STUDY OF SEXUAL DIMORPHISM IN HUMAN MANDIBLE

Dr. Sana Khan*	Assistant Lecturer, Dept. of Anatomy, MGM Medical College and Hospital Chh. Sambhajinagar (Aurangabad). *Corresponding Author
Dr Shaikh Shamama	Associate Professor, Dept. of Anatomy, MGM Medical College and Hospital Chh. Sambhajinagar (Aurangabad).
Dr Gautam A. Shroff	Professor & Head, Dept. of Anatomy, MGM Medical College and Hospital Chh. Sambhajinagar (Aurangabad).
Dr. Smita Shinde	Associate Professor, Dept. of Anatomy, MGM Medical College and Hospital Chh. Sambhajinagar (Aurangabad).
Mr. Pawan Sonawane	Assistant Lecturer, Dept. of Anatomy, MGM Medical College and Hospital Chh. Sambhajinagar (Aurangabad).

ABSTRACT **Introduction:** Data from the morphology and metric aspects of the skull, mandible, soft tissues, forensic odontology, and DNA analysis of teeth can all be used to detect sexual dimorphism. The mandible is the face bone that holds its shape the best out of all of them2. The mandible is the primary articulating section of the skull and its strongest and most mobile component. Its physical characteristics vary according to race, sex, and age. Mandible is the best choice to determine the sex, since it resists environmental and post mortem changes. Morphometric study of the mandible and its correlation with sex performs valuable role in the anthropological diagnosis. In present study attempts have been made to study role of Bigonial and Bicondylar Breadth in mandible in determining the gender. **Materials and Methods:** Present cross-sectional study was conducted from duration Jan. 2023 to May 2024. 59 adult dry, complete, undamaged human mandibles available in the Anthropology Museum of Department of Anatomy of MGM medical colleges were collected. The sex of the respective skull was known and the study was envisaged to confirm the sexual dimorphism in the mandible. Bigonial and Bicondylar Breadth were calculated in all. Sex as predetermined on the basis of skull and that determined from Bigonial and Bicondylar Breadth was taken into account. After all the measurements were done, observations in the male and female bones were statistically analysed. **Observations and Results:** Bigonial length (cm) Mean ±SD in males was 9.402 ±0.604 and in females it was 8.968 ±0.452. Difference was statistically significant (P=0.007). Sensitivity of Bigonial length for male was found as 24.39 % and for female as 72.22 %. Bicondylar length (cm) Mean ±SD in males was 11.201 ±0.599 and in females it was 10.979 ±0.489. Difference was not statistically significant (P=0.174). Sensitivity of Bicondylar length for male was found as 48.78 % and for female as 94.44 %. **Conclusion:** In present study bigonial breadth and bicondylar breadth was used for gender determination. Mean values of both bigonial breadth and bicondylar breadth in males were found higher than the females. Apart from application in gender discrimination these parameters could be a useful tool in case of treatment of dentofacial conditions

KEYWORDS : Bigonial Breadth, Bicondylar Breadth

INTRODUCTION

Data from the morphology and metric aspects of the skull, mandible, soft tissues, forensic odontology, and DNA analysis of teeth can all be used to detect sexual dimorphism[1]. Since it will be the basis for future interpretations and analyses, determining the sex of bones is a crucial component of research in anthropology and forensic science. Typically, morphological and metric techniques are employed to identify a bone's sex. The skull and pelvis are the most trustworthy human bones for determining a person's sex. When the pelvis is not complete, the mandible becomes a crucial source of sex confirmation. The mandible is the face bone that holds its shape the best out of all of them[2]. The mandible is the primary articulating section of the skull and its strongest and most mobile component. Its physical characteristics vary according to race, sex, and age[4]. Dental records are typically used to identify and determine the sex of victims in explosions, conflicts, aeroplane crashes, and earthquake disasters. Sex diagnosis of unknown mandibles is done when dental records are either nonexistent or unavailable. Loth and Henneberg (1996)[5] noted that the mandibular ramus flexure was used to differentiate between genders, and studies by Koski (1996), Indryana et al., Donnely et al., and Hill (2000) confirmed this use[6]. Following this, other attempts have been undertaken to investigate the morphological and osteometric characteristics of the mandibles of Koreans, indigenous people, and white and black South Africans in order to distinguish between males and females[2]. The importance of population-specific norms was underlined in these papers. Mandible is the best choice to determine the sex, since it resists environmental and post mortem changes. Morphometric study of the mandible and its correlation with sex performs valuable role in the anthropological diagnosis. In present study attempts have been made to study role of Bigonial and Bicondylar Breadth in mandible in determining the gender

Aims & Objectives

• To assess the accuracy of bigonial and bicondylar breadth in determination of sex of human dry mandibles

MATERIAL AND METHODS

Present cross-sectional study was conducted from duration Jan. 2023 to May 2024. Institutional ethics committee permission was taken prior to commencement of study. 59 adult dry, complete, undamaged human mandibles available in the Anthropology Museum of Department of Anatomy of MGM medical colleges were collected. The sex of the respective skull was known and the study was envisaged to confirm the sexual dimorphism in the mandible. Bigonial and Bicondylar Breadth were calculated in all. Only well-formed adult mandibles without any deformity were subjected for the study.

A. Bigonial breadth: It is the straight distance between two gonia
B. Bicondylar breadth: It is the straight distance between the most lateral points on the two condyles

Sex as predetermined on the basis of skull and that determined from Bigonial and Bicondylar Breadth was taken into account. After all the measurements were done, observations in the male and female bones were statistically analysed. Student "t" test was performed. Mean and standard deviation were calculated for the ranges of each parameter of both the genders. P value was determined to assess the significance of the observations

OBSERVATION AND RESULT
Table 1: Bigonial Length

Sr No	Details of measurements	Gender	
		Male	Female
1	No of bones	41	18
2	Range (cm)	8.13-10.673	8.007-9.54
3	Mean (cm)	9.402	8.968

4	Standard deviation	0.604	0.452
5	t value	-2.77	
6	P value	0.007 (S)	

As shown in Table 1, Bigonial length (cm) Mean ±SD in males was 9.402 ±0.604 and in females it was 8.968 ±0.452. Difference was statistically significant (P=0.007)

Table 2: Bicondylar Length

| Sr No	Details of measurements	Gender	
		Male	Female
1	No of bones	41	18
2	Range (cm)	9.972-12.667	9.796-11.763
3	Mean (cm)	11.201	10.979
4	Standard deviation	0.599	0.489
5	t value	-1.375	
6	P value	0.174 (NS)	

As shown in Table 2, Bicondylar length (cm) Mean ±SD in males was 11.201 ±0.599 and in females it was 10.979 ±0.489. Difference was not statistically significant (P=0.174)

Table 3: Bigonial Length Sensitivity

Sr No	Based on Bigonial length	Gender		Total n (%)
		Male n (%)	Female n (%)	
1	Male	10 (16 %)	5 (9 %)	15 (25 %)
2	Female	31 (53 %)	13 (22 %)	44 (75 %)
	Total n (%)	41 (69 %)	18 (31 %)	59 (100 %)
Sensitivity for Male 24.39 % & Female 72.22 %				

As shown in Table 3, 10 (16 %) mandibles were identified as male on the basis of Bigonial length as well as in the already available data. 13 (22 %) mandibles were identified as female on the basis of Bigonial length as well as in the data. 31 (53 %) mandibles were identified as female on the basis of Bigonial length but were of male based on data and 5 (9 %) mandibles were identified as male on the basis of Bigonial length but were of female based on data. Sensitivity of Bigonial length for male was found as 24.39 % and for female as 72.22 % (Graph 1)
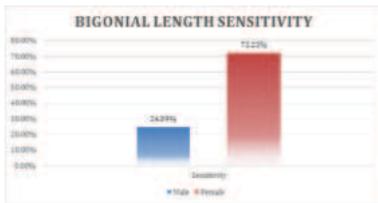

Graph 1: Bigonial Length Sensitivity

Table 4: Bicondylar Length Sensitivity

Sr No	Based on Bicondylar length	Gender		Total n (%)
		Male n (%)	Female n (%)	
1	Male	20 (34 %)	1 (2 %)	21 (36 %)
2	Female	21 (35 %)	17 (29 %)	38 (64 %)
	Total n (%)	41 (69 %)	18 (31 %)	59 (100 %)
Sensitivity for Male 48.78 % & Female 94.44 %				

As shown in Table 4, 20 (34 %) mandibles were identified as male on the basis of Bicondylar length as well as in the already available data. 17 (29 %) mandibles were identified as female on the basis of Bicondylar length as well as in the data. 21 (35 %) mandibles were identified as female on the basis of Bicondylar length but were of male based on data and 1 (2 %) mandibles were identified as male on the basis of Bicondylar length but were of female based on data. Sensitivity of Bicondylar length for male was found as 48.78 % and for female as 94.44 % (Graph 2)
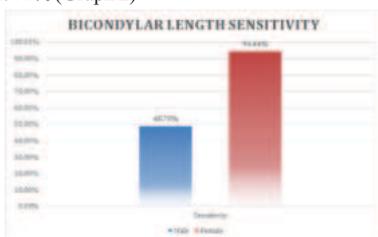
Graph 2: Bicondylar Length Sensitivity

DISCUSSION

Mandible is the largest, strongest and lower jaw bone in the face. It has lower teeth and gives attachment to the muscles of mastication. Mandible is the best choice to determine the sex, since it resists environmental and post mortem changes. Morphometric study of the mandible and its correlation with sex performs valuable role in the anthropological diagnosis. Mandible represents a reliable skeletal resistance to environmental factors, being usually well-preserved even in archaeological context. In present study attempts have been made to study role of Bigonial and Bicondylar Breadth in mandible in determining the gender. 59 adult dry, complete, undamaged human mandibles available in the Anthropology Museum of Department of Anatomy were evaluated and bigonial and bicondylar breadth was calculated in all. Sex as predetermined on the basis of skull and that determined from Bigonial and Bicondylar Breadth was taken into account. After all the measurements were done, observations in the male and female bones were statistically analysed. In present study Bigonial length (cm) Mean ±SD in males was 9.402 ±0.604 and in females it was 8.968 ±0.452. Difference was statistically significant (P=0.007). 10 (16 %) mandibles were identified as male on the basis of Bigonial length as well as in the already available data. 13 (22 %) mandibles were identified as female on the basis of Bigonial length as well as in the data. 31 (53 %) mandibles were identified as female on the basis of Bigonial length but were of male based on data and 5 (9 %) mandibles were identified as male on the basis of Bigonial length but were of female based on data. Sensitivity of Bigonial length for male was found as 24.39 % and for female as 72.22 %. In similar study by Vinay G et al (2013)[7] they found mean ± SD of bigonial in male as 9.45 ± 0.53 and in female as 8.74 ± 0.54. Sensitivity in male was found as 75.92 % and in female found as 71.16 %. Shree B et al (2023)[8] in their study found mean of bigonial in male as 8.94 and in female as 7.26. Singh, R et al (2015)[9] in their study found mean ± SD of bigonial in male as 9.62 ± 0.72 and in female as 8.43 ± 0.47. Vinay, G. et al (2013)[10] in their study found mean ± SD of bigonial in male as 9.45 ± 0.53 and in female as 8.74 ± 0.54.

In present study Bicondylar length (cm) Mean ±SD in males was 11.201 ±0.599 and in females it was 10.979 ±0.489. Difference was not statistically significant (P=0.174). 20 (34 %) mandibles were identified as male on the basis of Bicondylar length as well as in the already available data. 17 (29 %) mandibles were identified as female on the basis of Bicondylar length as well as in the data. 21 (35 %) mandibles were identified as female on the basis of Bicondylar length but were of male based on data and 1 (2 %) mandibles were identified as male on the basis of Bicondylar length but were of female based on data. Sensitivity of Bicondylar length for male was found as 48.78 % and for female as 94.44 %. In similar study by Vinay G et al (2013)[7] they found mean ± SD of Bicondylar in male as 11.34 ± 0.55 and in female as 10.82 ± 0.70. Sensitivity in male was found as 71.39 % and in female found as 63.54 %. Shree B et al (2023)[8] in their study found mean of Bicondylar in male as 11.58 and in female as 10.56. Singh, R et al (2015)[9] in their study found mean ± SD of Bicondylar in male as 11.22 ± 0.68 and in female as 10.17 ± 0.58. Vinay, G. et al (2013)[10] in their study found mean ± SD of Bicondylar in male as 11.34 ± 0.55 and in female as 10.82 ± 0.70

CONCLUSION

Identification of gender by non-metrical method from the available skeletal remains requires expert's ability and experience. Human skeletal has great anthropological and medicolegal significance. Adult mandibles exhibit sexual dimorphism and can be used to identify the genders with increased sensitivity and specificity. mandibles can be used for the determination of sex even with fragmentary remains of skeleton. In present study bigonial breadth and bicondylar breadth was used for gender determination. Mean values of both bigonial breadth and bicondylar breadth in males were found higher than the females. Apart from application in gender discrimination these parameters could be a useful tool in case of treatment of dentofacial conditions.

REFERENCES

1. B. Rai, J. Kaur. Sex determination methods in forensic odontology. Evidence- Based Forensic Dentistry. DOI.10.1007/978-3-642-28994-1_5@ Springer- Verlag Berlin Heidelberg 2013; 73-79.
2. Hu KS, Koh KS, Han SH, et al. Sex determination using nonmetric characteristics of the mandible in Koreans. J Forensic Sci. 2006;51(6):1376-82.
3. Tanveer Ahamed Khan H.S. J.H. Sharieff. Observation on Morphological Features of Human Mandibles in 200 South Indian Subjects. Anatomica Karnataka. 2011;5(1):44-49.
4. Warwick R. The relation of direction of mental foramen to growth of human mandible. J Anat. 1950;30(2):116-20.
5. Loth SR, Henneberg M. Mandibular ramus flexure: a new morphologic indicator of

sexual dimorphism in the human skeleton. Am J Phys Anthropol. 1996; 99(3): 473-85.

6. Steyn M, Iscan MY. Sexual dimorphism in the crania and mandibles of South African whites. Forensic Sci Int. 1998; 98(1-2): 9-16.
7. Vinay G., MangalaGowri S.R.2, Anbalagan J. Sex Determination of Human Mandible Using Metrical Parameters. Journal of Clinical and Diagnostic Research. 2013 Dec, Vol-7(12): 2671-2673
8. Shree B, Soni S, Sharma SK, Handge K, Kumar A, Das SS, et al. Analytical study of mandible: Prerequisite for sex determination. J Pharm Bioall Sci 2023;15:S1215-7.
9. Singh, R., Mishra, S.R.., Sushobhana, Passey, J., Kumar, P., Singh, S., Sinha, P. and Gupta, S. (2015). Sexual Dimorphism in Adult Human Mandible of North Indian Origin. Forensic Medicine and Anatomy Research, 3, 82-88.
10. Vinay, G., Gowri, S.R.M. and Anbalagan, J. (2013) Sex Determination of Human Mandible Using Metrical Parameters. Journal of Clinical and Diagnostic Research, 7, 2671-2673.