EAS Journal of Dentistry and Oral Medicine
Abbreviated Key Title: EAS J Dent Oral Med
ISSN: 2663-1849 (Print) & ISSN: 2663-7324 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-5 | Issue-1 | Jan-Feb-2023 | DOI:10.36349/easjdom.2023.v05i01.003

Original Research Article

Gender Determination by Orbital Aperture Morphometry in Nalgonda Population

Dr. Kankshini Pabba[1], Dr. Bindu Pendyala[1], Dr. Divya Jenson Oolakadan[1], Dr. Avinash Tejasvi, M. L[2*], Anulekha Avinash C. K[3], Dr. Archana Pokala[4], Dr. M. Mounika Reddy[4]

[1]Intern, Kamineni Institute of Dental Sciences, Narketpally, India
[2]Professor and HOD, Department of Oral Medicine and Radiology, Kamineni Institute of Dental Sciences, Narketpally, India
[3]Professor, Department of Prosthodontics, Kamineni Institute of Dental Sciences, Narketpally, India
[4]Senior Lecturer, Department of Oral Medicine and Radiology, Kamineni Institute of Dental Sciences, Narketpally, India

Article History
Received: 07.10.2022
Accepted: 14.11.2022
Published: 28.01.2023

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Background*:** The orbital aperture morphometry can be considered as a valuable tool in gender determination since orbit possesses resistance to damage and disintegration processes. ***Aim and Objective:*** The aim and objective of this study was to evaluate the orbital aperture dimensions in nalgonda population and verify their relationship with gender. ***Materials and Methods:*** The present retrospective study was conducted to evaluate the morphometric dimensions of orbital aperture seen on digital orthopantomogram taken using PLANMECA digital machine and ROMEXIS software. The height and width of the orbits were measured using measuring tools in the accompanying software. Data were analyzed using IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. ***Results*:** Linear measurements such as orbital height and orbital width, were significantly greater in males than females in the Nalgonda population with $P < 0.001$. The present study found 85.6% accuracy after subjecting the obtained value to discriminant function analysis. ***Conclusion*:** The discriminant scores greater than 1.5 value indicate the sample as male and scores lesser than 1.5 value indicate the sample as female. Therefore, orbital aperture measurements can be used for gender determination in human identification.

Keywords: Orbital Aperture measurements, Gender Determination, Orbital width, Orbital hight.

INTRODUCTION

Maxillofacial radiology plays a significant role in forensic anthropology in the absence of DNA samples and fingerprints, to identify human remains when the antemortem radiographic records are preserved and compared with postmortem records [1]. In forensic odontology, the gender and personal identification of skeletal remains of the human is a crucial stage in cases of mass disasters, such as earth quacks, cyclones, and fire accidents [2]. With a high percentage of 92%, the skull is the second most unique, versatile, and dimorphic anatomical structure after pelvis in a human body [3].

Sex determination of the adult skeleton is an important initial step as estimation of age and stature of individual is sex dependent [4]. In the human skull, there are various unique anatomic structures such as orbital aperture, sella turcica, frontal sinus, nasal septum, and vertical groove patterns can be used as an adjuvant tool for personal and gender identification [5].

The relationship between the orbital height and orbital width is given by orbital index (OI) which varies in different races of mankind. The OI is determined by the shape of the face and varies with race, regions within the same race and periods in evolution [6]. Metric analyses on the radiographs are often found to be of superior value due to their objectivity, accuracy, and reproducibility. Several radiographic techniques are used to determine the dimensions of the craniofacial structures [3]. Studies involving orbital aperture morphometry have been conducted on dry skulls for sex determination, but literature search hardly revealed any study with regard to orbital aperture measurements in Indian population using a digital Orthopantomoraph.

***Corresponding Author:** Dr. Avinash Tejasvi, M. L
Professor and HOD, Department of Oral Medicine and Radiology, Kamineni Institute of Dental Sciences, Narketpally, India

The present study was designed with an aim to measure, compare, and evaluate the various measurements of orbital apertures as observed on digital orthopantomogram radiographs and to assess the usefulness of orbital aperture Morphometry as an aid in gender determination.

MATERIALS AND METHODS

A retrospective study was conducted using digital Orthopantomogram view on 50 male and 50 female radiographs, which were taken using PLANMECA digital OPG machine and ROMEXIS software, using 68 kVp exposure and time of 13.8 s at 10 mA, were used for the study. Ideal Othopantomoram in respect to the anatomic integrity of the orbits were selected for the study. Radiographs revealing pathological, fractured, or deformed orbital morphology were excluded from the study. The orbital aperture measurements were carried out by measuring maximum width and height of the orbits. The maximum width (left and right) and maximum height (left and right) of the orbits were measured by a single observer using mouse-driven method (by moving the mouse and drawing lines using chosen points on the digital orthopantomograph, enhancing the image contrast to 75% for all the radiographs to provide an accurate and reproducible method of measuring the chosen points (Figure 1). The measurements were performed two times for each radiograph at different periods of time, and mean of the two measurements had been documented. All the linear measurements, obtained from each radiograph, were expressed in millimeters.

Fig 1: OPG

Statistical Analysis

The data were collected, tabulated, and subjected to statistical analysis using statistical package IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. The data were subjected to t-test and discriminant function analysis.

RESULTS

The measurements obtained were subjected to t-test and discriminant functional analysis. The *t*-test was applied to compare the different parameters between males and females. In our study Mean age is depicted in (Table 1 and Figure 2), the maximum mean left and right height in mean with standard deviation in males was 33.68 ±2.77 mm and 36.10 ±1.04 mm while in females was 30.49 ±2.32 mm and 31.58 ±1.75 mm, respectively. The maximum mean left and right width with standard deviation in males was 32.41 ±1.75 mm and 32.78 ±1.83 mm while in females was 30.16 ±1.41 mm and 30.27 ±1. 34 mm, respectively (Table 1 and Figure 3). In our study, the orbital width (left and right) and orbital hight (left and right) were greater in males when compared to the females and were statistically highly significant ($p<0.001$).

Table: 1 Mean Age

Gender	N	Minimum	Maximum	Mean	Std. Deviation
Males	50	20.0	66.0	39.12	15.26
Females	50	20.0	80.0	38.58	14.75
Overall	100	20	80	38.85	14.93

Table: 2 Mean Values of Various Parameters

Parameter	Side	Male		Female		Overall		P value
		Mean	SD	Mean	SD	Mean	SD	
Width	Right	32.78	1.83	27.76	1.34	30.27	2.99	<0.001**
	Left	32.41	1.75	27.90	1.41	30.16	2.76	<0.001**
Height	Right	36.10	1.04	31.58	1.75	33.84	2.69	<0.001**
	Left	33.68	2.87	30.49	2.32	32.09	3.05	<0.001**

**-Highly significant (p<0.001)

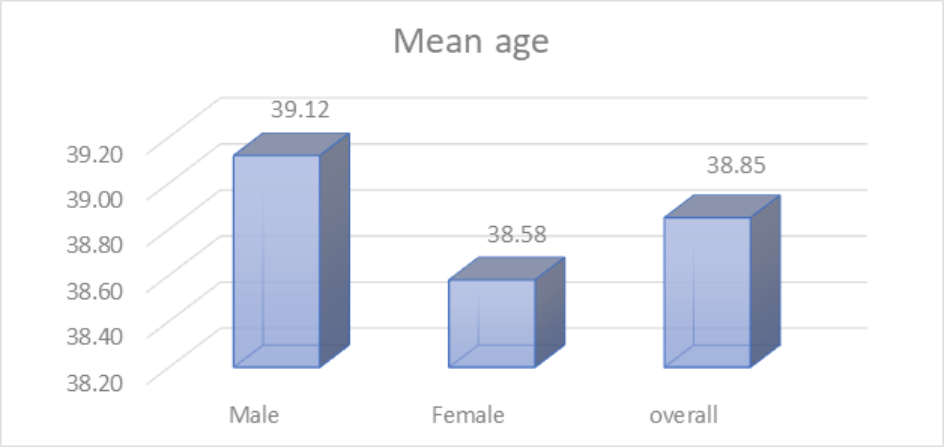

Figure: 2 Mean Age

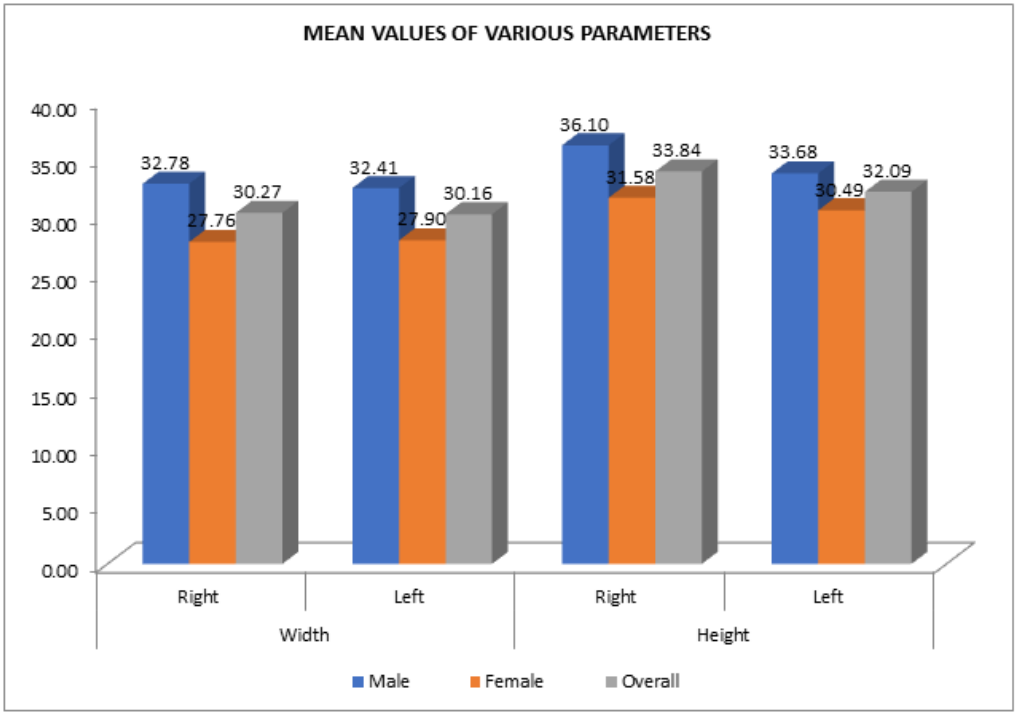

Figure: 3 Mean Values of Various Parameters

From the data presented, three discriminant formulas have been obtained for gender determination for classifying a given sample as male or female, in this study, the cutoff value was found to be 1.5. The

discriminant scores greater than this cutoff value indicate the sample as male and scores lesser than this value indicate the sample as female There is 85.6% accuracy with equation no 1, 75.1% accuracy with equation no 2, 72.2% accuracy with equation no 3 (Table 3) this was found to be statistically highly significant ($p<0.001$).

Table: 3 Discriminant Formulas For Gender Determination

S.no	Dependent variable (Y)	Regression equation	R square	Std. error	P value	Inference
1.	Gender	Y=-0.055*RW + (-0.040)*LW + (-0.083)*RH +(-0.008)*LH + 7.423	0.856	0.195	<0.001**	>1.5 - male, <1.5 - female
2.	Gender	Y = 6.227 + (-0.090)* RW + (-0.066)* LW	0.751	0.253	<0.001**	>1.5 - male, <1.5 - female
3.	Gender	Y = 7.024 + (-0.149)* RH +(- 0.015)* LH	0.722	0.268	<0.001**	>1.5 - male, <1.5 - female

DISCUSSION

The present study demonstrated that the gender difference was highly significant, and that the orbital aperture width and the height were larger in males than in females in Nalgonda population, as the orbit is the bony socket in the skull where the eye and its appendages are situated [7]. In the adult human, the volume of the orbit is 30–32 ml, of which the eye occupies only 1/5th of the space [8]. 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 [9]. The relationship between the orbital height and orbital width which varies in different races of mankind.

Nitek *et al.*, [10] in their study evaluated the orbital aperture width and height in 100 Polish dry human skulls and concluded that these dimensions were larger in males than in females. These findings of our study have been found to be consistent with this study Cheng *et al.*, [9]. Performed several measurements in orbits of Chinese skulls and concluded that the measurements were significantly greater in males than in females which was consistent with our preset study Kumar *et al.*, [11]. Performed morphometry of bony orbit related to gender in dry adult skulls of South Indian population, where the mean horizontal distance and vertical distance showed a significant increase in distance in males than females, which is in accordance with the present study.

Rajangam *et al*., [12] in the previous studies performed by him on Indian population, there was no significant difference in the height and breadth of the orbit between the two genders. However, in our study, the maximum width of the orbital aperture showed statistically highly significant differences between the genders. Sangvichien *et al*., [13] has reported that there was no significant difference in the height but a significant difference in the breadth of the orbit between the two genders Rossi *et al*., [14]. Evaluated the dimensions of the orbital aperture in 97 Brazilian subjects by posteroanterior Caldwell radiographic technique to verify its relationship with gender and concluded that the gender difference was highly significant and the orbital aperture width, area, and inter-orbital distance were larger in males than in females in Brazilian individuals, but the maximum height of the orbital aperture showed not statistically significant differences between genders.

CONCLUSION

The orbital aperture morphometry can be considered as a valuable tool in gender determination since orbit possesses resistance to damage and disintegration processes. The result of our study also establishes the reliability of orbital aperture morphometry using digital orthopantomogram radiographs for gender determination in forensic analysis.

REFERENCES

1. Soman, B. A., Sujatha, G. P., & Lingappa, A. (2016). Morphometric evaluation of the frontal sinus in relation to age and gender in subjects residing in Davangere, Karnataka. *Journal of forensic dental sciences*, *8*(1), 57.
2. Kaur, J., Yadav, S., & Singh, Z. (2012). Orbital dimensions-A direct measurement study using dry skulls. *J Acad Indus Res*, *1*(6), 293-295.
3. Saini, V., Srivastava, R., Rai, R. K., Shamal, S. N., Singh, T. B., & Tripathi, S. K. (2011). Mandibular ramus: An indicator for sex in fragmentary mandible. *Journal of forensic sciences*, *56*, S13-S16.
4. Scheuer, L. (2002). Application of osteology to forensic medicine. *Clinical Anatomy: The Official Journal of the American Association of Clinical Anatomists and the British Association of Clinical Anatomists*, *15*(4), 297-312.
5. Fawehinmi, H. B., Ligha, A. E., & Chikwu, P. (2008). Orbital dimensions of Nigerian adults. *J Biomed Afr*, 6, 1-2.
6. Munguti, J., Mandela, P., & Butt, F. (2013). Sex differences in the cranial and orbital indices for a black Kenyan population. *International Journal of Medicine and Medical Sciences*, *5*(2), 81-84.

7. Keith, L. M. (2010). Clinically Oriented Anatomy. 6th ed. Philadelphia, PA: Lippincott Williams and Wilkins.
8. Patil, G. V., Kumar, S., & Tejeshwari, I. (2017). Study of orbital index in human dry skulls of South Indian origin. *Int J Health Sci Res*, 4, 2249-9571.
9. Cheng, A. C., Lucas, P. W., Yuen, H. K., Lam, D. S., & So, K. F. (2008). Surgical anatomy of the Chinese orbit. *Ophthalmic Plastic & Reconstructive Surgery*, *24*(2), 136-141.
10. Nitek, S., Wysocki, J., Reymond, J., & Piasecki, K. (2009). Correlations between selected parameters of the human skull and orbit. *Medical science monitor: international medical journal of experimental and clinical research*, *15*(12), BR370-7.
11. Kumar, S. S., & Gnanagurudasan, E. (2015). Morphometry of bony orbit related to gender in dry adult skulls of South Indian population. *Int J Health Sci Res*, *5*, 207-214.
12. Rajangam, S., Kulkarni, R. N., Quadrilos, L., & Sreenivasulu, S. (2012). Orbital dimensions. *Indian J Anat*, *1*, 5-9.
13. Sangvichien, S., Boonkaew, K., Chuncharunee, A., Komoltri, C., Piyawinitwong, S., Wongsawut, A., & Namwongsa, S. (2007). Sex determination in Thai skulls by using craniometry: multiple logistic regression analysis. *Siriraj Medical Journal*, *59*(5), 216-221.
14. Rossi, A. C., de Souza Azevedo, F. H., Freire, A. R., Groppo, F. C., Júnior, E. D., Caria, P. H. F., & Prado, F. B. (2012). Orbital aperture morphometry in Brazilian population by postero-anterior Caldwell radiographs. *Journal of forensic and legal medicine*, *19*(8), 470-473.

Cite This Article: Kankshini Pabba, Bindu Pendyala, Divya Jenson Oolakadan, Avinash Tejasvi, M. L, Anulekha Avinash C. K, Archana Pokala, M. Mounika Reddy (2023). Gender Determination by Orbital Aperture Morphometry in Nalgonda Population. *EAS J Dent Oral Med*, *5*(1), 13-17.