Original Article

A cross-sectional clinical study on shape of nose inner-canthal distance and geometric progression as predictors for width of the maxillary incisor teeth

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Abstract

Objectives: The objective of this study is to evaluate the relationship of anatomical landmarks of the face and geometric progression as predictors for the width of the maxillary incisor teeth. **Materials and Methods:** The central incisor width (CIW), lateral incisor width (LIW), inner-canthal distance (ICD) and inter-alar distance (IAD) from a total of 150 subjects were measured clinically. The width of the root of the nose (WRN) was measured on standard photographs of the subjects. Student *t*-test has been used to find the significance of parameters between male and female. Pearson correlation has been used to find any relation of the parameters. **Results:** The IAD and the WRN measurements suggest that the shape of the nose is wider and more triangular in males. The mean maxillary CIW and ICD was significantly higher in males than females. **Conclusion:** The proportion of IAD to WRN seems to be a reliable guide for deciding the proportion of the maxillary central and LIW. The ICD, when multiplied by a decreasing function value of the geometric progression term 0.618 and divided by 2, was a reliable predictor of the maxillary CIW.

Key words: Central incisor width, inner-canthal distance, inter-alar distance, lateral incisor width, width of the root of the nose

INTRODUCTION

Literature for centuries have signified that, the teeth possess a beauty all their own and also contribute greatly to facial beauty. When no records of natural teeth are available, anatomical landmarks such as shape of the nose and inner-canthal distance (ICD) are used for selection of anterior teeth.[1] The appearance of complete and removable partial dentures involves creative, artistic ability, which includes the whole person and selection of artificial teeth is intimately related to both the appearance of patient and preservation of the residual ridges.[2] Various guidelines have been suggested for determining the width of the maxillary anterior teeth, when pre-extraction records are not available. These guidelines include bizygomatic width, intercommissural width,[3] interpupillary width,[4,5] intercanthal width[6,7] and inter-alar distance (IAD).[8-12] It is known that four maxillary incisors develop from the same embryonic origin as the nose. This is called the frontonasal process. An extension of this approach was that the proportion of the maxillary incisors can be derived on the basis of the nasal anatomy. The proportion of the IAD and the width of the root of the nose (WRN) can determine the proportion of the maxillary central incisor width (CIW) to the lateral incisor width (LIW).

Another anthropometric measurement of the face is the distance between the inner canthus of the eyes. The inner canthus is a point at the medial angle of the palpebral fissure. The ICD is defined as the distance between the medial angles of the palpebral fissures.[13]

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Proportion is the study of the harmony of structures in space.[14,15] When the proportion or ratio of a smaller to greater part is the same as the ratio of the greater part to the whole, it is said to be in geometric progression or a Fibonacci series.[16,17] Because of their immense importance in geometry and architecture and their manifestations in nature, these ratios are called golden proportions. Some parts of the face have been reported to manifest golden proportions. The width of the maxillary central incisor is in golden proportion to the width of the lateral incisor and the width of the lateral incisor is in golden proportion to the width of the canine.[17] The purpose of this study was to determine the relationship between ICD and the mesiodistal width of the maxillary central incisors in terms of geometric progressions.

MATERIALS AND METHODS

The study was carried out on 150 students (75 males and 75 females) within the age limit of 18-25 years. The criteria for selection of subjects were above the age of 18 years, with facial growth essentially complete. Subjects who had deformities and/or restorations were excluded and subjects who were presenting measurable data were included. The ICD, IAD, mesiodistal CIW and LIW were measured clinically with digital vernier calipers. (Dial caliper 505-675, Mitutoyo Corp.). The interproximal contact points were used as reference points for maxillary incisor width. Standard photographs were taken of each individual using a digital camera (Nikon Coolpix 990) to measure the WRN [Figure 1]. A water scale and a tripod stand were used to keep the camera position consistent. A cephalostat (craniostat), comprising of head positioning and stabilizing apparatus was used to ensure each head position was in a consistent position. The images were then transferred to a personal computer. Analysis of the photographs was performed in Adobe Photoshop 6.0 (Adobe). Two vertical lines adjacent to the nose on each side were drawn where the distance between the contact points was defining the inter-alar width of the subject. The distance of two intersection points of the intercanthal line and the nose provided the WRN.

The inter-alar width/WRN, CIW/LIW and Final central incisor width (FCIW) values were computed from the measurements. Statistical analysis was conducted with Student *t*-test (Independent, two tailed) to find the significance of parameters between male and female. Pearson correlation has been used to find any relation of the parameters.

RESULTS

The differences between the tooth measurements of the male and female subjects were not statistically significant. The IAD and the width of the nose measurements suggest that shape of the nose is wider and more triangular in males. The mean maxillary CIW and ICD were significantly higher for males than for females [Tables 1-3].

DISCUSSION

In a study of 443 Saudi subjects of Arab extraction, Al Wazzan[6] reported that the mean mesiodistal width of the central incisors of male subjects (8.61 mm) is significantly greater than that of females (8.36 mm). Variation based on gender has also been reported by Abdullah[7] (males 8.87 mm, females 8.69 mm); Lavelle[14] (males 8.79, females 8.54 mm in white subjects; males 9.33 mm, females 9.21 mm in black

Table 1: Results of the measurements of the IAD, WRN, CIW, LIW and ICD

Study parameters (mm)	Male	Female	*P* value
IAD	39.06±2.76 (32-45.24)	34.85±2.19 (30.05-44.71)	<0.001**
ICD	31.35±2.49 (26.16-38.35)	30.93±2.22 (25.13-39.57)	0.277
WRN	29.87±2.18 (25.33-38.43)	28.46±2.05 (24.33-31.88)	<0.001**
CIW	9.60±0.53 (6.14-10.76)	9.41±0.69 (7.88-11.70)	0.066+
LIW	7.56±0.57 (6.36-8.68)	7.41±0.70 (5.56-9.13)	0.140

IAD=Inter-alar distance; ICD=Inner-canthal distance; WRN=Width of the root of the nose; CIW=Central incisor width; LIW=Lateral incisor width

Table 2: Comparison of study parameters between males and females results are presented in mean±SD (min-max)

Study parameters	Male	Female	*P* value
CIW/LIW	1.27±0.09 (1.07-1.49)	1.28±0.11 (1.06-1.57)	0.642
IAD/WRN	1.31±0.11 (1.04-1.58)	1.23±0.11 (1.02-1.46)	<0.001**
CIW	9.61±0.53 (8.14-10.76)	9.42±0.69 (7.88-11.70)	0.066+
FCIW	9.68±0.77 (8.08-11.85)	9.55±0.68 (7.76-12.22)	0.293

WRN=Width of the root of the nose; CIW=Central incisor width; LIW=Lateral incisor width; IAD=Inter alar distance; FCIW=Final central incisor width; SD=Standard deviation

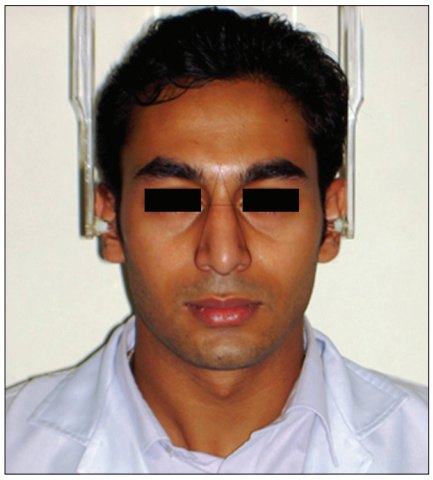

Figure 1: Clinical photograph showing subject in cephalostat with markings of inter-canthal distance and width of the nose

Table 3: Pearson correlation of study parameters

Study parameters	Male		Female	
	R value	*P* value	*R* value	*P* value
CIW/LIW versus IAD/WRN	−0.0143	0.714	−0.123	0.291
CIW versus FCIW	−0.031	0.794	0.103	0.181

WRN=Width of the root of the nose; CIW=Central incisor width; LIW=Lateral incisor width; IAD=Inter-alar distance; FCIW=Final central incisor width

subjects; and males 8.67, females 8.57 mm in Asian subjects); and Cesario and Latta[4] (males 8.92, females 8.52 in white subjects; males 9.02, females 9.13 in black subjects). In the latter two studies, gender based differences of the CIW was statistically significant in white subjects.

In the present study, the width of the central incisor seems to be slightly wider in male subjects (9.60 mm) in comparison to females (9.41 mm), but this difference is not statistically significant.

The results of this study confirmed a suggestive significant correlation ($P < 0.1$) between central incisors width and formulated CIW in females. The relationship between the shape of the nose and the proportion of the upper two incisors was suggested numerous times in the literature. The result of the present study suggests that there is statistically significant correlation between nose shape and incisor proportion in female subjects. The results of the present study also suggest that ICD may be a reliable predictor of the width of the maxillary central incisors. Interpretation and extrapolation of the results must be tempered, however, by an acknowledgement of the study's limitations. The ICD should be used only as a reference value in estimations of CIW. Final tooth selection for edentulous subjects should be made in accordance with facial form.

CONCLUSION

Within the limitations of this study, the following conclusions were drawn:

1. The results of the IAD and WRN measurements suggest that, the nose is wider and the shape of the nose is more triangular in males
2. The proportion of IAD to WRN seems to be a reliable guide for deciding the proportion of the maxillary central and LIW
3. Mean maxillary CIW and ICD were significantly higher for males than for females
4. ICD, when multiplied by a decreasing function value of the geometric progression term 0.618 and divided by two, was a reliable predictor of maxillary CIW.

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