Radiomorphometric Evaluation of Orbit and Inter-Orbital Distance for Gender Determination

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ABSTRACT

Introduction: Anthropometry deals with obtaining measurements of anatomical structures to assist in identifying the age, stature, gender and several aspects related to individual or ethnic group. Orbital measurements and inter-orbital distance are one of the craniofacial parameters that could be used in gender identification in terms of anthropological studies. Study aimed to measure the width of the orbital apertures on Postero-anterior skull radiographic view, to measure the height of the orbital apertures on Postero-anterior skull radiographic view, to measure the interorbital distance on Postero-anterior skull radiographic view and to determine gender from radiomorphometric evaluation of orbit and inter-orbital distance

Material and Methods: In this study, a total of 100 retrospective postero-anterior radiographs were selected from department's collection using KODAK-8000 panoramic and cephalometric system following radiation protection protocol. Subjects were in the age range of 18 to 50 years. The maximum width and height of orbit and inter-orbital distance of the orbits were measured using masterveiw software (Version 4.5.1). The data obtained was analyzed by using student "t" test.

Results: The mean orbital width in males was 4.91 and females was 4.97. The observed mean difference was statistically significant (P-0.005). The mean orbital height in males was 4.96 and females was 4.86. The observed mean difference was statistically significant (P-0.001) The mean inter-orbital distance in males was 3.37 and females was 3.00. The observed mean difference was statistically significant (P-<0.001)

Conclusion: Hence we conclude that orbit and inter-orbital distance can be used in determining the gender.

Keywords: Radiomorphometric, Evaluation of Orbit and Inter-Orbital, Gender Determination

INTRODUCTION

Anthropometry deals with obtaining measurements of anatomical structures to assist in identifying the age and stature.[1] The big four of personal identification are determination of age, sex, stature and ethnicity which form the feature of tentative identification. Sex can be like wise determined by various bones and among individual bones skull is known to provide 92% accuracy[2]

Natural disasters, mass transportation accidents, and terrorism, usually require a large number of individuals to be identified. The process is easy if the complete body are well preserved or documentation enables forensic identification. However, when the victims are carbonized, or have an advanced degree of tissue destruction, the process of establishing identity is difficult or impossible.[3]

Skull is composed of hard tissue and is the best preserved part of skeleton after death, hence in many cases it is the only available part for forensic examination. It is well known fact that the skull provides elements for gender identification.[4]

Dentomaxillofacial radiology plays a important role in dentistry to reveal craniofacial structures.[1] In establishing the identity of gender from a skull, lateral cephalograms and Posteroanterior radiographs assumes a predominant role, and they project images of frontal sinus, orbit and maxillary sinus. Radiographs in this regard provide a more precise, easier, accurate and reproducible aid.[4]

Orbital measurements and inter-orbital distance are one of the craniofacial parameters that could be used in gender determination.[1] Thus the aim of the present study was to determine the gender from radiomorphometric evaluation of orbit and inter-orbital distance.

Study aimed to measure the width of the orbital apertures on Postero-anterior skull radiographic view, to measure the height of the orbital apertures on Postero-anterior skull radiographic view, to measure the interorbital distance on Postero-anterior skull radiographic view and to determine gender from radiomorphometric evaluation of orbit and inter-orbital distance

MATERIAL AND METHODS

In this study, a total of 100 retrospective diagnostic postero-anterior radiographs were selected from the department collection using KODAK-8000 panoramic and cephalometric system following radiation protection protocol, with in the age range of 18 to 50 years from the department of oral

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Gender	Mean	Std. Deviation	Std. Error Mean
Male	27.84	5.71	0.81
Female	25.54	5.53	0.78
*denotes significant difference			

Table-1: Mean age of the subjects

Gender	Mean	Std. Deviation	Std. Error Mean	Mean Difference	t	P-Value	95% CI for Mean Difference	
							Lower	Upper
Male	4.21	0.13	0.01	-0.057	-2.840	0.005*	-0.096	-0.017
Female	4.25	0.15	0.02					
*denotes significant difference								

Table-2: Measurements of orbital width

Gender	Mean	Std. Deviation	Std. Error Mean	Mean Difference	t	P-Value	95% CI for Mean Difference	
							Lower	Upper
Male	4.16	0.21	0.02	0.098	3.263	0.001*	0.039	0.158
Female	4.06	0.21	0.02					
*denotes significant difference								

Table-3: Measurements of orbital height

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Inclusion criteria

Diagnostic radiographs of healthy individuals with no visible features of asymmetrical skull.

Exclusion criteria

History of patients with hereditary craniofacial abnormalities.

Patients with history of maxillofacial trauma.

In this study, the maximum width and height of orbital apertures and interorbital distance of the orbits was measured on postero-anterior skull view radiographs using masterveiw software (Version 4.5.1).

1. Orbit height was determined by measuring the maximum distance between the superior and inferior orbital margins on each side.

2. Orbit width was determined by measuring the maximum horizontal distance between the medial and lateral orbital rims on each side.

3. Inter-orbital distance was determined by measuring the distance between the medial walls of the orbits

The linear measurements obtained from each radiograph was expressed in centimeters. The data obtained was statistically analyzed and student "t" test was used.

RESULTS

The mean age of males was 27.84 and females was 25.54 years respectively (table-1). Higher mean orbital width was observed in females compared to the males. The difference in mean orbital width was found to be statistically significant (P-0.005) (table-2).

Higher mean orbital height was observed in males compared to the females. The difference in mean orbital height was found to be statistically significant (P-0.001*) (table-3).

Higher mean inter-orbital distance was observed in males compared to the females. The difference in mean inter-orbital distance was found to be statistically significant (P< 0.001*) (table-4).

DISCUSSION

Gender determination based on skeletal characteristics has a crucial role in legal medicine when compaand forensic anthropology. Studies have proposed two approaches, morphological and metrical, for the determination of sexual characteristics from bones.[1]

In this study, the mean age of males was 27.84 years and that of females was 25.54 years respectively [Table 1].

In females the mean orbital width observed was found to

Gender	Mean	Std. Deviation	Std. Error Mean	Mean Difference	t	P-Value	95% CI for Mean Difference	
							Lower	Upper
Male	3.37	0.25	0.04	0.370	7.210	<0.001*	0.268	0.471
Female	3.00	0.26	0.04					
*denotes significant difference								

Table-4: Measurements of inter-orbital distance (cm)

be high and statistically significant (P< 0.005*). [Table 2]. This finding was in accordance with the study conducted by Igbigbi, P.S et al (2009) where they observed increased orbital width in females, than in males. In females, the orbital margin has the form of a quadrilateral with rounded corners Thus contributing for larger width.

In males mean orbital height observed was found to be high and statistically significant (P<0.001*) [Table 3]. This finding was in accordance with the study conducted by Leko Bankole et al (2012) and Igbigbi, P.S et al (2009) normally, male skulls are more robust, and larger.[5] Hence morphologically, the anatomical structures appear to be larger thus contributing for larger height in males

The mean inter-orbital distance observed was found to be statistically significant (P. < 0.001*) in males [Table 4]. Our findings are consistent with studies conducted by Rossi et al, who also found increase in the inter-orbital distance in males.In males the growth continues to increase till the age of 21 years, in females growth begins to level off at about 13 years of age. hence the measurements in females fall more markedly behind the males.[6]

The gender difference was highly significant and that orbital height and inter-orbital distance was statistically significant in males, and the orbital width was statistically significant in females.

CONCLUSION

This study provides useful baseline anthropometric data to use anatomical structures and radiographs, that plays a vital role in forensic identification.

The radiomorphometry of the orbital aperture and inter-orbital distance parameter can be used for determining the gender.

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