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Correlation between Body Height, Mandibular Length and Intercanine Width in Subjects with Skeletal Class I and Class II Malocclusion

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Abstract

Introduction: The main objective of the study is to determine the correlation between mandibular body length, upper body length (sitting height) and total body length among patients between the age group of 8-16 years and also to determine its individual correlation in skeletal class I and class II malocclusions

Materials and Methods: Total sample size consisted of 40 patients (20 patients in each group) between the age group of 18-30 years. The inclusion criteria were healthy individuals of both genders with either skeletal class I or class II malocclusion. The exclusion criteria were history or clinical evidence of cleft lip or cleft palate; previous history of orthodontic treatment; presence of systemic diseases; developmental disorders or history of prolonged illness. The records include standing height in centimetres, sitting height in centimetres, mandibular length and intercanine width.

Statistical Analysis: The collected data were analysed with IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics, mean & S.D were used. To assess the relationship between the variables Pearson's Correlation was used. In the above statistical tool, the probability value 0.05 is considered as significant level.

Results: On comparing the individual variables between the two groups, there was a significant correlation of standing height with sitting height (p=0.0005), upper body height (p=0.0005), lower body height (p=0.0005), mandibular length (p=0.0005) and intercanine width (p=0.0005). There is a significantly high correlation of sitting height with upper body height (p=0.0005), mandibular length (p=0.0005) and intercanine width (p=0.0005).Within skeletal class I patients there was a significant correlation of the individual variables with a p value of 0.0005, the upper body height has significant correlation with mandibular length (p= 0.001) and intercanine width (p=0.010). the lower body height has significant correlation with intercanine width (p=0.0005). Among skeletal class II patients, there was no significance of the lower body length with the mandibular length and intercanine width (p=0.663 and p=0.303 respectively).

Conclusion: The upper body height can be used successfully to predict the mandibular length. However, the lower body height can be used for predicting the intercanine width however there is only a moderate correlation in class II individuals. The maxillary intercanine width can be used as a tool for assessing the stature of an individual when only the teeth are available for identification.

Keywords: Mandibular length, intercanine width, upper body height, lower body height, stature, skeletal class I, skeletal class II.

Introduction

The upper and the lower body components showcase different patterns of growth which has been a well-established fact. The peak in the growth of the long bones in the lower body on an average occurs one year before the peak in growth of the upper body. While increments in the upper body are larger than those of the lower body. Changes in standing height could be used with some success to imply the occurrence of craniofacial growth.

Jewair et al. (2018) investigated on the correlation of upper and lower body lengths with mandibular length and concluded that there was a strong correlation with the upper body length, compared to the lower body length. The upper body length includes both the head and the vertebral column lengths [1]. It was also stated that although cranial growth slows down after the age of 5, the head height and width have shown slight acceleration during growth spurt. Thus, the importance to perceive the relationship of mandibular length in relation to total body and upper body length becomes crucial in order to forecast the type of skeletal malocclusion that could turn up.

In case of a mass disaster or in mutilated cases, it is very difficult for victim identification. However, the teeth are extremely resistant to decomposition and can be used easily for identification [2]. Hence, they serve as an invaluable tool for identification of victims in forensic sciences. Previous studies have concluded that canines are the most stable teeth of the entire dentition and they have been recovered during many mass disasters and hurricanes. They are also less frequently extracted and hence readily available for identification [3,4].

Therefore, the objectives of the present study were to: 1) evaluate the correlation between mandibular body length, upper body length (sitting height) and total body length among patients between the age group of 8-16 years; and 2) identify if upper and lower body lengths can independently determine mandibular body length and; 3) to investigate its relation in patients with skeletal class I and class II malocclusion.

Materials And Methods

This prospective cross-sectional study examined relation between different anthropometric measurements from a sample size of 40 patients (20 patients in each group). Patients reporting to the Department of Orthodontics and Dentofacial orthopaedics, Meenakshi Ammal Dental college, Chennai, with chronological ages between 18 years-30 years were included in the study. Patients were informed regarding the study protocol and assent was obtained from them before collection of data. Records include standing height in centimetres, sitting height in centimetres, mandibular length and intercanine width.

The inclusion criteria were healthy individuals of both genders with either skeletal class I or class II malocclusion. The exclusion criteria were history or clinical evidence of cleft lip or cleft palate; previous history of orthodontic treatment; presence of systemic diseases; developmental disorders or history of prolonged illness.

The standing height (stature) of the patient was measured as a vertical distance from the vertex to the floor using an anthropometer. The patients were instructed to stand upright with barefoot, heels together and soles in contact. The patient’s head was positioned such that the Frankfurt horizontal plane was parallel to the floor. Measurements were taken to the nearest of 1mm (Figure 2b).

The upper body height was measured including head and trunk length. The patient was instructed to sit on a bench. Measurements were taken in this position with the patient’s head upright and knees directed over the edges of the seat. The head was postured such that the FH plane is parallel to the floor. Measurements were taken as described previously (Figure 2a). The height of the bench was then subtracted from the total sitting height.

The mandibular length and intercanine width were recorded with the help of a digital Vernier calliper (150mm) (Figure 3). Disinfection of the Vernier calliper was carried out with surfacept antiseptic solution after completion of each patient. The Vernier calliper had pointed tines which was used for assessing the linear measurements accurately. A display projected the distance between the pointed tines which was recorded. The intercanine width was measured horizontally between the cusp tips of maxillary right canine to the cusp tip of the maxillary left canine (Figure 4).

Statistical Analysis

The collected data were analysed with IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics, mean & S.D were used. To assess the relationship between the variables Pearson's Correlation was used. In the above statistical tool, the probability value 0.05 is considered as significant level.

Results

Table 1 depicts the descriptive statistics between both groups i.e. class I and class II skeletal malocclusions. A total of 40 patients were compared and mean and standard deviation was obtained for each variable as listed in the table.

Table 2 depicts the comparison of the individual variables between the two groups. The results reveal significant correlation of standing height with sitting height (p=0.0005), upper body height (p=0.0005), lower body height (p=0.0005), mandibular length (p=0.0005) and intercanine width (p=0.0005). There is a significantly high correlation of sitting height with upper body height (p=0.0005), mandibular length (p=0.0005) and intercanine width (p=0.0005). However, its correlation with lower body height is comparatively less. The upper body height has high significance with the mandibular length (p=0.0005) and intercanine width (p=0.0005). The lower body height has significant value of p=0.009 and 0.001 with intercanine width. The mandibular length has high significance with the intercanine width.

Table 3 details the descriptive statistics of the individual variables within class I skeletal malocclusion. Table 4 depicts significant correlation of the individual variables with a p value of 0.0005, the upper body height has significant correlation with mandibular length (p= 0.001) and intercanine width (p=0.010). the lower body height has significant correlation with intercanine width (p=0.0005). The correlation of mandibular length with intercanine width is comparatively less.

Table 5 depicts the descriptive statistics among the individual variables within class II skeletal malocclusion. Table 6 describes the significant correlation of the individual variables. There is no significance of the lower body length with the mandibular length and intercanine width (p=0.663 and p=0.303 respectively). There was a moderate correlation between sitting height and upper body height with intercanine width (p=0.018)

Discussion

Mandibular length has been studied widely because of its growth spurts and growth prediction. So far, anthropometric studies pertaining to the length of the mandibular arch and its association with the height of the individual especially in the Indian population have been scarce or non-existent.

Bishara et al (1997) and Bishara (1998) have concluded that the mandibular length in class II subjects were shorter than those with normal subjects [5,6]. However, in permanent dentition, the results were not significant. In contrary, Stahl et al (2008) found that there was a decrease in the mandibular length in class II patients even during postpubertal period [7]. Pelin et al (2010) evaluated correlation between height and different head types and found that they were not good height predictors [8]. Ahmed and taha (2016) conducted a study among sudanese arab students and concluded that there was a high correlation between height related to width of the base of the cranium and the bizygomatic width and bigonial width [9].

Sterrett et al (1999) conducted a study to assess the correlation of width, length, and width/length ratios of maxillary six permanent teeth in Caucasians. However, he could not find any significant correlation between the variables and height [10]. Khangura et al (2015) concluded from their study that the intercanine width and inter premolar width can be used for estimating the stature of an individual [11]. According to a study by Prabhu et al (2013) tooth crown variables such as buccolingual and mesiodistal dimensions have some correlation with the stature [12]. Yesha Jani (2018) concluded that when only the teeth are available for victim identification, the maxillary intercanine width can be used for assessing the stature of gujarati population [13].

So far, only a few anthropometric studies have been done to find the correlation between height and craniofacial measurements in India. Krishnan and kumar (2007) conducted a study on an endogamous group of castes in northern India and concluded that the highest correlation was with the circumference of the head [14]. Krishan et al (2008) concluded from a study among 996 adult gujjars that there was a positive correlation with all the variables such as Maximum head length, Maximum head breadth, Bigonial diameter, Morphological facial length and stature [15].

Limitations

1) The results obtained from the study cannot be generalised for other racial groups.

2) The growth rate and pattern differ for different ethnic groups due to various factors such as hereditary, socio-economic status etc.
3) Since our study is a cross-sectional study, the growth spurt, peak growth velocity etc could not be taken into consideration.

Conclusion

The following conclusions can be obtained from the study:

1) The upper body height can be used successfully to predict the mandibular length
2) The lower body height can be used for predicting the intercanine width however there is only a moderate correlation in class II individuals
3) The maxillary intercanine width can be used as a tool for assessing the stature of an individual when only the teeth are available for identification.

Legends Figure and Tables

Figure 1: Instruments used for measurements (Vernier calliper and divider)

Figure 2: Measurement of sitting height (a) and standing height (b) of the patient using an anthropometer

Figure 3: Measurement of mandibular length

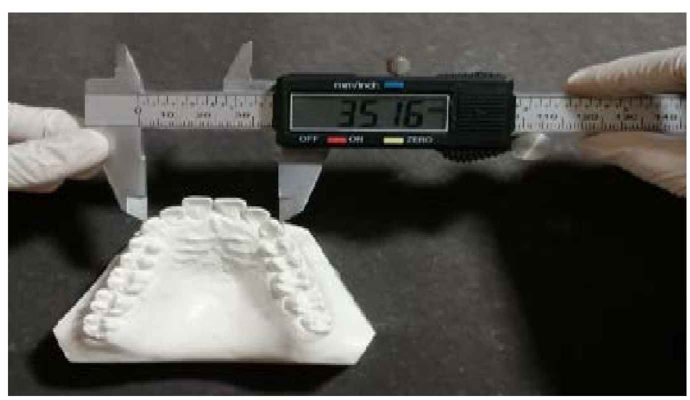

Figure 4: Measurement of intercanine width

Table 1: Descriptive Statistics

	MEAN	STD. DEVIATIOIN	N
STANDING HT	161.663	8.1613	40
SITTING HT	128.638	4.3145	40
UPPER BODY HT	78.638	4.3145	40
LOWER BODY HT	82.293	7.2917	40
MN LENGTH	107.9165	14.82241	40
INTERCANINE WIDTH	33.6340	4.65428	40

Table 2: Correlations

		SITTING HT	UPPER BODY HT	LOWER BODY HT	MN LENGTH	INTERCANINE WIDTH
STANDING HT	r-Value	0.832**	0.832**	0.722**	0.767**	0.857**
	P-Value	0.0005	0.0005	0.0005	0.0005	0.0005
	N	40	40	40	40	40
SITTING HT	r-Value	1	1.000**	0.388*	0.828**	0.736**
	P-Value		0.0005	0.013	0.0005	0.0005
	N		40	40	40	40
UPPER BODY HT	r-Value		1	0.388*	0.828**	0.736**
	P-Value			0.013	0.0005	0.0005
	N			40	40	40
LOWER BODY HT	r-Value			1	0.409**	0.519**
	P-Value				0.009	0.001
	N				40	40
MN LENGTH	r-Value				1	0.759**
	P-Value					0.0005
	N					40

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Class I:

Table 3: Descriptive Statistics

	MEAN	STD. DEVIATIOIN	N
STANDING HT	166.275	7.2936	20
SITTING HT	131.475	3.5780	20
UPPER BODY HT	81.475	3.5780	20
LOWER BODY HT	84.800	4.8974	20
MN LENGTH	119.3440	10.47897	20
INTERCANINE WIDTH	36.5940	3.52674	20

Table 4: Correlations[a]

		SITTING HT	UPPER BODY HT	LOWER BODY HT	MN LENGTH	INTERCANINE WIDTH
STANDING HT	r-Value	0.805	0.805	0.901	0.629	0.776
	P-Value	0.0005	0.0005	0.0005	0.0005	0.0005
	N	20	20	20	20	20
SITTING HT	r-Value	1	1.000**	0.468	0.664	0.559
	P-Value		0.0005	0.037	0.001	0.010
	N		20	20	20	20
UPPER BODY HT	r-Value		1	0.468	0.664	0.559
	P-Value			0.037	0.001	0.010
	N			20	20	20
LOWER BODY HT	r-Value			1	0.452	0.748
	P-Value				0.045	0.0005
	N				20	20
MN LENGTH	r-Value				1	0.504
	P-Value					0.023
	N					20

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

a. CLASS = Class I

CLASS II:

Table 5: Descriptive Statistics[a]

	MEAN	STD. DEVIATIOIN	N
STANDING HT	157.050	6.2237	20
SITTING HT	125.800	2.9082	20
UPPER BODY HT	75.800	2.9082	20
LOWER BODY HT	79.785	8.4802	20
MN LENGTH	96.4890	8.13882	20
INTERCANINE WIDTH	30.6740	3.68530	20

a. CLASS = Class II

Table 6: Correlations[a]

		SITTING HT	UPPER BODY HT	LOWER BODY HT	MN LENGTH	INTERCANINE WIDTH
STANDING HT	r-Value	0.639**	0.639**	0.600**	0.620**	0.788**
	P-Value	0.002	0.002	0.005	0.004	0.0005
	N	20	20	20	20	20
SITTING HT	r-Value	1	1.000**	0.075	0.655**	0.524*
	P-Value		0.0005	0.752	0.002	0.018
	N		20	20	20	20
UPPER BODY HT	r-Value		1	0.075	0.655**	0.524*
	P-Value			0.752	0.002	0.018
	N			20	20	20
LOWER BODY HT	r-Value			1	0.104	0.243
	P-Value				0.663	0.303
	N				20	20
MN LENGTH	r-Value				1	0.586**
	P-Value					0.007
	N					20

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

a. CLASS = Class II

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