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PHOTOMETRIC FACIAL ANALYSISIN GUJARAT REGION

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ABSTRACT Introduction: The soft tissues covering the bones and teeth vary greatly. That's why, the understanding of soft tissues and their normal range is essential in restoring or enhancing facial traits.Aim: To develop and compare facial asthetics "norms" or standards which may be used for diagnostic procedure and treatment plan for plastic surgeries of face in people of Gujarat region. Materials and Methods: Computer assisted analysis of lateral and frontal facial photographs of 320 subjects aged between 18 and 25 years was done. Vertical and angular measurements of face were taken by screen caliper and screen protractor software andanalyzed by student t - test.Results:The proportion of middle face was 38.99% in male, 40.29% in females of and the lower face proportion was 61.01% in males and 59.71% in females. The mean values of nasofrontal angle, nasofacial angle, nasomental angle and mentocervical angle were 123.33°, 38.13°, 124.23° and 102.43° in males and 129.31°, 36.13°, 124.71°, 100.82° in females respectively.Conclusions: From this study it is revealed that Gujarati population has got smaller middle face, bigger lower face and more projected nasal bridge. Among Gujarati population the females had less prominent glabella and depressed nasal bridge.

KEYWORDS : Facial Aesthetics, Nasofrontal, Nasomental,Nasofacial,Mentocervical, Gujarat population.

1. Introduction

The face or countenance, is the anterior aspect of the head that extends superiorly from the adolescent position of hairline, inferiorly to the chin and the base of the mandible, and on each side to the auricle.1

One of the primary goals of all medical specialities concerned with the treatment of the face is to attain and preserve optimal attractiveness. Most treatment plans based on only dentoskeletal analysis of the face have sometimes led to aesthetic problems. The soft tissues covering the bones and teeth vary greatly, so dentoskeletal pattern may be an inadequate guide in formulating treatment plan. That's why, the understanding of soft tissues and their normal range is essential in restoring or enhancing facial traits.2

It is well established that a single facial aesthetic norms or standards is not appropriate for application to diverse race and ethnic populations,3 as facial traits are largely influenced by factors such as race, ethnicity, age, sex, culture, etc.4 In addition, features of different races and ethnic groups are not randomly distributed, but appear in geographical clusters.5 Therefore, the need to study the soft tissues of the face in different ethnic groups to establish anthropometric data for populations with different ethnic backgrounds is imperative.

Facial analysis can be made by various methods such as cephalometry, anthropometry, with 3-dimensional imaging and photometry.6These techniques have been used to study soft tissue norms in different populations. Photometric facial analysis is important not only to document pre and post-operative results, communicating with patients, but also are essential in preoperative planning and accurate evaluation of post-operative results.7

Soft tissue profile standards using photometry have been reported for North American population (Powell and Humphreys, 1984)8, Spanish (Fernandez-Riveiro et al., 2003)9, Indians (Jain et al., 2004)10, BrazillianCaucasians (Reis et al., 2006)11, Croatians (Anic-Milosevic et al., 2008)12 and Turkish (Kale-Varlk, 2008; Senem et al., 2009)13. Vertical and angular facial parameters of soft tissue profile have reported for the Urhobos (LovedayOghenemavweEse et al., 2010)14, Itsekiri (Ese-Anibor et al., 2011)15 and Igbos (LovedayOghenemavweEse, et al.)16 people of Nigeria.

The purpose of this study is to determine normal range of soft tissues profile of the face in Gujarat. These will provide a data base that will be useful in orthodontics and facial plastic surgeries.

2. Materials and methods

The present study was done on students of B. J. Medical College, Ahmedabad, Gujarat. A sample of 320individuals(160 males and 160 females)was randomly selected among the age group of 18 and 25 years.

Only those subjects who were apparently healthy, with complete dentition, competent lips were included in this study. Care has taken that those with congenital abnormalities, significant facial asymmetry and history of orthodontic treatment were excluded from the study.

Standard photograph of the lateral and front view of the face were obtained in the Natural Head Position (NHP). The photographic set up included a tripod supporting a digital camera. The tripod had adjustable height to allow the optical axis of the lens to be maintained in a horizontal position. In order to take records in Natural Head Position (NHP), the subjects were positioned on a line marked on the floor 100cms from the camera. This distance was standard to obtain sharp image, which was critical to the study. The subjects were asked to sit on chair in relaxed position with both hands hanging besides the trunk. A meter rule was placed besides the subjects to allow measurement of life size. A mirror was kept 120cms in front of the subject. Then subjects were asked to look straight into the mirror at the eye level with their lips relaxed.

Computer assisted analysis of the facial photographs was done. The photographs were transferred into a computer by a universal serial bus (USB) cord. Soft tissue points, namely Glabella (Gl), Nasion (N), Subnasale (Sn), Menton (Mn), Porion (Po), Subcervicale (Sc) and Pogonion (Pog), were introduced on the photographic images. Tracing of these photographs and vertical and angular measurements was done by screen caliper and screen protractor software respectively.

Vertical measurements:
A vertical line drawn from nasion to menton (N - MN) and divided into two parts, from nasion to subnasale (N - SN) and subnasale to menton (SN - MN). Distances between these were measured(Figure 1 and 2) and converted into percent ratio (Proportion).

(a) Middle face proportion: This is the distance between the nasion and subnasale expressed in percent ratio by dividing it with the distance from nasion to menton and multiplying by 100 (i.e., N - Sn/ N-Me X 100).

(b) Lower Face proportion: This is the distance between the subnasale and menton expressed in percent ratio by dividing it with the distance from nasion to menton and multiplying by 100 (i.e., Sn

- Me/N-Me X 100).

Angular measurements:
Following angles were drawn and measured.

(a) Nasofrontalangle(Figure 3): It is formed by drawing a line tangent to glabella through the nasion that will intersect a line drawn tangent to nasal dorsum.

Measurements	Male		
	Range	Mean	SD
N – SN (cm)*	3.6 - 8.68	5.74	0.92
SN – MN (cm)*	5.7 - 14.4	9.01	1.54

(b) Nasofacialangle(Figure 4): It is formed by drawing a vertical line tangent to forehead at the glabella and tangent to the chin at the pogonion so that a line drawn along the nasal dorsum intersects it.
(c) Nasomentalangle(Figure 5): It is formed by a line drawn through the nasal dorsum intersecting a line drawn from the nasal tip to soft tissue chin at the pogonion.
(d) Mentocervicalangle(Figure 6): A vertical line tangent to forehead passing at glabella and second line intersecting tangent to the chin at Pogonion.

Vertical facial measurements and aesthetic facial angles of all subjects were taken. The mean, range and standard deviation were calculated. The data obtained was analyzed by using Data Analysis application in Microsoft excel 2010. Student t test was used to test for analyzing significance of differences between males and females of total subjects. The significance of differences between mean parameters of subjects of four Regions of Gujarat was analyzed by applying anova test.

3. Results

This study was carried out using 320 subjects aged between 18 and 25 years selected from students of B. J. Medical College, Ahmedabad, Gujarat. Vertical measurements and measurements of aesthetic facial angle were taken and analysed by student t - test.

Table-1
Vertical Facial Measurements in Males
N= Nasion, SN= Subnasale, MN= Menton, *Differences statistically significant (P < 0.05).

Table-2
Vertical Facial Measurements in female

Measurements	Female		
	Range	Mean	SD
N – SN (cm)*	4.1 - 6.83	5.36	0.57
SN – MN (cm)*	5.95 - 11.5	7.97	0.99

N= Nasion, SN= Subnasale, MN= Menton, *Differences statistically significant (P < 0.05).

Table 1 and 2 shows that among the all subjects studied the mean distance from nasion to subnasale (N - SN) was 5.74cm in males and 5.36cm in females while the mean distance from subnasale to menton (SN – MN) was 9.01cm in males and 7.97cm in females.

Table-3
Vertical Facial Measurements(%) in Males

Measurements	Male		
	Range	Mean	SD
Middle face proportion(%)*	29.85 - 47.63	38.99	3.42
Lower face proportion(%)*	52.37 - 70.15	61.01	3.42

N= Nasion, SN= Subnasale, MN= Menton, *Differences statistically significant (P < 0.05).

Table-4
Vertical Facial Measurements(%) in females

Measurements	Female		
	Range	Mean	SD
Middle face proportion(%)*	31.16 - 48.69	40.29	3.27
Lower face proportion(%)*	51.04 - 68.84	59.71	3.27

N= Nasion, SN= Subnasale, MN= Menton, *Differences statistically significant (P < 0.05).

Table 3 and 4 showed that The proportion of lower third of face [SN – MN / N – MN x 100 (%)] was higher than middle third of face [N – SN / N – MN x 100 (%)] in both males and females of Gujarat region. Middle third proportion was higher in females (40.29%) than in males (38.99%) while lower third proportion was higher in males (61.01%) than in females (proportion59.71%).

Table-5
Angular Facial Measurements in Males

Measurements	Male		
	Range	Mean	SD
Nasofrontal (°)*	100.34 - 146.93	123.33	8.94
Nasofacial (°)*	23.71 - 48.67	38.13	3.73
Nasomental (°)	112.62 - 142.62	124.23	5.62
Mentocervical (°)	83.38 - 131.1	102.43	8.20

N= Nasion, SN= Subnasale, MN= Menton, *Differences statistically significant (P < 0.05).

Table-6
Angular Facial Measurements in Females

Measurements	Male		
	Range	Mean	SD
Nasofrontal (°)*	104.65 - 153.89	129.31	8.29
Nasofacial (°)*	29.68 - 46.39	36.13	3.42
Nasomental (°)	114.19 - 138.39	124.71	3.81
Mentocervical (°)	81.36 - 123.24	100.82	7.68

N= Nasion, SN= Subnasale, MN= Menton, *Differences statistically significant (P < 0.05).

Table 5 and 6 showed that the mean values of nasofrontal angle, nasofacial angle, nasomental angle and mentocervical angle were 123.33°, 38.13°, 124.23° and 102.43° in males and 129.31°, 36.13°, 124.71°, 100.82° in females respectively.

Statistical Interpretation:
Differences in all vertical measurements were statistically significant in males and females (P<0.05).

In angular measurements significant difference were found in nasofrontal and nasofacial angles (P<0.05), while differences were insignificant in nasomental and mentocervical angles in males and females (P>0.05).

4. DISCUSSION

Photographic based study of soft tissues eliminates the exposure of subjects to x-ray. Malkoc et al. (2005)17 also enumerated other advantages offered by photogrammetry. Firstly, with photogrammetric analysis, angular measurements are not affected by photographic enlargement as in cephalometric analysis. Secondly, every profile fiducial point can be moved freely on a computer monitor using cephalometric software program to determine the most appropriate profile point. Thirdly, angular photographic profile analysis does not require equipment and complex procedures and it offer digitized results that are easily evaluated. Furthermore, the collected data can be arranged in unified charts.

Careful preoperative planning and objective evaluation of postoperative results are essential in facial plastic surgery. The best aesthetic results are achieved by experienced surgeons who perform thoughtful clinical examinations before and after their procedures. In the present study, soft tissue facial measurements were established by means of photogrammetric analysis in order to facilitate surgeons to carry out more quantitative evaluation and make disciplined decisions.

This study was carried out in people of Gujarat region of India to obtain average vertical and angular parameters that define the soft tissue facial profile of the investigated population by means of using standardized frontal and lateral view photographs taken in the Natural Head Position (NHP). NHP has gained an increasing interest as a basic reference in facial plastic surgery, orthodontics and craniofacial anthropometry.9 Houston (1991)18 stated, "Clearly it is desirable that norms for different population groups are obtained from radiographs taken in NHP".

North American Caucasians8 have average values of 43 and 57% while the Himachalis of Indian10 have average values of 44.63 and 55.57% for middle and lower face proportions respectively. One study showed a lower face of 53% for very attractive females and 54% for attractive females.

In the present study, the lower face proportion (61.01% in males and 59.71% in females) was higher than the middle face (38.99% in males and 40.29% in females) in the subjects of Gujarat region of India.

The present study revealed significant gender differences in all vertical measurements, nasofrontal and the nasofacial angles. The significant differences were also found in nasofrontal, nasofacial and mentocervical angles among the four major regions of Gujarat.

5. Conclusion
From this study it is revealed that Gujarati population has got, Smaller middle face (N-SN= 39.64%), Bigger lower face (SN-MN= 60.36%) and more projected nasal bridge (Higher nasofacial angle 37.13º). Among Gujarati population the females had less prominent glabella (Higher nasomental = 129.31º & lower nasofacial = 36.13º) and depressed nasal bridge (Lower nasofacial = 36.13º).

With the data available from past studies and results of present study it is concluded that aesthetic angles (Nasofacial, Nasofrontal, Nasomental and Mentocervical angles) may serve as means of ethnic and racial identification. These angles may also serve as tools in gender differentiation.
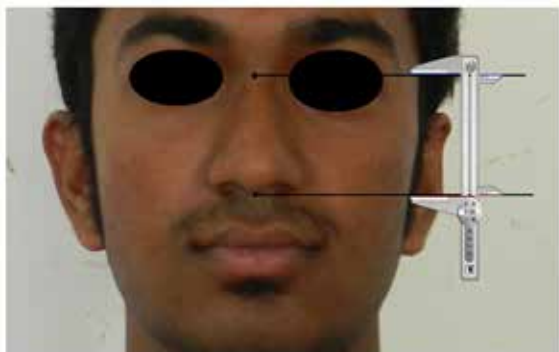

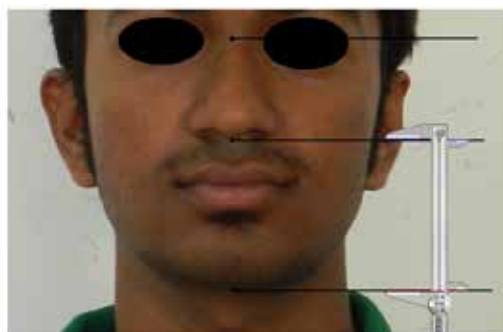**Figure – 1 Vertical Measurement N - SN**
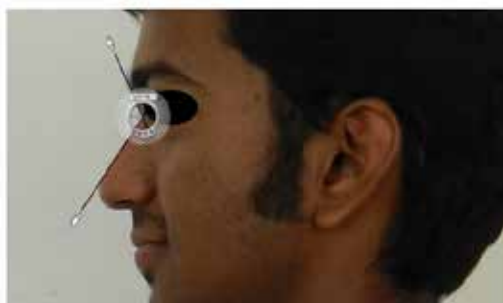

Figure – 2 Vertical Measurement SN - MN

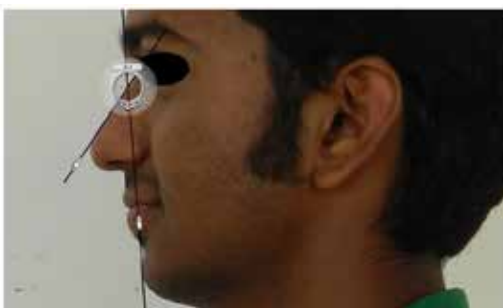**Figure – 3 Nasofrontal Angle**

Figure – 4 Nasofacial Angle

Figure – 5 Nasomental Angle

Figure – 6 Mentocervical Angle

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