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Original Article

Stature Prediction by Comparing Maxillary and Mandibular Intercanine Width and Intermolar Width among Tamil Nadu Population

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Abstract

Background: Teeth are one of the strongest hard tissues that can resist a variety of antemortem and postmortem insults and an important evidence in the field of medicolegal and forensics. In the identification of unknown human remains of the deceased, stature estimation is a preliminary investigation. Previously, the comparison of osteometry with odontometry in stature determination has been made. Similarly, an attempt is made to estimate stature using intercanine and intermolar width which may be a forensic tool in the future. **Aim and Objective:** The aim of this study was to determine stature using intercanine and intermolar width in the maxillary and mandibular arches and correlating to identify highly reliable parameter among the two. Further to evaluate the usefulness of odontometry in stature determination. **Materials and Methods:** Subjects for the study were recruited from the outpatient department of APDCH and students of APDCH. One hundred subjects were included in the study comprising fifty males and fifty females within the age group of 17–28 years as per inclusion criteria. Digital Vernier caliper for measuring intercanine width (cusp tips on either sides) and intermolar width (central fossa of 1st molar on either sides) on the study models and standard anthropometer for measuring the height of the subject (vertex to the floor). **Results:** Compared to other parameters, the maxillary intercanine distance is statistically significant to $P = 0.05$ with correlation value of 0.06 by Pearson correlation method. **Conclusion:** The data collected were subjected to statistical analysis and was found that out of the four selected odontometric parameters, maxillary intercanine width with a $P =$ of 0.032 and Pearson correlation of 0.307 in Group 1 (males) were found to show a significant correlation with height. Regression analysis was done, and regression equations were derived. The following regression equation can be used to calculate the height of an individual, Group 1 (male) −Y = B+ Ax. Y = 135.5 + 0.947X (X - maxillary inter canine width). This method of stature prediction may be of relative importance but not of absolute certainty, thereby making it an adjunct to various other methods of stature prediction. Therefore, using odontometric parameters in combination improves the predictability of estimating stature rather than a single parameter.

Keywords: *Forensic odontology, intercanine width, intermolar width*

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Introduction

Forensic means "COURT OF LAW." Odontology refers to the study of teeth.[1-4] Forensic odontology deals with identification, based on the recognition of unique features present in an individual's dental structures.[5] Dental identification is based on the theory that the human

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dentition is never the same in any two individuals. It is as individual as fingerprints; therefore, it can be used for human identification.[6,7] Odontometric characteristics play a major role in stature determination, where jaw, particularly with teeth in it, is the only available small skeletal fragment.[8-10] Teeth are one of the strongest and hardest structures in human body that can resist a variety of antemortem and postmortem insults.[7] They are an excellent material in living and nonliving populations for forensic investigations as they are the most stable tissue in the human body.[9] Estimating stature, along with age, sex, and race, is essential in preliminary screening and reconstructive identification of skeletal remains. Since the odontometric parameters remain constant over time, the anatomical landmarks are standard, well-defined, and easy to locate. The preliminary investigation for the identification of unknown human remains is stature estimation.[8] The term sexual dimorphism refers to those differences in size, stature, and morphology of the individuals differentiating males and females, which can be used as an tool for individual identification. The greatest degree of sexual dimorphism is exhibited by the canines, in particular making them highly valuable for identification.[11] Recently, studies have been carried out using first molars as an aid in gender determination.[7,12] The first permanent molars are the first permanent teeth to erupt in both the upper and lower arches and they have the less chances of being impacted.[13] Studies have been frequently reported establishing relationship of the stature of a person with skull and jaw dimensions among various populations.[11,14] This study is an attempt to investigate the correlation of the height of a person with odontometric parameters such as intercanine width and intermolar width and also an initial attempt using intermolar width as a parameter in stature determination. This study will help in forensic anthropology to estimate or give an approximate height of an individual.

Aim and objectives

Estimation of stature of a person by evaluating and correlating the intercanine and intermolar width of maxillary and mandibular arches.

- To determine the intercanine and intermolar width in the maxillary and mandibular arches
- To evaluate the usefulness of intercanine and intermolar width in stature determination
- To compare the intercanine width to intermolar width and determine the highly reliable parameter in determination of stature.

Materials And Methods

Subjects for the study were recruited from the outpatient department of Adhiparasakthi Dental College and students of Adhiparasakthi Dental College. One hundred subjects were included in the study comprising fifty males and fifty females within the age group of 17–28 years as per the inclusion criteria.

Inclusion criteria

- South Indian population
- Complete set of fully erupted teeth
- Periodontally healthy teeth
- Patients with normal overjet and overbite
- Patients with normal molar and canine relationship and satisfactorily aligned teeth.

Exclusion criteria

- Patients who are partially edentulous, partially erupted canine, and molar
- Patients with deleterious oral habits
- Patients with impacted canine, missing teeth
- Patient with anterior spacing
- Patients with broken teeth
- History or clinical evidence of developmental disturbances, cleft palate, orthognathic surgery, or trauma
- History or clinical features suggestive of endocrinal disorders, developmental disorders, and prolonged illness
- Patients who underwent orthodontic treatment
- Individuals who wear bridges, crowns, removable partial denture, and other appliances or had any anomalies that could influence the measurements.

Armamentarium

Methods to be followed

- After selecting the patients, the procedure and purpose of the study were explained, and written consent was obtained
- The patient was made to comfortably sit on the dental chair before starting the procedure
- Following aseptic conditions, wearing gloves, and using universal precautions for infection control and alginate impressions for both maxillary and mandibular arch taken
- Die stone used to prepare the study models of these impressions and base for the cast was put using ase former for analyzing the odontometric values
- Intercanine and intermolar width were measured using a digital Vernier caliper in millimeters.

Measurements

The different parameters were measured using the digital Vernier calipers on the study model of both the upper and lower arch.

- Intercanine distance (canine arch width)
- Intermolar distance (molar arch width)

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Maxillary and mandibular intercanine arch width

From the cusp tip of canine on one side to the cusp tip of canine on the opposite side of the same arch were calculated.

Maxillary and mandibular intermolar arch width

From the central fossa of the 1st permanent molar on one side to the central fossa of the 1st permanent molar on the opposite side of the same arch were calculated.

Stature estimation

Stature is the height of a person in the upright position. Measured using the standard anthropometer. The subject was made to stand erect barefooted on a horizontal resting plane. In a straight vertical position behind the subject, the anthropometer was placed with the head oriented in Frankfort horizontal plane and shoulder blocks and buttocks touching the vertical limb of the instrument. The vertical distance from the vertex to the floor was measured by bringing in the movable rod of the anthropometer in contact with the mid-sagittal plane. An anthropometer with one arm sliding against vertical plane was brought down on to the subject's head and the stature read off the scaled vertical plane. Stature was remeasured on twenty randomly selected subjects, also to assess possible intraobserver differences [Figures 1-3].

Results

The data collected were subjected to statistical analysis with the application of independent *t*-test; the mean and standard deviation for all the parameters in both the groups are tabulated. The comparison between the mean values of all the parameters was subjected to Pearson correlation, and the *P* value was found to be significant. Then, analysis of variance test was done to find the regression equation, which showed significant R value, and then, regression analysis was done to derive the regression equation.

Tables 1 and 2 show a detailed description of each parameter taken up for the study such as mean value and standard deviation for Group 1 (males) and Group 2 (females).

Table 3 is the correlation between stature and variables of both the groups; the statistical analysis showed that out of the four selected odontometric parameters, maxillary intercanine width with a $P = 0.032$ and Pearson correlation of 0.307 in Group 1 were found to show a significant correlation with height. However, the other parameters, mandibular intercanine width, maxillary intermolar width, and mandibular intermolar width when plotted against height, no statistically significant correlation was found between them.

Regression analysis was done, and regression equations were derived. The following regression equation can be used to calculate the height of an individual, Group 1 (male). $Y = B + Ax$

Where y – predicted stature of the individual, X – maxillary intercanine width values, B – constant for that parameter, A – regression coefficient for each parameter. Regression formula for stature prediction in males is derived.

$Y = 135.5 + 0.947X$ (X - maxillary inter canine width).

Discussion

Forensic dentistry is a multidisciplinary team effort and plays a major role in identification of those individuals who cannot be identified. Dental identification

Table 1: Intercanine width and intermolar width in individuals

Group=1				
	n	Minimum	Maximum	Mean	Std. Deviation
Maxillary inter-canine width	49	31	358	42.22	46.093
Mandibular inter-canine width	50	22	30	26.48	1.741
Maxillary inter-molar width	50	40	57	50.16	3.536
Mandibular inter-molar width	50	36	50	43.40	2.799
Stature	50	153	184	169.00	6.408

Table 2: Comparision of intercanine width and intermolar width in individuals

Group=2				
	n	Minimum	Maximum	Mean	Std. Deviation
Maxillary inter-canine width	50	31	38	34.72	1.629
Mandibular inter-canine width	50	23	29	26.18	1.587
Maxillary inter-molar width	50	43	51	47.10	2.033
Mandibular inter-molar width	49	33	47	40.88	2.421
Stature	50	144	172	156.88	4.922

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Figure 1: Armamentarium



Figure 2: Intercanine width and intermolar width measurement



Figure 3: Measuremenrt of length of the cranium

has always played a key role in natural and human-made disaster situations and in mass casualties investigations. As teeth are considered useful adjuncts in such scenarios since they are frequently recovered intact from skeletonized remains. Estimation of

Table 3: Correlation between stature and other paramaters

	Stature	Maxillary inter-canine width
Stature		
Pearson Correlation	1	0.307*
Sig. (2-tailed)		0.032
n	50	49
Maxillary Inter-canine width		
Pearson Correlation	0.307*	1
Sig. (2-tailed)	0.032	
n	49	49

stature, along with age, sex, and race, is an important parameter in medicolegal and forensic examination for identification of skeletal remains. Moreover, it is shown to have definitive biological correlation with body parts such as extremities, head, trunk, and vertebral column. Tooth dimension and stature in an individual presume a good correlation as both dentin and long bones originate from mesenchymal tissues and have similar structural components with collagen forming the organic, matrix and hydroxyapatite crystals being the inorganic component.

Traditionally, stature was predicted using cranial dimensions, cranial sutures, length of head, and odontometry.

Cranial dimensions

Includes three dimensions that are maximum cranial length, maximum cranial breadth, and auricular head height. Cranial dimensions were cused for racial prediction and gender prediction. Thapar *et al*. studied the use of cranial dimension along with tooth dimension in gender assessment and found the reliability in prediction of gender.[15] Illayperumal *et al*. studied the relationship between the cranial dimensions and height of an individual.[16]

Cranial suture

The bony plates of the skull communicate at the cranial sutures. The cranial sutures are coronal suture, sagittal suture, lambdoid suture, and squamous suture. Jagadishrao *et al*. conducted a study to predict stature for cranial sutures. Where coronal suture length gives more accurate results in estimating stature than sagittal suture.[17]

Length of head

Jadav and Shah; studied the correlation between the head length and body height and showed that there is definite correlation.[18]

Cephalofacial anthropometry

is the combination of cranial length and the facial length. Krishnan attempted to estimate stature from various

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anthropometric measurements of cephalofacial region of individuals belonging to an endogemous group in North India. Moreover, results indicated that the cephalofacial measurements of the cephalic region have strong correlation with stature then those of facial region.[19]

Odontometry is the tooth crown dimension (mesiodistal and buccolingual dimension) Prabhu *et al*. studied the usefulness of tooth crown measurements in stature prediction and may be used only as a supplement to more robust indicators of stature.[20]

Correlation of intercanine distance and height

Wankhede *et al*. used maxillofacial anthropometry for stature estimation and observed that in males, the total facial height had greater correlation with stature.[21] Kumar, *et al*. used the intercanine width and interpremolar width and found that the intercanine width and interpremolar width showed significant correlation to with height.[4]

Conclusion

The present study was initiated as a review of literature which revealed that common odontometric parameters have not been evaluated as forensic tools in stature estimation and there are only limited studies in the literature regarding the role of tooth dimensions in stature determination of an individual. This study shows a promising result as maxillary intercanine width is the highly reliable parameter in stature prediction of men out of four selected odontometric parameters. This study would create a platform for making the dimensional data as a standard that may be of better applicability in educational, research, and forensic arenas. This method of stature prediction may be of relative importance but not of absolute certainity, thereby making it an adjunct to various other methods of stature prediction. Therefore, using odontometric parameters in combination improves the predictability of estimating stature rather than a single parameter. Further studies are warranted with a larger set of population in the direction of definite improvement in the accuracy of stature estimation from odontometry and to emphasize the fact that dental dimorphism may be used for the assessment of the height of an individual and to estimate the accuracy of determining the stature of an individual using these regression equations for the selected odontometric parameters further research are required.

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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