

ORIGINAL ARTICLE

A morphometric study of the human mandible in the Indian population for sex determination



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Abstract: Sex determination from bones is important in forensic investigations for establishing identity in cases of mutilated bodies. Many morphometric criteria have been laid down for various bones for sex determination in previous studies. The present study aimed at setting up some parameters of the mandible as indicators of sex in the Indian population. The length of body of the mandible, angle of the mandible and minimum ramus breadth were considered as chief parameters for sex determination from dried bones obtained from the Departments of Anatomy in two medical colleges of Punjab and Chandigarh. There was a statistically significant difference found in the diagonal length, horizontal length and minimum ramus breadth with their mean values 79.77 ± 4.68 mm, 71.99 ± 4.54 mm and 30.93 ± 2.56 mm in adult males, respectively and 73.83 ± 4.84 mm, 68.62 ± 4.78 mm and 29.57 ± 2.86 mm in adult females, respectively, whereas no significant difference was found in the mandibular angle of males and females. The parameters used for the present study gave an overall 60% accuracy in determining the sex of the mandible. © 2015 The International Association of Law and Forensic Sciences (IALFS). Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

In the adult skeleton, sex determination is usually the first step of the identification process, as subsequent methods for age and stature estimation are sex dependent. Dependability of

sex determination relies on the completeness of the remains and the degree of sexual dimorphism inherent in a population, but it is usually considered that the two most sexually dimorphic elements of the skeleton are the skull (including the mandible) and the pelvis.

The need for such a type of research is due to the increased incidents of violence and the increased number of unidentified and mutilated bodies being referred to the forensic expert.¹ If different parameters are tested within specific population groups, both qualitative and quantitative criteria can be identified and used in combination to distinguish sex, age and ethnicity.²

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Jaws and teeth have been used since olden times to ascertain the sex of an individual, because they show sexual dimorphism in morphological features, but these are likely to be subjected to variation depending upon the experience of a worker. Therefore, some morphometric criteria need to be put in place which can be used as a reference for sex determination when combined with some other features. Various studies have clearly indicated that the skeletal characters vary by population, and there is a need to lay down population-specific standards.³

The mandible is the largest and strongest bone in the face with a horizontally curved body that is convex forwards with two broad rami, which ascend from the posterior end of the body. The rami bears the coronoid and condyloid processes.⁴ The mandible is considered suitable for study as it is the most durable bone of the facial skeleton and retains its shape better than other bones. Sexual dimorphism in the mandible may be due to the relative difference in the development of the musculoskeletal system, especially the muscles of mastication attached to the mandible.⁵

A study conducted earlier on the angle of the mandible on a mixed population included three age groups. The angle varied between 110° and 140°. It was also concluded that in the persons who retained their teeth, there is no tendency of increase in the angle with advancing age.⁶ A digital radiographic study carried out in 2012⁷ on the mandibular ramus indicated that the minimum ramus breadth was the best parameter for sex determination. An anthropological study was conducted by Thakur et al.⁸ on the mandibular angle and height of the ramus to know their role in sexual dimorphism, and it was found that both these parameters are greater in males than in females.

A previous study conducted on the facial height for various endogamous communities of Nepal concluded that there are racial differences in upper and lower facial height proportions, but no significant difference in males and females. The upper and lower facial heights increase in the same proportion with the increase in age.⁹

The present study was carried out on dried mandibles to establish some parameters as criteria for sex determination in the Indian population. The findings of this study may be useful

in providing anthropological data, which can be used in dental and medical practices too.

2. Materials and methods

The sample of 126 dried adult mandibles belonging to the Indian population was obtained from Gian Sagar Medical College, Ramnagar, Patiala, Punjab and the Government Medical College, Chandigarh. The sex of the mandible was determined according to the following criteria:

1. Gonial eversion marked in males/absent in females.
2. Chin square in males/rounded or pointed in females.
3. Male mandible robust, larger, broader/female slender, smaller.
4. In males lateral aspect of angle shows rough appearance. In females, the lateral aspect of the angle is comparatively smooth.

Six cases with uncertainty in sex determination not fitting into the above criteria were discarded; 93 were adult (63 male and 30 female) and 27 mandibles were old (15 male and 12 female) with resorbed alveolar border. The various parameters as shown in Figs. 1 and 2 were considered in the present study and were taken in accordance with the study conducted by Vodanovic et al.³ as follows:

- Angle of the mandible: It was taken with the help of a protractor as the angle between the base and a tangent drawn along the posterior border of the ramus, touching the posterior-most point on the condyle and the posterior-most point on the posterior border.
- Diagonal length (DL) of the mandible body: The DL (gonion-gnathion [Go-Gn] length) of the mandible body was measured from the point at the base of the mandible at the level of the symphysis menti (Gn) to the posterior-most point at the angle (Go) at the junction of the body and the ascending rami of the mandible with the help of a digital vernier calipers.

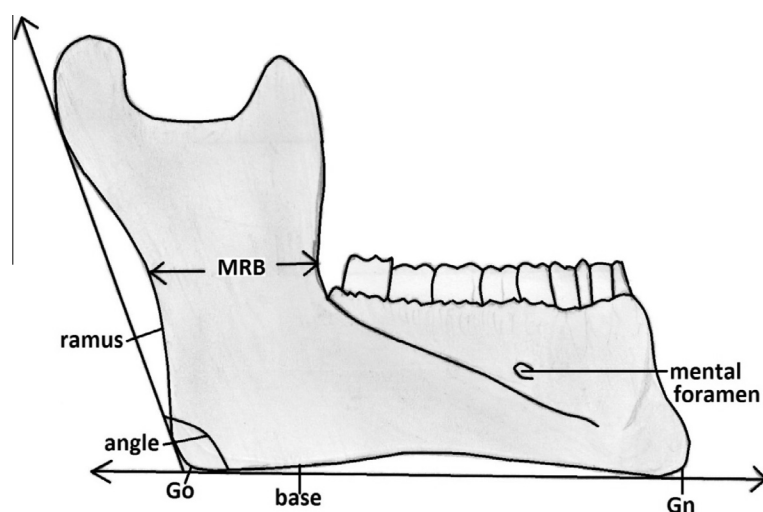


Fig. 1 Showing the parameters including the angle and minimum ramus breadth (MRB).

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