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ORIGINAL RESEARCH

A Study of some Morphometric Parameters of Human Mandible for Determination of Sex in Jaipur District

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Introduction:

Identification of individuals from skeletal remains is an important activity in medico legal, anthropological, archaeological and academic fields.

Determination of sex is one of the important, or, rather primary step in the process of identification of individuals from skeletal remains[1]

This is because, the other supplementary data i.e. determination of age, stature etc. are dependent on sex. Although many methods like Non-metric (Morphological) features, Anatomy, study of soft tissues, forensic odontology, DNA analysis, molecular methods etc. can be used for determining a person's gender; we found the metric methodology to be the most beneficial[2]

This was due to the fact that the results obtained via.

Metric methodology can be easily correlated with the studies of other researchers[3]

If we look at the current scenario of crimes, we see that, there is a deliberate attempt to obscure the identity of the victim by mutilation, burning, burying etc. Therefore, many a times only a portion of the body is available.[4] If only bones or bone fragments are available for study then pelvis and skull provide the best means for sex determination.In the absence of pelvis, the mandible is considered to be an essential source of sex identification.[5]

Mandible is one of the strong bones, and is well preserved against usual environmental conditions.[6,7] This was the reason for selecting mandible.

The phenotypical characteristics of mandible change with age, sex and race.[8]

Also, many different studies, where, different population were compared showed significant sexual dimorphism in mandibular morphology between the two genders and between the different population groups.[9]

Many factors influence the morphological features of mandible such as ecological, racial, genetic etc.[10,11] This was the reason because of which, a study in Jaipur region was found to be necessary. Currently, the determination of sex from mandible,especially during medico-legal examination is based primarily on morphological features which may yield wrong results due to the lack of experience or knowledge or even bias, on the part of the examiner.

We feel the metric methodology (Morphometric Parameters) would be more scientifically accurate, free from bias and can be correlated to other researchers.[12]

In the present study we analysed morphological & some morphometric parameters of mandible in the region of Jaipur District.

The use of both will increase the ability and precision in determination of sex of mandible.

Materials & Methods

The present study was conducted on 85 dry human mandibles of the region of Jaipur District. These were obtained from the Dept. of Forensic Medicine and the Dept. of Anatomy of JNU IMSRC Jaipur.

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Inclusion Criteria: Intact and well formed Mandible

Exclusion Criteria: Deformed, Damaged and Edentulous Mandible.
Using the knowledge of morphological features, the mandibles were grouped into Male and Female bones.

We segregated them into 45 male and 40 female bones.
Following five Morphometric parameters were observed and analysed[1]

1. Bimental Breadth: The distance between the two Mental Foramina at their inner margins over the bone.
2. Bigonial Breadth: A straight line separating two Gonias.
3. Coronoid Height: Distance between the Coronion and the inferior border of the bone.
4. Condylar Height: The distance between the tubercle, or most protruding part of the inferior border of the ramus of the mandible and the most superior location on the mandibular condyle.
5. Mandibular Index: Length of the lower jaw / Bicondylar Breadth X 100

Method of the study: The data of the observations of the parameters was obtained by using Digital Vernier Calipers.

Statistical Analysis: All the measurements obtained during observations of all the morphometric parameters were initially recorded and documented in Microsoft Excel in Spreadsheet programme. Later, 'Graphpad Prism (online)' was used for Statistical Analysis of the data. The results were analysed by using 'T- test Calculator' present in 'Graph pad Prism' by the application of 'Unpaired T- test'. Through this, we could obtain the 'p' value, the confidence interval, the T value, Mean, Standard Deviation, SEM (Standard Error of Mean).

Results
We studied and examined 45 male and 40 female adult female mandibles. The Mean and SD (Standard Deviation) values (in mm) of all the five Morphometric Parameters is given in Table No. 1.

Table: 1. Descriptive Analysis of Morphometric Parameters in Male and Female Mandibles

Morphometric Parameter	Gender	Mean ± SD	p- value
Bimental Breadth	Male	3.06 ± 0.45	0.41
	Female	2.64 ± 0.42	
Bigonial Breadth	Male	6.82 ± 1.34	<0.05
	Female	6.62 ± 1.77	
Coronoid Height	Male	4.40 ± 1.57	<0.05
	Female	3.94 ± 1.35	
Condylar Height	Male	4.97 ± 1.49	<0.05
	Female	4.54 ± 1.35	
Mandibular Index	Male	3.80 ± 1.22	0.13
	Female	3.92 ± 1.68	

We used the T-test calculator and found that the mean values were significantly higher in case of Coronoid Height, Condylar Height and Bigonial Breadth. The higher SD in males in all of these three parameters denote that Male mandibles show greater variability as compared to females.
While in the case of Bimental Breadth and Mandibular Index, it was not so.

Discussion
The morphological features of mandible differ significantly according to ethnicity, race and sex. Determination of sex is heavily dependent on morphological and morphometric characteristics of human mandible.[13,14] An individual's diet, lifestyle and surrounding environment also affect the morphometric parameters.[15] The morphometric parameters are more objective, reproducible and do not suffer from Examiner Bias.
We found a significant correlation between Condylar Height and Sex in our study (Table- 1). Jyothsna et.al. reported the findings for Male Condylar Height in their study. The Mean and SD of Mandibular Condylar Height in Males and Females respectively, were 4.97 ± 1.49 cm and 4.54 ± 1.35 cm each.[16]
Kumar et.al. recorded their findings of the Condylar Height as 4.97 ± 1.49 cm in Males and 4.54 ± 1.35 cm in Females.[1]
In our study, we found the mean value of Condylar Height in Males as 4.97 ± 1.49 cm and in Females as 4.54 ± 1.35 cm. Our study found a 'Statistically Significant Difference' between Male and Female Mandibles.

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Ongkana&Sudwan reported the Mean Coronoid Height for Males and Females to be 6.48 ± 0.50 cm and 5.98 ± 0.58 cm respectively.[17]

Kumar et.al. reported the values as 4.40 ± 1.57 cm and 3.94 ± 1.35 cm in Males and Females respectively.[1]

In our study, we found the mean value of Coronoid Height in Males as 4.40 ± 1.57 cm and in Females it was 3.94 ± 1.35 cm. Our study found a 'Statistically Significant Difference' between Male and Female Mandibles.

Saini et. al. reported that the Coronoid Height is the best predictor for Sex Determination of Mandible.[18]

Jaykaran et.al. reported for Bigonial Breadth, that in Male the mean was 9.38 ± 0.54 cm while in Female it was 8.71 ± 0.58 cm.[19]

Ranganath et.al. reported the Mean Bigonial Breadth of Male and Female Mandibles to be 8.68 ± 1.37 cm and 8.62 ±0.72 cm respectively.[20]

In our study, we found the mean value of Mean Bigonial Breadth in Males as 6.82 ± 1.34 cm and in Females as 6.62 ± 1.77 cm. Our study found a 'Statistically Significant Difference' between Male and Female Mandibles.

Kranioti et.al. reported that the average of Bimental Breadth in Male and Female was 44.55 mm and 43.82 mm respectively, but it was Not Statistically Significant.[21]

Kumar et.al. reported the Mean value of Bimental Breadth in Males as 3.06 ± 0.45 cm and in Females as 2.64 ± 0.42 cm, with No Statistical Significance.[1]

In our study, we found the mean value of Bimental Breadth in Males as 3.06 ± 0.45 cm and in Females as 2.64 ± 0.42 cm. Our study found 'No Statistically Significant Difference' between Male and Female Mandibles.

Vinay et.al. reported that the Mean Mandibular Index in Males was 66.52 ± 4.42 mm and in Females it was 66.41 ± 5.69 mm. The Mandibular Index value was Not Statistically Significant.[14]

Kumar et.al. reported the mean value of Mandibular Index in Males as 3.80 ± 1.22 cm and in Females as 3.92 ± 1.68 cm[1]. This was Not Statistically Significant.

In our study, we found the mean value of Mandibular Index in Males as 3.80 ± 1.22 cm and in Females as 3.92 ± 1.68 cm. Our study found 'No Statistically Significant Difference' between Male and Female Mandibles.

Summary & Conclusion

The basic aim of this study was to determine sex of mandible based on morphological and morphometric parameters and to verify and confirm the gender with morphometric parameters.

From our study, we can conclude with statistically certainty that morphometric parameters like condylar height, coronoid height and bigonial breadth; can be and should be used for identifying the sex. These can be helpful in not only unidentified bodies but also in mutilated ones.

Although in our study,bimental breadth and mandibular index were found to be of no statistical significance yet we feel that more work can be done on not only these two, but many more morphometric parameters, for the purpose of strengthening of the existing information.

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