Saudi Journal of Oral and Dental Research (SJODR) **ISSN 2518-1300 (Print)**
Scholars Middle East Publishers **ISSN 2518-1297 (Online)**
Dubai, United Arab Emirates
Website: http://scholarsmepub.com/

Application of Odontometry in gender determination: A cross sectional study

Avinash Tejasvi ML[1], Harsha Bhayya[2], Pooja M[3], Pavani Donempudi[4]
[1]Associate Professor, Department of oral medicine and radiology, Kamineni Institute Dental Sciences, Sreepuram, Narketpally, Telangana, India
[2]Assistant Professor, Department of oral medicine and radiology, Kamineni Institute Dental Sciences, Sreepuram, Narketpally, Telangana, India
[3]Assistant Professor, Department of oral medicine and radiology, SB Patil Dental College And Hospital, Near Bharat Ford Showroom, Bidar Humnabad Rd, Naubad, Bidar, Karnataka, India
[4]Assistant Professor, Department of oral medicine and radiology, YCMMRDF'S Dental College And Hospital, Ahmednagar, Maharashtra, India

Original Research Article

***Corresponding author**
Dr. Harsha Bhayya

Article History
Received: 22.07.2018
Accepted: 06.08.2018
Published: 30.08.2018

DOI:
10.21276/sjodr.2018.3.8.2

Abstract: Determining sex plays important role in the identification of the unknown person. The positive identification of human remains requires the matching of physical characteristics of the deceased with records of the physical characteristics made before death. Several methods may be used to produce identification with an aggregate high level of reliability. Sex determination is usually done by osteometry, DNA analysis and even by odontometric parameters. Aim of the study was to identify gender using measurements of mesiodistal crown width of the six maxillary anterior teeth (later added to derive combined mesiodistal widths), fronto-occipital head circumference, height, and diameter of the skull on a lateral cephalography. In this study, 100 persons were evaluated. After obtaining informed consent from the subject selected, measurements of mesiodistal crown width of the six maxillary anterior teeth (later added to derive combined mesiodistal widths), fronto-occipital head circumference, height, and diameter of the skull on a lateral cephalography were performed. Combined data, male, and female data were analyzed separately for binary logistical analysis for sex determination to the parameters recorded and discriminant function equation were derived for each parameter. In the present study mean values of all the parameters were calculated and showed a statistically significant variation between males and females. Discriminant function analysis was performed for all the variables which correctly classified 91% of the cases. Our Study suggests that the discriminant functional analysis has proved that the sex of unknown sex skull can be determined using above mentioned parameters. Studies at a large scale are in need to approve or disprove the above factor.
Keywords: Height, Skull, Odontometric, Gender.

INTRODUCTION

Every human have an identity of their own, indulgent societies require that, and this identity can be recognized even after death. The need for this identity of human remains is paramount after the death of individuals which represents a basic human right. Various methods can be used for the identification of human remains, but reliability of each method varies [1]. Gender determination is of chief importance in any forensic investigation.

Sex determination is usually done by osteometry, DNA analysis and even by odontometric parameters. The only method that can give a totally accurate result is the DNA analysis, but in many cases it cannot be used as it is expensive, not readily available, involves difficult DNA extraction technique, requires qualified trained staff. On the other hand, osteometry is favoured procedure because it is more effective in determining sex. However, those bodies which are badly mutilated, consisting of fragmentary remains of a skeleton, present problems in identification and in many instances may not be identifiable at all [2].

MATERIALS AND METHODS

The study was conducted in the Department of Oral Medicine and Radiology, Kamineni Institute of dental sciences with the Representative Telangana population of 100 patients as 50 males and 50 females in the age group of 20 - 40 years. Patients were included in the present study based on presence of complete set of fully erupted, periodontally healthy teeth, presence of non-carious, non-worn teeth with no dental history of any crown restorations, Complete set of intact and satisfactorily aligned maxillary anterior teeth, no history or clinical evidence of cleft palate, orthognathic surgery or trauma and no history or clinical features suggestive of endocrinal disorders, metabolic disorders, developmental disorders and history of prolonged illness. After obtaining informed consent from the

subject selected, measurements of mesiodistal crown width of the six maxillary anterior teeth (later added to derive combined mesiodistal widths), fronto-occipital head circumference, height, and diameter of the skull on a lateral cephalography were performed. All the measurements were performed by two investigators, with one recording the measurements and the other performing radiography. The skull diameter was derived as the linear distance between the glabella and the external occipital protuberance. This distance was measured on the lateral skull cephalography. The greatest mesiodistal crown widths of the maxillary anterior permanent six teeth were measured between the anatomic contact points of each tooth on either side of the jaw, using dividers with fixing device and pointed tines to access the interproximal areas, with the instrument held parallel to the occlusal plane. Maximal fronto-occipital circumference was measured by placing a non-stretchable plastic tape (calibrated in millimeters) just on the occipital prominence and the supraorbital ridges. Height was measured as vertical distance from the vertex to the floor using a standard anthropometry. A commercially available SPSS 18 software programme was used to analyze the data. Combined data, male, and female data were analyzed separately for binary logistical analysis for sex determination to the parameters recorded and discriminant function equation were derived for each parameter.

RESULTS

In the present study mean values of all the parameters were calculated and showed a statistically significant variation between males and females.

Table-1: Mean Values of various parameters in the study population

Parameter	Male	Female	Combined male and female	p-value
Height in mm	1721.2+ 71.16	1563.5 + 50.82	1642.35 + 100.33	<0.001**
Diameter of skull	54.64 + 1.86	52.32 + 2.29	53.48 + 2.38	<0.001**
Circumference	170.48 + 10.93	158.02 + 21.87	164.25 + 18.30	<0.001**
11	8.61 +0.97	8.44 + 0.94	8.525 + 0.95	0.377 NS
12	7.01 + 0.82	7.17 + 0.93	7.09 + 0.88	0.368 NS
13	7.7 + 0.96	7.55 + 0.78	7.625 +0.72	0.306 NS
21	8.57 + 0.96	7.95 + 0.98	8.26 + 1.01	0.002**
22	6.95 + 0.80	6.82 + 0.83	6.88 + 0.82	0.432 NS
23	7.72 + 0.56	7.28 + 0.75	7.5 + 0.69	0.001**
Combined mesio-distal width of upper anterior	46.56 + 3.79	45.21 + 4.25	45.88 + 4.06	0.091NS

**-Statistically Highly Significant (p<0.01), NS – Not Significant (p>0.05)

There is statistically significant difference present in the mean values of height, diameter, circumference of skull between males and females. Odontometric parameters like tooth 21,23 showed statistically significant difference between the both genders (Table-1).

The relationship was further explored by binary logistical analysis for sex determination. Discriminant function equation derived for the determination of sex is

Y (Sex) = 74.63 - 0.034* height – 0.230*diameter – 0.043* circumference – 0.399* @ 11 + 2.89 * @12 - 1.07 * @13 – 0.35 * @21 -0.98 * @22 + 0.13 * @23

By substituting the respective values into the equation we get the y value and males are classified if Y<1.5 and females if Y>1.5

Discriminant function analysis was performed for all the variables which correctly classified 91% of the cases (Table -2).

Table-2: Predicted sex

Actual		Predicted		
		Gender		Percentage Correct
		Male	Female	
Gender	Male	45	5	90.0
	Female	4	46	92.0
Overall Percentage				91.0

When only the significant factor Height is taken into consideration, Discriminant function equation derived for the determination of sex is

Y=53.37-0.033*Height

By substituting the respective values into the equation we get the y value and males are classified if Y<1.5 and females if Y>1.5

Discriminant function analysis was performed for height which correctly classified 89% of the cases (Table-3).

Table-3: Predicted sex for height

Actual		Predicted		
		Gender		Percentage Correct
		Male	Female	
Gender	Male	44	6	88.0
	Female	5	45	90.0
Overall Percentage				89.0

When skeletal parameters and combined mesiodistal width are considered Discriminant function equation derived for the determination of sex is

Y= 61.54 - 0.033 * Height – 0.078*diameter – 0.057 * circumference + 0.139 * combined mesiodistal width of upper anteriors

By substituting the respective values into the equation we get the y value and males are classified if Y<1.5 and females if Y>1.5

Discriminant function analysis was performed for skeletal parameters and combined mesiodistal width which correctly classified 89% of the cases (Table-4).

Table-4: Predicted sex for parameters and combined mesiodistal width

Actual		Predicted		
		Gender		Percentage Correct
		Male	Female	
Gender	Male	44	6	88.0
	Female	5	45	90.0
Overall Percentage				89.0

DISCUSSION

Teeth and Crania are considered to be useful adjuncts for sex assessment and in construction of a postmortem profile, however, there is very little information regarding the relationship between tooth and cranial size. The ideology of this study was to demonstrate the extent of sexual dimorphism of teeth and cranial size in an adult Indian population and their potential in sex estimation using logistic regression analysis. Various methods are used to establish the identity of unknown human remains [3] and reliability of each method varies from author to author based on methods employed. When the body has been mutilated, it is common to have the extremities or head amputated from the trunk. An estimate must then be made based on the known relationship of the remains to stature.

Most of the studies reported in the literature used cranial index for the gender determination by calculating the cranial length and breadth. In the present study we used the diameter and circumference of the skull along with height of the individual for gender determination. Gender determination of skulls by discriminant functional analysis of the crania was performed first by Giles and Elloit. In their study, 408 known sex American white and Negro crania were used and reported that the accuracy of 82-89% is attained in determining the sex [4].

Brikby studied 104 adult human crania and evaluated the sex of the skull using discriminant functional analysis. He reported that in deformed skull, the accuracy of the sexing is 50% and in non-deformed condition it was 80% [5]. Song H. W *et al*., have done study on 60 Chinese skulls (30 male and 30 female). They have measured about Forty-one variables on each skull and reported the significance of 41 variables on discriminant functional analysis. All the variables were divided in to two groups. One group of 14 and a second group of 5 variables which were selected from all the variables by applying multiple step- wise regression on a computer. The discriminant rate for the group of 5 variables resulted in accurate sex determination in 96.7% of cases [6]. For the group of 14 variables there was 100% success rate. In the Present study discriminant functional analysis was performed for all the variables which correctly classified 91% of the cases.

Paul [7] observed that all measurements in relation to the human skull the mean dimensions of male are greater than the female which was also observed in the present study. Lund and Mornstad [8]

studied on 58 dental cast of Swedish subject, found that canine is most dimorphic than other teeth. Lysell and Myrberg [9] in their study on 1000 subjects concluded that mandibular canine is more dimorphic than other teeth. In the present study, maxillary left canine showed a statistically difference between males and females.

When only the significant factor Height is taken into consideration, Discriminant function equation derived and Discriminant function analysis was performed for height which correctly classified 89% of the cases.

CONCLUSION

Our Study suggests that the discriminant functional analysis has proved that the sex of unknown sex skull can be determined using above mentioned parameters. Studies at a large scale are in need to approve or disprove the above factor.

REFERENCES

1. Bhayya, H., Avinash Tejasvi, M. L., Pooja, M., & Donempudi, P. (2018). Odontometric and Skull anthropometric parameters for assessing stature in Nalgonda population: A cross-sectional study.
2. Grewal, D. S., Khangura, R. K., Sircar, K., Tyagi, K. K., Kaur, G., & David, S. (2017). Morphometric Analysis of Odontometric Parameters for Gender Determination. *Journal of clinical and diagnostic research: JCDR*, *11*(8), ZC09.
3. Brickley, M., & McKinley, J. I. (2004). Guidelines to the standards for recording human remains. *IFA paper*, *7*.
4. Giles, E., & Elliot, O. (1963). Sex determination by discriminant function analysis of crania. *American Journal of Physical Anthropology*, *21*(1), 53-68.
5. Birkby, W. H. (1966). An evaluation of race and sex identification from cranial measurements. *American Journal of Physical Anthropology*, *24*(1), 21-27.
6. Song, H. W., Qing, L. Z., & Tao, J. J. (1992). Sex diagnosis of Chinese skulls using multiple stepwise discriminant function analysis. *Forensic science international*, *54*(2), 135-140.
7. Kajanoja, P. (1966). Sex determination of Finnish crania by discriminant function analysis. *American Journal of Physical Anthropology*, *24*(1), 29-33.
8. Lund, H., & Mörnstad, H. (1999). Gender determination by odontometrics in a Swedish population. *The Journal of forensic odonto-stomatology*, *17*(2), 30-34.
9. Lysell, L., & Myrberg, N. (1982). Mesiodistal tooth size in the deciduous and permanent dentitions. *The European Journal of Orthodontics*, *4*(2), 113-122.