To study the correlation between stature and facial parameters of human adults in North Indian population

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Abstract

Introduction: Stature is defined as natural height of human being in standing position. Each and every part are related with each other i.e. face, trunk, head and extremities. Stature estimation is important parameter when human remain such as mutilated body or facial remain of skull is brought for medicolegal examination for person's identity. This correlation will also be helpful in anthropological and geographical research. Our study aimed to determine the stature from facial parameters that were morphological facial length, upper facial length, and lower facial length.

Materials and Methods: The study was conducted in department of Anatomy, SN Medical College, Agra, on 300 medical students aged between 18yrs to 25yrs out of which 164 are males & 136 are females. Stature of person was measured by anthropometric rod & morphological facial length, upper facial length and lower facial length were measured by digital Vernier caliper. The mean, standard deviation, regression equation, were calculated.

Result: We observed correlation between stature &facial parameter and developed regression equation for it. The morphological facial length, upper facial length and lower facial length was found to be significantly higher in males compared to females.

Keywords: Stature, Morphological facial length, Upper facial length, Lower facial length, Digital vernier calliper, Anthropometric rod.

Introduction

The stature or height of person is one of the important factors to determine the physical identity of individual. Stature is biologically related with each & every part of body i.e. length of head, hand measurements, long bone length as limbs. This relationship helps a forensic expert to calculate stature from human body remains brought to him during investigation. When a complete dead body is found, stature determination is rather an easy task but in case when only some part of body was found, difficulty is encountered in estimation of stature. For medicolegal purpose especially in the identification of individual anthropometry has been used. Anthropometry also help in finding out of a person in any accidental case like road traffic accident, earth quack, burn, natural disaster, plane crash etc.

An important phenomenon occurring in human population is the variation in their physical morphology. Anatomy of the facial shape is one of the main characteristics by which human present themselves to the external world. Ecological, geographical, racial, age and gender factors affect the physical dimension of human body (Omotoso DR).[1] One of the important parts of anthropometry is cephalometry in which the dimensions of head and face are measured. Cephalometric results are used in forensic medicine, plastic surgery, oral surgery, paediatrics, dentistry and diagnostic knowledge between patient and normal population.

There were large number of studies have been done on estimation of stature from measurements of various body parts including length of head, hand measurement, vertebral column length, long bone length, maxillofacial anthropometry (Wankhede et al 2012).[2] So, the present study is on attempt to determine stature from morphological facial length in North Indian population.

Materials and Methods

The study was conducted on 300 medical students out of which 164 are males & 136 are females, age group between 18yrs to 25yrs. of S.N medical college, Agra from North India. The medical students were healthy and without any cranial & facial deformities. Detailed medical history was taken & clinical examination of all students was conducted to rule out significant disease or deformity that could had affected the general or bony growth.

Inclusion Criteria

1. The medical students were apparently healthy and without any craniofacial deformity like, retrognathia, micrognathia, inflammation of face, traumatic injuries, deformities and surgery.
2. The medical students of age group between 18yrs to 25yrs were included in our study. As completion of skeleton growth occur by this year of age.
3. The medical students were taken from only one endogamous group i.e. North Indian medical students.

Anthropometric Methodology

The stature & facial measurements of each subject were taken by using Vernier caliper & anthropometric rod in centimetre. The measurement includes:

Stature

It was measured as vertical distance from the vertex to the floor & was measured using the stadiometer to the nearest 0.1cm with students standing erect bare feet against stadiometer. Their buttocks & upper part of back in contact

with stadiometer upright. Their palms of hand were turned inwards and fingers pointing downwards. The student should align their head in Frankfurt plane. The movable rod of stadiometer was brought in contact with vertex in median sagittal plane.

Morphological Facial Length

It is measured from nasion to the gnathion by using a Vernier caliper in cms. Nasion is the depressed area between the eyes, just superior to the bridge of nose and ganthion is the lowest point on the lower point on the lower border of mandible in the mid sagittal plane. There is physiogynomic facial length also which is from trichion to ganthion. But in our study, we had taken morphological facial length.

Upper Facial Length

It is the distance between nasion and subnasale

Lower Facial Length

It is the distance between subnasale and ganthion

All measurements were taken in centimetre. To minimise subjective errors all measurements were taken three times and then mean was taken. Data thus collected were entered in Microsoft excel sheet 2007 and were subjected for statistical analysis. Statistical analyses were done by using computer software (SPSS Software Version 22). Linear Regression equation was derived based on different measurements.

Informed written Consent was taken from each medical student for the purpose of ethical issue before various measurements were taken.

Fig. 1: Measurement of morphological facial length in CMS

Fig. 2: Measurement of upper facial length in CMS

Fig. 3: Measurement of lower facial length in CMS

Observation and Discussion

Above table shows that the mean stature in male is 170.7 ±6.93. However, the mean stature female is 160.37 ±7.53. Mean stature was significantly higher in males as compared to females. Significant difference observed in stature with sex, and the mean value of morphological facial length in males is 11.48±1 cms. However, the mean morphological facial length in female is 10.95±0.99 cms. Gender difference with respect to mean morphological facial length was found to be significantly higher in males compared to females (P<0.0001).

Table 1: Comparison of stature (CMS) and morphological facial length between males & females

	Gender	**Number**	**Stature**			**Std. Deviation**	**P Value**
			Min	**Max**	**Mean**		
Stature (CMS)	Males	164	157	186.8	170.7	6.93	<0.0001
	Females	136	147	181	160.37	7.53	
	Total	300	147	186.8	165.16	9.02	
	Gender	Number	Morphological facial length			Std. Deviation	P Value
			Min	Max	Mean		
Morphological Facial Length (CMS)	Males	164	9.2	14	11.48	1	<0.0001
	Females	136	9.1	13.6	10.95	0.99	
	Total	300	9.1	14	11.21	1.05	

Table 2: Comparison of upper facial length UFL and lower facial length (CMS) between male & female

Upper facial Length (CMS)	**Gender**	**Number**	**Upper facial length**			**Std. Deviation**	**P Value**
			Min	**Max**	**Mean**		
	Males	164	4.2	7.3	5.19	0.65	<0.0002
	Females	136	3.8	7.8	5.12	0.71	
	Total	300	3.8	7.8	5.17	0.69	
Lower Facial Length (CMS)	Gender	Number	Lower Facial Length			Std. Deviation	P Value
			Min	Max	Mean		
	Males	164	4.5	8.9	6.29	0.65	<0.0001
	Females	136	4.7	7.6	5.84	0.58	
	Total	300	4.5	8.9	6.04	0.66	

Above table shows that the mean value of upper facial length in male is 5.19 ±0.65. However, the mean value of upper facial length in female is 5.12±0.71. Gender difference with respect to mean value of upper facial length was found to be significantly higher in male than female (P<0.0002). And the mean value of lower facial length in male is 6.29 ± 0.65. However, the mean value of lower facial length in female is 5.84 ± 0.58. Gender difference with respect to mean value of lower facial length was found to be significantly higher in male than female (P<0.0001).

Table 3: Comparison of students showing mean stature (CMS) with present study in males & females

S. No	**Authors**	**Population**	**Male**	**Female**
1	Chakarvarthy Marx (2015)[3]	USA	181.3	172.2
2	Swami S Kumar M (2015) [4]	Haryanivi Adult	168.71	155.18
3	Patil & Mody (2005)[5]	Central Indian	164.73	150.55
4	Rayan & Bidoms (2007)[6]	South Africans	153.27	143.08
5	Kalia et al (2008)[7]	Mysorean	171.65	155.67
6	Iiayperuma (2011)[8]	Srilankans	162.95	152.48
7	Sahni et al (2010)[9]	Northwest Indians	165.90	163.24
8	Aganihotri et al (2011)[10]	Indo Maurition	173.40	157.36
9	Asha & Prabha (2011)[11]	South Indian	169.92	156.39
10	Wankehade et al (2012)[2]	Nagpur	170.97	156.89
11	R. Nivesh Krishna (2016)[12]	Chenneai	164.48	160.08
12	Sinchal Datt (2017)[13]	Maharashtrian	166.57	156.41
13	Present Study	North Indian	170.7	160.37

Table 3 shows that, in present study mean stature is close toNagpur population in male & close to Chennai population in female. Maximum mean stature is observed USA population in male & female, & minimum mean stature is observed in south African population.

Table 4: Showing the mean morphological facial length (cm) of previous studies in males & females

S. No	**Authors**	**Population**	**Morphologcial facial length**	
			Males	**Female**
1	Sahni et al (2015)[9]	North west Indian	11.25	10.80
2	Aghnihotri et al (2011)[10]	Indo Mauritian	11.58	11.00
3	Wankhede et al (2012)[2]	Nagpur medical students	11.43	10.66
4	Swami S Kumar (2015)[4]	Haryanvi Baniyas	11.07	10.21
5	Patil & Mody (2005)[5]	Central Indian population	12.677	11.41
6	Frakas et al (2005)[14]	Japanese	12.28	11.38
7	Present Study	Agra, North India	11.48	10.95

Table 4 shows that, in present study mean morphological facial length is close to Nagpur population in male & female. Maximum mean morphological facial length is observed in Central Indian population in male & female, & minimum mean morphological facial length is observed in Haryanvi Baniyas population.

Table 5: Comparsion of mean upper & lower facial length (CM) of present study with previous study

S.No	Author	Population	Mean upper facial length		Mean lower facial length	
			Male	Female	Male	Female
1	P, Hatwal (2015)[15]	Uttarakhand	4.8	4.5	5.7	5.4
2	Present Study	Agra, North India	5.19	5.12	6.2	5.8

Above table shows the mean upper & lower facial length in male are higher than females.

Table 6: Linear regression equation for estimation of stature from various facial dimensions for both sexes & comparison of estimated stature with actual stature

Parameter	Regression equation	Estimated Stature (CMS)	Actual Stature (CMS)
Morphological facial length	Y=128.73 + 3.24x =128.73 + 3.24X11.21	164.73	165.16
Upper facial length	Y=150.53 + 2.83x =150.53 + 2.83X 5.17	165.14	165.16
Lower facial length	Y=134.60 + 5.05x = 134.60 + 5.05X6.04	164.502	165.16

Correlation gives the degree and direction of relationship between the two variables. A very modern statistical analysis is used to assess the association between two variables is regression analysis. It enables us to predict the value of one variable on the basis of another variable. Regression equation for our study was calculated on SPSS Version 22. The regression equations have been calculated by regression analysis, the value of constants a and b are calculated. A is the regression coefficient of the dependant variable, i.e. stature, and b is the regression coefficient of the independent variable, i.e. any of the facial dimensions. Regression equation calculated for the estimation of stature for the present study carried out in North Indian population is Y= a + bx.

We assumed here that variable X as one of the facial dimensions and Y as the stature of students. X is an independent variable and Y is dependent variable.

If facial remains are available then by using morphological facial length, stature can be calculated in North Indian population. Measurement of human face is used in identification of person in Forensic medicine, Plastic surgery, Orthodontics, Archaeology, Hairstyle design and examination of the differences between races and ethnicities. Facial anthropometry helpful in identifying variations in facial shape in a specified population.

Conclusion

Facial dimension use for treating congenital or posttraumatic facial disfigurements, surgeons require access to craniofacial data based on accurate anthropometric measurements. The results indicate that one can successfully estimate stature from facial diameters in North Indian population, where facial remains are brought for medicolegal examination. Estimated stature is 164.50±1 cm (Table 6) of present study population is almost equal to mean actual stature of the subjects i.e. 165.16cm (Table 6). So, to conclude, regression equation which we have calculated show good reliability & applicability of estimation of stature.

Conflict of Interest: None.

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