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Research Paper

Radiological Assessment of Orbital Dimensions of the Kalabaris and Ikwerres of Rivers State, Nigeria

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ABSTRACT

The use of Craniofacial measurements for ethno-racial and sex discrimination in forensic studies has been a major focus in recent times. This study compares orbital dimensions and index for the Ikwerre and Kalabaris tribes of Rivers State, Nigeria. 300 radiographs of the human skull, 150 females (both tribes) and 150 males (both tribes), were randomly selected from the Radiology Department in both Hospitals. The orbital length, width and depth were measured and orbital Index was calculated. The data were statistically analysed for means, standard deviation (SD) and Z-test (significant at $p \leq 0.05$). The Ikwerre male mean orbital length, width, depth and mean orbital index values were; 44.06±0.497, 42.87±0.531, 38.80±0.368 and 103.33±1.44 respectively, while Ikwerre female mean orbital length, width, depth and mean orbital index were; 44.26±0.448, 42.37±0.571, 39.08±0.377 and 105.25±1.24 respectively. The Kalabari male mean orbital length, width, depth and Index were; 44.67±0.402, 41.14±0.356, 38.27±0.337,103.98±0.956 respectively while Females mean orbital length, width, depth and Index were;42.22±0.441,41.14±0.380,38.89±0.401 and 102.92±1.10 respectively. No Sexual dimorphism ($p>0.05$) was observed for all orbital dimensions measured. However, there was a statistically significant difference in means of orbital length (between the two tribes in both sexes) and width (between tribes only in males).The result for the orbital index put both tribes into the megaseme category. The values for orbital dimensions of these indigenous tribes may be useful to clinicians and forensic anthropologist.

Keywords: Cranial measurements, Ikweres, Kalabaris, radiological assessment, orbital dimensions

INTRODUCTION

Orbital dimensions in developing countries have been mainly studied with the use of plain skull radiographs (Fawehinmi et al,2008; Ezeuko et al,2007, Igbigbi and Ebite,2010). Most studies on orbital dimensions were used to describe sexual, regional and racial/ethnic variations. (Igbigbi and Ebite,2010; Black 1928; Hisachi,1982; Patnaik et al, 2001; Fawehinmi et al,2008, Baretto et al,1999, Karampatakis 1998, Denis,1998).The usefulness of the knowledge of orbital dimensions is also underscored in understanding several abnormalities that may results from the aberration that occurred in the growth and development of the orbits in early fetal life and in cases of ocular diseases developed in later life(Dennis,1998; Trout,1994; Dilmen et al,2002).

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Based on the different values obtained for orbital index, three categories of the orbits have been described for different human populations. The megaseme and microsome categories were described for the yellow and black races respectively by Cassidy (1913a&b). The megaseme category is an orbital index of 89 or more while the microseme falls within the orbital index of 83 or less than. The third category, mesoseme, lies within the range between 83 and 89 (Mcgraw hill,2003).

Ukoha et al described the megaseme category for the Nigerian population. Black (1928), Harrower (1928) and Hisaschi(1982) described for the chinese population all three categories, stating that regional variability accounted for the presence of these three categories.

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MATERIALS AND METHODS

Materials Used: plain skull radiographs, X-rays film illuminators, transparent metre rule, pencils, eraser and a digital vernier caliper.

Study population: The frontal and lateral views of plain radiographs for patients attending the two teaching hospitals (UPTH and MUTH) located within the Rivers State of Nigeria, between the period 2005-2011,were employed for the study. These were carefully observed, based on the data for age, sex and tribes indicated in the patients' files, for selection of only those related to the two tribes concerned in this study. Only normal radiographs were used, cases with bone diseases and fracture were excluded from the study. A total of 300 radiographs were used which showed 150 females and 150 males (for both tribes, being equally distributed between tribes).

Measuring procedure: The height (length) and width of the orbits were measured using the frontal skull X-rays films while the depth was measured using the lateral skull X-rays.

(a) Height of the Orbital rim: The length of the orbital rim was measured from the frontal film of the skull as the maximum distance between the upper and lower margins of the orbital rim.

(b) Width of Orbital rim: This was measured from the frontal film of the skull as the distance between the midpoint of the medial margin of the orbit to the midpoint of the lateral margin

(c) Depth of Orbit: The depth of the orbit was measured from the lateral film of the skull as a distance between the lower third of the lateral margin of the orbital rim and the optic foramen, a distance just anterior to the anterior clinoid process. This was done in accordance with karanpatakis (1998),who measured the distance between the lateral margin of the optic foramen and the lateral border of the medium and outer third of the inferior orbital rim (retrobulbar needle pathway.)

(d) The Orbital Index: This was calculated from the formula: orbital height/orbital width x 100.

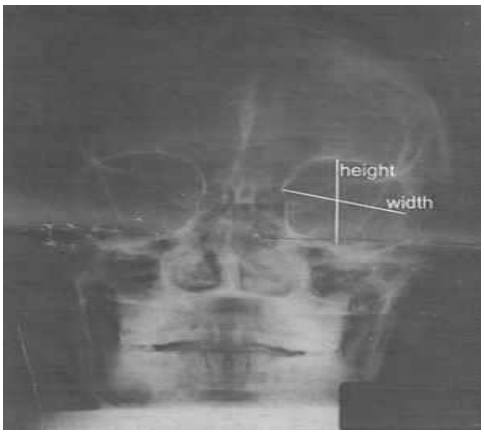

Plate 1
Plate showing typical measurement in this study

Statistical Analysis:
The data obtained for the orbital dimensions were analysed for Descriptive statistics: means, standard deviation and standard errors of Means calculated. Also, The Z-test for significance was conducted for the various parameters.

RESULTS AND DISCUSSION

The orbital dimensions for the Ikwerre males were: 44.06 ± 4.30, 42.87±4.60, 38.80±3.19, 103.33±12.50 for the orbital length, width, depth and Index respectively while the females have their values as: 44.26±3.88, 42.37±4.95, 39.08±3.26, 105.25± 10.77 (Table 1).

The Kalabaris showed orbital values of 42.67± 3.48,41.14± 3.09,38.27± 2.92,103.98± 8.22 in orbital length, width, depth and Index respectively for the males while their females orbital dimensions measured were; 42.22± 3.82, 41.14± 3.29,38.89± 3.48,102.92± 9.49 for the length, width, depth and index respectively (Table 2).

The observed discrepancies in some of the orbital dimensions measured between the sexes in both tribes bears no significance as reported in the result of the study. However, between tribes there was statistically significant differences observed in orbital length (in both sexes) and orbital width (only in males of both tribes).This may imply that the use of a single orbital parameter may better reflect ethnic variation within the same racial population than the orbital index which combines indices.

Table 1
Orbital dimensions of male and female Ikwerres subjects

Parameters	Sex	Sample size	Mean ± SD	Calculated Z-value	Inference
Orbital length	M	75	44.06± 4.30	0.299	Not significant
	F	75	44.26± 3.88	*Z=1.96	
Orbital width	M	75	42.87± 4.60	0.641	Not significant
	F	75	42.37± 4.95	*Z=1.96	
Orbital depth	M	75	38.80± 3.19	0.532	Not significant
	F	75	39.08± 3.26	*Z=1.96	
Orbital Index	M	75	103.33± 12.50	1.008	Not significant
	F	75	105.25± 10.77	*Z=1.96	

Table 2
Orbital dimensions of male and female Kalabari subjects

Parameters	Sex	Sample size	Mean± SD	Z-value	Inference
Orbital length	M	75	42.67± 3.48	0.954	Not significant
	F	75	42.22± 3.82		
Orbital width	M	75	41.14± 3.09	0.0000	Not significant
	F	75	41.14± 3.29		
Orbital depth	M	75	38.27± 2.92	1.182	Not significant
	F	75	38.89± 3.48		
Orbital Index	M	75	103.98± 8.22	0.731	Not significant
	F	75	102.92± 9.49		

Table 3.
Comparison of orbital parameters measured between Ikwerre and kalabaris males

	Tribes	Mean±SD	Z-value	Inference
Orbital length	Ikwerre	44.06± 4.30	2.192	Significant
	Kalabari	42.67± 3.48		
Orbital width	Ikwerre	42.87± 3.88	2.704	Significant
	Kalabari	41.14± 3.09		
Orbital depth	Ikwerre	38.80± 3.19	1.061	Not significant
	Kalabari	38.27± 2.92		
Orbital Index	Ikwerre	103.98± 8.22	0.376	Not significant
	Kalabari	102.92± 9.49		

Table 4
comparison of orbital parameters measured between Ikwerre and kalabari Females.

	Tribes	Mean± SD	Z-value	Inference
Orbital length	Ikwerre	44.26± 3.88	3.245	Significant
	Kalabari	42.22± 3.82		
Orbital width	Ikwerre	42.37± 4.95	1.792	Not significant
	Kalabari	41.14± 3.29		
Orbital depth	Ikwerre	38.08± 3.26	0.345	Not significant
	Kalabari	38.89± 3.48		
Orbital Index	Ikwerre	105.25± 10.77	1.406	Not significant
	Kalabari	102.92± 9.49		

The values recorded for the orbital index of both tribes, in both sexes, falls within the megaseme category. Thus, these representative sample for the Nigerian population is contrasted in category for orbital index described for other populations across the globe (Cassidy, 1919; Black, 1928; Harrower, 1928; Hisashi, 1982; Patnaik *et al*, 2001) but related to other Nigerian population ,of varied ethnic group, reported in an earlier work by Ukoha *et al* (2011). It therefore follows that the orbital index may be a better tool for racial discrimination.

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.

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