

Reliability of odontometric parameters in stature analysis

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Abstract

Background: To emphasize the role of odontometric parameters which may be used as a reliable forensic tool especially in cases with partial remains of the individual

Aim: To assess the reliability of odontometric parameters in stature analysis

Materials and Methods: The study was conducted on 100 patients (50 male and 50 Female). Mesiodistal width of anterior teeth, inter-canine width, Inter-premolar width and maxillary arch length were the parameters included. The results were tabulated with a linear regression formula obtained for each parameter.

Statistical Analysis: The data collected was statistically analysed using SPSS version 20 and a linear regression formula was obtained thereafter.

Results: Mesio-distal widths of individual maxillary canines, total mesiodistal width of maxillary anteriors and arch length showed a significant co-relation with stature. The combined linear regression formula was obtained for all parameters.

Conclusion: Odontometric parameters of mesio - distal widths of individual maxillary canines, total mesiodistal width of maxillary anteriors and arch length can be used as reliable parameters for stature analysis.

Keywords: Forensic, forensic odontology, odontometric parameter, partial remains, stature analysis

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INTRODUCTION

It has been proven time and again that each human although belonging to the same species is an inhabitant of different parts of the world and hence has varied environmental exposures.^[1] Identification of a severely decomposed or mutilated body poses a challenge to the forensic expert. Odontometric parameters are of great significance in such cases for stature analysis.^[2,3] Teeth of an individual are not only fire resistant but are also

chemically stable with the least turnover of tissue in the body. The chances of finding at least a few intact teeth of the mutilated or burnt body are high. This is especially true as the full complement of teeth is 32 in number. Teeth development is faster than maturation of the skeleton which helps in identification of young adults.^[4] Although long bones have been used widely to determine the stature of an individual, teeth can also serve as an odontometric parameter in stature determination. The height of a person in an upright position is known as stature. Forensic

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analysis of fragmented bodies poses a challenge as stature determination seems difficult.^[5] With the growing presence of a forensic odontologist in medicolegal cases, it becomes imperative to analyze remains anthropologically. This study was undertaken to test the reliability of odontometric parameters in analysis of stature.

MATERIALS AND METHODS

One hundred patients (50 Males and 50 females) from the outpatient department of the institution were included in the study after obtaining institutional ethical clearance. Patients with a full complement of teeth, with no grossly damaged teeth and with satisfactory teeth alignment were included. All the patients were between 18 and 20 years of age and those who were willing to sign the informed consent, thereby agreeing to participate in the study.

The following variables were recorded in millimeters (mm):

1. Mesiodistal width of individual anterior maxillary teeth
2. Intercanine width
3. Interpremolar width
4. Maxillary arch length.

The height of the patient was recorded using an anthropometer with measurements made from the vertex to the floor [Figure 1]. Armamentarium included a set of mouth mirror and probe, digital Vernier calipers and sterilized precut 22 gauge wire [Figure 2]. The maximum mesiodistal width of individual anterior teeth was recorded using a digital Vernier caliper, maintaining parallelism to the occlusal plane to prevent wrong readings [Figure 3]. Individual dimensions of the anterior teeth were summated for combined dimensions. Digital Vernier caliper was placed between the cusp tips of the canines to determine intercanine width. A sterilized precut 22-gauge wire was placed between buccal cusp tips of bilateral maxillary first premolars to measure interpremolar width [Figure 4]. The wire was also used to measure the arch length from one canine to the contralateral canine [Figure 5]. The wire was subsequently measured and values were recorded. All measurements were made by a single observer. Each measurement was repeated three times, and the average was recorded. The collected data was then statistically analyzed using SPSS Version 20, (SPSS Inc. Version 20, IBM, Chicago, US) and a linear regression formula was obtained.

RESULTS

The results were tabulated after statistical analysis [Table 1]. Pearson's co-efficient was calculated and *P* values were determined. The mesiodistal widths of both the canines significantly co-related with the height of the patient, with

P value of the right and left canine being 0.038 and 0.10, respectively. The total mesiodistal width of anterior teeth also co-related significantly with *P* = 0.33. The arch length statistically co-related with the height with *P* = 0.009.



Figure 1: Measurement of height in a wall mounted anthropometer



Figure 2: Diagnostic and measurement armamentarium



Figure 3: Measurement of mesiodistal width of anterior teeth using the digital Vernier calipers

Regression analysis was performed using the calculation of the linear regression co-efficient for individual parameters as well as for a combination of parameters. The individual canine dimensions, combined anteroposterior dimensions of anterior teeth and arch length, were statistically significant in predicting the height of a patient when compared with the actual height [Scatter Plot 1]. The linear regression formula was then calculated using combined parameters to determine the stature of an individual. The formula derived was as given below:

$$\text{Stature} = 3.781 \times \text{mesiodistal width of maxillary right canine} + 2.269 \times \text{mesiodistal width of maxillary right lateral} + 2.025 \times \text{mesiodistal width of maxillary right central} + 2.431 \times \text{mesiodistal width of maxillary left central} + 1.988 \times \text{mesiodistal width of maxillary left lateral} + 4.863 \times \text{mesiodistal width of left canine} + 0.699 \times \text{interpremolar width} + 0.33 \times \text{inter-canine width} + 0.605 \times \text{arch length}.$$

DISCUSSION

The identification of an individual by way of forensic odontology has evolved manifold since the first time it was used in the identification of Dr. Warren in the American Revolutionary war. Then, the identity of a person is unknown; stature determination could give clues about the possibility of identification. Other skeletal remains such as long bones have been historically used to determine identity, but in the case of incomplete remains, it becomes a difficult process.^[6] Teeth and restorations are rather unaffected by extreme temperatures and remain with their original form. These characteristics are usually exclusive to the individual and therefore could be used as evidence in the court of law.^[7] The current study evaluated odontometric parameters in young adults.

Stature estimation by using dimensions of teeth may be used as a supplementary method, and caution should be exercised as the linear regression formula derived is usually population specific. Hence, there may not be a single formula that suits all population groups. It has been proven that combined mesiodistal width of anterior teeth could estimate the stature although some studies do not consider it a reliable indicator.^[3] The present study determined the mesiodistal width of bilateral canines, the total width of the maxillary anterior teeth and the arch length which showed a significant co-relation in stature determination. This was in agreement with some studies where the combined mesiodistal width of maxillary anterior teeth proved to be a reliable method of stature determination.^[8] Some authors opine that although the combined mesiodistal width of anterior

teeth was not reliable, intercanine width may be accepted as a reliable indicator. Although it has been believed that



Figure 4: Measurement of interpremolar width

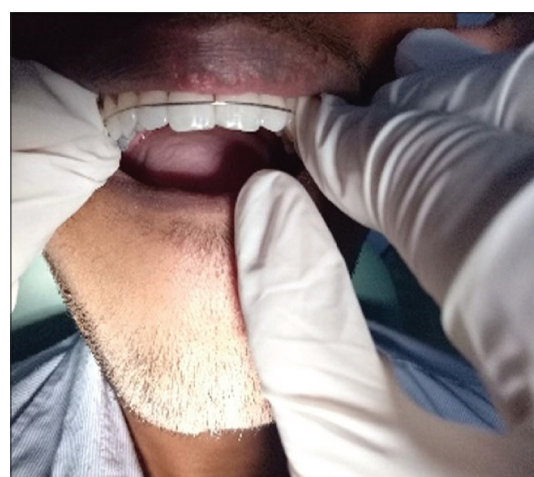
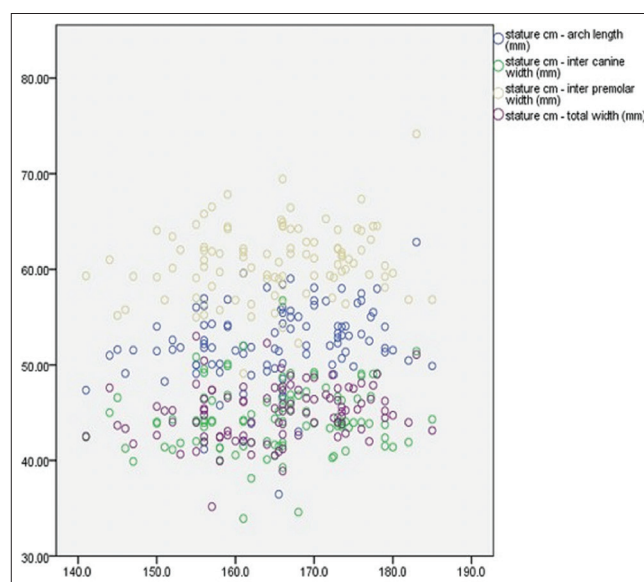


Figure 5: Measurement of arch length



Scatter Plot 1: Scatter plot depicting stature in cm (x-axis) and study measurements in mm (y-axis) showing a positive co-relation

Table 1: Relation between odontometric measurements and co-relation co-efficient, regression co-efficient and P

Parameter	Constant	Persons co-relation co-efficient	Regression coefficient	T	P	Significance
Mesiodistal width 13	136.92	0.207	3.781	2.100	0.038	Significant
Mesiodistal width 12	150.02	0.156	2.269	1.562	0.122	Not significant
Mesiodistal width 11	147.76	0.136	2.025	1.359	0.177	Not significant
Mesiodistal width 21	144.37	0.147	2.431	1.475	0.143	Not significant
Mesiodistal width 22	151.89	0.127	1.988	1.264	0.209	Not significant
Mesiodistal width 23	129.07	0.255	4.863	2.614	0.010	Significant
Total mesiodistal width	133.54	0.213	0.699	2.163	0.033	Significant
Interpremolar width	137.11	0.183	0.460	1.841	0.069	Not significant
Inter canine width	150.35	0.122	0.330	1.221	0.225	Not significant
Arch length	133.39	0.259	0.605	2.660	0.009	Significant

odontometric parameters by themselves may be largely unreliable, situations with only teeth available as evidence may serve to reiterate that parameters such as canine width could also serve as an adjunct in stature determination. This is also applicable without a gender predisposition.^[3,9] The current study used 10 parameters of which only the mesiodistal width of both the maxillary canines, the total mesiodistal width of the anteriors and the arch length were reliable indicators of the height of an individual.

CONCLUSION

It can hence be said with reasonable certainty that individual odontometric parameters as well as some combined parameters may be used in stature determination of partial or fragmented human remains. A larger sample size with varying age- and greater region-specific distribution may be required to gather data on parameters based on demographic and geographic variability.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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