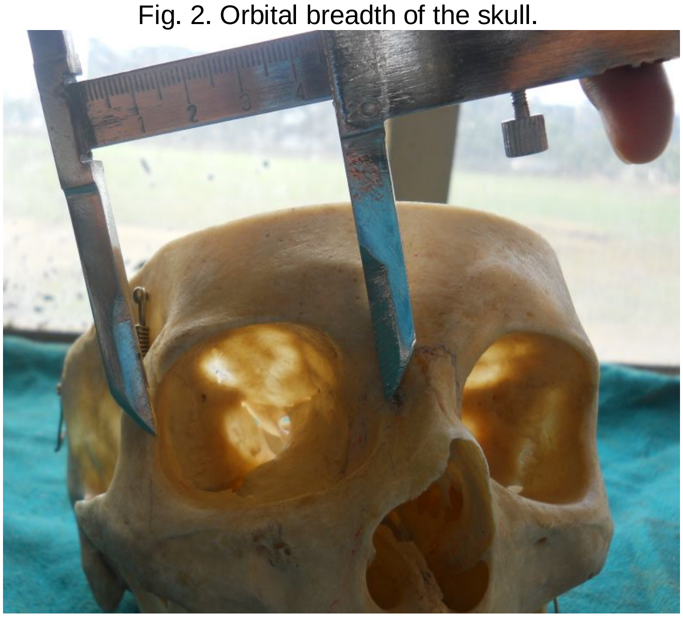
Materials and methods

Thirty (30) dry adult skulls of North population were obtained from the Department of Anatomy, Adesh Institute of Medical Sciences and Research, Bathinda. The direct measurements of both the right and left orbits were taken with the help of Vernier Caliper.

Measurements: The measurements for the dimensions of the orbital cavities were taken directly using a manual Vernier Caliper calibrated in millimeters.
Orbital length: This was measured as the maximum distance between the upper and lower margins of the orbital cavity (Fig. 1).
Orbital breadth: Distance between the midpoint of the medial margin of the orbit to the midpoint on the lateral margin of the orbit (Fig. 2).
Orbital index: calculated as Orbital height/ Orbital breadth X 100.
All measurements were recorded and expressed Means ± Standard Deviation and range (Min. value – Max. value of each measurement).

Fig. 1. Orbital length of the skull.

Fig. 2. Orbital breadth of the skull.



Results

The results indicate that the right orbital breadth showed the largest value (39.7 ± 2.2 mm) and the right orbital length showed the lowest value (31.9 ± 2.2 mm). From the results, orbital index was calculated as orbital length/ orbital breadth x 100. A mean orbital index of 81.65 was deduced (Table 1).

Table 1. Orbital length and breadth of the skull.

Orbital dimensions	Mean ± SD (mm)	Range (mm)
Right orbital length	31.9 ± 2.2	28.00 ± 36.00
Left orbital length	32.2 ± 1.8	30.00 ± 36.00
Right orbital breadth	39.7 ± 2.2	34.00 ± 45.00
Left orbital breadth	38.8 ± 3.1	31.00 ± 44.00

Discussion

Results from this study show that the orbital index of this north population is 81.65. This places this group of adult north population in the Microseme category. This study co-relates with the earlier study done by Cassidy (1913). The microseme category described for the black race by Cassidy (1913) 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 (Vidarsdotir *et al.,* 2002).

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. For example, 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) and in Perking province of China, studies showed orbital index of microseme category (80.68) (Black, 1928; Hisashi Suzuki, 1982). This study in north population co relates with these studies earlier done. 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 right 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.

Conclusion

This study presents for the first time the orbital parameters in adult North population (Microseme category) thus providing a useful baseline and an anthropometric data will be of clinical and surgical interest in ophthalmology, oral and maxillofacial surgery and indeed neurosurgery in this part. 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.

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