International Journal of Applied Dental Sciences 2018; 4(1): 33-36

ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2018; 4(1): 33-36

www.oraljournal.com
Received: 11-11-2017
Accepted: 12-12-2017

Harsha Bhayya
Assistant Professor,
Department of oral medicine and radiology Kamineni Institute of dental sciences Sreepuram, Narketpally Nalgonda, Telangana, India

Avinash Tejasvi ML
Associate Professor
Department of Oral Medicine and Radiology Kamineni Institute of Dental Sciences Sreepuram, Narketpally Nalgonda, Telangana, India

Pooja M
Assistant Professor
Department of oral Medicine and Radiology S.B. Patil of Dental College and Hospital
Bidar, Karnataka, India

Pavani Donempudi
Assistant Professor
Department of Oral Medicine and Radiology Ycmmrdf's Dental College and Hospital
Ahmednagar, Maharashtra, India

Correspondence
Avinash Tejasvi ML
Associate Professor
Department of Oral Medicine and Radiology Kamineni Institute of Dental Sciences Sreepuram, Narketpally Nalgonda, Telangana, India

Original Research

Odontometric and Skull anthropometric parameters for assessing stature in Nalgonda population: A cross-sectional study

Harsha Bhayya, Avinash Tejasvi ML, Pooja M and Pavani Donempudi

Abstract
Background: Stature is the height of a person in the upright posture, is an important anthropometric parameter that can be used to determine physical identity as it is one of the distinct visible factors of an individual. Stature exhibits a proportional relationship with that of every part of human body such as head, face, extremities etc., which plays a vital role in forensic examination to calculate the stature from dismembered and mutilated body parts.
Aims and Objective: To estimate the height of an individual based on odontometric and skull parameters. To investigate the relationship of the height of a person with the diameter and circumference of skull as well as with combined mesiodistal width of maxillary anterior teeth.
Materials and methods: In this study, 100 persons were evaluated. Mesiodistal widths of the permanent maxillary anterior teeth, diameter of skull, circumference of the skull and height were measured. Linear regression analysis was used for the known heights of the combined data and data for males and females against the odontometric and anthropometric variables.
Results: On linear regression analysis, the selected parameters were found to be statistically significant predictor of height. Highly significant correlation was observed between height and other parameters for combined data and data for males and females.
Conclusion: In present study based on linear regression analysis, various combinations have been tried for assessing the height. Hence mathematical formulas have been proposed for these parameters and combinations of various parameters for determination of height for nalgonda population.

Keywords: Height, Skull, Odontometric, Tooth Dimensions, Regression Analysis

Introduction

Every structure of the body in its morphology and in histology continuously functions and maintains physiological equilibrium. All the human beings occupying this globe belong to same species i.e. Homo sapiens, yet no two individuals are exactly alike in all their measurable traits, even genetically identical twins differ in some aspects. Skeletal development is influenced by a number of factors producing differences in skeletal proportions between different geographical areas; it is desirable to have some means of giving quantitative expressions to variables which such traits exhibits. Anthropometry is a scientific specialization which involves a metric analysis of human characteristics. Forensic anthropology deals with identification of human remains with the help of metric technique, [1] to supplement the law enforcement agencies. In highly mutilated bodies identification is very difficult. In forensic investigations of such cases, estimation of stature becomes equally important along with other identification parameters like age, sex, race, etc., Stature is the height of a person in the upright posture, is an important anthropometric parameter that can be used to determine physical identity as it is one of the distinct visible factors of an individual. [2-3] In cases where identification has to be performed based on skeletal remains, the most common stature estimates are derived from long bones. [4] These are based upon the principle that the various long bones correlate positively with stature. [5]

Stature exhibits a proportional relationship with that of every part of human body such as head, face, extremities etc., which plays a vital role in forensic examination to calculate the stature from dismembered and mutilated body parts. [6]

Various studies have been reported on Stature correlation to skull and jaw dimensions However, few studies have been done correlating various odontometric parameters with the height of an individual. This study was undertaken to investigate the relationship of the height of a person with the diameter and circumference of skull as well as with combined mesiodistal width of maxillary anterior teeth with the statistical aid of regression analysis of these variables.

Materials and Methods

The study was conducted in the Department of Oral Medicine and Radiology, Kamineni institute of dental sciences with the representative Telangana population of 100 patients as 50 males and 50 females in the age group of 20 - 40 years.

Patients were included in the present study based on presence of complete set of fully erupted, periodontally healthy teeth, presence of non-carious, non-worn teeth with no dental history of any crown restorations, Complete set of intact and satisfactorily aligned maxillary anterior teeth, no history or clinical evidence of cleft palate, orthognathic surgery or trauma and no history or clinical features suggestive of endocrinal disorders, metabolic disorders, developmental disorders and history of prolonged illness.

After obtaining informed consent from the subject selected, measurements of mesiodistal crown width of the six maxillary anterior teeth (later added to derive combined mesiodistal widths), fronto-occipital head circumference, height, and diameter of the skull on a lateral cephalography were performed. All the measurements were performed by two investigators, with one recording the measurements and the other performing radiography.

The skull diameter was derived as the linear distance between the glabella and the external occipital protuberance. This distance was measured on the lateral skull cephalography. The greatest mesiodistal crown widths of the maxillary anterior permanent six teeth were measured between the anatomic contact points of each tooth on either side of the jaw, using dividers with fixing device and pointed tines to access the interproximal areas, with the instrument held parallel to the occlusal plane.

Maximal fronto-occipital circumference was measured by placing a non-stretchable plastic tape (calibrated in millimeters) just on the occipital prominence and the supraorbital ridges. Height was measured as vertical distance from the vertex to the floor using a standard anthropometer.

A commercially available SPSS 18 software programme was used to analyze the data. Combined data, male, and female data were analyzed separately for linear regression of height to the parameters recorded and regression equations were derived for each parameter.

Results

Table 1: Mean Values of various parameters in the study population

Parameter	Male	Female	Combined male and female	p-value
Height in mm	1721.2+ 71.16	1563.5 + 50.82	1642.35 + 100.33	<0.001**
Diameter of skull	54.64 + 1.86	52.32 + 2.29	53.48 + 2.38	<0.001**
Circumference	170.48 + 10.93	158.02 + 21.87	164.25 + 18.30	<0.001**
11	8.61 +0.97	8.44 + 0.94	8.525 + 0.95	0.377 NS
12	7.01 + 0.82	7.17 + 0.93	7.09 + 0.88	0.368 NS
13	7.7 + 0.96	7.55 + 0.78	7.625 +0.72	0.306 NS
21	8.57 + 0.96	7.95 + 0.98	8.26 + 1.01	0.002**
22	6.95 + 0.80	6.82 + 0.83	6.88 + 0.82	0.432 NS
23	7.72 + 0.56	7.28 + 0.75	7.5 + 0.69	0.001**
Combined mesio-distal width of upper anterior	46.56 + 3.79	45.21 + 4.25	45.88 + 4.06	0.091NS

**-Statistically Highly Significant (p<0.01), NS – Not Significant (p>0.05)

In the present study mean values of all the parameters were calculated there is statistically significant difference present in the mean values of height, diameter, circumference of skull between males and females. Odontometric parameters like tooth 21, 23 showed statistically significant difference between the both genders [Table 1].

Further combined data, male, and female data were analyzed separately for linear regression of height to the parameters recorded. Equations were derived for all the parameters. Best equation for height is derived based on the least p value, highest correlation coefficient value, least standard error (SE) value [Table 2].

When combined mesiodistal width of maxillary teeth of females and combined gender was plotted against height, we found a statistically significant correlation between the two, but there was no statistical significance when males were taken. A higher correlation was observed when head circumference was regressed to the height for the combined genders and male and female separately. When combined head circumference and diameter were regressed there was a statistical significance except with females. When combined mesiodistal width of maxillary teeth with head circumference was regressed, there was a statistical significance except with males. When all the parameters were regressed to height for the combined male and female, data we found statistically significant correlation between two.

Table 2: Linear regression analysis for height estimation

Parameter (x)	Group	Formula	SE	p value	Correlation coefficient
Combined mesiodistal width of maxillary anteriors (X)	Combined	1369 + 6.08*X	97.72	0.013*	0.247
	Male	1667.38 + 1.15*X	71.76	0.671 NS	0.062
	Female	1368.16+4.32*X	41.9	0.010*	0.361
Head Diameter (X)	Combined	1343.79+1.81*X	95.13	0.001**	0.332
	Male	1378.83+2*X	68.39	0.029*	0.309
	Female	1567.33-0.034*X	51.37	0.943 NS	-0.01
Skull Circumference (X)	Combined	385.12+2.35*X	83.7	<0.001**	0.55
	Male	947.11 + 1.416*X	66.78	0.008**	0.37

	Female	1229.67 + 0.638*X	49.21	0.043*	0.287
Head Circumference (X1) + Skull Diameter(X2)	Combined	325.34+2.13*X1+1.08*X2	81.88	<0.001**	0.59
	Male	929.58+1.104*X1+1.1*X2	66.62	0.017*	0.339
	Female	1231.1+0.637*X1-0.008*X2	49.73	0.132 NS	0.287
Combined mesiodistal width of maxillary anteriors(X1) + head circumference(X2)	Combined	1098.77+1.74*X1+0.561*X2	92.81	<0.001**	0.4
	Male	1408.45+2.17*X1-0.123*X2	68.9	0.086 NS	0.31
	Female	1345.02+0.1187*X1+0.442*X2	48.34	0.035*	0.36
Skull Diameter(X1) + Combined mesodistal width of upper anteriors(X2)	Combined	324.65+2.71*X1+22.31*X2	83.43	<0.001**	0.56
	Male	939.63+0.236*X1+14.1*X2	67.48	0.031*	0.37
	Female	1155.62+3.67*X1+4.61*X2	47.27	0.012*	0.41
All the three parameters included	Combined	263.63+2.75*MDW+2.0*DS+1.08*C	81.57	<0.001**	0.6
	Male	956.62-0.91*MDW+1.09*DS+1.23*C	67.23	0.043*	0.4
	Female	1135.28+3.77*MDW+0.459*DS+0.108*C	47.7	0.032*	0.41

**-Statistically Highly Significant (p<0.01), NS – Not Significant (p>0.05)

MDW- mesiodistal width of maxillary anteriors, DS- Skull Diameter, C - Circumference of head

Discussion

Every human have an identity of his own, indulgent societies require that, and this identity can be recognized even after death. The need for this identity of human remains is paramount after the death of individuals which represents a basic human right. [7] Various methods can be used for the identification of human remains, but reliability of each method varies. In physical anthropology, identification can be made by estimating the stature. A drawback to these techniques is limited applicability to fragmentary remains.

Most commonly head or extremities are amputed from the trunk, when the body has been mutilated. An estimate must then be made based on the known relationship of the remains to stature. [8] The estimation of living stature from long bones is based upon the principle that the long bones correlate positively with the stature. However, when these bones are not available, measurements from other body parts should be used to predict body height. Similar to other bones of the body, dimensions of tooth and skull are also genetically determined. [9]

Osteometry seems to be the most accepted technique because it is more effective in determining sex and race to an extent. [8] The method of using teeth and skull measurements has several advantages as the anatomical landmarks are standard, well defined, and easy to locate, so careful study of skull can enable reliable determination of stature of the person. Therefore the present study was aimed to provide a reliable method for the estimation of stature using odontometric parameters.

In the present study, when combined mesiodistal width of maxillary anterior regressed with height, a statistical significance was seen, although a lesser correlation was seen when only values of males were plotted against height. Shalini Kalia *et al*., [10] concluded that odontometry alone is unreliable in stature estimation which is consistent with the results of present study.

Various studies have been done previously for assessing height by regressing the head and skull measurements. A study done on cadavers [11] showed a largest correlation of skull measurements and stature with combined data, a consistently lesser correlation (but statistically significant) for all parameters (except skull diameter) tested for females and sum of skull diameter and circumference most reliable in stature estimation. In present study when skull diameter and odontometric parameters were regressed they showed a high statistical significance. Similarly when combined skull measurement and odontometric parameter were plotted against height, they showed a highly statistically significant correlation.

In a study conducted by Ilayperuma [12], observed a Positive correlation between all cranial dimensions and stature, and concluded that cranial dimensions provide an accurate and reliable means in estimating the height of an individual. Similarly Introna F Jr *et al*., [13] evaluated the possible correlations between cranial diameters and height in a population of 358 young males aged between 17 to 27 years old and proposed a mathematical formula, applicable in forensic investigation, regarding the determination of the actual living stature of subjects for whom skills are the only skeletal remains available for identification procedures. Although the methodology was different from that of present study, positive correlation was found with that of skull parameters and height.

In present study, statistically insignificant correlation was seen for males individual when odontometric parameter and combined odontometric parameter with head circumference were regressed with height. Similarly statistically insignificant correlation was seen for females individually when skull diameter and combined head circumference with skull diameter were regressed with height.

Conclusion

For the establishment of identity of an unknown individual in forensic and anthropological studies, prediction of stature from incomplete and decomposing cranial remains is very important. Therefore, formulae based on the cranial dimensions and odontometric dimensions provide an alternative stature predictor under such circumstances. In present study based on linear regression analysis, various combinations have been tried for assessing the height. Hence mathematical formulas have been proposed for these parameters and combinations of various parameters for determination of height (Table 2).

References

1. Krishan K. Anthropometry in forensic medicine and forensic science-'Forensic Anthropometry'. The Internet Journal of Forensic Science, 2007.
2. Kumar J, Lilinchandra. Estimation of stature using different facial measurements among the Kabui Naga of Imphal Valley, Manipur. Anthropologist. 2006; 8:1-3.
3. Jadav HR, Shah GV. Determination of personal height from the length of head in Gujarat region. J Anat Soc India. 2004; 53:20-21.
4. Sopher IM. The dentist, the forensic pathologist and the identification of skeletal remains. J Am Dent Assoc. 1972; 85:1324-9
5. Holland TD. Estimation of adult stature from fragmentary tibias. J Forensic Sci JFSCA. 1992; 37:1223-

9
6. Krishan K. Estimation of stature from cephalo-facial anthropometry in North Indian population. Forensic Sci Int. 2008; 181:52.e1-6.
7. Taylor J. Development of the Australian society of forensic Odontology disaster victim identification forensic odontology guide. J Forensic Odontostomatol 2009; 27(2):56-63.
8. Jason DR, Taylor K. Estimation of stature from the length of the cervical, thoracic and lumbar segments of the spine in American whites and blacks. J Forensic Sci JFSCA. 1995; 40:59-62.
9. William PL, Bannister LH, Berry MM, Collins P, Dyson M, Dussk JE *et al*. Gray's Anatomy. 38th ed. ELBS/ Churchill Livistone. 1995, 607-10.
10. Kalia S, Shetty SK, Patil K, Mahima VG. Stature estimation using odontometry and skull anthropometry. Indian J Dent Res. 2008; 19:150-4.
11. Chiba M, Terazawa K. Estimation of stature from somatometry of skull. Forensic Sci Int. 1998; 97:87-92.
12. Ilayperuma, I. On the prediction of personal stature from cranial dimensions. Int. J. Morphol. 28(4):1135-1140, 2010.
13. Introna F Jr, Di Vella G, Petrachi S. Determination of height in life using multiple regression of skull parameters. Boll Soc Ital Biol Sper. 1993; 69:153-60.