Research Article

Sex determination & morphometric parameters of human mandible

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ABSTRACT

Goal: The knowledge about the anatomy of the mandible and its variations in age, sex and race will help physicians, surgeons, medico-legal authorities and anthropologists to give correct interpretations for the diagnostic procedures in living.

Methods: We collected the human mandible bones (N=80) from the department of Anatomy, SVIMS university and around the Tirupati region to study the morphological and morphometric features by using 22 different parameters.

Results: Among 22 parameters Six dominating parameters that possibly explain the nature of the mandible are height of the ramus, body thickness, anthropometric arch width, inter incisor width, mandibular index and mandibular angle are useful to determine the unknown sex of the mandible upto an extent of 75.2% in south Indian population. The incidence of the above mentioned sex determination parameters considered together and treated statistically.

Conclusion: The present study reveals that the mandible of unknown gender can be sexed to the extent of 75% accuracy by six dominating parameters and not to consider these for complete sex determination of the mandible bone in osteometric studies.

Keywords: Mandible bone, Ramus, Angle, Index

INTRODUCTION

Mandible is the largest, strongest and movable part of the skull. Mandible identification is important in medico-legal and anthropological work.[1] The teeth along with skull are best preserved part of human remains. Sex can be more accurately determined after the attainment of puberty. The differences are well marked in bony pelvis and skull. Mandible next to the pelvis in human remains will help us in identification of age, sex and race.[2,3] To evaluate the mandibular angle and to analyze the relationship of the angle and height & breadth of the

ramus of the mandible to the gender, so as to study its role in the anthropological diagnosis.[4] Sex determination based only on characteristics of teeth and their supporting structures had been a difficult task where as X-ray examination of the mandible gives definitive information about the sex. The mandibular condyles are smaller in females. By radiological examination sex determination of skull is possible to the extent of 88 percent.[5] Mandible and its variations in age, sex and race will help physicians, surgeons, medico-legal authorities and anthropologists to give correct interpretations for the results of diagnostic procedures in living.[1,3]

Table 1: Descriptive statistics.

S. No	Name of the variable	Range		Mean	Standard Deviation
		Minimum	Maximum		
1	Symphyseal height	23.00	40.00	29.63	3.51
2	Coronoid height	48.00	71.00	59.37	5.03
3	Minimum breadth of ramus	23.00	36.00	30.50	2.73
4	Maximum breadth of ramus	28.00	47.00	39.21	3.42
5	**Height of ramus – right**	51.00	76.00	62.92	5.30
6	Height of ramus – left	48.00	76.00	61.05	5.72
7	Body length	18.00	33.00	26.55	2.68
8	**Body thickness**	11.00	18.00	14.60	1.35
9	Body length	60.00	85.00	75.31	4.83
10	Bigonial diameter	80.00	112.00	92.22	6.37
11	Bicondylar diameter	91.00	126.00	110.32	6.52
12	Bimental breadth	37.00	50.00	43.19	2.76
13	**Mandibular angle**	104.00*	137.00*	122.55*	67.83
14	Length of lower jaw	50.00	74.00	63.98	4.78
15	**Inter incisor width**	13.00	20.00	15.89	1.68
16	Inter premolar width	28.00	40.00	33.75	2.36
17	Inter molar width	39.00	53.00	44.35	2.76
18	Arch length	34.00	50.00	42.40	2.82
19	Anthropometric arch length	48.00	64.00	56.21	2.94
20	**Anthropometric arch width**	34.00	52.00	42.39	2.99
21	Bicoronoid width	70.00	107.00	91.97	5.69
22	**Mandibular index**	44.00	67.00	58.13	4.75

* measured in degrees, all measurements in mm

METHODS

The material used for the study contained 80 human mandibles of unknown sex obtained from different grave yards in Tirupati town and from the department of anatomy, SVIMS University. The bones collected are free from any pathological lesions or fractures. Totally edentulous mandibles with absorbed alveolar margins were excluded from this study. The bones collected roughly belong to the age group of 18 to 60 years. By using sliding caliper and mandibulometer we studied the 22 parameters of mandible to determine the sex and recorded. Symphyseal height, Coronoid height, Minimum breadth of ramus, Maximum breadth of ramus, Height of ramus –right, Height of ramus – left, Body height, Body thickness, Body length, Bigonial diameter, Bi condylar diameter, Bi mental breadth, Mandibular angle, Length of lower jaw, Inter incisor width, Inter premolar width, Inter molar width, Arch length, Anthropometric arch length, Anthropometric arch width, Bicoronoid width, Mandibular index. This study was under clearance with ethical committee, SVIMS University, Tirupati.

RESULTS

Dry human mandibles of unknown sex were collected from different grave yards in and around Tirupati and from the department of Anatomy, SVIMS University. By eliminating pathologically misfit mandible 80 numbers fit for the present work were selected. Totally edentulous mandibles with absorbed alveolar margins were excluded from this study. The bones collected roughly belong to the age group of 18 to 60 years. We studied the external and internal surfaces andosteological aspects of the mandible bone. Each mandible was carefully measured for 22 parameters already described in methods. The data thus obtained is tabulated (Table 1).

Figure 1: Measuring Bimental breadth & other parameters of the mandible with sliding caliper.

Table 2: Sexing of the mandible by individual parameters.

S. No	Name of the variable	Male	Female	Undecided	Total
1	Symphyseal height	40	34	6	80
2	Coronoid height	47	33	--	80
3	Minimum breadth of ramus	50	26	4	80
4	Maximum breadth of ramus	41	36	3	80
5	Height of ramus – right	75	5	--	80
6	Height of ramus – left	70	10	--	80
7	Body length	65	12	3	80
8	Body thickness	74	5	1	80
9	Body length	20	57	3	80
10	Bigonial diameter	49	31	--	80
11	Bicondylar diameter	41	36	3	80
12	Bimental breadth	47	33	--	80
13	Mandibular angle	56	24	--	80
14	Inter incisor width	43	37	--	80
15	Inter premolar width	60	20	--	80
16	Inter molar width	61	19	--	80
17	Arch length	78	2	--	80
18	Anthropometric arch length	38	42	--	80
19	Anthropometric arch width	42	38	--	80
20	Bicoronoid width	44	36	--	80

Figure 2: Measuring lower jaw length & angle of the mandible with mandibulometer.

DISCUSSION

The Symphyseal height varies from 23 mm to 40 mm with a mean value of 29.6 mm. When this compared to the range of the known sex 40 mandibles out of 80 could be identified as belonging to male and 34 to female while 6 remain undecided (Table 2). However, when other parameters are taken into consideration the significance of Symphyseal height deciding the sex decrease. The height of the ramus is measured on right and left sides for all the mandibles; right side mean value shows slight higher value by 3 mm than left side. This difference may be due to the difference in the chewing habit of the individual. This needs further investigation since there were no such observations in the past. Body thickness ranges from 11 mm to 18 mm with mean value of 14.6 mm by which 74 belong to male, 5 female and 1 undecided. Body length ranges from 60 mm to 85 mm with a mean value of 75 mm by which 20 belong to male 57 to female and 3 undecided. The body height, length and thickness though facilitating to sex the mandibles at higher percentage, this is regarded as an insignificant factor in the known sex.[6] Anthropometric arch width ranges from 34 mm to 52 mm with a mean value of 42 mm by which 31 mandibles can be grouped as males and 57 as females. In the known sex the difference between the male and female of anthropometric arch width is said to be a significant parameter. Inter incisor width ranges from 13 mm to 20 mm with mean value of 16 mm by which 43 mandibles belong to male and 37 to female, this parameter having significant in sex determination. Mandibular angle ranges from 104° to 137° with a mean value of 123° by which 56 mandibles can be said to be male and 24 to be female. White races mandibles have greater and everted gonial angle.[7] Eversion of angle is characteristic of male and inversion is that of female.[8] It was concluded that round chin mandible with inversion or eversion cannot be a female one and 59.26 percent of accuracy in sex determination is possible with mandible.[9] Male mandibles will have well developed and flaring gonial regions.[10] Mean value of mandibular angle was more in females – males 118.60, females 123.00.[11] In males the lateral aspect of the angle of the mandible shows rough or rigid appearance. In females the angle of

the jaw is often more rounded and gracile in construction. The attachment surface of the masseter muscle is often much smoother.[12] In the present study, those that are considered as females presented with higher mandibular angle and males with lower mandibular angle. These findings are in agreement with the findings ofliteratures.[11] Bicondylar diameter ranges from 91 mm to 126 mm with a mean value of 110 mm by which 41 mandibles can be said to be male 36 to be female and 3 undecided. It is stated that sharp tubercles on the medial and lateral aspects of anterior surfaces of mandibular condyles are stress indicators.[13] Mandibular condyles were smaller in females.[5] In the present study those mandibles that are designated as belonging to females showed smaller condyles resulting in lesser diameters. Mandibular is calculated by Bicondylar breadth, length of lower jaw multiplies with 100 also significant parameter for sex determination.

CONCLUSION

The measurements were compared to the values of known sex to distinguish the sex of mandible. Every parameter, independent of other parameters provides certain percentage of certainty about the sex of mandible of unknown sex. This percentage of certainty significant shifts when considered in combination with other parameters. Therefore, based only on one or two variables the sex of mandible cannot be decided.[14,15] The present study reveals that mandible of unknown gender can be sexed to the extent by using the all above parameters.

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