OSTEOMETRIC ANALYSIS OF UPPER FACIAL SKELETON USING CRANIOMETRIC POINTS ON NORMA LATERALIS

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Running title: Osteometric analysis of upper facial skeleton using craniometric points on Norma lateralis

Type of study: original study

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ABSTRACT:

Introduction:

Osteometry is the study and measurement of the human or animal skeleton, particularly in an archaeological or anthropological context, employing craniometric points on the norma lateralis.

Aim:

The aim of the study is to perform osteometric analysis of the upper facial skeleton using craniometric points on norma lateralis.

Materials and Methods:

The morphometric parameters involved in this study are Fronto malar temporale,basion,nasion,prosthion,zygion.The morphometric parameters are measured using spreading caliber.

Results:

The present study has observed that the mean distance between fronto malar temporal to Prosthion, Basion to Nasion, Basion to Prosthion and Zygion to Prosthion on right and left side.

Conclusion:

The present study concludes by finding out the distance between important craniometric points on norma lateralis. The study's findings can be translated to aesthetic surgery,facial surgeries,for correction of craniofacial deformities.The study can be used to make an attempt to find out the ethnicity and race of skeletons. Anthropologists, anatomists, radiologists, and forensic scientists may find this study useful..

Key words: Craniometry, nasion, basion

INTRODUCTION:

Osteometry is the study and measurement of human skeleton or animal skeleton,especially in an anthropological or archaeological context.The facial skeleton comprises of facial bones that may contribute to the formation of the skull.The 14 facial bones that contribute to the formation of the facial skeleton are a pair of nasal,lacrimal,maxilla,palatine,zygomatic,mandible and vomer(1).In archaeology osteometry has been used to various ends in the subdisciplines of zooarchaeology and bioarchaeology.Zooarchaeology is a branch of archaeology that studies the remains of animals from archaeological sites.It is also called as faunal analysis.Faunal remains are the items left behind when an animal dies.These include bones,shells,hair,chitin,scales,hides,proteins and DNA. Craniometry is the scientific measurement of the dimensions of the skull and face in order to determine the characteristics of the skull and face in relation to sex, race, and body type. The basic concept of craniometry is that brain size is determined by the size and form of the skull.(2–5)

Craniometry is the process of taking exact measurements of the skull using 'anatomical markers.' These landmarks can be established using a variety of approaches, including physical direct measurement or 2D x-ray and CT scan pictures.(6,7). The study of bones and other biological components discovered in archaeological remains to learn about previous human existence and the environment is known as bioarchaeology. The comparison of many characteristics of ancient skeletons can be used to establish which species a skeleton belongs to and whether the differences are large enough to constitute a new species. Osteometry has also been used to determine the race and ethnicity of skeletons in the past.. Osteometry is utilised in paleobiological studies to get insights about former human populations. Anatomically, markers on the skull are important. Craniometric points can be utilised as surgical landmarks as well as for radiological and anthropological measurements of the skull. The fronto malar temporale (found on the temple region beside the eyes), nasion (also known as the bridge of the nose, it is the midline bony depression between the eyes where the frontal and two nasal bones meet, just below the glabella), and basion (the median point of the anterior margin of the foramen magnum) were all considered in this study. Various lines and measurements are made with basion in the diagnosis of atlanto-occipital dissociation [AOD] injuries,platybasia, and basilar invagination],prosthion (it is the most anterior point in the midline on the alveolar process of the atlanto-occipital dissociation [AOD] injuries,platybasia, and basilar invagination],prosthion (it is the most anterior point in the midline on the alveolar process of maxilla),zygion (it is present at either end of the bizygomatic diameter.it is the most commonly defined landmark on the temporal bone,also called the lateral or mid zygomatic).

It is preferable to study apportionable sections of the cranium rather than the entire cranium. (8) There are three intertwined ontogenetic processes or mechanisms that cause differences in adult human facial form. (9)Most of the masticatory and respiratory components of the cuncaicha are comparable to those of Lagoa Santa and Lauricocha. (10)
By employing discriminant function analysis, sexual dimorphism in metric relations between anatomical locations of the skull utilising CT scans in a Jordanian population does not appear to be significant. (11)In Chinese females, the area from the subnasale to the pronasale showed a more significant upward bend than in Chinese males..((12)
Literature review has revealed that there are not enough studies on the osteometric analysis of south indian skulls. (13–20),(21),(22),(23),(24,25),(26),(27),(28–32)
Therefore,the study aims at doing the osteometric analysis of the upper facial skeleton using craniometric points on norma lateralis of south indian dry skulls.

MATERIALS AND METHODS:

A total of 30 dry human skulls from the department of anatomy in Saveetha Dental College and Hospitals were used to carry out this study.The parameters included in this study are measuring the distance between fronto malar temporale to prosthion,basion to nasion,basion to prosthion,zygion to prosthion.The measurements are taken for both left and right sides of the skull.These parameters are measured using a spreading caliber.The data are collected and represented in graphs.Descriptive and inferential statistics are carried out using spss (statistical packages for social sciences) software. T test for the left and the right measurements of the parameters is conducted.

RESULTS:

The present study has concluded by calculating the mean/average distances between the craniometric landmarks included in the study and also by finding out the standard deviation values. The average distances between fronto malar temporale to prosthion on the left and right sides respectively are 8.6066 and 9.24.t test analysis shows that significant difference between right and left side with p value 0.000045. The result is significant at P<0.05. The average distances between basion to nasion on the left and right sides respectively are 10.1833 and 10.1666.t test analysis shows that significant difference between right and left side with p value 0.4547. The result is significant at P<0.05

The average distances between basion to prosthion on the left and right sides respectively are 9.7866 and 9.8366.t test analysis shows that significant difference between right and left side with p value 0.354325. The result is significant at P<0.05. The average distances between zygion to prosthion on the left and right sides respectively are 8.4466 and 8.5433.t test analysis shows that significant difference between right and left side with p value 0.23781. The result is significant at P<0.05. The standard deviation values for fronto malar temporale to prosthion on the left and right sides respectively are 0.4042 and 0.6964. The standard deviation values for basion to nasion on the left and right sides respectively are 0.5669 and 0.5451. The standard deviation values for basion to prosthion on the left and right sides respectively are 0.4475 and 0.5312. The standard deviation values for zygion to prosthion on the left and right sides respectively are 0.5660 and 0.4482.

The present study observed that in Table 1 represents the average/mean distance and standard deviation of the parameters on both left and right side for all 30 skulls.Figure 1 represents the distance between basion to prosthion on the left side of a dry human skull measured using a spreading caliber. Figure 2 represents the distance between basion to nasion on the left side o a dry human skull measured using a spreading caliber.Figure 3 represents the distance between fronto malar temporale to prosthion on the left side of a dry human skull measured using a spreading caliber.Figure 4 represents the distance between zygion to prosthion on the left side of a dry human skull measured using a spreading caliber.Figure 5 represents the distance between zygion to prosthion on the right side of a dry human skull measured using a spreading caliber.Figure 6 represents the distance between fronto malar temporale to prosthion on the right side of a dry human skull measured using a spreading caliber. Figure 7 represents the distance between basion to nasion on the right side of a dry human skull measured using a spreading caliber.Figure 8 represents the distance between basion to prosthion on the right side of a dry human skull measured using a spreading caliber.

PARAMETERS	MEAN		STANDARD DEVIATION	
	LEFT	RIGHT	LEFT	RIGHT
Fronto malar temporal to Prosthion	8.606667	9.24	0.404231	0.696419
Basion to Nasion	10.18333	10.16667	0.566954	0.447516
Basion to Prosthion	9.786667	9.836667	0.447516	0.531241
Zygion to Prosthion	8.446667	8.543333	0.566099	0.448231

TABLE 1: represents the average/mean distance and the standard deviation of the parameters on both left and right side for all 30 skulls

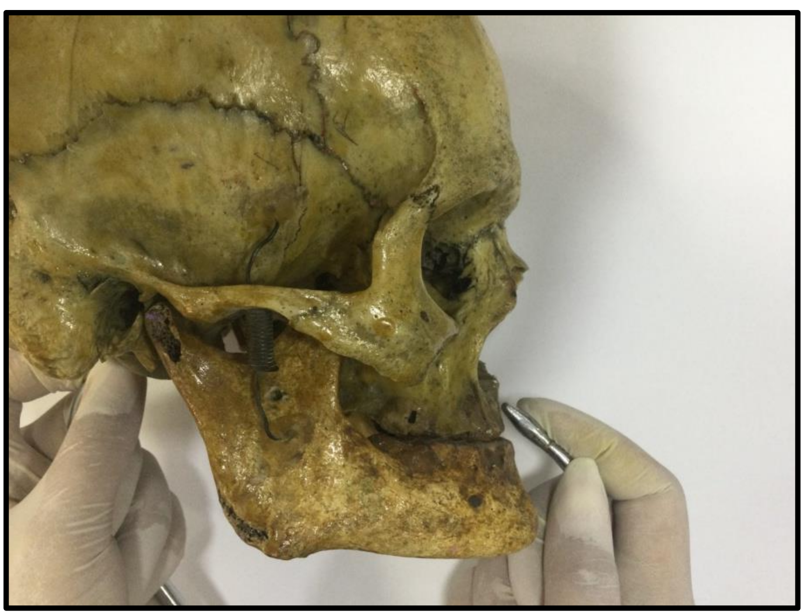

FIGURE 1: shows the distance between basion to prosthion of a dry human skull measured using a spreading caliber.

FIGURE 2: shows the distance between basion to nasion of a dry human skull measured using a spreading caliber.

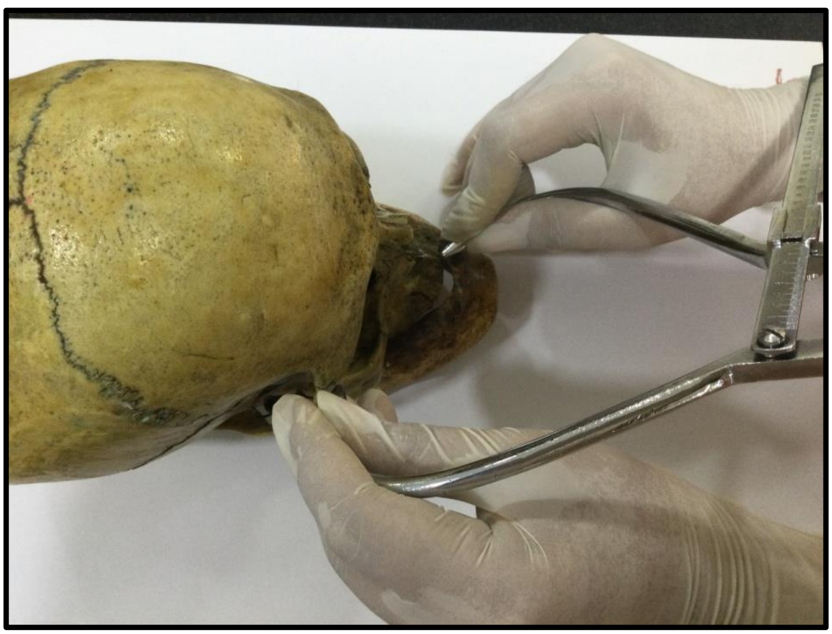

FIGURE 3: shows the distance between fronto malar temporale to prosthion of a dry human skull measured using a spreading caliber.

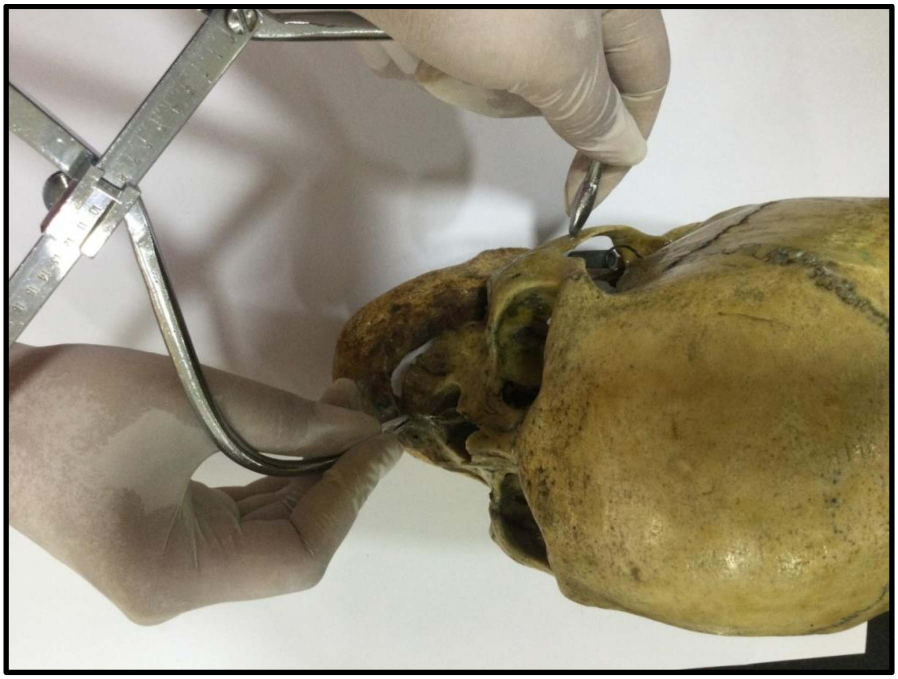

FIGURE 4: shows the distance between zygion to prosthion of a dry human skull measured using a spreading caliber.

DISCUSSION:

In metric relationships between anatomical locations of the skull, there is sexual dimorphism. To avoid additional exposure or damage to vital anatomical features, a full understanding of the interaction between the cranial surface and intracranial structures is essential. Since the 1800s, cranial points (CPs) have been employed in neuroscience. The identification of critical cerebral structures is possible thanks to the localization of the CPs.(33) The ability to locate interior cerebral anatomy using superficial markers is critical for recognising and avoiding crucial structures and, as a result, reducing surgical morbidity (34) It is critical for neurosurgical practise to master and be well-versed in the multilayer architecture of the brain. Dissections can be paired with recent breakthroughs in three-dimensional (3D) technology to better comprehend the spatial correlations between anatomical landmarks and neurovascular structures found during the surgical operation.(35) For anthropological investigations involving craniofacial applications, 3D-CT volume rendering pictures employing craniometric measures can be employed to localise interior cranial anatomy based on surface landmarks. (36) The northwest Ethiopian population has a high incidence of type 2 asterion, according to a prior study that determined the type and mapping of asterion and its relationship with the transverse-sigmoid venous sinus junction [TSSJ]. The TSSJ is usually found near the level of the asterion in most situations..(37)

Venter et al. conducted a study in 2019 to see if the inion and asterion can be used as superficial landmarks for the confluence of sinuses and the transverse sigmoid sinus junction, respectively, in a South African population. They found that neither the inion nor the asterion are directly related to the confluence of sinuses or the transverse sigmoid sinus junction.(38)

Venter et al. ran a study in 2019 to see if the inion and the In 2006, an analytical investigation was done to comprehensively measure human skulls in order to notice and quantify the difference. The data revealed that the orbit on the left side was much larger in terms of breadth, height, and surface area. They also measured a right-side mandible that was narrower..(39)
Robinson and Bidmos performed a to establish population specific standards for sex determination from the skull.the results of the previous study showed that diagnostic accuracy is lower than that obtained from the south african femur and tibia.(40)
Ibrahim et al. found that it is better to assess apportionable sections of the cranium rather than the entire cranium in a study published in 2020 to develop a methodology for measuring the sexual dimorphism of adult crania using three-dimensional geometric morphometric approaches. In a previous study, significant sexual differences in the morphology of the vault's midsaggital curve, upper face, nose region, orbits, and palate were discovered. (41)
Alhourani et al. did a study in 2020 utilising CT scans to assess the sexual dimorphism in metric connection between anatomical locations of the skull in a Jordanian population using discriminant function analysis. In the prior study, the results of discriminant function analysis did not appear to be significant. In 1991, Nerves and Pucciarelli conducted a study that yielded similar findings.(10,42).
The limitation of this study was that it had a small sample size and all the skulls belonged to south indian population only.For future scope, studies involving larger sample size and population and race/ethnic specific data needs to be developed.

CONCLUSION:

The goal of this study was to determine the distances between critical craniometric locations on the Norma lateralis. Radiologists, anatomists, anthropologists, and forensic scientists may find this study useful. These findings can be applied to aesthetic surgical practise to help the plastic surgeon and patient get more comfortable with each other's anatomy in order to better forecast, plan, and execute operations like filler injections and pre-orbital procedures. This research will improve morphometric understanding of the upper face skeleton and its usefulness in anthropological, evolutionary, sex determination, facial surgeries, clinical, and treatment of craniofacial malformations. It may also be used to determine the ethnicity and race of skeletons.

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AUTHOR CONTRIBUTIONS:

Ms.Vishaka: Literature search, survey, experimental data collection, analysis, manuscript writing
Mrs.S.Sangeetha: Study design, data verification, manuscript drafting

CONFLICTS OF INTEREST:

None to declare.

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