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SEXING OF SKULL THROUGH THE MORPHOMETRICS OF HARD PALATE

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ABSTRACT

One of the most important reasons for conducting anthropological studies on human skeleton is to determine the sex of the remains. This article presents an approach for evaluating the sexual dimorphism of the adult crania using the hard palate. The study comprised of 100 adult crania of known sex (50 male and 50 female). The parameters of hard palate were measured by the help of a sliding vernier calliper. The palatal length was measured from the anterior margin of incisive fossa to the posterior nasal spine. Palatal breadth was measured as the maximum width of the palate at right angles to the palatal length. The mean values for the palatal length in male and female were found to be 54.59 mm and 52.44 mm respectively. The reading observed for the palatal breadth in males and females were 38.49 mm and 35.89 mm respectively. The results after being put to statistical analysis, showed a significantly higher value of palatal breadth in males than in females ($p < 0.001$). The present study shows that mean palatal breadth values are sexually dimorphic.

Keywords: palate, sexual dimorphism, forensic, anthropologists

INTRODUCTION

The determination of sex is an important concern for the forensic experts, osteologists, anthropologists and jurists as it is critical for identification of an unknown individual. In cases of unidentified and missing people, it eliminates around 50% of the population from being considered further¹.

The degree of sexual dimorphism is influenced by environmental factors, and thus differs in each population. Various previous studies have pointed out significant sexual differences between populations and that therefore all the discriminant formulae for determination of sex are population specific. The accuracy of the methods based on sexual dimorphism of the cranial measurements diminishes when used

outside the reference population. Thus individual populations must have their own baseline standards^{2,3}.

There are two osteological techniques used widely to determine sex of an unknown individual; first is visual assessment to evaluate the morphological sex traits. Pelvis is by far the choice of bone used for this type of evaluation, cranium being the second choice, but this requires years of experience and expertise, moreover it is subjective in nature. The second method undertakes systematically postulated metrical methods, where sexual dimorphism is challenged through defined osteometric methods. The second method is said to be more reliable as it is

not subjective, it reduces the examiners bias and has higher sensitivity and specificity values⁴. During a review of morphological indicators of sexual dimorphism, 17 most important indicators used by researchers were analysed and their values were challenged to identify the collections of skull of known sex, individually as well as collectively. Observations thus made, proved the importance of palate in being sexually dimorphic and presented a high reproducibility of results⁵.

MATERIALS AND METHOD

This study was conducted on 100 skulls of known sex (50 male and 50 female) collected after excluding those skulls that presented evidence of trauma or any deformity from the departments of anatomy at Indira Gandhi government medical college Nagpur, Geetanjali medical college, Darshan dental college, Udaipur. On each skull following two parameters were measured, with the help of sliding vernier callipers (with a least count of 0.001mm) by a single investigator as a single reading to avoid observer bias.

- (1) Palatal Length : measured from the anterior margin of incisive fossa to the post nasal spine.
- (2) Palatal Breadth : measured as the maximum breadth of the palate, perpendicular to the palatal length.

The results were subjected to statistical analysis and were interpreted subsequently.

RESULTS

In the 100 analysed skulls, the lineal dimensions for the palatal breadth were found to be significantly higher in males as compared to females ($p < 0.001$) The maximum and minimum values for the palatal length were found to be 65.9 mm and 44.04 mm, while the same values for the palatal breadth were found to be 44.0 mm and 30.7 mm.

The values for the lineal dimensions for the palatal length and breadth have been shown in Table 1.

DISCUSSION

Standards of osteological determination of demographic characteristics as sex, are population specific^{2,6,7,8}. Secular changes due to changes in nutrition, genetic constitution, extreme division of labour and changes in socioeconomic status and technology contribute to sexual dimorphism^{9,10,11,12}. Thus data base of individual population are encouraged by researchers.

In sex determination, classical visual methods generally reach a sexing accuracy of about 90%. A set of morphometric traits of cranium allows for accurate estimation of sex in 80% of cases, with a risk of error of less than 10%¹³. The problem incurred by the researchers in determination of the sex of the individual is the damage the material has incurred. Determination of sex with the help of dimension from a single anatomic region of cranium provides a lower, but still relatively high success rate of classification^{14,15,16}.

The use of palate shape as a part of the protocol for the diagnosis of sex in human skulls had been recommended by many researchers^{17,18}. However, the palate, during its development and life, is subjected to various forces that change their shape, such as chewing forces, forces of the tongue muscles and perioral muscles which may also affect the study of morphological dimorphism using the palatal shape as a diagnostic indicator.

In our study the mean palatal length was found to be 54.59 ± 4.076 mm and 52.44 ± 3.82 mm in males and females respectively. The mean palatal length in previous study carried out by Robert S el al¹⁹ were found to be $51.8\text{mm} \pm 3.28$ and $49.6\text{mm} \pm 3.03$ for males and females respectively, and by Patel M²⁰ were $50.28 \pm 3.56\text{mm}$ and $47.45 \pm 3.68\text{mm}$ respectively. In the present study the palatal length was not found to be sexually dimorphic.

The mean palatal breadth which was significantly sexually dimorphic was 38.49 ± 2.795 mm and 35.89 ± 2.534 mm in males and females respectively ($p < 0.001$). The study conducted by Robert S¹⁹ et al and that by Patel M²⁰, also found the values to be

dimorphic sexually. The comparative data with the previous studies have been depicted in Table 2. Thus the present study demonstrated the accuracy of diagnosis of sex was significant through the palatal breadth, but not by palatal length.

CONCLUSION

Palatal breadth which has proven to be sexually dimorphic can be used in future by investigators to differentiate sexes of the unknown crania.

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Table 1: Mean Values for the Lineal Dimensions for the Palatal Length and Palatal Breadth

Parameter		Male	Female
	Palatal length		
Mean		54.59	52.44
Std dev		4.076	3.82
	Palatal breadth		
Mean		38.49*	35.89*
Std dev		2.795	2.534
P value < 0.001*			

Table 2: Comparative Data for the Mean Palatal Length and Mean Palatal Breadth with the Previous Studies

Parameter		Male	Female
	Palatal length		
Robert S et al		51.8 ± 3.28*	49.6 ± 3.03*
Patel M		50.28 ± 3.56*	47.45 ± 3.36*
Present study		54.59 ± 4.076	52.44 ± 3.82
	Palatal breadth		
Robert S et al		34.6 ± 3.03*	32.60 ± 2.8*
Patel M		37.17 ± 2.88 *	35.50 ± 3.07*
Present study		38.49 ± 2.795*	35.89 ± 2.534*
P value < 0.001*			