MAXIMUM CRANIAL BREADTH IN SEXING OF CRANIA- MEDICOLEGAL IMPORTANCE

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Abstract

Determining skeletal sex is a key element in any anthropological or forensic examination. [1] Study of sexual dimorphism of bones in human population is a matter of interest not only for the anatomist but also for the anthropologists and forensic experts.[2] Accurate methods of sex estimation from the human skeleton by using various criteria are important while dealing with the undocumented human skeletal material. There are many methods of sex estimation that can be implied to the human skeleton. Total 300 crania of known sex were studied. The maximum cranial breadth linear and curved were taken. The statistical sex difference was found in mean values of cranial breadth. The cranial breadth important parameter in sexing of crania.

Keywords: Sexing, Breadth, Crania, Medicolegal.

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1. Introduction

Determining skeletal sex is a key element in any anthropological or forensic examination. [1] The study of sexual dimorphism of bones in human population is a matter of interest not only for the anatomist but also for the anthropologists and forensic experts.[2] The four characteristic features for biological identification are sex, age, ethnic background and stature. Accurate methods of sex estimation from the human skeleton by using various criteria are important while dealing with the undocumented human skeletal material. Nearly every index and parameters of the human skeleton have been used to develop methods for estimation of sex with varying degrees of outcomes. The general anatomical areas used for sex determination are the pelvic girdle, the skull, and long bones, although many other bones have also been researched. The introduction of precise measurement methods not only provides simplicity and accuracy but allows no individual variation and is therefore entirely an objective assessment [3]. Traditionally, the skull was the single most studied bone in physical anthropology and human evolution based on cranial remains.Equally, traditionally the sexing of the skull has been done on the osteological basis. So that descriptive skeletal features have ruled other than dimensions. In a sexing of skull, the initial impression often is a deciding factor i.e. a large skull is generally male, a small skull female.

Metrical studies may provide certain advantages because it is more objective way of attaining data with the use of osteometric techniques, determination of sex from the skulls relied very much on statistical analysis.The known metrical parameters fail to show clear differences between the sexes hence the need was felt to establish more effective new parameters.

The aim of the present study is to study the sexual dimorphism of crania by using linear and curved maximum cranial breadth.

2. Material and Methods

Total 310 adult human crania of known sex as male or female were studied for the present study. The crania collected for the present study were from different ethnic groups and casts. Only fully ossified adult crania were included in the present study. Crania showing wear and tear, any fracture or pathology were excluded. The instruments used for the measurements of various parameters of cranium were spreading caliper, , scale, thread, marker.

Maximum cranial breadth [Linear (aB)]:
With the help of spreading caliper, the maximum cranial breadth (aB) was measured. The skull was placed on the pad. At right angle to the mid- sagittal plane; maximum breadth was taken. It was taken at the level of midpoint of the supramastoid crest. It was recorded with the help of spreading caliper.

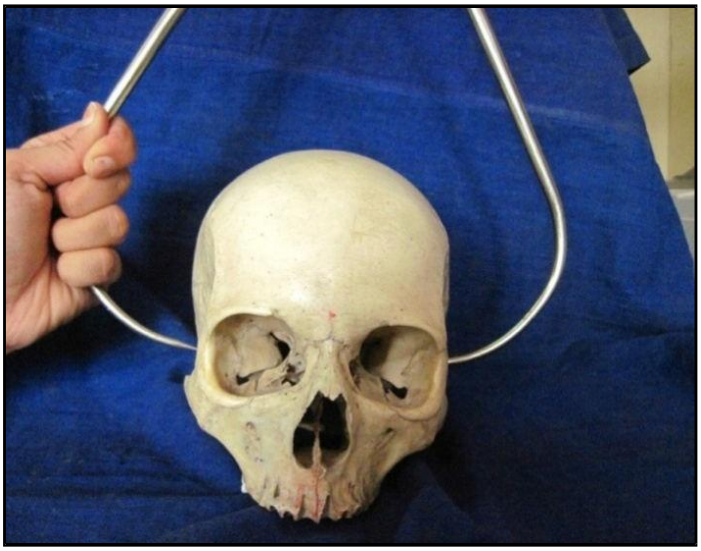

Figure 1 Maximum Cranial Breadth [Linear (aB)

Maximum cranial breadth [Curved (bB)]:

With the help of thread, the maximum cranial breadth was recorded at the level of mid point of supramastoid crest.

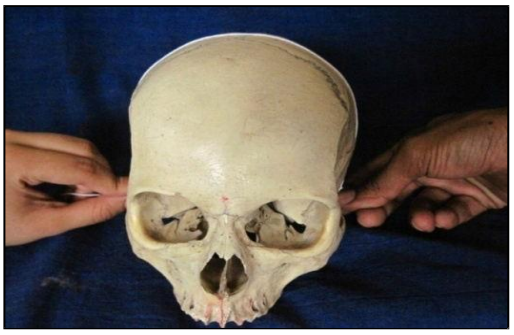

Figure 2 Maximum Cranial Breadths [Curved (bB)

Observations

In the metrical methods different cranial measurements were taken. Range, mean and standard deviation of these measurements of were calculated. The identification point for each parameter was calculated from the range of each measurement. From this percentage of identified crania was calculated.

This procedure has been followed for finding the limiting values (identification point) for determining the sex, but it is of doubtful value as it can give wrong results even in the same area when applied to unknown cases. However, when dealing with normal distributions which is the case in most biological variables, maximum and minimum limits can safely be calculated on the basis of standard deviation.

Thus, 'Mean ±1 S.D.' will give the range that covers 68.3% of the area or zone. 'Mean ±2 S.D.' will give the range that covers 95.4% of the area or zone. 'Mean ±3 S.D.' will give the range that covers 99.75% of the area or zone.

But when nearly 100% accuracy of sexing is required e.g. in medico-legal cases, it is advisable to calculate the maximum and minimum limits by adding ±3S.D to the mean value of each measurement. This gives the calculated range. It covers 99.75% of the sample from this zone and will be useful also for any other sample from this zone.

Demarking points were worked out from calculated range.[144] The percentages of crania identified by each demarking point in both sexes was estimated. The demarking points identify sex with 100% accuracy.[8]

The difference observed between means of male and female to know whether it is statistically significant, that is value of 'P' is calculated by applying 'Z' test.

Abbreviations used in following tables are:

Table 1 Maximum cranial breadth (Linear) (aB)

Sr No	**Details of measurements**	**Male**	**Female**
1	No. of bones	155	155
2	Range	12 – 14.1	11.1-12.9
3	Mean	**12.8**	**12.19**
4	Standard deviation	0.43	0.44

5	Statistical significance	**P < 0.001**	
6	Identification point	>12.9	<12
7	Percentage of identified bones	32.26	33.55
8	Calculated range	11.48- 14.08	10.88-13.5
9	Demarking point	>13.5	<11.48
10	Percentage beyond demarking point	3.87	4.52
	Z = 12.04		

In the present study, the Maximum cranial breadth (linear) of male cranium varies from 12cm to 14.1cm with an average of 12.8cm ± 0.43 whereas that of female it extends from 11.1cm to 12.9cm with an average of 12.19cm± 0.44. Cranial breadth of cranium more than 12.9cm is definitely of male and the one measuring less than 12cm is definitely of female. By this 32.26% of male crania and 33.55% of female crania do not overlap. The calculated range is obtained (mean ±3 S.D.). In males it varies from 11.48cm to 14.08cm and 10.88cm to 13.5cm in female crania. In medico-legal cases 100% accuracy of sexing is required this is done by using the demarking points,
Which cover up 99.75% of sample. When demarking points are applied, cranium having a Maximum cranial breadth more than 13.5cm is definitely of male and one having breadth less than 11.48cm is of female. By these points percentage of identified male crania came down to 3.87% and female to 4.52%. The sex difference in mean values of Maximum cranial breadth (linear) of male and in female crania is statistically highly significant (p<0.001).
Table 2 Maximum cranial breadth (Curved) (bB)

Sr No	**Details of measurements**	**Male**	**Female**
1	No. of bones	155	155
2	Range	25.2-33.4	25.2-29.7
3	Mean	**29.1**	**27.71**
4	Standard deviation	1.29	0.95
5	Statistical significance	**P < 0.001**	
6	Identification point	>29.7	<25.2
7	Percentage of identified bones	31.61	0
8	Calculated range	25.26-33.01	24.84-30.57
9	Demarking point	>30.57	<25.26

10	Percentage beyond demarking point	12.90	0.65
	Z = 11.07		

Maximum cranial breadth (Curved) (bB)

The Maximum cranial breadth (Curved) of crania ranges from 25.2cm to33.4cm with an average cranial breadth of 29.1cm Thus, the crania with cranial breadth above 29.7cm are of male while crania with cranial breadth less than 25.2cm are said to be of female. From identification point, percentage of identified crania in male is 31.61% and in female no crania identified.

The calculated range varies from 25.26cm ±1.29 in case of males while in females it ranges from 25.2cm to 29.7cm with an average length of 27.71cm ±0.95.

to 33.01cm in male and 24.84cm to 30.57cm in female crania. On applying demarking points, crania with cranial breadth more than 30.57 cm are definitely of male while less than 25.26 cm are definitely of female. Thus, 12.90% of crania are identified as definitely male whereas 0.65%

Table 6 Maximum cranial breadth (Linear) (aB):

Investigators Side	**No. Of Bones**		**Mean**	
	M	**F**	**M**	**F**
Hanihara K (1959)[9]	64	41	14	13.7
Kajanoja P (1966)[10]	165	67	14.3	13.7
Dodo Y (1986)[11]	28	21	14.09	13.36
Deshmukh AG (2006)[12]	40	34	13.1	12.7
Present study	155	155	12.8	12.19

The present study is compared with the studies of Yukino Dodo, Deshmukh AG, Kajanoja P, Hanihara. The mean values of maximum cranial breadth (Linear) (aB) of the presentstudy are comparable with the study of Deshmukh AG. Other studies showing the higher mean values in male and female skulls than the present study. This is may be because the short stature of the Indian population and malnourished crania.

3. Conclusion

The sex difference in mean values of Maximum cranial breadth (linear and curved) of male and in female crania is statistically highly significant ($p<0.001$). Hence the present study is useful for the anthropologist and the forensic experts.

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