Original Research

Estimation of Dental and Facial Proportions Using Height as Criteria

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Abstract:
Background: Ideal dental restoration is one which not only restores optimal functions but also confirm to standard dental and facial relations. This is important to achieve long term patient satisfaction both with regard to esthetics as well as functions. Objective was to find a credible relationship between dental and facial proportions using height of individuals as the criteria in a specific group of population. To determine a regression equation for determination of various dental and facial proportions using height.

Materials and Methods: One hundred and forty-four (*n* = 144) students, of which 91 were males (*n* = 91) and 53 were females (*n* = 53) of the dental college participated in this study. Height of the individual, the lower facial height, inter-incisal and inter-canine and inter-commissural width was measured as per protocol and resulting data was analyzed using SPSS 17 (SPSS Statistics for Windows, Version 17.0. Chicago SPSS Inc. Released 2008) version software regression equations were obtained.

Results: The study included 144 college students significant correlations were found between height of the individuals, inter-canine distance and lower facial height using Pearson correlation coefficient. The calculated values of *t*-test were significant. Regression equations were determined for determination of various parameters using height as the sole criteria.

Conclusion: There exists a definite relationship between height of the individual and their dental and facial parameters in this group of population and values of maxillary anterior teeth can be determined using regression equations.

Introduction

Selection of maxillary anterior teeth for complete dentures can be very challenging especially when there are no pre-extraction records available.[1,2] The from, size color and shape of the maxillary anterior teeth must be in harmony with surrounding orofacial structures. Maxillary anterior teeth are important in achieving pleasing dental esthetics. Many studies have been undertaken to determine the normal tooth dimensions.[3-6] selection of proper mesiodistal width of maxillary teeth is important criteria and considered more important than the height of this teeth.[7] Several anatomic criteria were used to measure the mediodistal width in many studies, which includes bizygomatic width (BZW),[8] inter-commissural width[9] inter-pupillary distance (IPD),[1] inter-canthal width[10] and interalar width.[2]

According to Young,[8] BZW-to-maxillary central incisor width ratio was of 1:16 and a BZW-to-maxillary anterior teeth width ratio of 1:3.3. According to Cesario and Latta[1] relationship between the IPD and mesiodistal width of maxillary central incisors, a ratio of 1:6.6 was determined in 95% of white and black female patients in black male patients, the ratio was 1:7. Silverman[9] found that the distal surface of maxillary canines was ±4 mm from the commissures. al-el Sheik and Athel[11] in their study in Saudi population found the average multiplying factor to estimate the width of the maxillary anterior teeth using interalar width was 1.56. Al Wazzan[12] using inter-canthal dimension for four maxillary anterior teeth found that biometric ratios of 1:0.267 and 1:1.426 could be used to estimate the central incisor width and the combined widths of the six anterior teeth, respectively.

There are no studies conducted until now, which link height of individual and dental facial proportions, especially in South East Asia (India) therefore this study was undertaken to find credible evidence of link between height of the individual and the dental and facial proportions in this group of population.

Materials and Methods

This study was conducted on the 144 dental college students, of which 91 were males and 53 females who volunteered to participate in the study following inclusion and exclusion criteria. The study was approved by the College Ethics

Committee. The study was explained in detail to the students and a written informed consent was obtained.

Inclusion criteria
1. Normal dental college students willing to participate voluntarily.
2. No history of facial trauma.
3. No history of periodontal disease.
4. No history of orthodontic treatments.
5. No history of significant dental treatments including dentures bridges in anterior segments, attritions, restorations.

Exclusion criteria
1. Crowding or spacing in anterior teeth or malocclusion.
2. History of facial surgery.
3. History of congenital abnormalities.
4. Students who were unwilling to participate.

Demographic information such as the age and gender of each student were recorded height of subjects was recorded. After removing the shoes subject was asked to stand upright on the flat floor keeping the feet parallel to heels, buttocks, and shoulder and back of the head touching the wall. The head was held comfortably erect with the lower border of the orbit in the same horizontal plane as the external auditory meatus. The arms were positioned by the side of the body. The height was measured as vertical distance from the vertex to the floor.[13,14]

The lower facial height was measured by asking participants to be seated on a dental chair set upright with their Frankfort horizontal plane parallel to the floor. With the aid of a Willis gauge the distance between the septum of the nose and the chin of each participant was measured as the lower facial height. The inter-incisal and inter-canine distances were measured by asking the subject to bite on modeling wax. The inter-incisal distance was measured as the distance between distoproximal surface of the indentation of maxillary right permanent lateral incisor and the same area of maxillary left lateral incisor and inter-canine distance was taken from distoproximal surface of maxillary right permanent canine to the same on the left permanent canine.[15]

Results
This study included a total of 144 dental college subjects out of which 91 (63.19%) were males and 53 (37.8%) were females, majority of the subjects 97 (67.36) were between the age group of 18 and 23 years where as 47 (32.64%) subjects were in age group of 24-28 years (Table 1).

The mean height of males was 166.5 cm and maximum height for males was 173.5 cm and minimum height recorded was 149 cm for females mean height was 156.2 cm and range (95% confidence interval [CI]) was 139.4-170.2 cm, the Pearson coefficient relation shows a value of 0.82, which shows strong correlation and the calculated $P = 0.0003$ which was significant (Table 2).

Among the males, the inter-incisal distance mean value was 2.73 range (95% CI) 1.8-3.66 cm for females mean values were 2.60 cm and range was 2.14-3.29 cm; however, the coefficient relation value was 0.27, which indicates only sight correlation and the calculated $P > 0.05$ was insignificant.

Similarly in males, the inter-canine distance shows mean values of 3.48 cm and range (95% CI) from 2.32 to 4.35, and females mean value was 3.35 cm the Pearson coefficient relation r value was 0.66 again showing significant correlation and the $P = 0.05$ which is significant. The inter-commissural distance for males mean was 7.06 cm in this group and range (95% CI) was 5.64-8.84 cm and females mean was 6.65 cm with range (95% CI) of 5.53-7.77, the coefficient correlation and the P values were not significant. The lower facial height for this group males mean values was 5.9 cm and the range (95% CI) was 4.72-7.08 and females the mean = 5.21 cm and range (95% CI) was 4.01-6.41 the calculated coefficient correlation $r = 0.76$ showing strong correlation and the $P = 0.007$, which is significant as shown in Table 2.

Discussion
Many dental and facial characteristics differed form one geographic location to other based on race ethnicity methods of measurement etc. Therefore, information regarding tooth norms in a group of population is useful for dentists when restoring teeth (Figure 1).[16] The present study was conducted in a dental college where majority of students were young

Table 1: Age wise distribution.			
Age group years	Number of males (%)	Number of females (%)	Total
18-20	38 (41.75)	25 (47.16)	63
21-23	22 (24.17)	12 (22.64)	34
24-26	20 (21.97)	11 (20.75)	31
27-28	11 (12.08)	5 (9.4)	16
Total	91 (100)	53 (100)	144
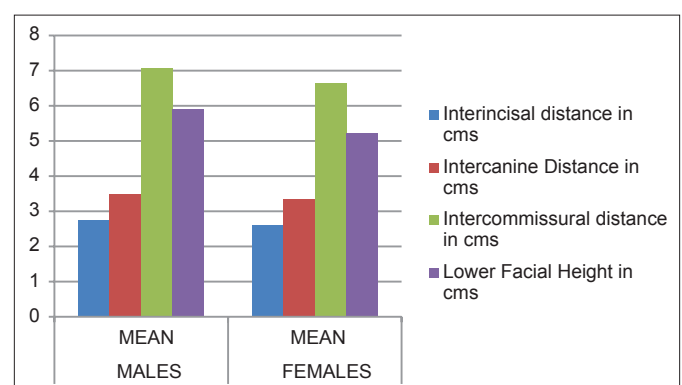
Figure 1: Mean values of dental and facial parameters in males and females.

Table 2: Mean of variables recorded in males and females.						
Variable	Males		Females		r value	P value
	Mean±SD	(95% CI)	Mean±SD	(95% CI)		
Height in cm	166.5±3.5	149, 173.5	156.2±2.8	139.4, 170.2	0.82	0.0003*
Inter-incisal distance in cm	2.73±0.31	1.8, 3.66	2.60±0.23	2.14, 3.29	0.27	0.375
Inter-canine distance in cm	3.48±0.29	2.32, 4.35	3.35±0.31	2.73, 3.97	0.66	0.05*
Inter-commissural distance in cm	7.06±0.71	5.64, 8.48	6.65±0.56	5.53, 7.77	0.18	0.375
Lower facial height in cm	5.9±0.59	4.72, 7.08	5.21±0.6	4.01, 6.41	0.76	0.007*
*Significant, SD: Standard deviation, CI: Confidence interval						

and were from local and surrounding areas which ensured the sample section was relatively homogeneous. In our study there was a good relation between height and inter-incisal distance, which was showing strong positive correlation. There was a significant relationship between the parameters of height, inter-canine distance and lower facial height as shown by significant *P* values, which are <0.05.

In this study, all the tooth dimensions were relatively larger for males when compared to females which are consistent with previous studies.[3,4] The mean combined width of maxillary central incisors was 27.3 mm, which was slightly lesser compared with 30.02 mm as reported by Al Wazzan[12] who conducted study on Saudi population extracted teeth. This may be due to ethinic variation and difference in measurement technique. Most of the studies conducted in this field made measurements using extracted teeth.[11,16]

The mean value of combined six anterior teeth was 34.8 mm this is slight agreement with the value 36.5 mm as reported by Esan *et al.*[15] The mean inter-commissural distance was 70.6 mm in males and 66.5 mm in females was greater than the mean inter-canine distance in both groups this shows that the inter-commissural distance differed significantly with the mouth width which is similar in findings to Stephan.[17] The inter-canine method is based on hypothesis that the distal surfaces of maxillary canine should be located approximately at the commissures of the mouth. Silverman[9] found that the distal surface of maxillary canines was ±4 mm from the commissures. In one study conducted by Hasanreisoglu *et al.*[18] they found the dimensions of central incisors and canines varied with gender and there was a proportional relationship between the inter-canine and inter-incisal width, which is consistent to our findings.

There are no studies done till date which determined the width of the maxillary anterior teeth using height as sole criteria in this group of population. In the present study, we derived a regression equation to calculate various dental and facial proportions using height as the parameter. Table 3 presents the regression for calculation of various parameters using height in centimeters. Such equations may be very helpful to dentists in finding out the width of the maxillary anterior teeth in absence of any pre-extraction records also the regression equations here gives values with a single parameter that is height which is very

Table 3: Regression equations for calculation of variables using height for both males and females.	
Variable	Regression formula
Inter-incisal distance	=0.73+0.012×height in cm
Inter-canine distance	=1.16+0.014×height in cm
Inter-commissural distance	=0.4+0.04×height in cm
Lower facial height	=−5.25+0.067×height in cm

unique because the measurement of height is so simple, fast and does not require any elaborate equipment. However one has to note that the equations can be applied only for maxillary anterior teeth not the mandibular. Another limitation of the present study was the sample size, however when we see strict inclusion and exclusion criteria it, but natural to have limited individuals who pass the criteria. Nevertheless, such studies should be continued in future with other group of population over-come shortcomings.

Conclusions
Within the limitations of the present study, it can be concluded that there exists a definite relation between the height of the individual and the dental and facial parameters and the regression equations obtained may be used to determine the mesiodistal diameter of the maxillary anterior teeth in this group of population.

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