Anthropometric Study of The Facial (Prosopic) Indices: A Proof for Gender Dimorphism

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Abstract

Background: Facial esthetics is one the factor affecting personal confidence in a social community. Facial indices are essential to obtain a facial aesthetic in Orthodontic treatment. *Aim*: This study assess facial dimensions and types of facial characteristic among dental students through an Anthropometric study. *Materials and Methods*: This cross-sectional study was done on 291 students with a mean age of 17-23 years. The measurements of facial diameters determined by using Martin Saller Cephalometer with an accuracy of 0.5 mm. According to the sex, the facial index estimated, and statistical analyses by using a t-test were carried out. *Results*: The mean Facial index found as 83.4 ± 9.2 in males and 80.0 ± 8.6 in females. The most dominant type of face shape in males was Mesoproscopic (51.3 %), followed by Hypereuryproscopic (18.2%). In females, the dominant type of face was Hypereuryproscopic (36.3%), followed by Mesoprosopic (28.6%). *Conclusion*: There were variations in the face index between males and females; further study with a large sample size recommended among dental students.

Keywords: Anthropometry; Face length; Face width; Facial index; Prosopic Phenotypes.

Introduction

Anthropology used for the identification and understanding of human physical features. It helps in the classification of races and the identification of human remains. Anthropometric measurements have a direct correlation between sex, age, shape, and various forms.[1-2]

The facial anthropometric measurement helps to describe racial and sexual differences.

Two persons are never alike in their measurable characters. Hence, the study of intra- and inter-population, a variation among different morphological characters, has long been an interest of the anthropologists.[3]

Anthropometry is a Greek word which means a measurement of man: Anthropos-man and metron-refers to the measurement.[4]

Anthropometry is a science which deals with the measurement of human beings, whether living or dead or of skeletal materials. It constitutes a series of systematized measuring techniques of expressing the form of the human body and skeleton quantitatively.[5]

Anthropometry constitutes the technique of expressing quantitatively the form of the body, and the sexual dimorphism refers to phenotypic characteristics that differ between males and females of the same species.[6]

The comparison of the changes in facial index between parents, offspring, and sibling can give

a clue to the genetic transmission of inherited characters.[7]

Human facial contour has always been an exciting subject for Anatomists, Anthropologists, Plastic surgeons, and artists and also the identification of an individual's race is an essential component in Forensic identification and Reconstructive surgery.[8-9]

Accurate facial analysis such as facial height, facial width, and facial index is essential for the diagnosis of genetic and acquired anomalies for the study of normal and abnormal growth and morphometric investigations. The facial index may be an essential factor in increasing susceptibility to obstructive sleep apnea as Europrosopic facial type favors the nasal breathing mode.[10]

It indicates that there is a research vacuum in facial height, facial width, and facial index; that is why it demands more studies.

With this perspective, the present study was done to compare the facial index between dental students.

Aim of the study:

a) To establish the mean vertical facial dimensions and indices of adults.

b) To establish the sexual differences of some vertical facial dimensions and indices between the adult males and females.

Material and Methods

A pre-set pre-tested structured questionnaire comprising the demographic profile and other necessary information was used to match the pre-requisites of the subjects for their inclusion and to obtain the necessary information to keep records and data analysis. This helped to obtain a "pure" subject of a respective community fulfilling all pre-requisites.

The study was carried out with protocol presentation and followed by ethical committee clearance.

The written consent was obtained from every student before taking the measurements.

Type of study: Descriptive and Cross-sectional.

Subjects and sample size:

The present study was carried out with two hundred and ninety one (291) dental students (143 male and 148 female students) of a private dental college. Dental students were selected because of easy availability. The age of the students ranged from 17 – 23 years.

Two variables, namely facial length, and breadth, and facial index, were analyzed through physical procedures in the present study. (Table.1, 2) Convenience sampling was used.

The appropriate sample size for this population-based survey was determined by three factors:

a) The estimated prevalence of the variable of interest.

b) The desired level of confidence.

c) The acceptable margin of error.

Thus the formula for calculation of sample size in epidemiological surveys was used.

Inclusion Criteria

a) Participants who were willing to participate in the study.

Exclusion Criteria:

a) Participants were included in the pilot study.

b) Participants not willing to participate in the study.

c) The participant with any obvious craniofacial abnormalities.

Sample collection:

Before the beginning of the study, intra and inter-observer standardization was carried out among the three researchers who were to assess students with the researcher leader in order to identify anthropometric points, visual assessment, and measurement using an instrument.

Besides, a pilot test was conducted to calibrate the measuring instrument, the data collection form, as well as the whole assessment process, in order to make corrections where required.

Materials used:

a) Stainless steel digital caliper: Neiko 01407Acaliper with extra-large LCD (liquid crystal display) screen and instant SAE-metric (Society of Automotive Engineers) conversion, New York, USA.

b) Measuring scale.

c) Pencil.

d) Anthropometer datasheet.

e) Consent form.

Calipers were manufactured in India by UNA and CO, scale reading up to 60 cms.

Somatometric Measurements (Morphological): (Table.1)

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1.　　　Face

a)　Total facial length (TFH)-(n-gn)

b)　Face Breadth (Bizygomatic Diameter/ (zy-zy)

Procedures for Measuring the Variables Studied:

Two female experimenters were trained to become accustomed to the measurements' tools and procedures.

The subjects were fully informed of the measurement procedure and the purpose of the study. Features are initially identified as skeletal landmarks on the face. The points were marked with a surgical marker before measurement. Finally, the measurements are taken using calipers.

Usually, the investigators worked in a private room to provide the subject with the most preferable environment. All subjects were provided with a non-disclosure agreement to preserve their names.

All measurements were made by one person to ensure the uniformity of measurement.

All measurements were taken on the subject (student) sitting on a chair in a relaxed mood.

Head was kept in Frankfurt-horizontal plane, i.e., infraorbital margin and tragion lie in the same horizontal plane in order to decrease postural stress while taking the measurement and make the features more accessible to the experimenter. Linear measurements were taken to the nearest millimeter and were recorded in centimeters and to an accuracy of 0.10.

All the measurements of face length and head breadth was taken following the techniques of Martin and Saller (1957) and Singh and Bhasin (1989). (Table.1, 2).

Based on the international classification of the facial index (Williams et al., 1995), the head shape was classified based on the range of the facial index. (Table.1, 2).

The method used for assessing the cephalic index is Hrdlicka's method.[11]

All measurements were taken twice to control the measurement error. The final value that was used for the study was the average of the two obtained values. A third reading was taken if the initial two measurements showed a significant discrepancy, and the two closer readings would then be used. All measurements were expressed in millimeters.

Data Processing and Analysis:

The SSPS (version 21.0) program for Windows was used for statistical analysis of the results of the measurements. The mean and standard deviations were also calculated. A two-tailed "t" test (independent and paired samples "t"-test) at the 95% confidence interval was used to study the bilateral variation as well as to check for statistical significance. A p-value of less than 0.05 was considered to be statistically significant.

Observation and Results

From the available data of anthropometric variables of the study population, the mean, standard deviation (SD) were calculated for the range values of Facial length, width, and facial index.

After analyzing the data statistically, a summary of observations and results were presented in the following tables and graphical representations.

In the present study, 291 dental students were participated. (Table.2).

Table 3 shows the facial length of males ranged from 89.4 mm to 109.4 (mean 101.4 ± 5.6), while that of females ranged from 89 mm to 102.2 mm (mean 97.8 ± 3.6) with a statistically significant difference between both means (p<0.001).

The head breadth of males ranged from 104.3 mm to 145 mm (mean 121.5 ± 12.9), while that of females ranged from106.2 mm to 121 mm (mean 122.1 ± 13.6) with a statistically significant difference between both means (p<0.001).

Total mean facial index for the male was 83.4, and for female, it was 80.0

In the present study, Table 4 shows frequencies of facial types according to the cephalic phenotype in a different gender.

Mesoproscopic facial type was the most prevalent (51.3%), and the Hyperleptoprosopic type was the least prevalent (2.7%) in the male group.
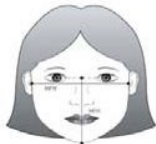
Among females also) is the most common facial form among females

The long face (Hypereuryprosopic facial type) was the most prevalent (36.3 %), and Hyperleptoprosopic type was the least prevalent (2.7%) in the female group.

The facial dimensions measured directly showed statistically significant differences between females and males (p<0.02), with males having higher mean values than females (Tables 3 and 5).

Table.1. Proscopic/Facial Index(Fi)

International Descriptions (Williams et al., 1995).		Head length and breadth Martin & Saller (1957).		
		Face size	Range (mm)	
Facial types based on Facial index			Male	Femalr
Facial phenotypes	Facial index (Range)%	Facial Length	98.54–130.8	94.6–120.9
Hypereuryproscopic (very broad, short face)	X - 79.9	Facial Width	115.6–149.	112.7–140.66
Euryproscopic (broad, short face)	80 – 84.9			
Mesoproscopic (average face , round)	85 – 89.9			
Leptoproscopic	90 – 94.9			
Hyperleptoproscopic (very tall, narrow face)	95 – X			

✓ Facial Length (n-gn):Nasion-Gnathion

✓ Face width (zy'-zy'): It is the distance in mm between left zygomatic (the most prominent point of the zygomatic bone) and right zygomatic = Zy.

✓ Gnathion(gn): The lowest point of the chin, on the midsagittal plane.

✓ Nasion(n): The interception of the midsagittal plane and the line crossing the superior palpebral creases, above the upper eyelids.

✓ Zygion (zy): The widest point in the region of the zygomatic bone seen in the frontal view.

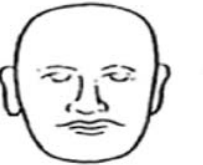FI= $\frac{\text{Facial Length(n-gn)}}{\text{Face width (zy-zy)}}$ x 100

(Martin and Saller)

| Hypereuriprosopic | Euriprosopic | Mesoprosopic | Leptoprosopic | Hyperleptoprosopic |

Instrument/Material Used

i. Scale
ii. Measuring tape
or
iii. Sliding vernier caliper/Gliding vernier caliper

Table 2: Social -demographic variables of respondents (n=291).

Individual Scenario.

Variables	Respondents	Responses (n)	Frequency (%)
The total number of respondents.		291/300	97
Age. [Mean ± SD].		21.7± 2.17	
Gender.	Male.	143	49.1
	Female.	148	50

Table 3. Descriptive statistics of the study population (Facial).

Individual Scenario.

Variables(cm)	Descriptive statistics					
	Male			Female		
	Mean(mm) ± SD	Z - Value	p –valve	Mean(mm) ± SD	Z - Value	Inferential Statistics
Facial length	101.4 ± 5.6	-5.0	p <0.0001 HS	97.8 ± 3.6	-7.0	p <0.0001 HS
Facial width	121.5 ± 12.9	-3.7	p <0.0001 HS	122.1 ± 13.6	-3.8	p <0.0001HS
Total	111.4 ± 9.2	2.4	P = 0.015 SS	110 ± 8.6	2.0	P = 0.04 SS
Facial index	83.4			80.0		

Statistical Inference: HS-Highly significant SS- Statistical significant.

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Table 4: Different types of Facial phenotypes of Males and Females.

Individual Scenario.(n=291)

Facial index

Facial phenotypes	Male(n=143)		Female (n=148)		Total (n=291)	Responses (%)
	Responses (N)%	Facial index	Responses N (%)	Facial index		
Hypereuryproscopic (very broad, short face)	27 (18.2)	73.9	52 (36.3)	70.7	79	27.1
Euryproscopic (broad, short face)	22 (14.8)	82.2	19 (13.2)	83.1	41	14
Mesoproscopic (average face , round)	76 (51.3)	85.5	41 (28.6)	86.9	117	40.2
Leptoproscopic	19 (12.8)	91.4	27 (18.8)	91.6	46	15.8
Hyperleptoproscopic (very tall, narrow face)	4 (2.7)	96.11	4 (2.7)	96.1	8	2.7

Table 5: Sex differences in Facial phenotype.

Individual Scenario.

Variables(cm)		Descriptive statistics		
	Mean ± SD	df	unpaired t test	Inferential statistics
Male	111.4 ± 14.1	df = 141	t = 0.55	P = 0.57
Female	110 ± 15.8			SS

Statistical Inference: SS- Statistical significant

Discussion

In the present study, the facial anthropometric features of 291 dental students from a private dental college were evaluated.

The face is developed from different bony structures, in which its final characteristics depend mainly on the changes in the proportion and position of these facial components.

It has been confirmed that the development and growth of humans are affected by different factors, such as sex, race, age, and geography.[12-14]

Each population has specific anthropometric features, for example, in their facial dimensions, which are essential for identification of an individual and as well in the operational planning for patients with facial defects due to tumor, trauma, or congenital malformations.[15-18]

The morphometric dimensions of the face are the most critical parameters in cephalometry used for the description of human morphology. Facial indexes are used to express the facial morphometric dimensions. It is the ratio of facial length to its width. So, broader faces are having low facial index while longer faces have a high facial index.[19]

When the present study was compared with Malaysian Indians, a study by Ngeow and Aljunid (2009)[20] showed that the facial index of males was 85.5, and in females, it was 85.4, which showed to be Mesoprosopic.

In a study of craniofacial measurements by Nagle et al. (2005)[21] among Latvian and non-Latvian residents showed face length and face width of both males and females. There was no significance in the comparison between Latvian and non-Latvian residents. Nevertheless, Latvian males showed a mean face length of 124.8 ± 5 mm, which was higher compared to our study (Table 3). Latvian females also showed a higher value of face length 118.8 ± 6.5mm as compared to the present study (Table 3). This showed that Latvian residents had longer face as compared to Indians and Malaysians. The difference seen was due to the regional difference in population.

The majority of the Nigerian population has Hyperleptoprosopic facial form as concluded by J.M. Raji et al. (2010)[22] Joshaph Antenor Firmin (2000)[23] found that Australian and African population has Hypereuriprosopic type of face among females which was correlated to the present study.

Jahanshahi M. et al. (2008)[24] found that a significant type of face in native Fars and Turkman ethnic groups of Iran is Mesoprosopic in males, which was correlated to the present study.

In our study, we found that Hyperleptoprosopic form is the most prevalent type of facial form followed by Mesoprosopic Leptoprosopic Euryprosopic and Hypereuryprosopic among females.

Among males, Mesoprosopic form is the most prevalent type of facial form, and

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Hyperleptoprosopic is the least form of the face.

In the study conducted by Ghosh's and Malikon (2007)[25] the Indian population showed that the Hypereuryprosopic and Euryprosopic types of official forms are present in the highest percentages in the Santhals of West Bengal which is different from the present study.

Another study by Bhasin (2006)[26] among Indians showed that the dominant typeface shape of Mesoprosopic, which co-relates the present study. According to Bhasin, the mean value of the facial index among Indians is 86.34, which can vary from 75 among Naga Sundan of Nagaland to 122.80 in Bhil Khandesh of Maharashtra region.

In the study conducted by Shetti et al. (2006)[27] among Indian male's dominant type of face shape was Mesoprosopic with 32%. In females, they have observed both Mesoprosopic and Euryprosopic as the dominant type with 32% each, respectively. Hypereuryprosopic type was the least common type in both males and females with 5% and nine %respectively. The study was not in correlation with the present study.

A study of native Fars and Turkman ethnic groups (Jahanshahi et al., 2008)[24] found that the dominant type of face shape in both native Farsand Turkman females was Euryprosopic (37.7%and 51.7%, respectively)which does not correlate with the present study

The dominant type of face shape in both native Fars and Turkman males was Mesoprosopic (44% and 38.4%, respectively), which is correlating with the present results). The mean facial index in Turkman males and females was 87.25% and 81.48%, respectively. The mean facial index in Fars males and females was 88.22% and 84.48%, respectively. It showed that Iranian males had a globular face, and Iranian females had a broader face.

The present study reports the anthropometrical variations in the facial index in dental students taking face length, face width, facial index as parameters.

Summary and Conclusion:

After conducting the research, it was concluded that the dominant facial phenotype Mesoprosopic and Hypereuryproscopic in males and females, respectively.

The data obtained in our study may be useful in anthropological research, forensics, genetic research, as well as in clinical medical and dental practice (reconstructive surgery).

Limitations:

Future studies are recommended for better exploration of this field in different population groups.

Ethical Approval: non-invasive study.

Ethical disclosures:

Protection of human and animal subjects: The authors declare that no experiments on humans or animals for this study.

a) Confidentiality of data: The authors declare that no patient data appear in this article.

b) Right to privacy and informed consent: The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author owns this document.

Conflict of interest and source of funding:

The author declares that there is no exceptional financial support for this research work from the funding agency and there is no conflict of interest among all authors

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