



## Correlation between Morphological Facial Index and Canine Relationship in Adults - An Anthropometric Study

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### Abstract

The aim of this study was to correlate the morphological facial index and canine relationship in adults.

**Materials and method:** The research was conducted on 1000 subjects (563 males and 437 females), aged 18-40 years, selected randomly. The parameters were morphological facial height and facial width. The standard spreading caliper with its scale was used for the measurement of facial parameters. Canine relationship was observed intra-orally with the subjects seated on the dental chair.

**Result:** Euryprosopic facial type (53.2%) was most common in majority of the subjects followed by Mesoprosopic (21.6%), Hypereuryprosopic (19%), Leptoprosopic (5.6%) and the least common was Hyperleptoprosopic (0.6%). The canine relation was mostly Class I in both the genders, females showed a higher value of Class II and Class III canine relation.

**Conclusion:** The overall majority had the euryprosopic facial type and there was no significant association between facial morphologic types and canine relationship in both the genders in different age groups at either side. The canine relationship association with facial morphologic type was significant only for left side.

**Keywords:** Facial Width; Facial Height; Morphological Facial Index; Canine relationship

### Introduction

In forensic applications, person's identity is one such field where facial measurements play a very important role, particularly in different procedures of facial reconstruction where the measurements help the forensic team to make the final face irrespective of the methods used. Anthropometric measurements especially facial measurements are important for determining various face shapes [1]. The Prosopic Index (PI) classifies individuals into Hypereuryprosopic, Euryprosopic, Mesoprosopic, Leptoprosopic and Hyperleptoprosopic based upon the ratio of the length of the face to the facial width. Differences in facial types are encountered in every population. Studies show that the ethnic variations in the face type among individuals [2].

Since malocclusion affects a large-scale of the population, it is by definition as a public health problem. Malocclusion is endemic and wide spread throughout the world however it is found widely in different communities and knowledge of the nature of malocclusion is a necessary step for planning orthodontic services on community [3].

Angle's classification system was proposed by an American Orthodontist, Edward Angle in 1899 [4]. This classification is still in use after almost more than a century of its introduction due to its simplicity in application. The prevalence of canine asymmetries is also very limited, such information may be more relevant to determine the morphological facial index since the aim of everyday clinical practice is to establish a perfect class I canine relationship, with the accompanying molar relationship being a result of the extraction alternative. It is widely accepted that maxillary and mandibular canines are an essential part of facial and dental aesthetics, significant for canine guidance, and important for occlusal stability [5]. This study aims in correlating the Morphological Facial Index and Angle's canine relationship in adults.

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## Materials and Methods

The study was conducted on 1000 subjects (563 males and 437 females), aged 18-40 years, who were selected randomly. The subjects were made to sit on a dental chair in upright position and relaxed. Measurements were performed under natural light. All the measurements were repeated three times and the mean value of the measurements was taken for further analysis. All the measurements were made with a permissible error of 1 mm. A standard spreading caliper with a measuring scale was used for the measurement of facial parameters. Landmark points used in measuring of the parameters were (Figure 1):

- I. N = Nasion: the midpoint of the nasofrontal suture
- II. gn = Gnathion: in the midline, the lowest point on the lower border of the chin;
- III. Zy = Zygon: zygomatic prominences, the most lateral point on the zygomatic arch.

Morphological facial height (FH) is the distance between nasion and gnathion (N-gn). It was measured by spreading caliper with scale as follows (Figure 2):

- The fixed tip of the spreading caliper was placed at the subject's gnathion and the movable part was moved to place on the nasion. The morphological maximum width of face (FW) is the distance between the two bilateral zygomatic prominences (zygion to zygion). It was also measured by spreading caliper with a scale in the following way (Figure 3):

-after palpation by fingers, the most lateral point of the zygomatic arch (arcus zygomaticus) on both sides of the face were located, the ends of spreading caliper were placed at these points, with enough pressure to feel the bone under the spreading caliper. The spreading caliper was slightly shifted in the directions of up and down and back and forth, until the maximum value was shown.

Facial Index (FI) is the ratio of morphological facial height (FH) and maximum facial width (FW) and can be calculated according to the formula:

$$FI = \frac{FH}{FW} \times 100$$

The values of Facial Index (FI) were used to determine the incidence of certain facial types according to Martin-Saller's scale [3]. Based on the Facial Index (FI), the facial phenotype was classified as:

Facial (Prosopic) Type	Range Of Facial (prosopic) Index (FI) %
Hypereuryprosopic	(FI ≤ 78.9) %
Euryprosopic	(79.0 - 83.9) %
Mesoprosopic	(84.0 – 87.9) %
Leptoprosopic	(88.0 – 92.9) %
Hyperleptoprosopic	(FI ≥ 93.0) %

The patients were placed in their respective categories based on their index values. The subject's canine and molar relation were recorded with the help of mouth mirror using the Angle's classification. Assessment of the antero-posterior relationship of canine was based on modified Angle's Classification that includes

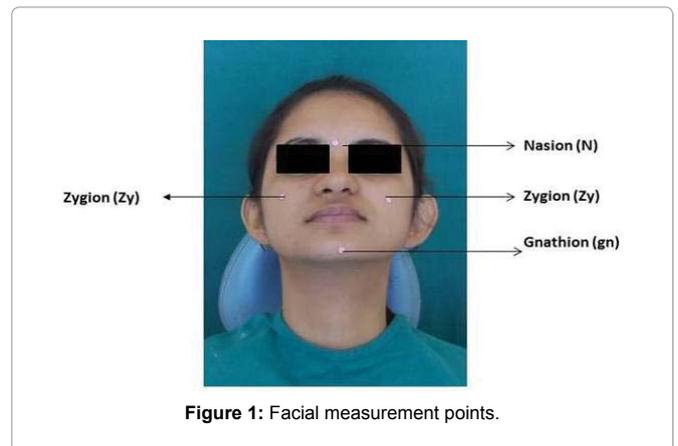


Figure 1: Facial measurement points.

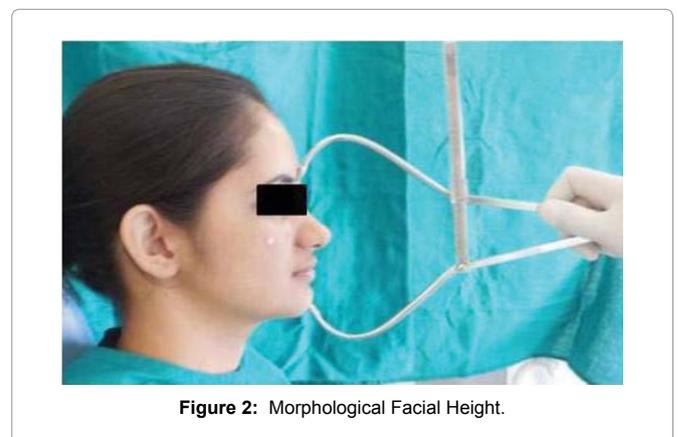


Figure 2: Morphological Facial Height.



Figure 3: Morphological Facial Width.



three basic classes [4]:

- Class I: The tip of the maxillary canine lies in the embrasure in between the mandibular canine and the first premolar.
- Class II: The tip of the maxillary canine lies mesial to the embrasure in between the mandibular canine and first premolar.
- Class III: The tip of the maxillary canine lies distal to the embrasure in between the mandibular canine and first premolar.

### Statistical Analysis

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) (Version 15) statistical analysis software. The data was subjected to descriptive analysis for mean, standard deviation, median. A student t-test was applied to test the significance of two means.

### Results

Overall, majority had Euryprosopic type (53.2%) followed by those having Mesoprosopic type (21.6%), Hypereuryprosopic type (19%), Leptoprosopic (5.6%) and Hyperleptoprosopic type (0.6%) (Table 1). However, in males, though majority were Euryprosopic (58.4%) however at next sequence Hypereuryprosopic and Mesoprosopic types had equal distribution (18.8% each) followed by Leptoprosopic (3.6%) and Hyperleptoprosopic type (0.4%) respectively. Among females, although maximum were Euryprosopic, yet they comprised 46.5% of total females followed by Mesoprosopic (25.2%) and Hypereuryprosopic (19.2%) types. Leptoprosopic and Hyperleptoprosopic types comprised the 8.2% and 0.9% of total females enrolled in the study. Statistically, there was a significant difference between two genders with respect to facial morphological type ( $p < 0.001$ ).

Canine relationship for both right and left sides, Class I was most common. However, for both the sides prevalence of class II and III was significantly higher in females as compared to males ( $p < 0.05$ ) (Table 2). Irrespective of facial morphologic type, Class I canine relationship was most common. Although prevalence of Class I canine relationship was maximum for Hyperleptoprosopic type as compared to other facial morphologic types yet this association was not significant statistically for canine relationship of either side ( $p > 0.05$ ) (Table 3).

### Discussion

Humans are constantly striving to improve their fate. Using

Morphological Type	Males (n=563)		Females (n=437)		Total (n=1000)	
	No.	%	No.	%	No.	%
Hypereuryprosopic	106	18.8	84	19.2	190	19.0
Euryprosopic	329	58.4	203	46.5	532	53.2
Mesoprosopic	106	18.8	110	25.2	216	21.6
Leptoprosopic	20	3.6	36	8.2	56	5.6
Hyperleptoprosopic	2	0.4	4	0.9	6	0.6

**Table 1:** Distribution of cases according to Facial Morphological Classification and its association with gender.

Relationship Class	Males (n=563)		Females (n=437)		Total (n=1000)	
	No.	%	No.	%	No.	%
<b>Canine Relationship (Right side)</b>						
I	501	89.0	357	81.7	858	85.8
II	61	10.8	77	17.6	138	13.8
III	1	0.2	3	0.7	4	0.4
$\chi^2=11.327$ (df=2); $p=0.003$ (S)						
<b>Canine Relationship (Left side)</b>						
I	506	89.9	340	77.8	846	84.6
II	56	9.9	94	21.5	150	15.0
III	1	0.2	3	0.7	4	0.4
$\chi^2=27.764$ (df=2); $p<0.001$ (S)						

**Table 2:** Comparison of Canine Relationship between two genders.

facial, craniofacial, and maxillofacial surgical techniques, our main aim is to obtain aesthetically superior results for our patients. To judge the appeal of a face, it is compared with norms that are today defined by canons or anthropometric proportions. The availability of values for facial sizes and proportions enables us to reproduce cosmetically attractive proportions for our patients [6]. Craniofacial anthropometry is used for the determination of the morphological characteristics of the head and face. Face shape is dependent on many factors, such as gender, race and ethnicity, climate, socioeconomic, nutritional, and genetic factors. The facial parameters are used to determine the facial trauma, congenital and traumatic deformities and easier identification of many congenital malformations. The collected data can be used in anthropology and forensic medicine for identification of racial and sexual differences as well as in reconstructive surgery for facial reconstruction [7].

Diversity and individuality of people are seen due to variations in the physical shape of their faces. Studies on craniofacial relations and variations in human will assist in understanding the frequency and distribution of human morphologies. Craniofacial anthropometry has become an essential tool for genetic counselors to identify any dysmorphic syndromes. Measurements taken from a person can be compared with the normal values obtained from a reference population, and these deviations from the normal values can be evaluated [8]. Cephalic and prosopic indices are important parameters that are used in anthropological studies for showing the variation between different sex as well as ethnic groups [9].

In this study, the maximum facial height (FH) observed in males it was 133 mm and in females it was 129 mm. The data were compared statistically, the difference was found to be significant. Similar result was obtained from the study done by Jeremic et al. [7] in Central Serbian population, where they observed facial height to be 121.4 mm in males and 110.8 mm in females. The present study shows that males have higher facial height than females.

The maximum facial width (FW) in males was 137 mm and in females it was 135mm. The minimum facial width observed in males was 103 mm and in females it was 100 mm. On comparing the data statistically, the difference was found to be significant ( $p < 0.001$ ). These findings were in accordance to the results obtained by the study done by Young et al. [10], where the maximum facial width was 139.9 mm in bruxers and 131.9 mm in non-bruxers. Jeremic et al. [7] measured facial widths of 129.1 mm in males and 119.9



Morphological Type	Canine Relationship						Total (n=1000)	
	I		II		III		No.	%
	No.	%	No.	%	No.	%		
<b>Canine Relation (Right Side)</b>								
	N=858		N=138		N=4		N=1000	
Hypereuryprosopic	156	82.1	33	17.4	1	0.5	190	19.0
Euryprosopic	459	86.3	72	13.5	1	0.2	532	53.2
Mesoprosopic	190	88.0	24	11.1	2	0.9	216	21.6
Leptoprosopic	47	83.9	9	16.1	0	0.0	56	5.6
Hyperleptoprosopic	6	100.0	0	0.0	0	0.0	6	0.6
$\chi^2=6.963$ (df=8); $p=0.561$ (NS)								
<b>Canine Relation (Left Side)</b>								
	N=846		N=150		N=4		N=1000	
Hypereuryprosopic	153	80.5	36	18.9	1	0.5	190	19.0
Euryprosopic	458	86.1	73	13.7	1	0.2	532	53.2
Mesoprosopic	184	85.2	30	13.9	2	0.9	216	21.6
Leptoprosopic	45	80.4	11	19.6	0	0.0	56	5.6
Hyperleptoprosopic	6	100.0	0	0.0	0	0.0	6	0.6
$\chi^2=7.659$ (df=8); $p=0.467$ (NS)								

**Table 3:** Association between facial morphologic types and Canine relationship.

mm in females showing that males have higher facial width than females.

Overall, facial index values ranged from 70.4 to 121% with a mean value of  $89.94 \pm 4.54\%$ . In males, the values ranged from 76.6 to 114.6% with a mean value of  $90.16 \pm 3.97\%$  whereas in females, the values ranged from 70.4 to 121% with a mean value of  $89.65 \pm 5.16\%$ . On comparing the data statistically, the difference was found to be significant ( $p < 0.001$ ).

These findings were similar to the results obtained by the study of Shetti et al. [11], who observed mean facial index of 87.19% in males and marginally higher value of 86.71% in females indicating Mesoprosopic facial form. Similar findings were found in a study which was done by Kurania et al. [12], the facial index of 89.5% in males and 86.6% in females. In another study it was observed that the facial index was 85.4% in females and 85.5% in males which is dissimilar to observations of our study [13]. The probable cause could be that their study was on a different race (Malaysian Indian).

Overall, as well as for both the genders, majority of subjects were 18-25 years old. However, proportion of females in age group 18-25 years (83.1%) was higher as compared to corresponding proportion of males (68.4%) whereas relatively higher proportion of males was aged 26-30 and 31-40 years (20.8% and 10.8% respectively) as compared to females (11.7% and 5.3% respectively). Statistically, there was a significant difference between two genders with respect distribution in different age groups ( $p < 0.001$ ). This is in accordance with the study done by Rexhepi A and Meka V [14] in 2008 on Albanian Kosova population.

In this (present study) study the overall majority had Euryprosopic facial type (53.2%) followed by those having mesoprosopic type (21.6%), hypereuryprosopic type (19%), leptoprosopic (5.6%) and Hyperleptoprosopic type (0.6%).

However, in males, though majority were euryprosopic (58.4%) however at next sequence Hypereuryprosopic and Mesoprosopic types

had equal distribution (18.8% each) followed by Leptoprosopic (3.6%) and Hyperleptoprosopic type (0.4%) respectively.

Among females, although maximum were euryprosopic, yet they comprised 46.5% of total females followed by Mesoprosopic (25.2%) and Hypereuryprosopic (19.2%) types. Leptoprosopic and Hyperleptoprosopic types comprised the 8.2% and 0.9% of total females enrolled in the study. Statistically, there was a significant difference between two genders with respect to facial morphological type ( $p < 0.001$ ).

Jeremic et al. [7] on central Serbian population found the dominant facial type Leptoprosopic with an incidence of 81.7% which was followed by 14.28% of Mesoprosopic and Hyperleptoprosopic with a frequency of 4% which is different from the result of our study. In 2003 Gopalipour et al. [15] observed the Turkman and Fars population and found that the dominant and rare facial type was hypereuryprosopic and leptoprosopic respectively. The findings of this study were different from the present study in terms of dominant facial type which was euryprosopic.

In the study done by Heidari Z et al. [16], they found that in 18-25 years old Baluchi and Sistani young woman, the dominant and rare facial type was Euryprosopic and Hyperleptoprosopic respectively in both the populations. This is in accordance to the present study as in females of 18-25 years old age group, majority of the subjects were Euryprosopic and Hyperleptoprosopic facial type was found to be less common.

According to the study done by Rexhepi A and Meka V [14] in 2008, they found that the Leptoprosopic was the dominant facial type in males followed by Hyperleptoprosopic while in females; Hyperleptoprosopic was very common in the age group of 18-35 years of Kosova Albanian population. Hypereuryprosopic was the least common followed by euryprosopic facial type among both the genders. This result was dissimilar with our study.

The study done by Bayat PD and Ghanbari A [17] in 2009, in Ark, Fars and Turkmen (newborn population of central Iran



and Iranian racial subgroups) found that the dominant facial type was Hypereuryprosopic for Fars and Ark while Mesoprosopic for Turkmen. In 2010, Raji et al. [9] found in north-eastern Nigerian population that the dominant and rarest facial type in both the genders was Hyperleptoprosopic and Hypereuryprosopic. With respect to the canine relationship for both right and left sides, Class I was most common. However, for both the sides prevalence of class II and III was significantly higher in females as compared to males ( $p < 0.05$ ). When the association between morphological facial type, canine relationship was observed, it was found that Class I canine relationship was most common. On comparison of different facial types, canine relationship, Euryprosopic was found to be dominant facial type supported by the study done by Young et al. [10]. Irrespective of facial morphologic type, Class I canine relationship was most common. Although prevalence of class I canine relationship was maximum for Hyperleptoprosopic type as compared to other facial morphologic types yet this association was not significant statistically for canine relationship of either side ( $p > 0.05$ ). In terms of canine relationship, A significant association between canine relationship and facial morphologic type was observed at both right and left sides ( $p < 0.05$ ). On comparing the data, there was no significant association found between facial morphologic types, canine relationships in both the genders in different age groups on either side. Only canine relationship association with facial morphologic type was significant for left side.

## Conclusion

The following conclusion may be drawn from the present study:

- The general facial morphological types did not show any significant association with canine relationship except for gender. The age confounded relationship did not show an empirical pattern for all the age group when evaluated independently.
- Euryprosopic facial type (53.2%) was most common in majority of the subjects followed by Mesoprosopic (21.6%), Hypereuryprosopic (19%), Leptoprosopic (5.6%) and the least common was Hyperleptoprosopic (0.6%).
- Males and females both showed the majority of 58.4% and 46.5% respectively of Euryprosopic facial type on comparing the data with facial type to gender. This showed the significant difference between two genders with respect to the facial morphology.
- The canine relationship showed Class I in both the genders while Class II and Class III were slightly increase in females.
- The association between morphological facial type, molar and canine relationship was observed and found that the class I molar and canine relationship was most common.

- In males, the prevalence of Class I canine relationship was significantly higher in Mesoprosopic and Hyperleptoprosopic as compared to other types for both the sides.
- In females, there were no significant association found between morphological facial types, canine relationship on either side.
- There was no significant association between facial morphologic types and canine in both the genders at either side. The canine relationship association with facial morphologic type was significant for left side.

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