Original Research Article

Interzygomatic and Intercanthal width - Gender determination methods in forensic dentistry

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Abstract

Background: Personal identification is a subtle perception and often one of the most significant priorities in the investigation of criminal cases, mass disasters, and in forensic concerns. Gender determination is one of the important parameters in forensic identification. The study of anthropometric characteristics is of fundamental importance to solve problems related to such cases.
Aim: This study aimed to determine gender using physical anthropometric methods like interzygomatic and intercanthal width.
Materials and Methods: A cross-sectional study was conducted among 60 individuals (30 males and 30 females) in the department of Oral Pathology, Government Dental College and Hospital Srinagar. Interzygomatic width, and intercanthal width was determined using a digital sliding caliper. All the measurements were taken twice. The final value was the average of the two obtained values.
Results: There was significantly higher mean interzygomatic and intercanthal width in males as compared to females.
Conclusion: Interzygomatic and intercanthal measurements may serve as diagnostic markers for gender identification in forensic applications like mass disasters.

Key words

Interzygomatic, Intercanthal, Width, Gender, Forensic, Dentistry.

Introduction

Forensic odontology is an investigative aspect of dentistry that analyzes dental evidence for human identification. Apart from assisting in the identification of an individual, it reveals the age and gender of the same [1].

Sex determination is a subdivision of forensic odontology and it is very important especially when information relating to the deceased is unavailable. Sex determination becomes the first priority in the process of identification of a person by a forensic investigator in the case of mishaps, chemical and nuclear bomb explosions, natural disasters crime investigations, and ethnic studies [2].

Various methods have been used for the identification of sex. Sex determination can be done either by Morphological analysis of the tooth, skull and other soft tissues of oral and paraoral region or molecular analysis. Anthropological patterns have been investigated in different regions around the world for human identification. Methods involving physical anthropology present high rate of accuracy for human identification and gender estimation [3]. With this background this study was undertaken to determine gender using intercanthal and interzygomatic width.

Materials and methods

An institutional based cross-sectional study was conducted in Government Dental College and Hospital Srinagar, J&K, India. The study group included 30 males and 30 females of 30 to 40 year age group.

Variables studied through physical anthropometry in both the genders were interzygomatic width, and intercanthal width. All the physical measurements were taken using a digital sliding caliper after each individual was asked to maintain a neutral, relaxed facial expression without lifting the head and to breathe calmly through their nose (**Figure – 1 to 4**). All the measurements were taken twice to control the measurement error, and the average of the aforementioned values was used for the study. Ethical clearance was obtained from the research and Ethical committee of Govt. Dental College and Hospital Srinagar.

Figure - 1: Interzygomatic width measurement in a male subject.	**Figure - 2:** Intercanthal width measurement in a male subject.

Figure - 3: Interzygomatic width measurement in a female subject.	**Figure - 4:** Intercanthal width measurement in a female subject.

Results

The mean anthropometric measurements viz interzygomatic and intercanthal width between males and females is summarized in **Table - 1**. It is obvious from the results that both interzygomatic and intercanthal widths are greater in males as compared to females. Correlation of interzygomatic distance among males and females is given in **Figure - 5**. **Figure - 6** shows the correlation of intercanthal widths among males & females. To assess the reliability of results, the measurements assessed by observer 1 were reassessed by another independent observer in random order. **Table - 2** summarises the stastical analysis of the observations. The interzygomatic distance in males was as mean ± SD (105.5±2.1818) & (103.2±1.357) in females with P=0.0001.

The intercanthal width in males was as mean±SD (31.83± 0.068) and (26.26±2.68) in females with P= 0.0001. The differences were statistically significant with $p<0.05$.

Figure - 5: Correlation of interzygomatic distance between males and females.

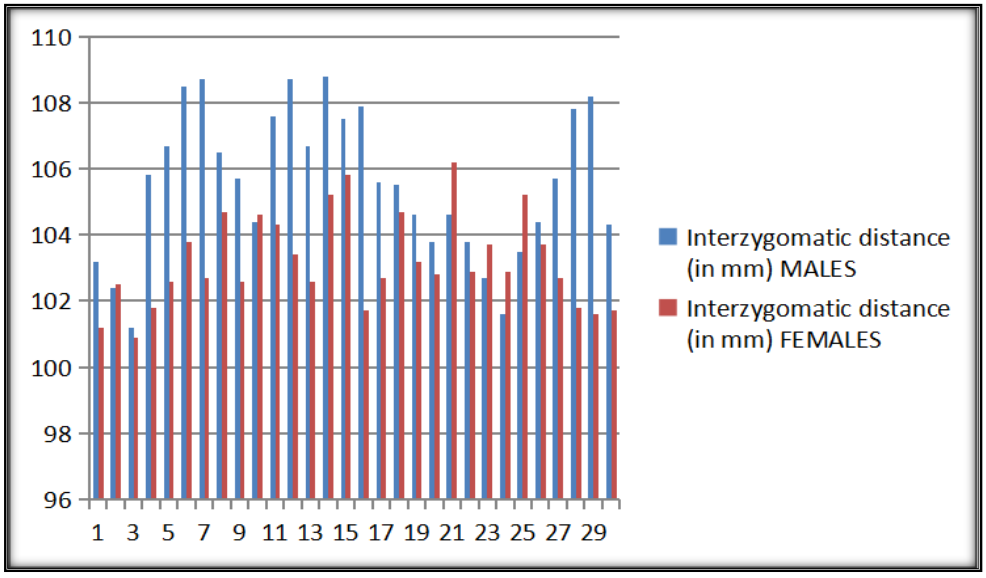


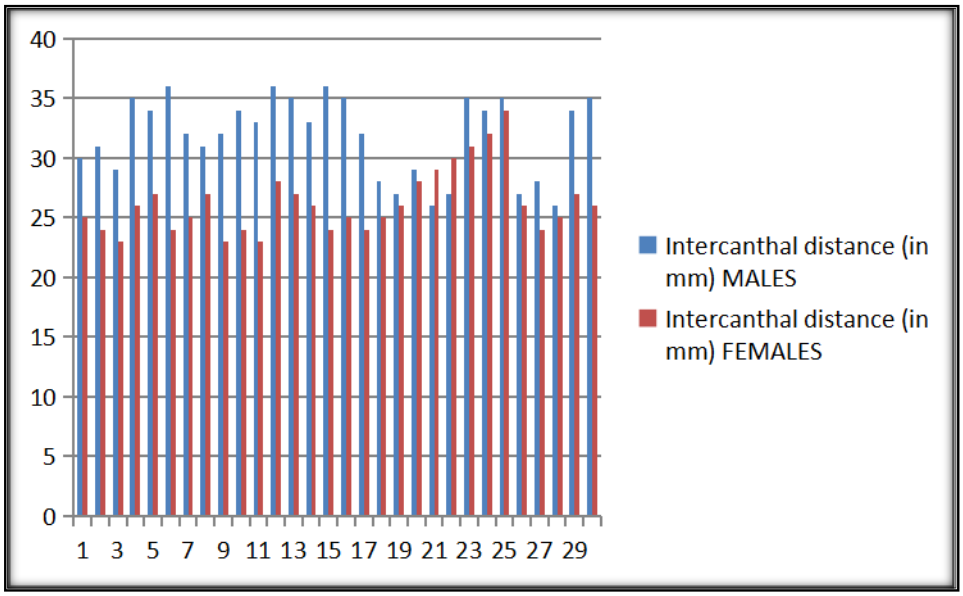
Table - 1: Mean interzygomatic and intercanthal width in males and females**.**

Males			**Females**	
S.no	**Interzygomatic distance (in mm)**	**Intercanthal distance (in mm)**	**Interzygomatic distance (in mm)**	**Intercanthal distance (in mm)**
1.	103.2	30	101.2	25
2.	102.4	31	102.5	24
3.	101.2	29	100.9	23
4.	105.8	35	101.8	26
5.	106.7	34	102.6	27
6.	108.5	36	103.8	24
7.	108.7	32	102.7	25
8.	106.5	31	104.7	27
9.	105.7	32	102.6	23
10.	104.4	34	104.6	24
11.	107.6	33	104.3	23
12.	108.7	36	103.4	28
13.	106.7	35	102.6	27
14.	108.8	33	105.2	26
15.	107.5	36	105.8	24
16.	107.9	35	101.7	25
17.	105.6	32	102.7	24
18.	105.5	28	104.7	25
19.	104.6	27	103.2	26
20.	103.8	29	102.8	28
21.	104.6	26	106.2	29
22.	103.8	27	102.9	30
23.	102.7	35	103.7	31
24.	101.6	34	102.9	32
25.	103.5	35	105.2	34
26.	104.4	27	103.7	26
27.	105.7	28	102.7	24
28.	107.8	26	101.8	25
29.	108.2	34	101.6	27
30.	104.3	35	101.7	26

Table - 2: Statistical analysis.

Stastics	**Interzygomatic width in millimeters**		**Intercanthal width in millimeters**	
	Males	Females	Males	Females
n	30	30	30	30
Mean ± SD	105.5±2.1818	103.2±1.357	31.83±3.27	26.26±2.68
Mean ± SEM	105.5±0.405	103.2±0.252	31.83±0.068	26.26±0.498
P value	0.0001		0.0001	
T, Df	T=4.9043, Df= 58		T=7.2159, Df=58	
Stastical significance	Significant ($p < 0.05$)		Significant ($p < 0.05$)	

Figure - 6: Correlation of Intercanthal distance between males and females.



Discussion

George Buschan, A pioneer in dental anthropology has done various studies about anthropometric characteristics which is of fundamental importance [4]. Many parts of the skeleton can be used for identification of a person, however the most reliable parts of the skeleton are those which are anatomically variable or which do not exhibit change due to trauma, illness or surgical intervention [5]. Matching specific features detected on the dead bodies with data recorded during the life of an individual is an important aspect in forensics, and can be performed by fingerprint analysis, deoxyribonucleic acid matching, anthropological methods, radiological methods and other techniques which can facilitate age and sex identification [6]. Determination of gender and estimation of stature from the skeleton is vital to medicolegal inquiries. Determination of sex is an important concern to the forensic anthropologist as it is critical for individual identification. Gender has long been determined from skull, pelvis, and the long bones with epiphysis and metaphysis in unknown skeletons. The use of anthropometry may arise under several circumstances, i.e., natural, intentional, and accidental (air crash, train accidents, flood, fire, etc.). The gender of an individual can be identified accurately in 80% of cases using skull alone.

In the present study, the interzygomatic arch width was significantly higher (105.5±2.1818) in males as compared to females (103.2±1.357) with P =.0.0001. The findings of the present study are in accordance with the findings of Kasaab who reported greater interzygomatic distance in males compared to females in their study among dental students of University of Mosul [7].

In the present study, the mean intercanthal width was greater (31.83±3.27) in males than females (26.26±2.68) (p= 0.0001). The results of our findings are consistent with the study done by Oladipo, et al. who reported that the intercanthal distance was significantly higher in males (3.40 ± 0.14 cm) as compared to females (3.00 ± 0.39 cm) among Nigerians [8]. Agarwal, et al. reported the intercanthal width in as (32.50 ± 2.82 mm) in males and (32.00 ± 2.67 mm) in females among the residents of Chhattisgarh region [9]. Lett, et al. reported that facial profile can vary in different ethnic groups and that the dominant characteristics of the Asian faces were a wider ICD in relation to shorter palpebral fissures compared to Caucasians [10]. Normal values of inner and outer canthal distances,

canthal index serves as useful parameters in the evaluation and treatment of congenital or post traumatic deformities of the cephalic and facial regions such as telecanthus, occular hypotelorism and craniosynostosis. Laestadius reported that in 78% of adults, the ICD is attained by the age of 1 year, after which the growth in this area is slow in contrast to outer orbital dimension [11]. According to Epker and Fish, these values are established by 6–8 years of age and do not change significantly after this time. This stable landmark can be identified, located and measured accurately [12]. Vasanthakumar, et al. did their study in Malaysian South Indian ethnic adults and found intercanthal distance to be 34.1 mm in males; and 32.77 mm in females respectively [13]. These values are very high compared to the values of present study. JR singh etal in their study found intercanthal distance as 31.5 mm and 30.9 mm in males & females respectively [14]. Our study had similar results for males, however in case of females the intercanthal distance is lesser. Harinee in her study on Kanyakumari population reported mean intercanthal distance of 32.7 mm which is slightly higher than our study [15].

Conclusion

Anthropometric measurements differ in different races, sexes and ages. The craniofacial features may serve as diagnostic markers to discriminate male and female genders and can also be used interchangeably. In the present study, we assessed two parameters to differentiate the genders. It was concluded that the measured dimensions of male was found to be larger than those of female & this difference was statistically significant. The results obtained were comparable to the previous studies & can be used as an aid in forensic anthropology for gender determination. Knowledge of mean facial dimensions is important in the evaluation of age, sex and racial differences, in clinical and in forensic application.

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