



AN ANATOMICAL STUDY OF HUMAN MANDIBLE IN DETERMINATION OF SEX BY USING VARIOUS MORPHOLOGICAL AND MORPHOMETRIC PARAMETRES

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ABSTRACT Determination of sex from unknown human mandible has an important role in forensic field in relevance with medicolegal issues to trace victim. Aim: To determine the sex of human mandible by using various morphological & morphometric data. Materials and methods: The study was conducted on 82 dry human mandibles of unknown sex. Based on morphological features the mandibles are grouped into Male (50) and Female (32) bones and the following morphometric parameters are taken for further statistical analysis. 1) Symphyseal height 2) Ramus height (Rt) 3) Ramus height (Lt) 4) Bimetal width 5) Inter premolar width 6) Inter molar width 7) Bicononoid width. Results: There was a statistically significant difference found in the height of ramus (right), with mean value of $54.84 \pm 4.5\text{mm}$ for males and $50.56 \pm 5.4\text{mm}$ for females ($P < 0.05$), height of ramus (left) with mean value of $53.24 \pm 4.3\text{mm}$ in males and $49.81 \pm 5.03\text{mm}$ in females ($P < 0.05$) and bimetal width with mean value of $42.96 \pm 2.6\text{mm}$ in males and $41.58 \pm 1.8\text{mm}$ in females ($P < 0.05$), whereas no significant difference was found in symphyseal height, bicononoid width, inter premolar width and inter molar width of male and female mandibles. The parameters used in this study gave an overall 76.8% accuracy in determining the sex of the mandible. Conclusion: Out of 7 parameters taken into account the interesting observation is that 3 parameters are most reliable and dependable for determination of sex. Out of these, 2 parameters have given most sensitive data and high accuracy rate for the determination of the gender.

KEYWORDS : Ramus height, bimetal width, medicolegal issues, sex determination.

Introduction

Mandible forms the lower jaw and is the only movable bone of skull, articulating with the temporal bones at synovial temporo mandibular joints¹. The mandible is the largest, strongest and lowest bone in the face. This is only bone in the skull (with the exception of tympanic ossicles) that is capable of separate movement². Mandible consists of horse shoe shaped body and two rami projecting upwards and backwards. Symphysis menti, indicates fusion of two halves of the fetal bone³. External surface of body presents at symphysis menti a triangular mental protuberance, which is sometimes depressed and exhibits mental tubercle on each side of its base¹. Mental foramen can be seen below the second premolar tooth; transmits the terminal branches of the inferior alveolar nerve and vessels⁴. Posterior surface of symphysis menti presents mental spines or genial tubercles. Mylohyoid line extends diagonally upwards from symphysis menti, divides internal surface into an upper, smooth sublingual fossa for sub lingual gland and lower concave sub mandibular fossa for superficial part of sub mandibular gland¹. Below the mylohyoid line, mylohyoid groove conveys mylohyoid vessels and nerve. In foetus this groove is occupied by part of Meckel's cartilage⁵. Ramus presents lateral and medial surfaces, 4 borders i.e., Upper, lower, anterior and posterior borders. Lateral surface provides attachment to masseter. Medial surface presents mandibular foramen which is the superior opening of the mandibular canal. The inferior alveolar nerve and vessels pass through this foramen⁶. Lower border of the ramus continuous with mandibular base meets the posterior border at the angle⁷. Coronoid process is a triangular upward projection, produced by the upward pull of temporalis muscle¹ and receives attachment of temporalis muscle. Head of condylar process articulates with anterior part of mandibular fossa of temporal bone and forms the temporo-mandibular joint and neck bears on its antero medial surface a depression called pterygoid fossa for insertion of lateral pterygoid muscle. The present study is conducted to see morphological and morphometric parameters in adult dry mandibles.

Materials and methods

The present study is conducted on 82 dry human mandibles of Rayalaseema zone of unknown sex from the department of Anatomy

SVIMS – SPMC(W), department of Anatomy SVMC and Department of Physical Anthropology SV University, Tirupati. Based on Morphological features the mandibles are grouped into Male and Female bones and morphometric measurements are taken for further statistical analysis.

FIGURE 1: SHOWING MANDIBULOMETER



Morphological features: Shape of chin - square in males and rounded in females, Gonial flare - everted in males and inverted in females Muscle markings are more prominent in males as compared to females

Inclusion criteria: All the intact, well-formed mandibles were included in this study.

Exclusion criteria: Damaged, deformed and edentulous mandibles were excluded from this study.

Method of the study: The parameters observed and the data is obtained by using Vernier calliper are Symphyseal height, Height of ramus – Right (Rt), Height of ramus – Left(Lt), Bimetal width, Inter premolar width, Inter molar width, Bicononoid width. The data collected is mentioned in terms of mean \pm standard deviation (SD) and level of statistical significance was performed using SPSS VERSION 20 for Binary logistic regression.

FIGURE 2: SHOWING MEASUREMENT OF RAMUS HEIGHT



FIGURE 3: SHOWING MEASUREMENT OF BIMENTAL HEALTH



Observations and Results

Table 1: Showing descriptive statistics

Parameter	Male				Female				p value
	Min	Max	Mean	S D	Min	Max	Mean	SD	
Symphyseal height	12.06	36.1	26.9	4.1	19.2	35.9	26.4	3.57	0.54
Height of Ramus(Rt)	45	67	54.8	4.5	40	64	50.5	5.4	0
Height of Ramus(Lt)	43	66	53.2	4.3	41	63	49.8	5.03	0.002
Bimental breadth	36.76	49.8	42.9	2.6	38	46.1	41.5	1.81	0.006
Inter premolar width	23.74	39.8	30.8	3.3	25.4	34.2	29.6	2.18	0.087
Inter molar width	37.57	53.9	44.6	3.6	35.8	53.8	43.12	3.43	0.064
Bicoronoid width	83.19	103.1	92.1	4.8	75.7	102.2	91.08	8.07	0.476

The mean value of symphyseal height of mandible is 26.98 ± 4.1 mm in males and 26.47 ± 3.5 mm in females ($P > 0.05$) and there is no significant difference between males and females. Height of ramus (Rt) of mandible was 54.84 ± 4.5 mm for males and 50.56 ± 5.4 mm for females ($P < 0.05$). Height of ramus (Lt) of mandible is 53.24 ± 4.3 mm in males and 49.81 ± 5.03 mm in females ($P < 0.05$). There was a significant difference between mean values of height of ramus on both sides in males and females. Bimental breadth of mandible is 42.96 ± 2.6 mm in males and 41.58 ± 1.8 mm in females ($P < 0.05$) and significant difference between males and females is observed. Inter premolar width of mandible is 30.80 ± 3.3 mm in males and 29.64 ± 2.1 mm in females ($P > 0.05$) with no significant data difference between males and females. Mean value of inter molar width of mandible is 44.61 ± 3.6 mm in males and 43.12 ± 3.43 mm in females ($P > 0.05$). There is no significant difference between males and females. Mean value of bicoronoid width of mandible is 92.11 ± 4.8 mm in males and 91.08 ± 8.07 mm in females ($P > 0.05$). There was no significant difference between males and females.

Discussion

The present study is conducted on 82 dry human mandibles of Rayalaseema zone of unknown sex from the Department of Anatomy SVIMS, Department of Anatomy SVMC and Department of Physical Anthropology SV University, Tirupati. Based on Morphological features i.e., shape of chin, gonial flare and muscle markings, mandibles are grouped into Male (50) and Female (32) bones. Among human bones, pelvis and skull are most reliable source for sex determination⁸.

Ramus height (Right & Left): In the present study the mean value of height of ramus (Rt) of mandible was 54.84mm for males and

50.56mm for females and standard deviation of 4.5 in males and 5.4 in females. Height of ramus (Lt) of mandible is 53.24mm in males and 49.81mm in females and standard deviation of 4.3 in males and 5.0 in females. There was a significant difference between mean values of height of ramus on both sides in males and females.

Nutcharin Ongkana et al⁹ in a study on 102 dry mandibles found that mean value for height of ramus for males was 68.1mm and 62.6mm for females and P value is statistically significant. Kishore Chandra Thakur et al¹⁰ based on measurements in 60 mandibles (30males, 30 females) reported that there is a significant difference between males and females. Anupam Datta et al¹¹ based on measurements of 50 mandibles observed that there is a statistically significant difference is observed with both males and females. Dr. Deepak N Kawale et al¹² studied on 80 mandibles and reported that there is significant difference is observed between males and females. Dr. Vinodini Lakmala et al¹³ studied 70 mandibles and reported that mean value is more in males than in females. Aprajita Sikka et al¹⁴ based on measurements of 126 human mandibles reported that significant difference is observed between males and females. B. Kartheeki et al¹⁵ in their study on 500 digital OPGs observed that significant difference is noted between males and females.

All of the studies showed statistically significant difference between male and female mandibles. The present study is correlated with all these studies.

Bimental width: In the present study the mean value of bimental width of mandible is 42.96mm in males and 41.58mm in females and standard deviation of 2.6 in males and 1.8 in females. Significant difference between males and females is observed. The present study is correlated with Anupam Datta et al¹¹ who conducted study on 50 dry human mandibles and reported that gender differences in mean values of bimental breadth of male and female is statistically significant.

Symphyseal height: The observations made in the present study, the mean value of symphyseal height of mandible is 26.99mm in males and 26.47mm in females with standard deviation of 4.1 in males and 3.5 in females. There is no significant difference between males and females. The present study correlated with study done by Nutcharin Ongkana et al⁹ on 102 dry mandibles, observed that mean value for symphyseal height, in male and female was statistically not significant. Also correlated with Dr. Deepak N Kawale et al¹² who observed that sex differences in mean values of symphyseal height of male and female is statistically not significant. But our studies are not correlated with Mihai Marinescu et al¹⁶ from their studies concluded that there is a significant difference between mean values of males and females. Anupam Datta et al¹¹ reported that gender differences in mean values of symphyseal height of male and female is statistically highly significant and significant difference is observed in both males and females and Aprajita Sikka et al¹⁴ by reported that symphyseal height showed significant difference between males and females.

Bicoronoid width: In the present study the mean value of bicoronoid width of mandible is 92.11mm in males and 91.08mm in females with standard deviation of 4.8 in males and 8.0 in females. The present study is correlated with Sheela D. Kadam et al¹⁷ conducted studies on 157 dry human mandibles, reported that bicoronoid width is statistically not significant between males and females. Our study is not correlated with Kanchankumar P. et al¹⁸ conducted study on 82 dry human mandibles and from their study bicoronoid width showed significant difference between males and females. In our study there was no significant difference between males and females and the observations are at par with other authors.

Inter premolar width: In the present study the mean value of inter premolar width of mandible is 30.80mm in males and 29.64mm in females with standard deviation of 3.37 in male and 2.18 in female. The gender differences in mean values of inter premolar width of male and female is not significant.

Inter molar width: In the present study mean value of Inter molar width is 44.61mm in male and 43.12mm in female with standard deviation of 3.62 in male and 3.43 in female. There is no significant difference between males and females.

SUMMARY & CONCLUSION

The essential core of the work is to throw some light for deciding sex based on Morphological and Morphometric methods and to doubly

confirm the gender with these methods. From the present study, it can be concluded that parameters like ramus height, bimental width will be of immense help in identifying the sex upto 76.8% of mutilated and unidentified bodies when combined with some other criteria used for sex determination. This study will be helpful to the forensic medicine and anthropologists to give their correct identification of sex of the individual in medico legal cases. The present work is done with professional vision to give valuable contribution for the already available literature. The present work has no claim for comprehensiveness nor for exhaustiveness but it is hoped that this work may provide the strengthening basis for the existing information.

REFERENCES:

1. A.K. Datta, Essentials of Human Anatomy (Head and Neck) part – II, 6th edition; APRIL, 2017. 33-35.
2. T.Jayachandra Pillai1, T.Sobha Devi2, C.K.lakshmi Devi3, Studies on Human Mandibles.IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 13, Issue 1 Ver. II (Jan. 2014), PP08-15.
3. Susan, Standring, GRAY'S Anatomy, The Anatomical Basis of Clinical Practice, 39th Edition.
4. Richard S. Snell, MD, PhD, Clinical Anatomy By Regions, 9th edition, 2016.
5. HAMILTON W J, Text book of human anatomy, 2nd Edition, 1976. 79-81.
6. Richard L. Drake, A. Wayne Vogl, Adam W. M. Mitchell, Gray's Basic Anatomy, 2nd edition, 2018. 501.
7. Williams PL, Bannister LG, Berry MM. Gray's Anatomy. 38th Ed, New York, Churchill Livingstone; 2000:409-19.
8. Vinay G, Mangala Gowri SR, Anbalagan J. Sex determination of human mandible using metrical parameters. Journal of clinical and diagnostic research: JCDR.2013 Dec; 7(12) :2671.
9. Ongkana N, Sudwan P. Gender difference in Thai mandibles using metric analysis. Chiang Mai Medical Journal-เชียงใหม่เวชสาร. 2009;48(2):43-8.
10. Thakur KC, Choudhary AK, Jain SK, Kumar L, chandra Thakur K. Racial architecture of human mandible-An anthropological study. J Evol Med Dent Sci. 2013 Jun 10;2:4177-88.
11. Datta A, Siddappa SC, Gowda VK, Channabasappa SR, Shivalingappa SB, Srijiith DD. A Study of Sex Determination from Human Mandible Using Various Morphometrical Parameters. Indian Journal of Forensic and Community Medicine.2015 Jul ; 2(3):158 - 66.
12. Kawale DN, Kulkarni PR, Shivaji SB, Chaya DV. Sexual Dimorphism in Human Mandible: A Morphometric Study. IOSR - JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 14, Ver. III, PP42-45.
13. Lakmala dv, inala . International Journal of Pharma and Bio Sciences. Int J. Pharm Bio Sci 2016 Jan ; 7: 216 – 220.
14. Sikka A, Jain A. Sex determination of mandible: a morphological and morphometric analysis. International Journal of Contemporary Medical Research. 2016; 3:1869-72.
15. Kartheeki B, Nayyar AS, Sindhu YU, Lakshmana N. Accuracy of mandibular rami measurements in prediction of sex. Archives of Medicine and Health Sciences. 2017 Jan 1; 5 (1) : 50.
16. Marinescu M, Panaitescu V, Rosu M. Sex determination in Romanian mandible using discriminant function analysis: Comparative results of a time-efficient method. Rom J Leg Med. 2013 Dec 1; 21(4):305-8.
17. Kadam SD, Roy PP, Ambali MP, Doshi MA. Variation in the Shape of Coronoid Process in Dry Mandible of Maharashtra Population.
18. Wankhede KP, Bardale RV, Chaudhari GR, Kamdi NY. Determination of sex by discriminant function analysis of mandibles from a Central Indian population. J Forensic Dent Sci. 2015;7(1):37-43.