

SEXUAL DIMORPHISM IN THE LOCATION OF MANDIBULAR FORAMEN USING DISCRIMINATIVE FUNCTION ANALYSIS TEST

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ABSTRACT

Aim: To determine the sexual dimorphism of mandible based on the location of the mandibular foramen using discriminative function analysis test.

Materials and Methods: This study was carried out on 70 mandibles (43 male, 27 female) which were collected from the department of Anatomy. A total of 140 mandibular foramina (70 left and 70 right) were included in the study. The distance from the center of mandibular foramen to various anatomical land marks were measured. From the center of mandibular foramen to the anterior border of ramus of mandible, From the center of mandibular foramen to the posterior border of ramus of mandible, From the center of mandibular foramen to the inferior borders of ramus of the mandible and From the center of mandibular foramen to the the mandibular notch were measured using digital vernier calipers and data was analyzed using spss 16th version.

Results: The results showed that there is a significant difference between the distance from the center of the mandibular foramen to the anterior border and mandibular notch. Stepwise and direct discriminative analysis shows sexual dimorphism with 90% accuracy bearing Wilkin's lambda and Eigen values as 0.475 and 1.104 respectively.

Conclusion: In the present study the sex of the mandible was determined with 90% accuracy by using the distance from the center of the mandibular foramen to the borders of ramus of the mandibles.

KEY WORDS: Mandible, Sex determination, Mandibular foramen, Ramus of mandible, Discriminative functional analysis.

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Access this Article online

Quick Response code



DOI: 10.16965/ijar.2017.229

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 23 Apr 2017
Peer Review: 24 Apr 2017
Revised: None

Accepted: 23 May 2017
Published (O): 30 Jun 2017
Published (P): 30 Jun 2017

INTRODUCTION

Identification of a human is based on three important factors in the forensic science; they are age, sex and stature. Bones are the important tool for it and among human bones the pelvis and the skull are the most reliable source for sex determination [1].

However, a perfect pelvis is not present in most circumstances, and a mandible of the skull becomes an important source for sex confirmation. As a component of the skull, the mandible may be considered as second most sexually dimorphic bone. The skull is the second most sexually dimorphic region of the human skeleton apart

from pelvis. As a component of the skull, the mandible may also be considered sexually dimorphic [2]. In mass disasters it can retain its shape better than other and commonly resist post mortem damages and form an important source of information about sexual dimorphism [3].

The mandible is the largest and strongest bone in the face with a horizontally curved body that is convex forwards with two broad rami, which ascend from the posterior end of the body. The rami bears the coronoid and condyloid processes. The mandibular foramen (MF) is located above the center on the medial surface of the ramus of the mandible. The mandibular canal starts at the MF and descends obliquely forward in the ramus and later in the body of mandible containing the inferior alveolar neurovascular bundle [4].

In general male mandibles are large, prominent muscular attachment sites and slightly more robust than the female mandibles. The outer appearance of male mandibles is usually irregular, whereas that of females is likely to be even. Several non-metric traits of the mandible have been associated with sex. This contradiction may be caused by relative development of the musculoskeletal system in different sexes. Therefore, mandibular size and shape is affected by variable lifestyles, dietary behaviour, and also racial groups [2].

So the study was carried out to assess the sexual dimorphism in mandible. The sex predetermined on the basis of the skull was taken as standard and accordingly 27 female and 43 male mandibles were taken in the present study.

MATERIALS AND METHODS

This study was carried out on 70 mandibles (43 male, 27 female) which were collected from the department of Anatomy. Total of 140 mandibular foramen (70 left and 70 right) were included in the study. The sex of the mandible was determined according to the following criteria: Gonial eversion marked in males/absent in females; Chin square in males/rounded or pointed in females; Male mandible robust, larger, broader/female slender, smaller; In males lateral aspect of angle shows rough appearance. In females, the lateral aspect of the angle is comparatively

smooth.

Fig. 1: Showing the distance from the center of mandibular foramen to the anterior border of ramus of mandible.



Fig. 2: Showing the distance from the center of mandibular foramen to the posterior border of ramus of mandible.



Fig. 3: Showing the distance from the center of mandibular foramen to the inferior borders of ramus of the mandible.



The following metric parameters were used to locate the mandibular foramen. The distance from the center of mandibular foramen to various anatomical land marks were measured.

From the center of mandibular foramen to the anterior border of ramus of mandible (Figure 1), From the center of mandibular foramen to the posterior border of ramus of mandible (Figure 2), From the center of mandibular foramen to the inferior borders of ramus of the mandible (Figure 3) and From the center of mandibular foramen to the the mandibular notch (Figure 4) were measured using digital vernier calipers and data was recorded.

Fig. 4: Showing the distance from the center of mandibular foramen to the mandibular notch.

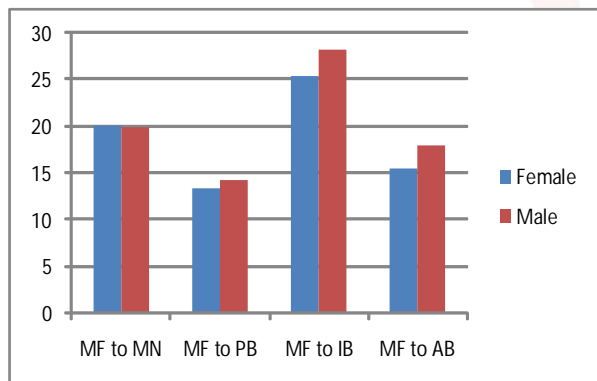


RESULTS

Table 1: Showing the Gender variation in the location of the mandibular foramen.

Parameter	Gender	Range	Mean	SD
MF to MN	Female	13.3- 25.3	20.1	2.49
	Male	11.1- 26.7	19.9	3.06
MF to PB	Female	10.1 – 21.3	13.4	1.99
	Male	10.7 – 20.5	14.3	1.8
MF to IB	Female	14.7 – 34.0	25.5	3.69
	Male	21.1 – 39.3	28.2	3.84
MF to AB	Female	10.73 – 19.7	15.56	16.27
	Male	13.23 – 23.1	17.97	17.41

Fig. 5: Showing the gender variation in bar diagram.



The average distance between the mandibular foramen to mandibular notch, the posterior border of ramus, the inferior border of ramus

and the anterior border of ramus in male and female mandibles were recorded in table 1. Significant difference was observed between male and female mandibles (Figure 5)

The data was processed for functional discriminative analysis by using SPSS software (Version 16). Discriminative functional analysis was developed for all the variables and presented in table 2. The variable distance from the mandibular-foramen to anterior border was found to be most dimorphic for sex determination followed by distance between mandibular foramen to superior and inferior borders (Table 2,3,4). The eigen value was found to be 1.104 and the Wilks' Lambda was found to be 0.475 which variable contributes significance in discriminat function. In the present study the mandibles were classified into male and female groups with 90.0% of accuracy (Table 5).

Table 2: Variables in the analysis.

STEP	Tolerance	F to Remove	Min D Squared	Between Groups
1 MF - AB	1	35.644		
2 MF - AB	0.994	21.017	1.842	.00 and 1.00
MF - MN	0.994	16.697	2.149	.00 and 1.00
3 MF - AB	0.992	19.502	2.56	.00 and 1.00
MF - MN	0.993	15.189	2.913	.00 and 1.00
MF - IB	0.997	6.942	3.706	.00 and 1.00

Table 3: Eigen values.

Function	Eigen value	% of variance	Cumulative %	Canonical correlation
1	1.104	100	100	0.724

Table 4: Wilks' Lambda test.

Test of functions	Wilk's Lambda	Chi-square	Df	Sig
1	0.475	49.474	3	0

Table 5: Group classification.

Gender		Predicted group membership		Total
		Female	Male	
Original	Count	F 22	M 5	27
	%	F 81.5	M 18.5	100
Cross validated	Count	F 22	M 5	27
	%	F 81.5	M 18.5	100

90.0% of original grouped cases are correctly classified

DISCUSSION

Many researchers carried out studies on sex determination of mandible based on the

morphological features of mandible such as robustness of the mandible, ramus flexure, gonial eversion, square shape of chin, etc., but unlike skull, determination of sex from isolated mandible poses problems even for an experienced examiner. Very few studies describing the discriminant function analysis of mandibles, but due to population specificity of the discriminant function, the results obtained in one area cannot be applied to other area [6]. The discriminant function analysis of mandibles on location of the mandibular foramen was not considered in any studies. The present study was focused on determination of sex of the mandible based on the location of the mandibular foramen in south Indian population.

The results of the present study were compared with other studies done on different population groups. Giles et al., studied on mandibles of American whites and blacks with eight variables and discriminated sex with 84% accuracy, whereas Hanihara et al., had used four variables of mandibles belonging to Japanese population and discriminated the sex by 85% accuracy [7,8]. Dayal et al., studied six mandibular measurements of South African Blacks and noted that average accuracy for sexing varies from 80 to 85% [9]. In all the above studies location of the mandibular foramen was not considered at all. The present study focused on the location of the mandibular foramen and the results of the present study reported determination of sex of the mandible with 90% accuracy.

Location of mandibular foramen can be considered in determination of sex when complete mandible is not available for analysis. Most of the other parameters like bicondylar breadth, coronoid breadth and bigonial breadth need complete mandibles. When a piece of ramus of mandible was found in forensic and or anthropological analysis, the sex determination can be done based on the location of the mandibular foramen.

CONCLUSION

The uniqueness of the craniofacial features is well known and comparison of the Ante mortem and post-mortem skull configurations may contain sufficiently distinctive patterns for personal identification, even in very badly hurt

bodies. This study has resulted in development of population specific data for south Indian population. The result of present study is promising, and the studied MF showed, sexual dimorphism with accuracy comparable with other skeleton elements next to cranium and pelvis.

Conflicts of Interests: None

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How to cite this article: Shiny Vinila B H, Eshwar T, John Jims V, Sri Kavya T. SEXUAL DIMORPHISM IN THE LOCATION OF MANDIBULAR FORAMEN USING DISCRIMINATIVE FUNCTION ANALYSIS TEST. *Int J Anat Res* 2017;5(2.3):3964-3967. **DOI:** 10.16965/ijar.2017.229