A Craniometric Study of Adult Human Skulls From Andhra Pradesh

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Abstracts: Background & Objectives: The human skull has been studied both metrically and non- metrically previously. Cranial index and other cranial indices are useful in differentiation of racial and gender difference. This study investigates cranial index of dried human skulls present in the department of Anatomy of three medical colleges present in three different region of Andhra Pradesh (India). Material and Methods: This study was carried out on 136 (77 male & 59 female) dry human skulls at Narayana Medical College, Nellore; Dr Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinnaoutpalli, Gannavaram Mandal, Krishna District and Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar (A.P. INDIA). Out of these, 20 skulls were of known sex. By comparison with skulls of known sex, sex of remaining skulls was decided. Results: The mean of cranial index in males and female was 72.47 ± 5.13. The mean of cranial index in males was 70.18 ± 3.39 and in females was 74.96 ± 4.31. Interpretation and Conclusion: Cranial measurements and indices offer the simplest and fairly accurate way of judging the similarities and dissimilarities when comparing skulls. Craniometry has further application in clinical specialities such as plastic surgeries and oral surgery with craniofacial deformities. [Salve V et al NJIRM 2012; 3(1) :63-66]
Key Words: Cranial Index, Cranial Length, Cranial Breadth, Craniometry

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Introduction: The human skull has been studied both metrically and non- metrically previously. These studies have thrown light on the functional and morphological aspect of the skull. To identify the unknown person from bone is the most common practice. Critical problem faced by anatomist, forensic expert and anthropologist in this regard. Skeletal remains have been used for sexing the individual as bones of the body are last to perish after death, next to enamel of teeth. Almost all bones of the human skeleton show some degree of sexual dimorphism. Sex of unknown skull can be determined with the help of metric analysis of skull.

The study of anthropometric characteristics is of fundamental importance in solving problems related to identification. Craniometric features are included among these characteristics since they are closely connected to forensic dentistry and can be used to aid in identifying an individual from a skull found detached from its skeleton. Craniometric analysis is performed by locating anthropometric points and determining anthropometric measurements, which have already been established in the literature, in order to test the precision and accuracy of measurements, and these can usually be obtained by simple rulers, calipers and other specific tools[1]. The physical differences between people can be recorded by measurements and based on these measurements different indices can be worked out. Cranial index and other cranial indices are useful in differentiation of racial and gender difference [2].

As studies on sexual dimorphism of cranium were very few, we have taken this study to document the cranial differences in cranial index of Andhra Pradesh crania. This study investigates cranial index of dried human skulls present in the department of Anatomy of three medical colleges present in three different regions of Andhra Pradesh (India).

Material and Methods: This study was carried out on 136 (77 male & 59 female) dry human skulls at Narayana Medical College, Nellore (A.P. INDIA) and Dr Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinnaoutpalli, Gannavaram Mandal, Krishna District (A.P. INDIA) and Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar (A.P. INDIA). Out of these skulls 71 from Narayana Medical College, Nellore

and 30 from Dr Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinnaoutpalli, Gannavaram Mandal, Krishna District (A.P.) and 35 from Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar. Out of these, 20 skulls were of known sex. These skulls were derived from burial ground of Department of Anatomy, Narayana Medical College, Nellore and Dr Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinnaoutpalli, Gannavaram Mandal, Krishna District (A.P.) and Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar. By comparison with skulls of known sex, sex of remaining skulls was decided.

Following external features are compared for sex determination:

No	Male	Female
1	Supra-orbital ridges more prominent	Supra-orbital ridges less prominent
2	Glabella more prominent	Glabella less prominent
3	Frontal eminences more prominent	Frontal eminences less prominent
4	Upper orbital margins blunt	Upper orbital margins sharper
5	Mastoid process large & more prominent	Mastoid process smaller & less prominent

For each skull, following linear dimensions were measured.

1. Maximum Cranial Length: - Maximum antero-posterior length measured between glabella and inion with the help of spreading caliper and scale (figure 1).
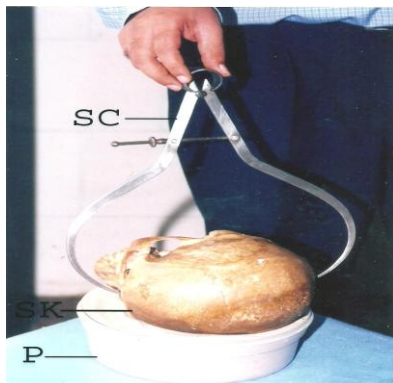

Figure 1

2. Maximum Cranial Breadth: - Maximum breadth measured between two parietal eminences with the help of spreading caliper and scale (figure 2).
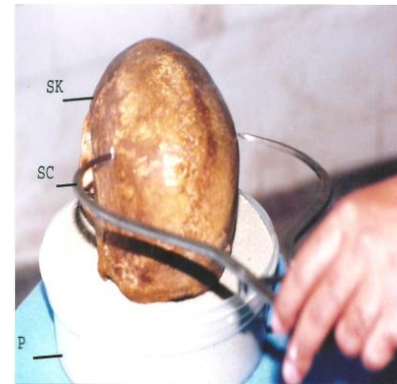

Figure 2
(SK – skull, P –pot, SC- spreading calliper)

Each measurement was taken to the nearest millimetre at least three times and the average was considered for computation. The data for each skull was recorded in a special form.

Data analysis: The data was entered into the computer and analyzed using NCSS statistical package. The differences in means of cranial index, cranial length and cranial breadth were tested for statistical significance by independent sample "t" test.

Result: The mean and SD of cranial length, cranial breadth, and cranial index are depicted in Table no.1. Table no.2 shows types of skulls classified according cranial index.

The mean and SD of cranial index in males and female was: 72.47± 5.13 (Range: 62.43-86.18). The mean and SD of cranial index in males was: 70.18± 3.39 (Range: 62.43 -74.43), and in females: 74.96 ± 4.31 (Range: 68.32 - 86.18). The difference between male and female skulls cranial index was significant (p<0.001). The mean and SD of cranial length in males and female were: 172.86 mm ± 8.59 (Range: 152 -186). The mean and SD of cranial length in males was: 178.93 mm ± 5.31 (Range: 167-186), and in females: 164.86 mm ± 4.49 (Range: 152-173). The difference between male and female skulls cranial length was significant (p<0.001). The mean and SD of cranial breadth in males and female were: 124.14mm ± 5.53 (Range: 110 -134). The mean and SD of cranial breadth in males was: 123.34mm ±

Table no 1: Showing statistics of various parameters of present study

Variable	n	Min.	Max.	Mean	S.D.	S.E.	P Value
Cranial index (male)	77	62.43	74.43	70.18	3.39	0.629	<0.001
Cranial index (female)	59	68.32	86.18	74.96	4.31	0.918	<0.001
Cranial index (male &female)	136	69.11	84.52	72.47	5.13	0.719	----------
Cranial length of male (mm)	77	167	186	178.93	5.31	0.986	<0.001
Cranial length of female (mm)	59	152	173	164.86	4.49	0.956	<0.001
Cranial length of male & female (mm)	136	152	186	172.86	8.59	1.203	----------
Cranial breadth of male (mm)	77	113	134	123.34	4.49	0.834	<0.001
Cranial breadth of female (mm)	59	110	135	125.18	6.62	1.411	<0.001
Cranial breadth of male & female (mm)	136	110	135	124.14	5.53	0.774	----------

(CI - cranial index, n- sample size, S.D. – standard deviation, S.E. – standard error,
Max. - maximum, Min.-minimum)

4.49 (Range: 113-134), and in females: 125.18 mm± 6.62 (Range: 110-135). The difference between male and female skulls cranial breadth was significant (p<0.001).

Table no 2: Showing classification of skulls based on cranial index.

Classification of skull	Total	Male	Female
Dolicocephalic (CI below 75)	98	77	21
Mesocephalic (CI between 75-80)	32	00	32
Brachycephalic (CI above 80)	06	00	06
Total	136	77	59

Discussion: Cranial indices give numerical expression to certain features of the skull, which can be difficult to describe otherwise [5]. P. Jaysingh et al studied 300 human skulls. The mean cranial index was 74.35. According to classification based on cranial index, in this study 57.3% skull belongs to dolicocephalic group [6].

Chaturvedi and Harneja in their study found mean cranial index 70.75 [7]. Kranioti et al measured 90 males and 88 female skulls of Creaton population. The mean cranial length in this study was 181 mm ± 6.63 for male and 172.89 mm ± 6.48 for female [8]. Usha Dhall and K. Gopinath studied normal 89 adult skulls belonging to the North Indian population at Rohtak Medical College. During their study they found 78 skulls dolicocephalic, 10 mesocephalic and 01 brachycephalic. Thus they conclude that most of the North Indian skulls belong to dolicocehalic group [9]. Morant G M, studied 32 Tibetian skulls in 1923. He measured cranial length, cranial breadth, cranial height, facial height and facial breadth. If we put these values in formula for cranial index and vertical index; the mean cranial index was 75.25 [10].

Adejuwon S A et al studied 96 adult human skulls of unknown sex and age from collections in the Department of Anatomy, University of Ibadan, Nigeria. The mean cranial index of all the studied skulls was 72.54 ± 2.33. The mean cranial indices for male and female skulls examined were 72.97 ± 2.16 and 71.72 ± 2.48, respectively. There is no significant difference between the cranial indices of male and female skulls (p>0.05) [11].

The cephalic index which measured on heads of living is roughly two units higher than cranial index which measured on dried human skulls. In Mongoloid race dolicocephaly is rare while brachycephaly is rare in Negroid race. Human knowledge of paleontology and available data suggest that early man was generally dolicocephalic. Brachycephaly developed later as a result of repeated mutation and various other factors [12]. Lobo S.W. studied 267 Gurung community people in Nepal. The mean cephalic index for male was 83.1 and for female 84.6 (difference of 1.5) which was statistically significant [2]. Shah G. V. and Jadav H.R. studied 500 (198 female and 302 male) medical students at B. J. Medical College, Ahmedabad. The mean cephalic index for male was 80.42 and for female 81.20 (difference of 0.78). The mean cephalic index for total population was 80.81 [13].

According to Cunningham's text book of Anatomy, dolicocephalic skulls were found in Australians, Zulus, Eskimos and Fijians. Mesocephalic skulls were found in European (mixed), Chinese, and Polynesians (mixed). Brachycephalic skulls were found in Malays, Burmese, American Indian and Andamanese [14].

In our study 77 out 136 (72.06 %) skulls belong to dolicocephalic group. Thus our study results are almost similar to the study conducted by Usha Dhall and K. Gopinath and P. Jaysingh et al. The mean cranial index in our study was 72.47. It is slightly higher (difference of 1.72) than the study of Chaturvedi and Harneja. It is slightly lower (difference of 1.88) than the study of P. Jaysingh et al. But these studies are carried out on different Indian population, which may be reason for difference in cranial index.

Cranial measurements and indices offer the simplest and fairly accurate way of judging the similarities and dissimilarities when comparing skulls. Craniometric methods have a special usefulness in forensic practice while making identification in medicolegal cases [6]. Cranial indices can be playing a part in reconstruction of skeletal remains. Craniometry has further application in clinical specialities such as plastic surgeries and oral surgery with craniofacial deformities [4].

Conclusion: The result of present study shows that majority of male skulls of Andhra Pradesh can be classified as dolicocephalic and female skulls as mesocephalic. There was a significant difference between cranial index of male and female skulls. Thus we can conclude that cranial index of the female skull is 2-4 point higher than the male skulls in Andhra Pradesh population. This data can be useful for forensic medicine experts, plastic surgeons, anatomist, anthropologist and oral surgeons for clinical and research purpose.

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