

Sexual Dimorphism in Bizygomatic Breadth Amongst Indian Population: An Original Research Article

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Abstract: Numerous facial anthropometric studies have been conducted. In present study, we have documented a data on bizygomatic width. The bizygomatic width is arguably one of the most important parameters in facial anthropometry. It shows sexual dimorphism. There are various constructive and comparative techniques of identification. All these techniques either antemortem or post-mortem are of utmost importance. Facial analysis is very useful for clinical diagnosis of any disease. Not only it is an important tool in identifications but also it has got a major role in the field of health-related problems.

Keywords: Bizygomatic Breadth, Facial Anthropometry, Sexual Dimorphism

INTRODUCTION

Face is the epitome of complex phenotypes, a myriad of social characteristics. Ever-growing literatures have proved that facial anthropometry is an important tool in facial reconstruction surgery, for the forensic experts for identification, to determine sex & ancestry. Numerous facial anthropometric studies have been conducted. In present study, we have documented a data on bizygomatic width. The bizygomatic width is arguably one of the most important parameters in facial anthropometry. It shows sexual dimorphism. There are various constructive and comparative techniques of identification. All these techniques either antemortem or post-mortem are of utmost importance. Facial analysis is very useful for clinical diagnosis of many diseases. Not only it is an important tool for identification but also it has got a major role in the field of health-related problems. Craniofacial anthropometric studies have been conducted for identification, pre and post-operative monitoring and to diagnose any clinical syndromology (Solon E C C

et al, 2012)¹. Over the years, various facial anthropometric studies have been conducted in psychosis, schizophrenia, craniosynostosis, down's syndrome, Klinefelter syndrome whereas in case of metabolic disorders we have found studies on diabetes mellitus, hypertension and foetal alcohol syndrome. But various studies are there using the other anthropometric parameters such as body mass index (BMI), waist circumference, waist hip ratio, waist to height ratio etc. Numerous studies of nasal anthropometry which is a branch of craniofacial anthropometry have been also found. The studies have proven to be of great clinical use in otorhinolaryngology and plastic surgery prior to the rhinoplasty operation. Anthropometry is classified as: 1] Osteometry- i] Craniometry - Odontometry ii] Measurements of post cranial skeleton. 2] Somatometry- a] Measurements of the total and post cephalic body & b] Cephalometry. Scientific anthropometry was first started by Johann Friedrich Blumenbach. He was the founder of Craniology. Based on the Norma verticalis, he classified humans into different races. In the seventeenth century, Peter Camper studied the facial form. Charles white developed - Osteology. Broca, Flower and Turner further developed the study of skulls. Broca defined the landmarks, measurements and instruments of craniometry. Flower invented a sliding calliper known as Flower's calliper, with curved arms on one side and straight arms on the other. Different schools of anthropometry are named as German and French Schools of Anthropometry. The International committee for standardization of anthropological techniques was founded in London in 1932 with members from 200 different countries. To understand the human diversity, the idea of anthropometry was

produced. Human race is variable depending upon the physical and environmental changes and these could be easily studied by anthropometry. If we see the history, in the eighteenth century, anthropometry was used to determine the physical quality of slaves compared to the Americans.

In the nineteenth century, the use of anthropometry became quantitatively effective and formalised. Anthropometry has gained its importance due to its low cost and due to its simple application. Anthropometry can classify any race easily. Facial morphology can be studied in many ways but most importantly studied by direct anthropometry.

Later-on it was used for investigation of adults and child health in human welfare. During twentieth century the use of anthropometry accelerated for study of nutritional status in practice of epidemiology. There is a major use of anthropometry in public health as well as in the selection process of many professions such as army, navy etc. Linnacus in his taxonomy of species included the classification of human groups. Researchers also included physiologists and nutritionists as part of the study as it was very useful for them to assess one's nutritional status. Forensic Anthropology is the application of physical anthropology in forensic context. The person who deals with forensic anthropology is forensic anthropologist. "Forensic anthropology represents the application of knowledge and techniques of human skeletal biology to modern medical legal problems", as defined by Ubelakar.

Forensic anthropology is a branch of physical anthropology which deals with the identification of skeletonised remains of suspected human being as described by T.D.Stewart. Roots of forensic anthropology were first seen with the work of Jean-Joseph Sue. He was an instructor of art anatomy at Louvre in Paris. He published measurements of cadavers of fetus to young adults. It was for stature calculation as it provides accurate information on body proportions which changes with age. In Paris, Paul Broca founded the world's first official organization of physical anthropology in 1859. Broca is best known for Neuroanatomy. Various instruments such as Goniometer, Stereograph and Osteometric board were also invented by Broca. American board of Forensic anthropology (ABFA) was founded in 1977. They helped to promote acceptance of quality of forensic anthropology. Facial anthropometry: Facial study is

not only important for identification, medicine but also has got clinical applications. Anthropometry provides scientific techniques and methods for measurements on the living man and also skeleton (Demayo CG et al, 2009)². Every person differs in all their measurable characters and also the same person undergoes changes since birth to death in varying degrees (Shetti et al, 2011)³. Anthropometry of face can be helpful in the field of forensic odontology. The arc length, facial height and rugae are helpful in dental anthropometry (Kallianpur S et al, 2011)⁴. Face is a pleasant and beautiful asset, it can be liable to a therapist for diagnosing many diseases, if any disproportion occurs (Chandra J H et al, 2012)⁵. Craniofacial anthropometry is a vital division of craniofacial surgery & syndromology. It is a very important technique to study the growth of human and also used for the study of different races, ethnicity as well as for diagnosis of many diseases and treatment (Oladipo et al, 2012)⁶. Facial anthropometry is useful in forensic medicine, plastic surgery, oral surgery & for diagnosis of any disease which is affecting soft tissue over face compared with normal individuals (Uttekar K et al , 2012)⁷. Type of face is also useful to define ethnicity and it is also determined by craniofacial anthropometry. Determination of facial parameters is of great importance for forensic science and reconstructive surgery (Jeremic D et al, 2013)⁸. Body shape & sizes are also found to be determined by nutritional factors. Accurate facial analysis is essential to study normal growth and acquired diseases (Kumar M et al, 2013)⁹. Facial morphology can provide us clues for health related problems in future life. There is a hypothesis by Sierra-Johnson and Johnson that facial characteristic e.g. Cheek fat can be an indicator to diagnose insulin resistance. Rantala and colleagues observed that regional fats are mostly deposited in the face (Lee J B & Kim Y J, 2014)¹⁰. Quantitative morphometric techniques have got great potential to demonstrate facial dysmorphology. Accumulation of extracellular substrates are mostly deposited in facial compartment (Lee J B & Kim Y J, 2014)¹⁰. It has been seen that visceral obesity is related to chronic diseases such as diabetes mellitus, metabolic syndrome, cardiovascular diseases and insulin resistance. It is seen that waist circumference is more accurate predictor than BMI (Body mass index). Over the last few years, lots of studies have been conducted to find out the association between facial anthropometric

features and visceral obesity. Most studies suggested strong association between facial characteristics & body mass index (BMI) (Lee J B & Kim Y J, 2014)¹⁰. Face is a harmonious asset. A therapist takes responsibility of a persons' desirable beauty of face. Various angular & linear measurements have been conducted using anthropometric landmarks. It can be useful for maxillofacial surgeons. The desired results are not brought by hard tissues rather soft tissue plays an important role in surgical procedures performed for facial aesthetics (Chandra J H et al, 2015)¹¹. In the last two decades, morphometrics has undergone revolution. Various newer techniques have been produced (Utkaulp N and Ercan I, 2015)¹².

MATERIALS AND METHODS

STUDY SAMPLE: After obtaining permission from the Institutional Ethics Committee for the study, we prepared consent form and proforma for each and every subject.

INCLUSIVE CRITERIA: Study was conducted on hospital-based population. Data collection was collected randomly from the general OPD.

EXCLUSION CRITERIA: The subjects who were having previous history of facial or orthodontic surgery, any facial deformity, and patients suffering from hypertension, diabetes mellitus, thyroid disease, liver failure, renal diseases, psychosis, other metabolic disorders and any facial reconstructive surgery.

STATISTICAL ANALYSIS: For finding association between categorical variable, we have applied Chi square test and some graphical tools and for quantitative variable applied t-test, z-test or finding the relation between variables using Pearson correlation test.

TYPE OF STUDY: Cross-sectional observational study.

SAMPLE SIZE: 216.

Sample Size Calculation: The whole study has been conducted on hospital-based population. By using EPI Info 7, we have calculated sample size with prevalence rate of 10% and allowable marginal error is 4, hence our calculated sample size is nearly 216 at 95% confidence interval.

Sample size: Random sampling.

P= Prevalence= 10%= 0.10

q= (1-p)= 90= 0.90

d= 4

Substituting these values, we will get= 216.

ANTHROPOMETRIC MEASUREMENTS: (Singh P and Bhasin M K, 2004)¹⁹

Somatometric measurements have been conducted at the same fixed time and by the same individual. We have measured all the facial parameters by using Digital Vernier Calliper

BIZYGOMATIC BREADTH (zy-zy)

Definition: It measures the straight distance between the two zygia (zy) i.e., the most lateral points on the zygomatic arch. The greatest breadth of the bizygomatic arch is usually found near the ear and not on the cheek (Singh P and Bhasin M K, 2004)¹⁹

Method: At first, we marked a point about 2 cm in front of the tragus to determine the zygomatic arch by measuring with scale. After that we held the tips of the spreading calliper between thumb and index finger over the zygomatic arch in such a way that the joint of the spreading calliper should be in the midsagittal plane. We were careful about the displacement of the skin over that area.

Instrument used: Spreading calliper.

ZYGION (zg): It is the most laterally placed point on the zygomatic arch. These points are determined by taking bizygomatic breadth (Singh P and Bhasin M K, 2004)¹⁹



FIGURE 8: Bizygomatic breadth

RESULT & DISCUSSION

1. Comparison of the parameters in male population
2. Comparison of the parameters in female population
 - a. Comparison of the parameters in the age group of 40-45 yrs.
 - b. Comparison of the parameters in the age group of 46-50 yrs.
 - c. Comparison of the parameters in the age group of 51-55 yrs.
3. Correlation between group & gender.
4. Correlation between group & age.

	Male	Female
BZB	133.92 ± 6.79	126.86 ± 8.77

Comparison of parameters in the age group

	25-30	31-35	36-40
BZB	128.95 ± 8.63	127.77 ± 10.24	131.13 ± 7.04

	Male(mm)	
Very narrow	≤127	≤120
Narrow	128-135	121-127
Medium	136-143	128-135
Broad	144-151	136-142
Very broad	≥152	≥143

Normal range-variation of Bizygomatic Breadth (according to Lebzelter & Saller)

In present study, the bizygomatic breadth in male is 133.92 ± 6.79 whereas in female is 126.86 ± 8.77 mm. In the age group of 25-30yrs it is 128.95 ± 8.63, 127.77 ± 10.24 mm in the age group of 31-35 and 131.13 ± 7.04 mm in the age group of 36-40 yrs. According to the range we can classify the type of face in the population, in males the mean bizygomatic breadth is 133.92 ± 6.79 mm that means it is narrow in type while in case of females the mean is 126.86 ± 8.77 mm that means it is also narrow in type. Solon E C C et al (2012)¹ had also used the landmark zygon to compare the shape of the face of hypertensive & non hypertensive subjects. They had found great degree of displacement of the cheeks in hypertensive patients as compared to non-hypertensives. Moore S E et al (2002)¹³ had also used the parameter bizygomatic breadth by measuring the straight distance between two zygon for their study on fetal alcohol syndrome. Demayo C G et al (2009)² also used the landmark zygon in their study and they found the right zygon was at a higher position in diabetics, compared to non-

diabetes. In a study by Philip R.N Sutton et al on 208 zygions, they found considerable difference¹⁴. They reported the range between 1.4 mm to 21.4 mm. which was related to general body build. In a study by Maryna Steyn et al. stated that bizygomatic breadth as the most dimorphic parameter with accuracy of 80% in a sample size of 44 males & 47 female skeletons¹⁵. Another study by Oskam C.L. et al on 31 damaged skull, zygomat arch is a fragmented structure. Bizygomatic arch is one of the most useful measurements in craniometry¹⁶. Rawat A et al conducted a study on correlation of bizygomatic breadth and maxillary central incisor. They concluded the positive finding of correlation between Pound’s formula and bizygomatic breadth¹⁷. Arboleda et al (2011)¹⁸ evaluated a study on craniofacial development over a period of eight years where the bizygomatic breadth was selected as an important parameter. They compared the growth on cranial & facial measurements.

CONCLUSION

The present study reports the sexual dimorphism in bizygomatic breadth. Very limited studies on bizygomatic breadth have been reported with sexual dimorphism. Bizygomatic breadth is an important somatometric parameter as a part of anthropometry. The findings of the study will be useful for facial reconstructive surgery, faciomaxillary surgeon, forensic science.

CONFLICTS OF INTEREST: There is no conflict of interest found for this study.

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