Original Research

Correlation of Canine Height to Overall Facial Height: An Observational Study

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How to cite this article: Revati Keluskar, Namrata Patil, Anjana Bagewadi. Correlation of Canine Height to Overall Facial Height: An Observational Study. Indian Journal of Forensic Medicine and Toxicology/Volume 18 No. 1, January-March 2024.

Abstract

Background: Identifying individuals by determining their body parameters plays a major role in criminal investigation. These parameters play an integral role in the identification of a person. Teeth, particularly canines, can help in identification, as they are the most stable teeth in the oral cavity because of the labiolingual thickness of the crown and root anchorage in the alveolar process.

Aim: To establish a relationship, if any between the crown length of the maxillary canine tooth and the facial height of an adult individual and intersex differences.

Materials and methods: This study was conducted at a dental college where patients reported for treatment. The study group comprised 100 participants (50 men and 50 women, aged 18-23 years. To measure the facial height, photographs were taken and analyzed using Adobe Photoshop software. The face was divided into the upper, middle and lower thirds considering the hairlines, glabella, subnasalis, and menton as reference points. The length between the hairline and glabella is the upper facial height (UFH), that between the glabella and subnasalis is the middle facial height (MFH), and that between the subnasalis and menton is the lower facial height (LFH). For tooth measurements, impressions of the upper arches were made using alginate and dental stone casts were obtained. The length between the cervical line and cusp tip is the canine height(CH) and the mesiodistal length is the canine width(CW). Measurements of teeth were recorded using digital verniercalliper. Statistical analysis was performed using Statistical Package for the Social Sciences software (SSPS) version 16. The Mann-Whitney U test was used to determine the correlation between facial height and canine height.

Results: Total Facial Height (TFH), Canine Height (CH), Canine Width (CW) in males and females was done using descriptive statistics. This study demonstrated a correlation between TFH and CH in both men and women. This study showed that, as TFH increased, CH also increased. Therefore, TFH and CH were directly proportional, and hence there was a correlation between TFH and CH.

Conclusion: The total facial and canine heights are directly proportional to each other. There is a correlation between the facial height and canine height.

Key words: Face, Facial Height, Canine teeth, Canine Width

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Submission Date: June 29, 2023 **Revision Date:** July 14, 2023 **Publication date:** Jan 19, 2024

Introduction

Forensic examination carries medicolegal importance and assist in individual identification. The identification of an individual is mainly done by determining body parameters, especially in the investigation of various crime scenes [1].These parameters play an integral role in identifying individuals. It is known fact that the individual identity depends on the facial features and also the facial measurements. Hence, facial measurements play a pivotal role in both ante- mortem and post-mortem cases, also in different facial reconstruction techniques. In this regard, odontometric analysis is invaluable, because these structures are highly resistant and indestructible, as they combat bacterial mortification[2]. Moreover there are various researches conducted in correlating the facial morphometrics with that of the odontometric morphometrics. In these studies the tooth length, clinical crown length, mesiodistal width of the crown, and labiolingual width of the anterior teeth were considered.

Among the anterior teeth, the use of canines can help in person identification,as these teeth are the most stable in the oral cavity owing to the labiolingual thickness of the crown and root anchorage in the alveolar process of the jaws. In addition, the crown portion of the canine is shaped in such a way that it promotes cleanliness, exposure to less plaque, calculus, abrasion from brushing, or heavy occlusal loading compared to other teeth, they are also less severely affected by periodontal disease and are usually the last teeth to be extracted with respect to age. This self-cleansing quality and efficient anchorage in the jaws tends to preserve these teeth throughout life. Therefore, they have been used for personal identification[3,4]. It is also reported that a study on permanent canine teeth offers several advantages and these teeth have can survive air and hurricane disasters [5].

This study was aimed to establish a relationship between the crown length of the maxillary canine tooth, facial height of adults, and intersex differences.

Materials and Methods

This study was conducted at a dental college where patients reported for treatment. The study group comprised 100 subjects (50 men and 50 women aged–18-23 years, Figure 1 and 2). Patients with a full set of dentitions in the maxillary and mandibular arches, no interdental spacing or crowding, no restoration of the permanent maxillary canine tooth, and no history of orthodontic treatment were included in the study. Patients with dental irregularities, apparent loss of tooth structure due to attrition, fracture, caries, or restorations were excluded from the study.

After informed consent was obtained, facial measurements were obtained from each subject using photographs. To measure the facial height, Adobe Photoshop software was used to assess the facial height in the photographs (Figure 3). The proposed landmarks were established on the face and were measured using the same software. The face was divided into the upper middle and lower thirds using the hairline, glabella, subnasalis, and menton as the reference points. The length between the hairline and glabella is the upper facial height (UFH), that between the glabella and subnasalis is the middle facial height (MFH), and that between the subnasalis and menton is the lower facial height (LFH).

For tooth measurements, impressions of the upper arches were made using alginate material and dental stone casts were obtained (Figure 4). The length between the cervical line and cusp tip is the canine height (CH) and the mesiodistal length is the canine width (CW). Measurements of the teeth were recorded using digital vernier-calliper (Figure 5).

Statistical analysis was performed using Statistical Package for Social Sciences software (SSPS) version 16. The data were subjected to descriptive analyses of the means and standard deviations. The Mann-Whitney U test was used to determine the correlation between facial height and canine height.

Figure 1: Female patient

Figure 2: Male patient

Figure 3: Adobe Photoshop for facial measurements

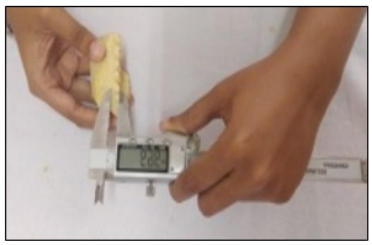

Figure 4: Dental cast **Figure 5:** Digital vernier callipers

Table 1: Descriptive Statistics

Gender		Minimum	Maximum	Mean	Std. Deviation
50Females	Upper Facial Height (UFH)	35.74	63.27	50.90	7.94553
	Middle Facial Height (MFH)	45.51	65.47	54.71	4.73174
	Lower Facial Height (LFH)	41.91	63.37	54.26	6.07886
	Total Facial Height (TFH)	131.08	181.28	159.89	14.25915
	Canine Height (CH)	5.22	11.35	8.73	1.17262
	Canine Width (CW)	7.00	9.29	7.88	.60039
50Males	Upper Facial Height (UFH)	45.33	62.06	53.58	5.14978
	Middle Facial Height (MFH)	41.52	68.82	55.26	6.38332
	Lower Facial Height (LFH)	45.93	71.63	56.03	6.36429
	Total Facial Height (TFH)	137.04	202.51	164.88	14.72946
	Canine Height (CH)	6.60	10.63	8.35	.98529
	Canine Width (CW)	6.1850	8.25	7.48	.45897

*All the values are expressed in millimeters (mm)

Table 2: Mann-Whitney U Test

	Gender	Mean Rank	Sum Of Ranks	Z	P Value
Upper Facial Height (UFH)	Female	23.72	593.00	-.863	.388
	Male	27.28	682.00		
Middle Facial Height (MFH)	Female	24.18	604.50	-.640	.522
	Male	26.82	670.50		
Lower Facial Height (LFH)	Female	24.12	603.00	-.669	.503
	Male	26.88	672.00		
Total Facial Height (TFH)	Female	23.64	591.00	-.902	.367
	Male	27.36	684.00		
Canine Height (CH)	Female	21.94	548.50	-1.727	.084
	Male	29.06	726.50		
Canine Width (CW)	Female	20.92	523.00	-2.222	.026**
	Male	30.08	752.00		

***P<0.05 Statistically Significant

Table 3: Correlation Coefficient(R) for Canine Height

Canine Height In Mm	Upper Facial Height In Mm	Middle Facial Height In Mm	Lower Facial Height In Mm	Total Facial Height In Mm	Canine Width In Mm
	.259	.289*	.526**	.475**	.401**
P Value	.069	.042***	.000***	.000***	.004***

***p<0.05 statistically significant

Table 4: Correlation Coefficient(R) for Canine width

Canine Width In Mm	Upper Facial Height In Mm	Middle Facial Height In Mm	Lower Facial Height In Mm	Total Facial Height In Mm	Canine Width In Mm
	-.003	-.050	.256	.052	.401**
P Value	.985	.731	.073	.722	.004***

***p<0.05 statistically significant

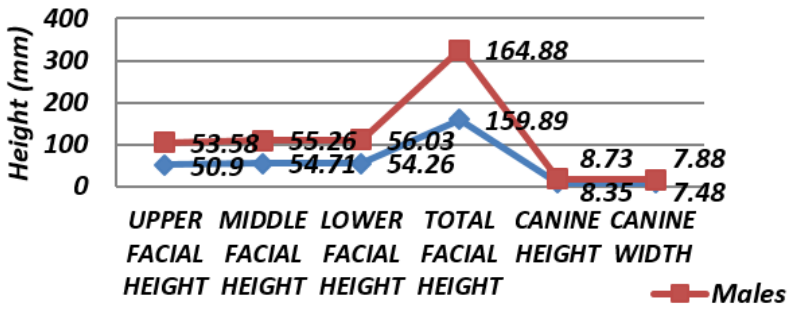

Figure 6: Comparison of different facial and dental measurements between males and females

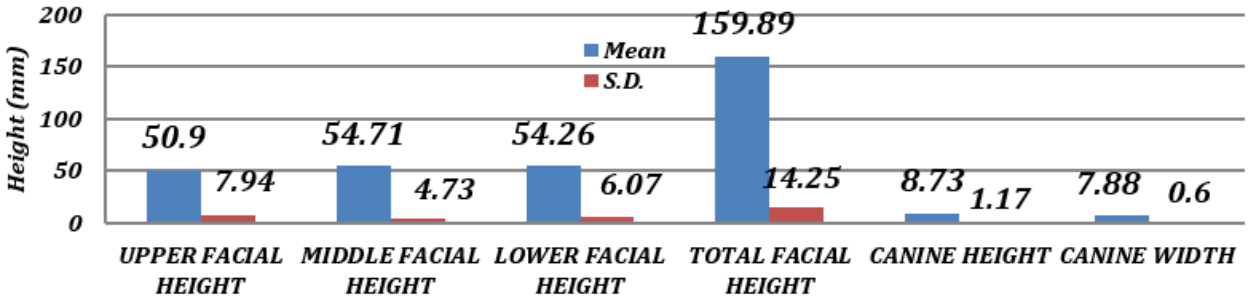

Figure 7: Comparison of different facial measurements in females

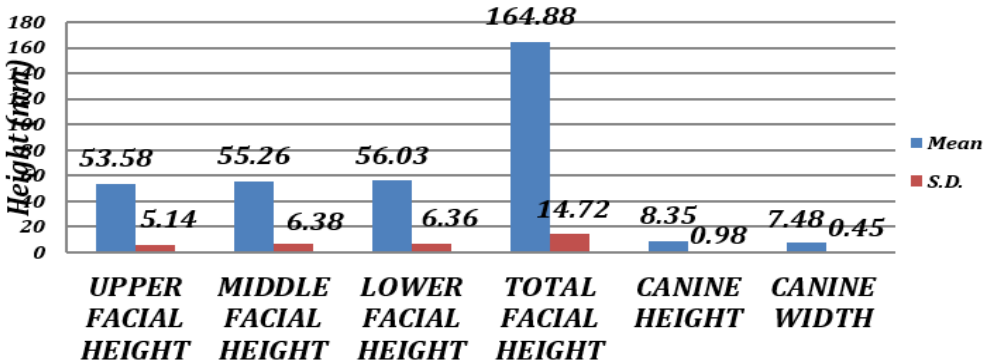

Figure 8: Comparison of different facial measurements in males

Results

This observational study included 100 participants (50 males and 50 females). The mean of Upper Facial Height in mm (UFH), Middle Facial Height in mm (MFH), Lower Facial Height in mm (LFH), Total Facial Height in mm (TFH), Canine Height in mm (CH), Canine Width (CW) in males and females was calculated using descriptive statistics (Table: 1). UFH, MFH, LFH, TFH, CH, CW in females were 50.90, 54.71, 54.26, 159.89, 8.73, 7.88 mm respectively. The mean UFH, MFH, LFH, TFH, CH, and CW in men were 53.58, 55.26, 56.03, 164.88, 8.35, 7.48 mm respectively.

This study demonstrated a correlation between TFH and CH in both men and women. This study showed that, as TFH increased, CH also increased, and hence, TFH and CH were directly proportional; hence, there was a correlation between TFH and CH (Table 1).

Statistical analysis was performed using the Mann–Whitney U test. The p-values for UFH, MFH, LFH, TFH, and CH in both men and women were not significant; however, the p-value for CW in both men and women was moderately significant ($p = 0.026$) (Table 2) (Figure 6).

The correlation coefficients (R) between CH and UFH, MFH, LFH, TFH, and CW were significant for both men and women (Table 3).The correlation coefficients (R) for CW and UFH, MFH, LFH, and TFH were not significant (Table 4). In men, the study showed a strong correlation between TFH and CH, which was directly proportional and statistically significant. In females, it showed moderate correlation between TFH and CH, which was directly proportional and statistically significant. Overall, there was a moderate correlation between CH and TFH, which was directly proportional to each other. Hence, this study showed that there was a correlation between TFH and CH.

Discussion

The relationship between crown length and facial height indicates the growth patterns and aids in the identification of individuals. Facial and odontometric measurements play important roles in person identification and facial reconstruction techniques. Various studies have shown that there is a possible relationship between tooth dimensions and body size. These study have dwelled on this subject with differing results.

Nalawade et al. [6]. found a definite relationship between the height of the individual, facial measurements, and their odontometric measurements. This study stated that the values of maxillary anterior teeth can be determined using regression equations. In the present study, canine height was directly correlated with the canine height to total facial height ratio, which also showed statistical significance.

Attokaran [7] showed the relationship between the teeth and facial parameters. The study found that the inner intercanthal distance and mesiodistal width of six maxillary anterior teeth in women showed high statistical significance, with no significance in men. However, the present study showed a relationship between the teeth and facial parameters in the vertical dimension in both sexes. A study by Banu et al[8] stated that there was a significant correlation between the interalar, intercommissural, intercanthal, and interpupillary distances and the mesiodistal width of maxillary anterior teeth in all subjects. In women, there was a significant correlation between the interalar, intercanthal, and interpupillary distances and mesiodistal width of the maxillary anterior teeth. SapnaRadia[9] also conducted a prospective clinical study to determine the relationship between maxillary central incisors, facial height and width in adults. The ratio of 1:18 was proposed for the maxillary central incisor height to total face height. They found a correlation between maxillary central incisor height and total face height, which is consistent with the present study that also showed a correlation between maxillary canine height and total face height. Raghavendra et al[10] conducted a study to establish the evidence of a statistical correlation between facial height and body height; however, no definitive correlation was found between the total crown length and body height. However, the present study was conducted to determine the correlation between facial and canine heights in both sexes.

Conclusion

The total facial and canine heights were directly proportional; hence, there was a correlation

between facial and canine heights. To the best of our knowledge, very few studies have been conducted to correlate facial parameters to that of the canine tooth. However, further research can be conducted using similar parameters, with larger sample sizes and different populations using newer technology and advanced imaging modalities.

Ethical Clearance: Ethical clearance was obtained from the institutional ethical board.

Informed consent: The authors certify that we have obtained all appropriate patient consent forms from the patient for clinical information to be reported in the journal.

Funding: Nil

Conflicts of Interest: None

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