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Original Research Article

An Odontometric approach for estimation of stature from autopsy cases brought to tertiary health care centre in south Gujarat

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Abstract

Introduction: Identification is the determination of the individuality of a person based on certain physical characteristics. Stature is the height of a person in the upright posture. Forensic Odontology plays an important role for identification in such cases. Few studies have been carried out correlating various Odontometric parameters with the height of an individual.
Materials and Methods: The Prospective study of 252 autopsy subjects has been carried out in the Department of Forensic Medicine, Government Medical College, and New Civil Hospital, Surat during the period from September 2019 to October 2020. The data collected was subjected to statistical analysis & a linear regression formula was obtained.
Result: Correlation coefficient with the stature along with r, y= a+ bx, SEE and p value of combined mesio-distal width were 0.36, y=1.37E2+0.59X,0.09and 0.000 respectively and showed highest correlation.
Conclusion: Odontometric parameters along with regression equations may be used as a supplementary approach for stature estimation, especially in situations of unavailability of extremities.

Keywords: Odontometric parameters, Stature, Linear regression formula

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1. Introduction

Identification is the determination of the individuality of a person based on certain physical characteristics.[1] It is of two types- partial identification & absolute identification. In partial identification, certain facts are determined, e.g., race, age, sex, stature, etc.,[2,3] Stature is the height of a person in the upright posture[3] and is a minor criteria for establishing the identity.[4] Routine methods of estimation of stature have some limitations, especially in highly mutilated bodies which make the identification difficult.[5] It is common that, mutilated bodies, dismembered body parts or just fragmentary remains are presented for medico legal examination.[6]

Few studies have been carried out correlating various odonto-metric parameters like greatest mesio-distal crown width of six maxillary anterior permanent teeth including central incisor, lateral incisor, and canine of right and left quadrant (RCI, RLI, RC, LCI, LLI, LC) with the height of an individual.[7] The method of using teeth has several advantages as it is easy to locate & measure, relatively resistant to decompose, damage and most of the odonto-metric parameters remain constant over the time after puberty.8,9 [8 & 9]. As such teeth are extra ordinarily resistance to putrefaction and the effect of external agents (physiological, thermal, mechanical, chemical or biological)which makes them invaluable elements for anthropological, genetically, odontological, evolutionary and forensic investigation[10,11] Teeth measurements seem to be the most reliable method in forensic investigations due to its advantages of being quick, less time consuming, non invasive and easy to perform.[12].

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2. Aim and Objective

To determine the relationship between combined meiso-distal width of maxillary anterior teeth and stature of an individual.

3. Materials and Methods

The present study has been carried out in the mortuary of Department of Forensic Medicine, Government Medical College, and New Civil Hospital, Surat during the period from September 2019 to October 2020. Of all the cases brought for medico legal autopsy. It was a prospective study conducted on 252 autopsy subjects. Permission of the ethical committee on the use of human material for research purpose was obtained.[GMCS/STU/ETHICS/APPROVAL/25709/19]

3.1. Inclusion criteria

1. The dead bodies aged between 21 years to 40 years. Reported age from either case papers or relatives records available.
2. Complete set off fully erupted, peri-odontically healthy, non-carious, non-worn, intact and satisfactorily aligned maxillary anterior teeth with no gross dental anomalies.

3.2. Exclusion criteria

a) Cases of age less than 21years and greater than 40 years of age.

b) Unidentified/Decomposed/Mutilated/Fragmented bodies.

c) Cases with skeletal anomalies especially of spine, long bones and those affecting the stature of an individual.

d) Cases of deep burns, where due to flexor attitude the height cannot be assessed properly.

e) Presence of deciduous teeth.

Detailed information regarding the vital data of the deceased like name, age, sex, occupation, education, address, marital status, and the circumstances of death was collected from the police and relatives and recorded after taking their informed written consent. The stature of dead body was measured in centimeters after all the limbs are kept straight and parallel to the body. One straight wooden block was placed touching the vertex at the head and another straight wooden block was placed touching the heel. The distance between both the wooden boards was measured with the metallic scale and was obtained the height of the body. The odontometry parameters including greatest mesio-distal crown width of six maxillary anterior permanent teeth including central incisor, lateral incisor, and canine of right and left quadrant (RCI, RLI, RC, LCI, LLI, LC) were measured directly on the subjects between anatomic contact points of each tooth on either side of the maxilla with the help of digital Vernier's Caliper (Tiny Deal, precision value +/- 0.01 mm) and these were checked regularly before usage for precision and accuracy.

The width of tooth were measured using internal jaws of the digital caliper. Combined Mesio-Distal Width (CMDW) of maxillary anterior teeth were calculated by summing up the widths of central incisors, lateral incisors and canine of both contra lateral sides. The locking screw was tightened making sure that beaks of the digital caliper did not move apart during recording the width of the teeth. Two measurements per tooth were made and their mean was calculated and all the measurements were recorded; It was noted by a single observer on both sides to minimise subjective errors. statistical descriptive analysis was done using software SPSS version. and correlation coefficient and regression equation was developed by liner regression analysis.

4. Discussion

Studies concerning the estimation of stature from odontometric parameters are limited in Indian population. Therefore, the present research aimed to provide the valuable data pertaining to the correlation of stature with tooth for Indians. The idea of deriving combined regression formulae by considering males and females as a whole group is in the situations where gender identification of teeth is questionable.

4.1. Odontometric parameters

The odonto-metric parameters namely the combined mesio-distal width of six maxillary anterior teeth, inter canine teeth, inter premolar teeth and individual tooth dimension of maxillary anterior teeth were evaluated to determine, if there is a significant correlation between these odonto-metric parameters and the stature of an individual. Yadav AB et al.[5] observed that canine is best predictor than other individual teeth. Khangura et al.[14] and Nishant et al.[6] observed that inter-canine and inter premolar teeth were statistically significant for stature estimation. Harshala et al.; each odonto-metric parameter was correlated with the height of an individual; all were found to be significant. When combinations of 2 parameters (CW+IC, CW+IP, IC+IP) [cw=combined width, IP=inter-canine teeth, IP= inter premolar teeth] were correlated with height, then statistically significant correlation was obtained. When all the 3 parameters (CW+IC+IP) were correlated with height, they too were found to be statistically significant. where Jani et al; studied same but only inter canine teeth was statistically significant for height. khangura et al. observed that combined mesio-distal width of maxillary anterior teeth was statistically insignificant for stature, in contrast combined mesio-distal width of maxillary anterior teeth was statistically significant which is similar result in my study.

4.2. Age

In my study total 252 subjects among them 21 to 40 years of age group. where 21 to 45 years of age group in Yadav AB et

al.[5] 20-30 years of age group in Hrashala et al,18 to 30 years of age group. Jani et al.[3] and Rao et al.[8] have indicated that the early permanent dentitions provide the best sample for tooth size measurements because early adulthood dentition has less mutilation & less attrition in most individuals. Consequently, the effect of these factors on the actual dimension tooth parameters would be minimum. Thus, only subjects in the 21-40 years' age group were included in the study sample.

4.3. Live versus dead

All study in past Yadav AB et al[5] et al; Hrashala et al; Jani et al3 khangura et al; Nishant et al.[6] and Rao et al.[8] in live subjects, in contrast in my study medico legal autopsy subjects were taken so on an average, the body lengthens after death by about two cm. due to complete loss of muscle tone, relaxation of large joints and vertebral discs and loss of tensioning effect of paraspinal muscles on intervertebral discs, causing flattening of vertebral curvature.

4.4. Stature estimation

All study in past Yadav AB et al[5] et al; Hrashala et al; Jani et al[3], khangura et al; Nishant et; and Rao et al.[8] were stature estimation as the vertical distance from the vertex to the floor using a standard anthropometer. Measurements were taken by making the subject stand erect on a horizontal resting plane barefooted. Anthropometer was placed in straight vertical position behind the subject with the head oriented in the Frankfurt Horizontal Plane & shoulders & hips touching the vertical limb of the instrument.

In contrast in my study, the stature of dead body was measured in centimeters after all the limbs are kept straight and parallel to the body. One straight wooden block was placed touching the vertex at the head and another straight wooden block was placed touching the heel. The distance between both the wooden boards was measured with the metallic scale and was obtained the height of the stature of the body. So when the stature estimates in lying position it was greater by one to three cm.

Table 1: The comparison of r (correlation co efficient), P value, results and regression equations of combined mesio distal width of anterior maxillary teeth in various studies

SR. No	Authors	Years	R	P value	Result	Regression equation (y= a+ bx)
1.	Yadav AB et al [5]	2016	0.237	0.000	S	y= 124.69 + 0.87 MDW
2.	Patil H S	2017	0.579	0.000	S	y=118.437+0.976x
3.	Jani Y et al[3]	2018	0.124	0.220	SN	y=1556.58+1.948*x*
4.	Khangura RK et al[14]	2015	0.121	0.232	SN	y=14825.56+34.624x
5.	Gondivkar SM et al.[7]	2017	0.256	0.010	SN	y=2308.36+10.51*x*
6.	Bhyya H et al.[9]	2018	0.247	0.013	S	y=1369 + 6.08*X
7.	Rao K et al.[8]	2019	0.02	0.814	SN	y= C+ mx
8.	Hinduja S et al.[4]	2018	0.327	0.068	SN	y=20.776+0.694x
9.	Kalia S et al.[13]	2008	0.15	0.000	S	y=982.421+13.645x
10.	Present Study	2020	0.36	0.000	S	y=1.3E2+ 0.59X

S= statistically significant, SN= Statistically not Significant.

Table shows the comparison of r(correlation co efficient), SD(Standard Deviation), P value, results and regression equations of combined mesio distal width of anterior maxillary teeth in different studies where combined mesio distal width of anterior maxillary teeth was statistically significant in Yadav AB et al.[5] Patil HS, Bhayya H et al.[9] Hinduja S et al[4], Kalia S et al.[13] and Present study, not significant in Jani Y et al.[3] Khangura RK et al.[14] Gondivkar SM et al[7] and Rao K et al.[8].

5. Results

Out of 252 autopsy cases there were 205 male and 47 female. Predictors of stature by different odonto-mertic measurements will be calculate by following regression equation. (y) = a + bx.

y= Stature,
a= constant,
b= Regression coefficient,
x= variable.

The Standard Error of Estimate (SEE) was calculated for each formula, which depicts the deviation of estimated stature from the actual stature. A low value was indicative of the greater reliability of prediction from a particular measurement and the higher value of SEE denotes less reliability of prediction. The regression equation with the least Standard Error (SE) was considered to be the best regression for the estimation of stature.

Two-Sample Independent t Test						
Input Data						
Two-sided confidence interval		**95%**				
	Sample size	**Mean**	**Std. Dev.**	**Std. Error**		
Group-1	252	161.78	5.77			
Group-2	252	162.16	1.83			
Result	**t statistics**	**df**	**p-value1**	**Mean Difference**	**Lower Limit**	**Upper Limit**
Equal variance	-0.99654 2	502	0.3195	-0.38	-1.12918	0.36918
Unequal variance	-0.99654 2	301	0.3198	-0.38	-1.13038	0.370383
		F statistics	Df (numerator, denominator)		p-value1	
Test for equality of variance2		9.94144	251,251		<0.0000001	
1 p-value (two-tailed)						
2 Hartley's f test for equality of variance						

Table 2: Correlation coefficient between stature and odontometric parameters.

Sr. No.	Parameters	Pearson's Correlation Coefficent (r)	Y= a + bx	Standard Error Estimation (SEE)	p-value
1.	Right central Incisor	0.27	1.51E2 +1.37x	0.31	0.000
2.	Right Lateral Incisor	0.17	1.52E2 +1.63x	0.57	0.005
3.	Right canine	0.27	1.49E2 +1.81x	0.40	0.000
4.	Left Central Incisor	0.38	1.46E2 +2x	0.30	0.000
5.	Left Lateral Incisor	0.14	1.54E2 +1.35x	0.57	0.01
6.	Left Canine	0.17	1.54E2 +1.16x	0.42	0.007
4.	Combined mesio distal width of anterior maxillary teeth	0.36	1.37E2 +0.59x	0.09	0.000

Statistically significant- P <0.0000001, statistically not significant- P >0.0000001 (as per two sample independent t test).

Table shows the correlation coefficient of all the parameters with the stature of individuals along with there respective p value. The findings of the present study revealed that all odontometric parameters showed positive correlation with stature, with correlation coefficient (r) value ranges from 0.14 to 0.38. Among them combined mesio distal width showed highest correlation.

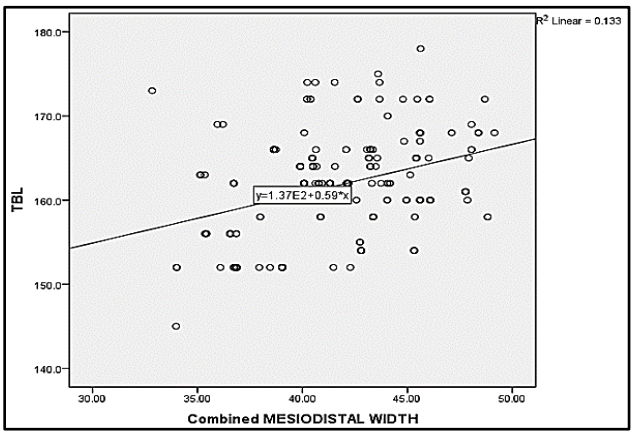

Figure 1: Scatter diagram showing positive correlation between Combined Mesio distal width and Total body length.

The Regression equation for correlation between Combined Mesio distal width and total body length is Stature= 1.37E2 + 0.59*x. The Regression equation for correlation between Combined Mesio distal width and total body length is significant with p value of 0.000.

6. Conclusion

From the present study, it can be concluded that regression equations generated from Odontometric parameters (Combined Mesio distal width) can be used as a medicolegally approach for the estimation of stature as identification of individual when extremities are not available but with caution as these are population specific and cannot be used on other populations of the world. However, Combined Mesio distal width can aid in estimation of stature.

7. Ethical Clearance

Taken.

8. Source of Funding

None.

9. Conflict of Interest

None.

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