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Craniometry Patterns of Nigerians and its Correlation with Chronological age

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Abstract

Cranial dimensions and cranial indices are considered as simplest and most efficient way to indicate facial differences and age variations. Cranial morphology and dimensions are used to evaluate various aspects of growth and development thus helping in population differentiation.

Aim: the study is to investigate the craniometrical patterns in the Nigerian population based on three dimensional computed tomographic data, with the objectives of determining the age of individuals in the eastern part of Nigeria as well as determining if the skull of individual varies with age using computed tomography.

Methodology: involves a descriptive study design with age determined using standard ageing techniques. 150 dry adult human skulls cases (male and female both) constituted the material for the present study between age group of 25-60 years. Data were scanned in the radiology department and the CT data were processed in a computer workstation at the department. The CT scan acquisition was performed with 1.5mm slice thickness and reconstruction was done with 1.0 m 2 m slice thickness. All the CT data were recorded using DICOM 3.0 as a medical image file format into CD-ROM. The segmentation techniques were used to identify the region of interest of the computed tomography image based on Hounsfield unit. The selected region was calculated into 3-D modem based on the traditional definition with the modification into 3D model. The anatomical landmarks in craniometrics study were: Glabella (GL), Bregma (BR), Opisthocranium (OPC), Nasion (NA), Basion (BA). The measurements were interpreted using statistical analysis and reported in form of comparism of the mean values and mean difference, standard deviation, and confidence interval in respect to the various landmarks. Analysis of variance was utilized with p-value 0.005 alpha level of significant.

Result: the total number of sample for each landmark group is 1050 which covers the range value of 6 with a minimum number 1 and maximum number 7. The total sum of all Landmarks d is 4,200. The mean statistics of the seven groups is 4.00 with standard error of 0.62. The total number of length is 1050 with range of 119. The length attracts the minimum and maximum value of 80 and 199 with total sum of 132282. The mean statistics is 125.98 with standard error of 0.740.

Keywords: Craniometry • Anthropometry • Cranial vault • Cranium • Encranial • Sex • Age variations

Abbreviations

SS: Sum of Squares; MSS: Mean Sum of Squares; TRT = Treatment; F-ratio: Mean sum of squares of treatment/mean sum of square of error, N: Number of sample; K: Total number for each treatment, DF: Degree of freedom

Introduction

Craniometry being the scientific study and measurement of the skull has been useful in anthropometry for the morphometric and non-morphometric identification of the sex and age and in forensic practice when cranial remains are compared with living photographs. Cranial dimensions and cranial indices are considered as simplest and most efficient way to indicate facial differences and age variations. For instance, cranial volume expresses several aspects of growth and development and permits critical evaluation of unusually large or smallcrania [1]. Through skull morphology, population differentiation has been explored by recent studies [2-5], showing that not only vault features but also various facial characteristics are responsible for both inter and intra-regional differences within a region. These cranial index variations between and within population have been attributed to a complex interaction between genetic and environmental factors. There are several skeletal indicators that are used to estimate age at death for adults such as Cranial suture closure or suture synostosis of which Nawrocki (1998) introduced 14 regression equations for determining age at death using these sutures and as Acsadi and Nemeskeri (1970) opined in an attempt to create an age estimation method using endocrinal suture closure while examining 285 symmetrically closing crania suggest that as age increases so does mean suture closure [6,7].

The aim of the study is to investigate the craniometric patterns in the Nigerian population based on three dimensional computed tomographic data with the objectives of determining the age of individuals in the eastern part of Nigeria as well as determining if the skull of individual varies with age using computed tomography since it enables 3-D reconstruction and assesses the cranium data both inner and outer anatomical landmark for the craniometric study.

Methodology

Methodology Involve a descriptive study design with age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000) [8]. Normally, the practice consists of taking precise measurements using 'anatomical landmarks' on the skull. The inclusion criteria include individuals within ages 25 to 60 with no incidence of head trauma or abnormality, no loss of teeth from the maxilla and no chronic illness that might affect the cranium. The exclusive criteria include individuals with anatomical deformities and children. The data was collected from a CT SCAN's radiological department in Abia state Diagnostic center, Umuahia and Union diagnostic center, Port Harcourt Rivers State. Patients were scanned in the radiology department and the CT data were processed in a computer workstation at the department. A spiral computed tomography scanner (SIEMEN) was used to obtain data from 150 crania. The CT scan acquisition was performed with 1.5mm slice thickness and reconstruction was done with 1.0m 2m slice thickness. All the CT data were recorded using DICOM 3.0 as a medical image file format into CD-ROM and

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subsequently will be imported to the medical imaging software (MIMICKS). The segmentation techniques will be used to identify the region of interest of the computed tomography image based on Hounsfield unit. The selected region was calculated into 3-D modem which enabled determination of the 3-D Craniometric data. During each scanning, each subject was placed in a supine position. Axial scanogram was obtained from the setting that the tube voltage is 120KVP and tube current be 52 mA, with 0.58 rotation time and 1mm slice thickness, the CT scan lateral view 300 applications present in the machine so as to avoid problem of magnification. To determine the craniometric data in the present study, the first step was to define the anatomical landmarks which can be classified as median and bilateral types. All landmarks used in the present study were based on the traditional definition with the modification into 3-D model. The most prominent anatomy in 2-D/3-D views were selected to state the proper position of each anatomical landmark. The second step was to calculate the craniometric parameters, which were derived from the two and three coordinate points for linear and angular measurements respectively. The measurement data were typed in Microsoft Excel and then exported to SPSS version 20.0 for the statistical analysis.

The anatomical landmarks in craniometric study are categorized into median and bilateral landmarks [9].

The mean landmarks are approximately located on sagittal plane. The landmarks are:

Glabella (GL) - the most anterior point of frontal bone between supraorbital in the sagittal plane. Bregma (BR) - the crossing of the coronal and sagittal sutures on the top of the skull. Opisthocranium (OPC) - the most posterior point in midline of inion bone which length of the skull is maximum when measure from Glabella point.

Nasion (NA) - the intersection point of the internasal and frontonasal sutures in the sagittal plane. Basion (BA) - the most anterior point of the great foramen magnum in the sagittal plane.

Each of the three-dimensional models of skull is used to determine the anatomical landmark. Only one investigator locates the entire landmarks in every skull to avoid uncertainty of intra-observer. The measurements are interpreted using statistical analysis and reported in form of comparism of the mean values and mean difference, standard deviation, and confidence interval in respect to the various landmarks. In order to distinguish Craniometric parameters of each age, analysis of variance was utilized for analysis. A p-value 0.005 alpha level of significant that was used to determine the difference. 150 dry adult human skulls cases (male and female both) constituted the material for the present study between age group of 25 - 60 years. In this study,we considered only complete union of the glabella occiput length, basionnasion length, basionbregma height, nasionbregma cord, bregma lambda cord, lambda opisthion length, basionprosthion length sutures instead of taking into account other scoring system of suture closure and compared with standard data mentioned in different previous studies.

Results

Result of the study shows that the total number of sample for each landmark group in table 1.1 is 1050 which covers the range value of 6 with a minimum number 1 and maximum number 7. The total sum of all Landmarks d is 4,200. The mean statistics of the seven groups is 4.00 with standard error of 0.62. The total number of length is 1050 with range of 119. The length attracts the minimum and maximum value of 80 and 199 with total sum of 132282. The mean statistics is 125.98 with standard error of 0.740.Table1.4 describes the data in terms of the mean, standard deviation, standard error and the confidence interval for the mean. The total for each group mean, standard deviation, standard error and confidence interval (CI) can be seen at the columns of the Table 1.

Table 1.2 describes the confidence interval for the mean (upper bound), minimum value and maximum value of the length for each group. LOL has the least value with a cumulative mean of 99.89 and it is considered as the group minimum number of mean (xmin). BNL has the second least value with the cumulative mean of 115.26 and is considered as second minimum number of mean (x2min). BLC is the third minimum with the cumulative mean of 117.34 (x3min). BBH is the fourth minimum with the cumulative mean of 123.25 (x4min). BPL is the fifth minimum with the cumulative mean of 124.53 (x5min). NBC is the sixth minimum with the cumulative mean of 128.14 (x6min) and GOL has the maximum cranium length value with the cumulative mean of 173.46 and is considered as the group with maximum number of mean (xmax) Tables 2 & 3.

From the distribution of means among the various group. We notice that the difference between each group is not large but rather each group differences from another group b a few number which ranges from 1 to at least 50 Tables 4 & 5.

Decision Rule: If F-ratio value is less than or equal to 0.05 alpha level of significance then the test is statistically significant.

The between group has sum of squares of error 470793.851, the degree of freedom (df) is 6, the mean square error 78465.642, F-ration of 617.463 and significant value 0.00. The within groups has sum of squares of error 132541.840, degree of freedom 1043 and mean square error 127.078. The total sum of squares of error is 603335.691, the total degree of freedom I 1049.

Table 1. Descriptive Analysis-LENGTH (Lower Bound).

	G0L	BNL	BBH	NBC	BLC	LOL	BPL	Total
N	150	150	150	150	150	150	150	1050
Mean	173.46	115.26	123.25	128.14	117.34	99.89	124.53	125.98
Std. Deviation	13.860	8.404	13.317	9.313	10.987	12.535	9.215	23.982
Std. Error	1.132	1.686	1.087	1.760	1.897	1.023	1.752	1.740
95% Confidence Interval for Mean	171.22	113.90	121.10	126.64	115.57	97.87	123.05	124.53

Table 2. Descriptive Analysis -LENGTH (Upper Bound).

	G0L	BNL	BBH	NBC	BLC	LOL	BPL	Total
95% Confidence Interval for Mean	175.70	116.6	125.40	129.64	119.11	101.92	126.02	127.44
Minimum	144	94	98	102	90	80	99	80
Maximum	199	139	171	149	142	169	150	199

Table 3. Tabular Representation of Landmarks - LENGTH.

	LOL	BNL	BLC	BBH	BPL	NBC	G0L
Subset for alpha = 0.05Sig	150	150	150	150	150	150	150
	99.89	115.26	117.34	123.25	124.53	128.14	173.46
	1.000	.684	.958	.083	1.000		

Table 4. Comparing the Group Means.

Parameters Age	GOL	BNL	BBH	NBC	BLC	LOL	BPL
25-35	31.2228	20.7468	22.185	23.0652	21.1212	17.9802	21.6864
36-45	20.8152	13.8312	14.78	15.3768	14.0808	11.9868	14.4576
46-55	52.038	34.578	36.578	38.442	35.202	29.967	36.144
56-65	69.384	46.104	46.104	51.256	46.936	39.956	48.192

Table 5. Anova Analysis - LENGTH.

	Between Groups	Within Groups	Total
S/N	150	150	
Sum of Squares	470793.851	132541.840	603335.691
Df	6	1043	1049
Mean Square	78465.642	127.078	
F-ratio	617.463		
Sig.	0.000		

From Table 1.1 the alpha (α) level of significance used was 0.05. The confidence interval for each group was displayed in each column. The significance value or p-value was 0.00. In this research work the significance value is 0.00 which means that the researcher is 90% confident that the results are accurate.Therefore, the test is statistically significant which means that the cranium results have an acceptable amount of error. The confidence interval for each group is given as LOL=99.89, BNL=115.26, BLC=117.34, BBH=123.25, BPL=124.53, NBC=128.14, GOL=173.46. with p-value or significance values in each rows 1.00, 0.684, 0.958, 0.85 and 1.000.Since all the p-value are less than or equal to 1.00 therefore we are 90% confident that the result is accurate and the research work is statistically significance, the aim of the craniometric research is achieved.

Conclusion

can be drawn that the craniometric data of Nigerians age have statistical significant differences in their mean values. Age of the cranium skulls suture of glabellooccipu t length, basionnasion length, basionbregma height, nasionbregma cord, brema lambda cord, lambda opisthion length, basionprosthion length suture was matching with standard data given in the table that was analyzed.

References

1. Haack DC and Meihoff EC. “A method for estimation of cranial capacity from cephalometricRoentgnograms.” *Am J PhysAnthropol* 34(1971): 447-452.
2. Hienaux J. “Physical anthropology of the living populations of Sub-Saharan Africa.” *Ann Rev Anthropol* 5(1976): 149-168.
3. Howells WW. "Skull shapes and the map: craniometrics analyses in the dispersion of modern homo." Papers of the Peabody Museum of Archaeology and Ethnology 79(1989).
4. Froment A. "Origines du peuplement de lEgypteancienne: lapport de lanthropobiogie." Archeo-Nil 2(1992): 79-98.
5. Froment A. Le peuplement de lAfrique Centrale: contribution de la paleoanthropology. In Delneuf M, Essomba JM and Froment, A 25 (eds) Paleoanthropologie en Afriquecentrale: Un Bilan de l Archeologie en Cameroun 1(1998): 13-90. Paris: LHamattan.
6. Nawrocki S. "Regression formula for estimating age at death from cranial suture closure. In: Reichs K (ed)." Forensic Osteology: Advances in identification of human remains. Springfield, IL: CC Thomas 1(1998): 276-292.
7. Acsadi GY and Nemeskeri J. “History of human life span and Mortality.” Budapest: Akademiai Kiado (1970).
8. Cox M and Mays S. "Ageing human skeletal material’ in Human Osteology in Archaelogy and Forensic Science." London: Greenwich medical media ltd 1(2000): 61-82.
9. Rooppakhun Piyasin S and Vatanapatimakul N “Craniometric Study of the Thai Skull based on Three-Dimensional Computed Tomography Data.” *J Med Association of Thailand* 93(2010): 90-98.

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