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Morphometric measurements of mandibular ramus - A digital panoramic study

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Abstract

Forensic odontology employs dental evidence to address issues pertaining to human identification. Gender determination marks the beginning of the identification process. Generally, stature of the skeleton elements are good morphological indicators of sexual dimorphism in more than 95% of cases, but in mass disasters only some fragments of bones are found resulting in difficulty in obtaining correct diagnosis. Orthopantomography is a radiographic procedure that is readily available and is employed in daily clinical routine practice. Thus, antemortem panoramic radiographs may be of immense value in establishing human identity. Hence, the present study was undertaken to assess various morphometric measurements of mandible in gender determination with the aim to evaluate various mandibular ramus measurements on digital panoramic radiography and objective to establish a correlation between mandibular ramus measurements with respect to gender and its usefulness in forensic dentistry.

Introduction

Forensic odontology employs dental evidence to address issues pertaining to human identification. Gender determination marks the beginning of the identification process.[1]

Generally, stature of the skeleton elements are good morphological indicators of sexual dimorphism in more than 95% of cases, but in mass disasters only some fragments of bones are found resulting in difficulty in obtaining correct diagnosis.

Pelvis and skull bones are the most reliable sources among human bones for gender distinction, providing accuracvy more than 92%. But in absence of pelvis bones or non- intact skull bones, mandible becomes a source and plays a major role in sex determination as it is considered most dimorphic, more durable, largest and the strongest bone of skull. The presence of a dense layer of compact bone makes it very durable.

Sexual dimorphism of the mandible is influenced by genetic, hormonal and socioenvironmental factors such as food, nutrition, climate, masticatory forces and the presence of various pathologies. Though several researchers have derived discriminant functions that employ parameters related to individual parts of the mandible, the results obtained need to be population specific.[4]

Orthopantomography is a radiographic procedure that is readily available and is employed in daily clinical routine practice. Thus, antemortem panoramic radiographs may be of immense value in establishing human identity.[5] Various studies have been performed on dry adult mandibles for gender determination. However, a review of literature revealed a paucity of research related to linear measurements of the rami on panoramic radiographs.[5]

Considering the importance of mandible in sexual dimorphism this study was undertaken to evaluate the utility of linear mandibular ramus dimensions digital panoramic images for gender determination in the North-Indian population.[5]

Aim

To evaluate various mandibular ramus measurements on digital panoramic radiography.

Objective

To establish a correlation between mandibular ramus measurements with respect to gender and its usefulness in forensic dentistry

Materials and method

This retrospective study shall comprised of 60 subjects (30 males and 30 females). Digital panoramic radio graphs of optimum quality, clearly depicting the mandibular ramus without distortion in dentate patients aged between 18 to 50 years were retrieved from the archival computer data base of Radiology section of department of OMDR, and permission from institutional ethical committee was obtained for the Study Pathologies affecting the posterior mandible, the angle and ascending ramus region, trauma/ surgeries performed in the mandibular posterior region and completely edentulous arches of both maxilla and mandible region were excluded from the study.

Linear measurements were performed using adobe acrobat reader according to the criteria adopted by Maloth K N et al as under: Figure 1

a) Upper ramus breadth (URB): the distance between the most anterior to the most posterior point of the ramus passing through the sigmoid notch

b) Lower ramus breadth (LRB): the distance between the most anterior to the most posterior point of the ramus at the level of the occlusion plane along a line parallel to the previous one

In order to achieve standardization, prior to marking the following (c to e), a horizontal orientation line shall be digitally traced passing through the summit of the gonial angle. (Figure 2)

c) Condylar ramus height (CNRH): the distance from the Condylion to the intersection of the orientation line with the inferior border of the ramus

d) Projective ramus height (PRH): the projective distance between the Condylion and the orientation line

e) Coronoid ramus height (CRRH): the distance between coronion and the intersection of the orientation line with the inferior border of the ramus.

The descriptive statistics included mean, standard deviation. The level of the significance for the present study was fixed at 5%. The intergroup comparison for the difference of mean scores between two independent groups was done using the unpaired/independent t test. The gender prediction was done using the Canomical discriminate function analysis.

Results and Discussion

In the present study a total of 60 subjects of which 30 males and 30 females showed mean values of about 25.86 in female group with the standard deviation of 3.82 than the male group of about 3.11 as the standard deviation.

This is similar to the study done by Maloth KN et al in 2017 stated that the male has higher values than females.[5]

The right projective ramus height (RPRH) showed the mean value of 50.84 with standard deviation of 2.79 in female group.

Similarly on the left projective ramus height (LPRH) also with the mean values of 50.54 in males and with standard deviation of 3.37 and in females of about 44.68 with 2.300 standard deviation which is statistically significant with value of 0.001, which is in accordance with the study done by Jambunath U et al in the year 2016[6]

The right condylar ramus height (RTCNRH) showed higher mean value of about 51.14 with standard deviation 3.8 than females and the left condylar ramus height also showed the higher mean values in males with 51.09 of standard deviation. 5.28 which is significantly statistically with P value of 0.001 which is similar to the study done by Abu Taleb NS et al in the year 2015[7]

However, the right coronoid ramus height and the left coronoid ramus height (CRRH) also showed higher mean measurement values in males of about 45.89 and 46.14 with standard deviation of 2.50 and 3.71 which is significant with the P value of 0.001 which is in agreement with the study done by Damera A et al in the year 2016[8]

The right and left coronoid ramus height also showed significant values with the P value of 0.001 which is higher in males than females of about 45.89 with standard deviation of 3.99 and 46.14 with standard deviation of 3.71 respectively. However, the right and left upper ramus breath mean measurement showed more in males of about 31.71 with standard deviation of 3.43 and on left side it is predominant in of 3.74 which is statistically with P value of 0.005 and 0.744 respectively which is in accordance with the study done by Mostafa RA et al in th year 2020[9]

The right and left sides of the lower ramus breath also showed predominant in male group with the mean measurement of 27.15 with standard deviation of 3.65 and 27.94 with standard deviation of 3.74 which is non-significant with P value of 9.26 and 0.864 respectively which is similar to the study done by Sharma M et al in the year 2015[10]

Discriminant analysis for both sides' parameters

-17.125 + 0.105 x Right Projective Ramus Height + 0.089 x Right Condylar Height + 0.059 x Right Coronoid Height + 0.065 x Left Projective Ramus Height + 0.028 x Left Condylar Height + 0.87 x Left Coronoid Height -0.091 x Left Upper Ramus Breadth

Sex	Predicted Group Membership		Total
	Male	Female	
Male	28 (93.3%)	2 (6.7%)	30
Female	2 (6.7%)	28 (93.3%)	30

Accuracy of Prediction -93.3%

Discriminant analysis for both sides' parameters of right side

-18.646 + 0.205 x Right Projective Ramus Height + 0.149 x Right Condylar Height + 0.039 x Right Coronoid Height

SEX	Predicted Group Membership		Total
	Male	Female	
Male	26 (86.7%)	4 (13.3%)	30
Female	1 (3.3%)	29 (96.7%)	30

Accuracy of Prediction -91.7%

Accuracy of Male Prediction -86.7%

Accuracy of Female Prediction -96.7%

Discriminant analysis for both sides' parameters of left side

-15.457 + 0.191 x Left Projective Ramus Height + 0.070 x Left Condylar Height + 0.131 x Left Coronoid Height - 0.081 x Left Upper Ramus Breadth

SEX	Predicted Group Membership		Total
	Male	Female	
Male	27 (90.0%)	3 (10.0%)	30
Female	2 (6.7%)	28 (93.3%)	30

Accuracy of Prediction -91.7%

Accuracy of Male Prediction -90.0%

Accuracy of Female Prediction -93.3%

Conclusion

From the present study, it was concluded that various parameters like the projective ramus height, minimum ramus breath and coronoid ramus height can prove to be of great help in gender identification.

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Legends Figure

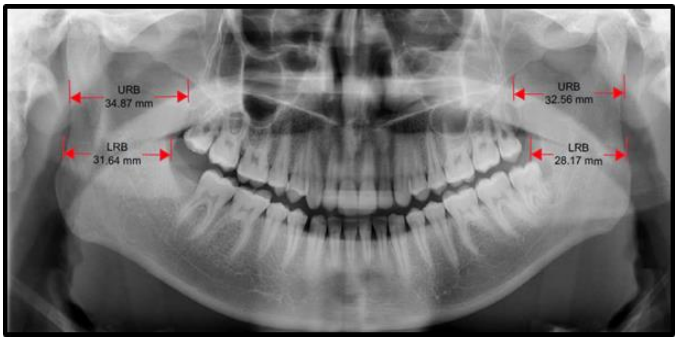

Fig 1: showing measurements of URB and LRB on both sides

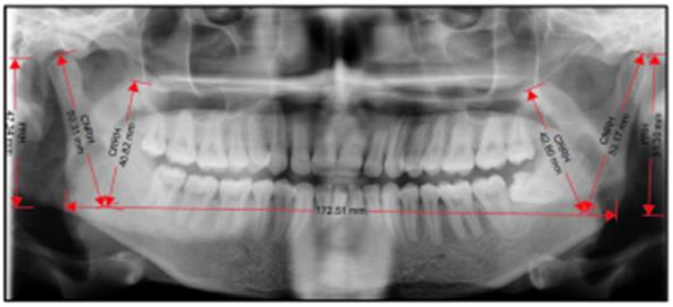

Fig 2: Projective ramus Height, Condylar Ramus Height, Coronoid Ramus Height