Sexual Dimorphism in Facial Dimensions of Crania

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Abstract

Problem: Craniometry holds an important place in anthropology especially physical anthropology, where it is helpful in gaining perspectives about population and individual variations and also racial classifications. ***Approach:*** The present study represents the data collected on a total of 64 (32 male and 32 female) crania from different institutions of Lucknow, Uttar Pradesh, with no deformities, to study the various facial dimensions in the two sexes. ***Findings:*** The study shows the results for dimensions of facial parameters of male and female crania, and it is seen that sexual dimorphism does exists between the two sexes studied and is also in accordance with the works of other researchers. ***Conclusion:*** The present study shows that the two sexes differ in the facial dimensions and this could be helpful in forensic science investigation, ethnic and other personal identifications in various spheres.

Key words: Craniometry, Sexual Dimorphism, Facial Dimensions, Crania.

Introduction

Anthropometry aids the understanding of anatomical structures, constitutes the technique of expressing quantitatively the form of human body and skeleton. It is a basic tool of biological anthropology and has been of immense help in the development of forensic sciences in general and forensic medicine in particular. Anthropometric studies are an integral part of craniofacial surgery and syndromology (Novit, 2006).Anthropometry and its sub division- craniometry not only high lights its use in forensics and surgeries, but also reveals the paleoanthropological aspect too. The study of fossils has led us to understand the evolutionary stages through which humans have pasted in order to achieve its present stage. It was possible, because bones especially the cranium and mandible are hardest part of body and reveal a lot about the biology, culture and environmental conditions, if fossilized accurately.

The Problem

Determination of gender is being done from bones- skull, pelvis and other long bones in general, since ages in anthropology, for which anthropometry is playing a significant role.
Identification of an individual is important in any medicolegal investigation. The primary factors that helpful in the identification include age, sex and stature (Vij, K. 2001). Skull is important in this regard as it resists adverse environmental conditions over time (George J Armegalos, 2005).Thus because of this, the present study aims to determine whether sexual dimorphismexists in male and female crania, with respect to facial attributes and morphology. The results for which will be obtained through craniometric measurements of face, that are also helpful in anthropometric and medicolegal perspectives.

Methodological Approach

A total of 64 crania were studied, differentiated as 32 male and 32 female crania on the basis of characteristics of male and female skull. The skulls were studied with the help from the department of anatomy, medical college Lucknow and department of anthropology, Lucknow university. 10 parameters were studied for facial dimensions. Sliding caliper was used for taking the measurements from one bony landmark to the other.

Certain statistical considerations were also made like mean, standard error of mean, standard deviation, standard error of standard deviation and coefficient of variation. Following measurements were taken to study the facial dimensions of skull.

- Nasal height: from nasion to nasospinale
- Nasal breadth: from alare to alare
- Orbital height: perpendicular to orbital breadth
- Orbital breadth: from dacryon to ectoconchion.
- Bi orbital breadth: from ectoconchion to ectoconchion.
- Upper facial height: from nasion to prosthion
- Bi zygomatic breadth: from zygion to zygion.
- Nasal index = $\frac{\text{Nasal breadth} \times 100}{\text{Nasal height}}$
- Orbital index = $\frac{\text{Orbital breadth} \times 100}{\text{Orbital height}}$
- Superior facial index = $\frac{\text{Upper facial height} \times 100}{\text{Bi zygomatic breadth}}$

The indices have been calculated as per Martin & Saller (1957), while the measurements were taken by the procedure suggested by H.H. Wilder (1920).

Landmarks defined: -

- **Alare: -** lateral most point on the lateral margins of nasal aperture.
- **Dacryon: -** it is the point just on the anterior margin of the orbit, at the junction of frontal, lacrimal and maxillary bones.
- **Ectoconchion: -**it is the lateral most point on the posterior margin of orbit, just opposite to dacryon.
- **Nasion: -**it is the most sunken point on the intersection of fronto - nasal suture & internasal suture in the mid sagittal plane.
- **Nasospinale: -**it is the point on mid sagittal plane, which intersects the tangent drawn from the lowest margin of nasal aperture.
- **Prosthion: -** it is the most anterior point on the alveolar process of maxilla on inter maxillary suture in the mid sagittal plane.
- **Zygion: -**lateral most point on the zygomatic arch, that gives the maximum bizygomatic breadth.

The Findings

The present study represents the data collected for 10 anthropometric parameters on 64 crania (32 male & 32 female) from Lucknow, Uttar Pradesh, India. The results obtained has been presented in table no. 1(a)&1(b).

The table no.1(a)&1(b)shows the ten measurements of face undertaken for the present study. Sexual differentiation is seen between the two sexes significantly in all parameters, but less significant variation is witnessed amongst the two sexes in nasal breadth and orbital breadth.Table no.1(a) shows the values for nasal height are 47.25mm ± 3.17 for male and 39.7mm ± 2.92for females. The values for nasal breadth are 24.0 mm ±2.03 for male and 21.0 mm ± 2.97 for females. The orbital height is 32.0mm ± 1.70 for male and 29.0 mm ± 2.33 for female crania. The orbital breadth is 38.0mm ± 3.09 for male and 35.0 mm ± 3.70 for female crania. The bi-orbital breadth is 94.3mm ± 3.81 for male and 84.2 mm ± 6.20 for female crania.

The bi-zygomatic breadth is 124.9mm ± 4.92 for male and 109.4 mm ± 9.22 for female crania. The upper facial height is 62.7mm ± 4.70 for male and 52.4 mm ± 7.39 for female crania.

From the table 1(b), it is clear that the crania from Lucknow have **mesorrhinae (medium) nose** in male (mean value is 51.0±5.62) and **broad nose** in females (mean value is 53.0±7.16). The upper facial index shows **mesene type (middle upper face)** in male (mean value is 50.2±5.92) and**euryene (short face)** in females (mean value is 47.8±6.16). The orbital index study shows **hypsiconch or long orbit,** both for male (mean value is 86.4±4.98) and female (mean value is 87.3±4.36) crania.

Discussion

The present study has been compared with the works of Vidya et al. (41 male and 39 female skulls), M.V. Knight (93 skulls), and Jaswinder et al. (30 skulls of unknown sex). The compared data has been presented in table no. 2&3. Sexual dimorphism can be seen in between all the male and female crania in the present study as well as with other populations too. Although differences do exist between populations, but they are more marked in female counterparts.

Table no. 2 shows dimensions of face in different populations. It is seen that the measurements for nasal height are 50.35 for male & 49.5 for female crania as studied by Knight (1915), 4.79cm ± 0.57 for male & 4.54cm ± 0.35 for female (Vidya et al). Nasal breadth shows the values of 2.36cm± 0.26 for male & 2.23cm± 0.24 for females (Vidya et al). Similarly, Vidya et al also studied bi-zygomatic breadth (12.73cm± 1.56 for males & 12.61cm ± 1.45 for females), upper facial height (6.09cm±0.47 for male & 6.02cm± 0.40 for females). Orbital height studied by Knight shows value of 33.83 for male and 33.78 for females, while orbital breadth for male crania is 42.52 and for female crania it is 41.56. Jaswinder et al study shows the value of 32.2± 1.8 for orbital height and 38.8± 3.1 for orbital breadth.

Table no. 3 exhibits the three indices studied and compared with the works of Vidya et al and Jaswinder et al. Nasal index is 49.38± 7.50 for male & 49.24± 6.37 for female, while upper facial index is 48.13± 7.08 for male and 47.85±6.06 for female (Vidya et al). the values of orbital index as studied Jaswinder et al is 81.69.

It is suggested from above that the population studied by Vidya et al has mesorrhinae (medium) nose and euryene (short face) both in male and female crania. While the present study exhibits medium nose in male and broad nose in females. The upper facial index shows mesene type (middle upper face) in male and euryene(short face) in females.

The orbital index represents mesoconch or medium orbit for the population studied by Jaswinder et al., while the present study shows hypsiconch or long orbit, both for male and female crania.

Conclusion

Anthropometry is a tool that can be very well used in determining the sex of cranium. The measurements of nose, orbit and over all upper face can be used in deciphering the gender of any given population, that can be further helpful in identification of an individual also, as per craniology. Such knowledge is also useful in medicolegal as well as forensic science, apart from plastic surgery and studies pertaining to craniological deformities.

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References

1. Dr. Vidya C. S, Dr.Prashantha B, Dr.Gangadhar M.R, (Oct.2012). Anthropometric Predictors for sexual Dimorphism of Skulls of South Indian Origin. IJSRP. Vol.2(10):1-3.
2. George J Armegalos. (2005), A century of skeletal biology and paleopathology: contrasts, contradictions and conflicts. American anthropologists. 105(1): 51-62.
3. Jaswinder Kaur, Savita Yadav and Zora Singh. (November 2012), Orbital dimensions: A direct measurement study using dry skulls. J. Acad. Indus. Res. Vol. 1(6):
4. Knight, M.V. (1915). The craniometry of Southern New England Indians. University of Michigan.
5. Martin R. Saller K. (1957). Lehrbuch de Anthropologie. Band 1. Stuttgart: Gustov Fisher Verlag.
6. Novit, M. 2006. Facial, upper facial and orbital index in Batak, Klaten and Flores students of Jember University. Dent.J. (Maj. Ked. Gigi.). 39(3): 116-119.
7. Vij. K, (2001). Identification in textbooks of forensic medicine: principles and practice. 1st ed. New Delhi, B.I. Churchill Livingstone Pvt. Ltd, pp:62-135.
8. Wilder, H.H. (1920), A Laboratory Manual of Anthropometry. P. Blakistens Son and Co., Philadelphia.

Table no. 1(a): Facial Measurements of Crania

Name of Measurement	Gender	Mean (x) in (mm)	Standard Error of Mean (S.E. of x) ±	Coefficient of Variation (C.V.)	Standard Deviation (S.D.) ±	S.E. of S.D. ±
Nasal Height	M	47.25	0.56	6.74	3.17	.39
	F	39.7	0.52	6.20	2.92	.36
Nasal Breadth	M	24.0	0.36	8.45	2.03	.25
	F	21.0	0.53	14.1	2.97	.37
Orbital Height	M	32.0	0.30	5.31	1.70	.21
	F	29.0	0.41	8.03	2.33	.29
Orbital Breadth	M	38.0	0.55	8.82	3.09	.38
	F	35.0	10.6	11.2	3.70	10.4
Bi-orbital Breadth	M	94.3	0.68	4.05	3.81	.47
	F	84.2	1.10	7.34	6.20	.77
Bi-zygomatic Breadth	M	124.9	0.87	3.93	4.92	.61
	F	109.4	1.64	8.45	9.22	1.1
Upper Facial Height	M	62.7	0.83	7.46	4.70	.05
	F	52.4	1.31	14.21	7.39	.92

Table no. 1(b): Indices of Crania

Name of Measurement	Gender	Mean (x) in (mm)	Standard Error of Mean (S.E. of x) ±	Coefficient of Variation (C.V.)	Standard Deviation (S.D.) ±	S.E. of S.D. ±
Nasal index	M	51.0	1.00	11.01	5.62	.70
	F	53.0	1.27	13.50	7.16	.89
Orbital index	M	86.4	0.88	5.76	4.98	.62
	F	87.3	0.96	6.21	4.36	.67
Upper facial index	M	50.2	--	--	5.92	--
	F	47.8	--	--	6.16	--

Table no. 2: Comparative Measurements of Populations.

Name of measurement	Gender	M.V. Knight (mm)	Vidya et al. (cm)	Jaswinder et al. (mm)	Present study (mm)
Nasal height	M	50.35	4.79± 0.57	--	47.25± 3.17
	F	49.4	4.54± 0.35		39.7± 5.92
Nasal breadth	M	--	2.36± 0.26	--	24.35± 2.03
	F	--	2.23± 0.24		21.0± 2.97
Bizygomatic breadth	M	--	12.73± 1.56	--	124.9± 4.92
	F	--	12.61± 1.45		109.4± 9.22
Upper facial height	M	--	6.09 ± 0.47	--	62.7± 4.70
	F	--	6.02 ± 0.40		52.4± 7.39
Orbital height	M	33.83	--	32.2 ± 1.8	32.0± 1.70
	F	33.78	--		29.03± 2.33
Orbital breadth	M	42.52	--	38.8± 3.1	38.0± 3.09
	F	41.56	--		35.01± 3.70

Table no. 3: Comparative Indices of Populations.

Name of Measurement	Gender	Vidya et al.	Jaswinder et al.	Present study
Nasal index	M	49.38± 7.50	--	51.0± 5.62
	F	49.24± 6.37		53.62± 7.16
Orbital index	M	--	81.69	86.4± 4.98
	F	--		87.3± 5.43
Upper facial index	M	48.13± 7.08	--	50.2± 5.92
	F	47.85± 6.06		47.8± 6.16