Original Research Article

STUDY OF MANDIBULAR RAMUS AS PREDICTOR OF SEX

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ABSTRACT

Background: Methods based on measurements and morphometry are accurate and can be used in determination of sex. Even the bony remains like mandibular ramus can be used to predict the sex of the individual which will be of help for forensic experts. Morphometry of mandibular ramus will also be of importance for anthropologists, anatomists and prosthetists.

Materials and Methods: Coronoid height, maximum ramus breadth, minimum ramus breadth and maximum ramus height was measured in 200 adult cadavers.

Results: The coronoid height varied from 42.02 mm to 68.46 mm in males and it varied from 40.08 mm to 66.76 mm in females. The maximum ramus breadth in male mandible varied from 28.84 mm to 42.28 mm and in females it varied from 27.44 mm to 41.42 mm. The minimum ramus breadth in males varied from 21.92 mm to 36.80 mm, in females it varied from 17 mm to 34.26 mm. The maximum ramus height in males varied from 47.76 mm to 68.64 mm and in females it varied from 42.56 mm to 69.56 mm.

Conclusion: All the parameters measured were higher in males than females. Comparison studies revealed that the South Indian parameters were lesser than Thais, Croatians and Africans.

KEYWORDS: Mandibular ramus, Coronoid height, Ramus height, Ramus breadth.

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INTRODUCTION

The identification of sex from human remains is of fundamental importance in criminal investigations as well as in the identification of missing persons and in attempts at reconstructing the lives of ancient populations [1]. Sex identification is of significance in cases of mass fatality incidents where bodies are damaged beyond recognition and it depends largely on the available parts of skeleton [2]. Sex can beestablished from a gross examination of the skeleton using either metric or morphological techniques. They should be used in conjunction to produce the most accurate and complete assessment of sexual dimorphism. Metric methods of sex determination is beneficial when compared to morphological methods, because they rely on standard landmarks [3].

The skeletal components most often investigated for gender determination are the pelvis and the skull. Pelvis helps to accurately determine the sex in 95% cases, skull alone in 90% cases, both

pelvis and skull in 98% and long bones in 80% cases [4].

Since a complete pelvis and skull is not always present; it is essential to obtain as much detail as possible from less obvious components. The Mandible is appropriate for the study because it is the most durable facial bone, it retains its shape better than others and it is most dimorphic. Ramus of mandible and mandibular condyle is considered most dimorphic. [5].

Numerous studies have clearly demonstrated that skeletal characteristics vary by population and that there is a need for population specific standards for sex determination [6]. Most of the parameters in Indian mandibles differ markedly from other ethnic groups. Such a racial variation is expected to exist because of genetic makeup and social habits of different races.

The present study was conducted with an aim to get more information about Mandibular ramus in South Indian population and to use it as a predictor for sex determination.

MATERIALS AND METHODS

The study was conducted on 200 adult mandibles, which were obtained from Kasturba Medical College, Mangalore and Manipal, JSS Medical College, Mysore. The damaged mandibles, mandibles presenting significant alveolar resorption due to excessive tooth loss were excluded from the study.

All the measurements were taken in millimeters and degrees using sliding vernier calipers, protractor and measuring scale.

The randomly numbered bone was subjectively sexed, independently, using morphological features given in the standard textbooks of Anatomy, Anthropometry, and Forensic science.

The following measurements of mandibular ramus were recorded on randomly numbered mandibles (figure 1 and 2):

1. Coronoid Height: Distance between superior most point on coronoid process and basal border of the mandibular body.

2.Maximum Ramus Breadth: Distance between the most anterior point on them mandibular ramus and a line connecting the most posterior point on the condyle and the angle of the jaw.

3.Minimum Ramus breadth: It is the smallest breadth of the mandibular ramus and is measured perpendicularly to the height of ramus.

4. Maximum Ramus height: Direct distance from the highest point on the mandibular condyle to gonion.

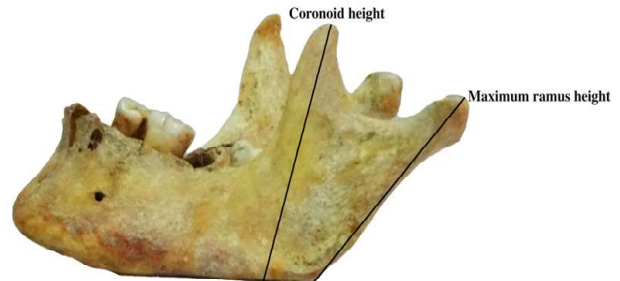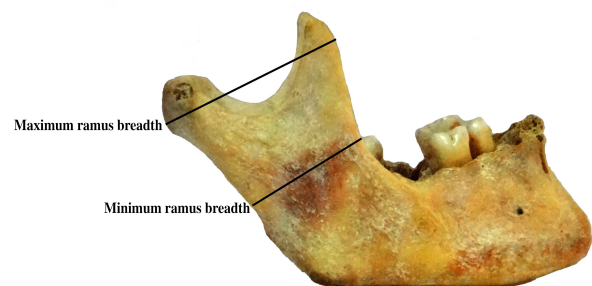**Fig. 1:** Coronoid height and maximum ramus height.

Fig. 2: Maximum and minimum ramus breadth.

RESULTS AND DISCUSSION

There has been many quantitative studies describing the morphometry of mandible in different population, but the literature regarding Indian mandibles were very few. This study is an effort to know more about mandibular morphometry in South Indian mandibles and its usefulness in determining the sex. Since the literature says that anatomical variation of mandible exists between different populations, the different parameters of the present study has been compared with the parameters of mandibles in foreign studies.

The coronoid height in males varied from 42.02 mm to 68.46 mm with an average of 58.20 ± 4.70 mm. In females it varied from 40.08 mm to 66.76 mm, with an average of 55.59 ± 5.25 mm. It was observed that the coronoid height in males was 2.61 mm higher than that of the females and the differences were statistically very highly significant (p= 0.000). [Table 1]

The mean coronoid height of males and females (58.20 mm and 55.59 mm) in the present study

is much lesser than the values obtained by N. Ongkana on Thai mandibles (64.8 mm in males and 59 mm in females) [7] and radiographic values obtained by Tejavathi Nagaraj et al (69.13 mm in males and 65.88 in females) [8]. In all these studies it was observed that, the coronoid height is higher in males than in females and the differences were very highly significant (p<0.001) on statistical analysis. Coronoid height alone is considered as single best parameter to predict sex with an accuracy of 74.1% [9].

The maximum ramus breadth in male mandible varied from 28.84 mm to 42.28 mm with an average of 35.82 ± 3.09 mm. In females it varied from 27.44 mm to 41.42 mm, with an average of 34.19 ± 3.17 mm. It was been observed that the maximum ramus breadth in males was 1.63 mm broader than that of the females and the differences were statistically very highly significant (p= 0.000). [Table 1]

The mean maximum ramus breadth of males and females (35.82 mm and 34.17 mm) in the present study is lesser than the values obtained by Vodanovic M on Croatian mandibles (44.20 mm in males and 41.23 mm in females) [10] and lesser than values obtained by Tejavathi Nagaraj et al (40.55 mm in males and 39.44 in females) [8]. In all these studies it was observed that, the maximum ramus breadth is greater in males than in females and the differences were very highly significant (p<0.001) on statistical analysis.

The minimum ramus breadth in males varied from 21.92 mm to 36.80 mm with an average of 28.89 ± 2.95 mm. In females it varied from 17 mm to 34.26 mm, with an average of 27.49 ± 3.18 mm. Minimum ramus breadth in males was 1.40 mm broader than that of the females and the differences were statistically very highly significant (p= 0.000). [Table 1]

The mean minimum ramus breadth in males and females (28.89 mm and 27.49 mm) in the present study is lesser than that of the study done by Vodanovic on Croatians (31.26 mm in males and 28.36 mm in females) [10], N. Ongkana on Thais (32.8 mm in males and 31.4 mm in females) [7] and and lesser than values obtained by Tejavathi Nagaraj et al (33.50 mm in males and 32.63 mm in females) [8].

In all these studies it was observed that the minimum ramus breadth is greater in males than the females and the differences were highly significant (p<0.01) on statistical analysis.

The maximum ramus height in males varied from 47.76 mm to 68.64 mm with an average of 59.21 ± 4.69 mm. In females it varied from 42.56 mm to 69.56 mm, with an average of 55.55 ± 4.93 mm. Maximum ramus height in males was 3.66 mm taller than that of the females, and the differences were statistically very highly significant (p= 0.000). [Table 1]

The mean maximum ramus height in males and females (59.21 mm and 55.55 mm) in the present study is lesser than that of the study done by Mbajiorgu on Zimbabweans (59.8 mm in males and 61.3 mm in females) [11], Vodanovic on Croatians (67.42 mm in males and 61.46 mm in females) [10] and N. Ongkana on Thais (68.1 mm in males and 62.6 mm in females) [7].

Except in the study done by Mbajiorgu on Zimbabweans, all other studies showed that the maximum ramus height is greater in males than in females, but in the observation done by Mbajiorgu ramus height was more in females than in males. All these studies showed very highly significant differences between the males and females (p<0.001) on statistical analysis.

Table 1: Comparative statistics of male and female mandible.

Parameter	Sex	Range	Mean ± Standard deviation	p value
Coronoid height	Male	42.02 – 68.46	58.20 ± 4.70	P = 0.000 Very highly significant
	Female	40.08 – 66.78	55.59 ± 5.25	
Maximum ramus breadth	Male	28.84 – 42.28	35.82 ± 3.09	P = 0.000 Very highly significant
	Female	27.44 – 41.42	34.19 ± 3.17	
Minimum ramus breadth	Male	21.92 – 36.8	28.89 ± 2.95	P = 0.001 Very highly significant
	Female	17 – 34.26	27.49 ± 3.18	
Maximum ramus height	Male	47.76 – 68.64	59.21 ± 4.69	P = 0.000 Very highly significant
	Female	42.56 – 69.56	55.55 ± 4.93	

CONCLUSION

Mandibular ramus was studied to appreciate its value as a predictor of sex. Coronoid height, Maximum ramus breadth, minimum ramus breadth and maximum ramus height was measured, statistically analysed and compared with previous studies. All the parameters measured were higher in males than females. Comparison studied revealed that the South Indian parameters were lesser than Thais, Croatians and Africans.

These morphometric findings on mandibular ramus can be used to predict the sex of the bony remains which will be of help for forensic experts, the study also emphasizes the inter-population variation which will be of importance for anthropologists, anatomists and prosthetists.

Conflicts of Interests: **None**

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